DDV Gold Ltd
a 100% owned subsidiary of
Atlantic Gold

FOCUS REPORT
TOUQUOY GOLD PROJECT
MOOSE RIVER GOLD MINES, NOVA SCOTIA

Prepared For:
DDV Gold Limited

REPORT TEXT

NOVEMBER 2007
REF. NO. 820933 (8)
This report is printed on recycled paper.

Prepared by:
Conestoga-Rovers
& Associates
31 Gloster Court
Dartmouth, Nova Scotia
Canada, B3B 1X9
Telephone: 902.468.1248
Facsimile: 902.468.2207

CONESTOGA-ROVERS
& ASSOCIATES

Worldwide Engineering, Environmental, Construction, and IT Services

TABLE OF CONTENTS

Page

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES

ABBREVIATIONS

ABA	Acid base accounting
ACCDC	Atlantic Canada Conservation Data Council
Ag	Silver
ARD	Acid rock drainage
As	Arsenic
ASL	Above seal level
ATP	Adenosine triphosphate
ATVs	All-terrain vehicles
BAM	Beta Air Monitor
BMPP	Best Management Practices Plan
BOD	Biochemical oxygen demand
Ca	Calcium
CCME	Canadian Council of Ministers of the Environment
Cd	Cadmium
CFIA	Canadian Food Inspection Agency
CIL	Carbon-in-leach
CLC	Citizens Liaison Committee
Cm	Centimetre
CMM	Confederacy of Mainland Mi'kmaq
CN	Cyanide
CN	Cyanide
CN_F	Free cyanide
CN_T	Total Cyanide
CN_{WAD}	Weak-acid dissociated Cyanide
Co	Cobalt
CO_2	Carbon dioxide
COSEWIC	Committee on the Status of Endangered Wildlife In Canada
CPAWS	Canadian Parks and Wilderness Society
CRA	Conestoga Rovers and Associates Ltd.
CRM	Cultural Resources Management
CSA	Canadian Safety Association
Cu	Copper

CWS	Canadian Wildlife Service
dB	Decibel
DbA	Decibel adjusted
DFO	Department of Fisheries and Oceans
Dm	Dispersion Modeling
DO	Dissolved Oxygen
EA	Environmental Assessment
EARD	Environmental Assessment Registration Document
EC	Environment Canada
EF	Emissions factor
EPA	Environmental Protection Agency
ERP	Emergency Response Procedure
ES	Emissions summary
EV	Exposure value
Fe	Iron
G	Gram
GF	General Foreman
GHG	Greenhouse gas
GIS	Geographic Information System
GLC	Ground Level concentration
Gov't	Government
H_2S	Hydrogen sulphide
Ha	Hectare
Hg	Mercury
Hr	Hour
HRM	Halifax Regional Municipality
HS& E	Health, Safety, & Environment
HUs	Hydrostratigraphic Units
Hwy	Highway
IA	Industrial Approval
ICMC	International Cyanide Management Code
ILE	Institution of Lighting Engineers
ISQG	Interim Sediment Quality Guideline
Kg	Kilograms
Km	Kilometres

Kph	Kilometres per hour
L	Litre
Leq	Equivalent sound level measured over a specific interval
LPG	Liquified petroleum gas
LUX	A photometric unit of illuminance or illumination equal to one lumen per square meter
M	million
MCE	Maximum credible earthquake
Mg	Magnesium
Mg	Milligrams
Mgmt	Management
Ml	Millilitre
MLA	Member of Legislative Assembly
Mm	Millimetres
MMER	Metal Mining Effluent Regulations
Mn	Manganese
Mo	Molybdenum
Mol	Mole
MSC	Meteorological Service of Canada
Mt	Metric tonnes
MVA	Motor vehicle accident
N_2O	Nitrogen dioxide
NAAQS	National Ambient Air Quality Sampling
NAG	Net Acid generating
NAPS	National Air Pollution Surveillance Network
NDP	The New Democratic Party of Canada
Ni	Nickel
NP	Neutralizing Potential
NPR	Neutralization Potential Ratio
NS	Nova Scotia
NSDAF	Nova Scotia Department of Agriculture and Fisheries
NSDNR	Nova Scotia Department of Natural Resources
NSEL	Nova Scotia Environment and Labour
NSM	Nova Scotia Museum of Natural History
NW	Northwest

O_3	Ozone
OMS	Operations, Maintenance, & Surveillance
Oz	Ounces
PCA	Peter Clifton & Associates
PEL	Probable Effects Level
Pers. comm.	Personal communication
PM	Particulate matter
PMF	Probable maximum flood
POR	Point of Reception
Ppb	Parts per billion
Ppm	Parts per million
Q & A	Question and answer
QA/QC	Quality assurance/quality control
ROM	Run-of-mine
SO_2	Sulphur dioxide
SSTL	Site specific target levels
Supt	Superintendent
T	Tonne
TMF	Tailings Management Facility
TOR	Terms Of Reference
Tpd	Tonnes per day
TSP	Total Suspended particulates
U	Uranium
UK	United Kingdom
USEPA	United States Environmental Protection Agency
VEC	Valued Ecological Component
VSC	Valued Socio-economic Component
WRSP	Waste Rock Stockpile
WS	White Sucker
WSC	Water Survey of Canada
YP	Yellow Perch
Zn	Zinc

EXECUTIVE SUMMARY

Background

The Touquoy Gold Project entails the construction and operation of a relatively small open pit gold mine including a process plant and waste management facilities. Mining is expected to produce at least 9 Mt of ore containing 500,000 oz gold over a 5-7 year minelife. Construction will take one year and closure another two years. There may be potential to extend the project life although plans to do so are beyond the scope of this report.

The Project site is located at Moose River Gold Mines in Halifax County, approximately 115 km from Halifax. The total property area is approximately 400 ha of which 265 ha will be disturbed as a result of the development.

DDV Gold Limited, the project proponent, submitted an Environmental Assessment Registration Document (EARD) on March 15, 2007 As a result of the subsequent review, the Minister of Environment and Labour directed DDV Gold to prepare a Focus Report to provide additional details on certain specific aspects of the project. The nature of the Focus Report was detailed in the Terms of Reference (TOR) in a public letter to DDV Gold dated April 15, 2007.

The Focus Report Study Area (FRSA) as designated by the Minister encompasses an area of 54,337 ha in the general area of Moose River Gold Mines in Halifax County. Geographic boundaries extend north to Caribou Mines, south to the community of Lake Charlotte, west to Shaw Little Lake, and east to Snowshoe Lake.

The TOR specified that the proponent should examine the impact of the project on the surrounding area, in particular the downstream watershed, existing nearby wilderness areas, and undeveloped lands to the southwest. The physical, biological, ecological, and cultural aspects of the FRSA were to be described. The decisions underlying the project design were to be detailed and all measures employed to mitigate and monitor impacts were to be explained.

The Focus Report is not organized in the manner of a typical technical document in order to make the information it contains more accessible to the non-technical reader. There is traditional technical discussion of project design, the FRSA description, and potential project impacts in Sections 2, 3, and 4.

Section 5 provides a description of the public engagement process undertaken and is linked to Section 6 where stakeholder concerns are addressed. It is in Section 6 that the detailed explanation of impact mitigation measures can be found presented in a question and answer format. Here, over 250 questions identified as being of greatest importance to the majority of stakeholders, are addressed.

In Section 7 a complete listing of all the over 300 mitigation and monitoring measures designed into the Project can be found. Also in Section 7 is additional detailed discussion of wildlife mitigation, compensation, contingency, and reclamation. Section 8 provides conclusions.

Project Design

The Project design was developed based on a number of guiding principles. The most significant of these are (1) impacts can be limited to the property boundaries and (2) the mine can co-exist with the proposed adjacent wilderness area. The design process addresses technical and financial viability initially and then determines if the proposed plan is consistent with sound management of environmental and socio-economic impacts.

The project development scheme is dictated by the physical nature of the deposit in terms of size, location, geology, and metallurgy. The implications of these factors on the adopted development plan can be summarized as follows:

- The value of the deposit presents as near surface, widespread, disseminated gold mineralization directing that development will be dependent on low cost open pit mining methods

- Sufficient tonnage and grade exists to support relatively small scale, bulk mining extraction reinforcing the need to develop the orebody using surface mining methods

- Grade and style of mineralization is not concentrated enough to bear the capital and operating costs associated with underground development

- Flotation and direct cyanidation both offer similar recoveries

- Smelter penalties and transportation costs make it uneconomic to generate a flotation concentrate and ship it to a smelter for gold extraction

- A process plant milling 4,000-5,000 tpd employing gravity/CIL gold recovery would provide the best trade-off between throughput and capital cost

Based on the above, a relatively small open pit supplying a 4,000-5,000 tpd process plant employing gravity/CIL gold recovery is the most viable means of developing the property.

Once a technically feasible and economically attractive development plan has been identified, the design process assesses the impact on valued environmental components (VEC) on the Project site and in the surrounding area. For the Touquoy Gold Project, these elements were identified as:

- Aesthetics: Noise and Visual impact
- Air and Water Quality
- Recreational Value and Wilderness Experience
- Flora/ Fauna and associated Habitat
- Access and Community

The design process assesses the impact of the development on each of these elements in the context of (1) regulatory standards, (2) best practice, and (3) sustainability. Assessment of the environmental and socio-economic impacts for the various options available leads to the following conclusions:

- The most significant impact from the development of the open pit is the removal of the existing community, notwithstanding its declined state.
- The selected waste rock storage pile (WRSP2) location avoids impact to fish habitat and facilitates effective management of site runoff, albeit at a higher operating cost than the alternative
- The P3 plant location (P3) best addresses safety issues with regard to the proximity of the facility to the open pit and offers site specific opportunities to minimize disturbance and manage runoff, albeit at higher capital cost
- The TMF3 tailings facility location is superior to the alternatives as it presents no risk to Moose River, Square Lake, and the public road while avoiding destruction of fish habitat on site
- Given the proposed operating plan and design standards, discharge to Scraggy lake does not present an undue risk for downstream impact nor diminish the value of the adjacent lands
- The final facility layout is not the lowest cost but represents the design which best mitigates environmental impacts for the chosen development scheme

Study Area Description

The TOR required a detailed description of the Valued Ecosystem Components (VECs) within the Touquoy Gold Project site and the greater FRSA. To meet this requirement the Focus Report characterizes flora and fauna/rare species and species-at-risk, aquatic resources, atmospheric conditions, surface waters and wetlands within the FRSA. Ambient light and noise levels, ecological value, and recreational value were also addressed in the course of examining the area.

An updated review of the Atlantic Canada Conservation Data Centre (ACCDC) database of uncommon to rare species was undertaken for flora and fauna in the FRSA. One red-listed species and seven yellow-listed species of Plants of Special Status may be expected to occur within the FRSA, though none has been identified within the actual Project site.

Two red-listed and seven yellow-listed lichen species are known from the Project site. These are all cyano-lichens. Most of these occur in more than one location on the site. The rare boreal felt lichen has never been reported on the site. It is likely that the nine listed species also occur in the general area, outside the boundaries of the Project site.

An area of elevated moose density lies within the FRSA. Moose presence on the project site has been established by pellet surveys but sightings are few. The project site itself is considered non-critical moose habitat. The development is not expected to affect moose wintering, calving or travel throughout the region.

No rare birds have been identified on the project site although the Northern Goshawk may inhabit the area. The FRSA provides vast tracts of alternative habitat in the event these species do live in the area planned for development. The Wood Turtle is the only red-listed herpetile which occurs within the FRSA but no suitable habitat exists on the Project site itself. Six red-listed and six yellow-listed odonates also occur in the FRSA. Again, however, the site lacks suitable habitat.

Fish surveys were conducted in Scraggy and Square Lakes. The surveys indicated no resident salmonids. Fish collected were limited to suckers, bullhead, and perch. The lake waters in the region are characterized by high acidity in the winter and high temperature and low oxygen in the summer. Tissues samples of fish were analyzed for mercury and levels found to be in almost all cases below Health Canada guidelines.

Baseline atmospheric and meteorological studies were performed. The FRSA is characterized by moderate rainfall and temperatures and air quality typical of non-industrialized rural areas. The nearest sensitive receptors subject to the effects on air quality of site activities were 3 km (seasonal) and 5 km (permanent) distant.

Wetlands in the FRSA were reviewed and classified. Wetlands types present include bogs, fens, swamps, marshes, and shallow water wetlands. All tolled these comprise less than 10% of the FRSA total area. The Project site area is comprised of about 5% wetlands.

The FRSA is centered on the Fish River watershed which includes Square Lake, Scraggy Lake, the Fish River, and Lake Charlotte. Total contained water volume is on the order of 200 M m^3 with average annual flows of 1 m^3/s from Scraggy Lake. A hydrologic model for the FRSA was created using Weather Service Canada data calibrated against three years of site data measurements and Environment Canada data from the discontinued monitoring site at Crawford Falls on the Musquodoboit River. Ground water flows are predominantly near surface due to thin soils and impermeable, near-surface bedrock.

Acoustic studies of the area were performed. Ambient noise levels were found to be about 40 dBA. Ambient light levels at night were not measurable, even within the existing community.

The FRSA was subject to a literature review to establish the ecological make-up of the region. Of the four ecodistricts represented, three, the Eastern Drumlins, Eastern Granite Uplands and Eastern Interior ecodistricts are the most significant. The Project site and the FRSA share similar proportions of forest cover (70%), wetlands (10%), lakes and rivers (10%), and cleared areas (10%). The Project site has somewhat more cleared land and less wetlands, however.

The recreational value of the FRSA was assessed through existing literature, websites, interviews with area users, and field studies. It was found that the FRSA contains valued existing parks and wilderness areas and present abundant, though not unique, recreational opportunities. The predominant recreational uses of the area are fishing, canoeing, and hunting. Usage is of low intensity due to the inaccessible nature of the terrain.

A comprehensive soil sampling program was conducted over the entire Project site. Analyses show high levels of aluminum and arsenic, exceeding CCME guidelines but typical of the region. An investigation conducted to determine the extent of historic mine tailings within the project area identified three separate areas that show anomalous levels of arsenic and mercury.

Adverse Effects and Environmental Impacts

Background light levels were below detection at the Project site. Predicted light levels are all below applicable guidelines. Talking into account that the surrounding forest will inhibit light migration, sensitive receptors in the FRSA will not be negatively affected.

The worst case facility sound level measurement for a 1 hour period was estimated for each receptor to be 35-42 dBA or about equal to ambient. Occasional equipment activity on the tailings dam would remain below the NSEL daytime sound level criteria for a receptor at the north end of Scraggy Lake. In relative terms, the predicted noise levels in and around the Project site will not be louder than a moderate gust of wind blowing through the trees at 40 ft

The proposed blast design for the site utilizes a maximum of 206.8 kg/delay and the concussion air blast noise is predicted to be 122 dB at the nearest sensitive receptor. This is the equivalent of a car door slamming and of similar duration. Predicted ground vibrations are also expected to be below the NSEL criteria of 12.5 mm/s and will not negatively effect the environment. Blasting was also determined not to have impact on fish habitat or fish spawning based on DFO guidelines.

The maximum ground level concentrations for each air contaminant at each of the sensitive receptors are predicted to be well below the established limits. Greenhouse gas emissions are estimated at 8,100 tpa which places the site at a level equal to 0.05% of all mining GHG emissions in Canada. The main source of sulphur dioxide is vehicle exhaust. Emissions will not be sufficient to affect sensitive lichens on or off the project site.

Visual impact analysis determined that the top of the waste rock stockpile would be visible from 2% of the FRSA at final height. This would be dependent on circumstances including forest cover, atmospheric conditions, and disposition of the observer. Also at final height, glimpses of the top of the tailings dam may be visible from Scraggy Lake but again this would depend on conditions.

Start up of the mill could reduce the volume of Square Lake by 6% in the driest month but it would recover in the succeeding month. Also, collection of runoff during construction of the tailings dam indicates that, depending on weather, it may not be necessary to withdraw any water from Square Lake for start-up. Dewatering of the open pit is not expected to affect the Moose River although water levels will be monitored during operations. Groundwater systems are near surface and local in nature. There is no indication that activities at site will impact the quality of water in wells on the Eastern Shore 20-25 km distant.

The quality of treated tailings effluent and its impact on downstream water quality was modeled. Treated tailings water will exceed all MMER requirements for discharge. Discharge to an engineered wetland will ensure that upon mixing in Scraggy Lake, lake water contaminant loading will not exceed CCME guidelines for the protection of aquatic life. Even prior to treatment, aged tailings effluent quality exceeds MMER standards for most parameters.

A management plan was developed that determined that on-site containment in the tailings facility was the best option for disposal of historic tailings encountered during development. A risk assessment process was recommended to determine whether to dispose of or leave in place historic tailings in the mine area which need not be removed.

Public Engagement

A broadened program of public engagement was undertaken in support of Focus Report activities. Over 30 community, government, industry, and regulatory organizations were met in over 50 separate meetings. In addition, the proponent held two additional open house information sessions on the Eastern Shore and in the Musquodoboit Valley bringing the total since 2004 to five and attended four public meetings hosted by Eastern Shore Forest Watch. In all, the proponent met with and answered questions with over two hundred interested members of the general public.

Answers to stakeholder concerns raised during the public engagement process are provided in detail in Section 6 in a question and answer format covering 24 separate topics. In addition, the public engagement process provided the proponent with valuable feedback that was used to enhance the project design. In all, 25 significant changes to the project design were made to address the concerns of the neighbouring communities and other stakeholders.

Independent polling conducted on the Eastern Shore and affected areas of the Musquodoboit Valley and Guysborough county indicated that 67% of residents were aware of the project and that 66% were in favour of the development in some shape or form.

The proponent felt that the public engagement process was highly beneficial for all parties involved. The biggest challenge facing mine development in Nova Scotia appears to be the belief that mining and environmental protection are mutually exclusive. The proponent recognizes the need to demonstrate that well-managed, environmentally responsible mine development can occur without adversely effecting nearby wilderness areas.

Answers to Stakeholder Concerns

The Focus Report answers over 250 questions posed during the public engagement process. The majority of these relate to the project benefits, the safety of the tailings facility, and water treatment.

The mine will draw 90% of the required employees from the Eastern Shore and Musquodoboit Valley. Training will be provided and wages commensurate with industry standards will be paid. More than $200 M will be spent in capital and operating costs over the project life with a significant portion finding its way into the Nova Scotia economy. As legislated, a royalty will be paid on all gold produced and taxes will be payable after the project investment is recovered.

The tailings facility is designed with four barriers to contain a release of tailings into downstream areas in the highly unlikely event of a dam failure. The dams themselves are designed to withstand a magnitude 8 earthquake, a standard more than 1,000x higher than that used for building and bridge construction in Nova Scotia. An earthquake of this magnitude has never occurred in Nova Scotia.

The dams have a clay core to inhibit seepage and are cemented into bedrock to prevent leaking. The tailings facility is sited in an area of low permeability bedrock to further prevent seepage. Any seepage which does occur will be collected and pumped back into the facility.

The tailings impoundment is designed to contain the inflow from the 1/200 year storm. In addition, the dams will be raised one year ahead of schedule so that at any given time there is a minimum surge capacity of 3x the maximum probable flood or 7x the inflow from the 1/200 year storm.

The effects of a tailings dam failure were simulated. To do so, the study had to ignore the spillways and three of the four dams to generate a significant result. A maximum of 10% of the contained tailings volume could be expected to be released. The water in the tailings pond would already be at discharge quality at the time of release therefore minimum impact would be expected once initial mixing occurred in Scraggy Lake. Emergency response procedures and contingency plans have been developed for tailings facility.

Acid rock drainage is not anticipated to be an issue at the Project site. The host rock contains excess neutralizing potential. Static and kinetic testing has repeatedly shown that neutral and alkaline terminal pHs can be expected. The existing mini-pit on the property sunk into the ore zone 18 years previously has a pH of 6.6-7.9 and hosts a fish population.

The plant design will employ an SO2/Air cyanide destruction process to treat tailings prior to storage in the tailings impoundment. The process will drop CN_{WAD} from 170 ppm to 3 ppm. The cyanide concentration in the tailings water will further diminish to less than 1 ppm during its 30-60 day retention time in the tailings pond prior to recycle or treatment and discharge.

Effluent treatment will remove the dissolved arsenic and metals from the tailings effluent prior to discharge. Laboratory testing shows that dissolved arsenic concentration can be expected to be more than 80x below the MMER limit. Waste from the effluent treatment process will be stored in a purpose-built containment cell at the north end of the tailings facility. The cell will be clay-lined and earthquake resistant.

Treated effluent quality will exceed all MMER standards. However, despite the effectiveness of effluent treatment, DDV Gold's self-imposed goal of achieving zero impact on downstream water quality requires that additional measures be taken. As such, treated water will be discharged to an engineered wetland than will remove residual contaminants, mostly in the form of suspended solids, before flowing into Scraggy Lake.

Water purification through a wetland is a highly effective and proven form of treatment recommended for the treatment of industrial wastes by Environment Canada. Water quality modeling indicates that the proposed series of treatment processes will preserve the downstream water quality and prevent harm to aquatic life.

Mitigation and Monitoring

The impact mitigation philosophy behind the Project plan is based on a complementary system of measures employing design, operating procedures, and monitoring supported by contingency plans in the event of a system breakdown. The Focus Report details over 300 mitigation and monitoring measures employed in the Project to protect the environment and address socio-economic issues.

Monitoring will include measurements of water, air, and soil quality as well as the effects of noise, light, and dust generated by the Project. The tailings facility will be a focus of monitoring activity that will ensure that the containment dams are operating within design parameters and that water treatment is effective. Lastly, environmental effects monitoring as prescribed by MMER will confirm that no risk exists to the downstream watershed.

Wildlife will be largely unaffected by the development. A Moose Management Plan will be implemented to provide information and assist in the recovery of moose in the project area. Surveys for nesting birds will be conducted if nesting habitat is to be disturbed between April and September. Periodic surveys of flora and fauna on and about the property will help determine if the project is having impacts which require management.

Compensation will be provided for unavoidable impacts. An interpretative centre will be established to replace the park and museum, both displaced by the open pit development. Wetlands disturbed by the construction of the tailings facility will be replaced within the same watershed at a ratio agreed to with NSDNR. Studies will be undertaken to determine the extent of rare lichens which are similarly affected by the development.

Contingency plans for the tailings facility have been developed. These include actions to be taken in the event of a water treatment failure, excessive seepage, a dam overflow, or a dam failure. Also, a conceptual reclamation plan for the Project site has been developed. The open pit will be allowed to flood becoming a lake, the plant removed to foundations, and the waste rock stockpile and tailings facility re-sloped and vegetated. Water draining through the site will be treated until its quality returns to that which existed prior to development.

Conclusions

The Focus Report concludes that the TOR, as directed by the Minister, have been fulfilled. The study provides a thorough explanation of the rationale behind the project design and a detailed description of FRSA. The impacts of the development are discussed and evidence provided in the form of modeling of air and water quality that effects will not extend beyond the property boundaries.

The Project design entails world's best design standards for the tailings facility which dramatically exceed those for civil construction elsewhere in the province. The facility is also engineered to manage the effects of extreme weather and employs a complementary program of operating procedures, monitoring, and contingency plans to ensure fail-safe operation.

In the course of completing the Focus Report, the proponent has gone above and beyond expectations in engaging the public and employing feedback to enhance the Project plan. The result is a project development that is both technically and economically sound while being responsive to community concerns. Independent polling results attest to the fact that the public shares this view.

1.0 INTRODUCTION

1.1 BACKGROUND AND PURPOSE

DDV Gold Limited submitted an Environmental Assessment Registration Document (EARD) on March 15, 2007 to the Minister of Environment and Labour. This document provided project details and requested that an Environmental Assessment Approval be granted. A review of the EARD was completed by the public and regulators over a 25 day period and the Minister's decision was issued on April 10, 2007. The Minister directed DDV Gold in a letter that although "the adverse effects or significant environmental effects which may be caused by the undertaking are limited" a Focus Report was required to provide additional details on certain aspects of the project. A copy of this letter has been provided in the Focus Report (Appendix A). This letter outlined that Terms of Reference (TOR) for the Focus Report would be issued that would detail what DDV Gold was to provide and would include a Study Area for the Focus Report. The TOR is included in Appendix A. It is important to note that the Province felt that only certain aspects of the Touquoy Gold Project required additional details. DDV Gold has addressed these details in this Focus Report and has provided a Table of Concordance below to show how DDV Gold has addressed the requirements. **It is imperative to read the Environmental Assessment Registration Document provided before reading the Focus Report.**

1.2 PROJECT DESCRIPTION

The mine is planned as a surface operation with drill-and-blast, load-and-haul, process-on-site type development. Production is estimated at approximately 4,500 tonnes of ore per day with a total ore production estimate over the life of the mine of at least 9 million tonnes for recovery of almost 0.5 million ounces (oz) of gold. Following a 12 month construction and commissioning phase, the mine life is estimated to be six years for production and two years for closure. However, once in production Project economics are expected to allow additional reserves to be identified, developed and mined over a longer period.

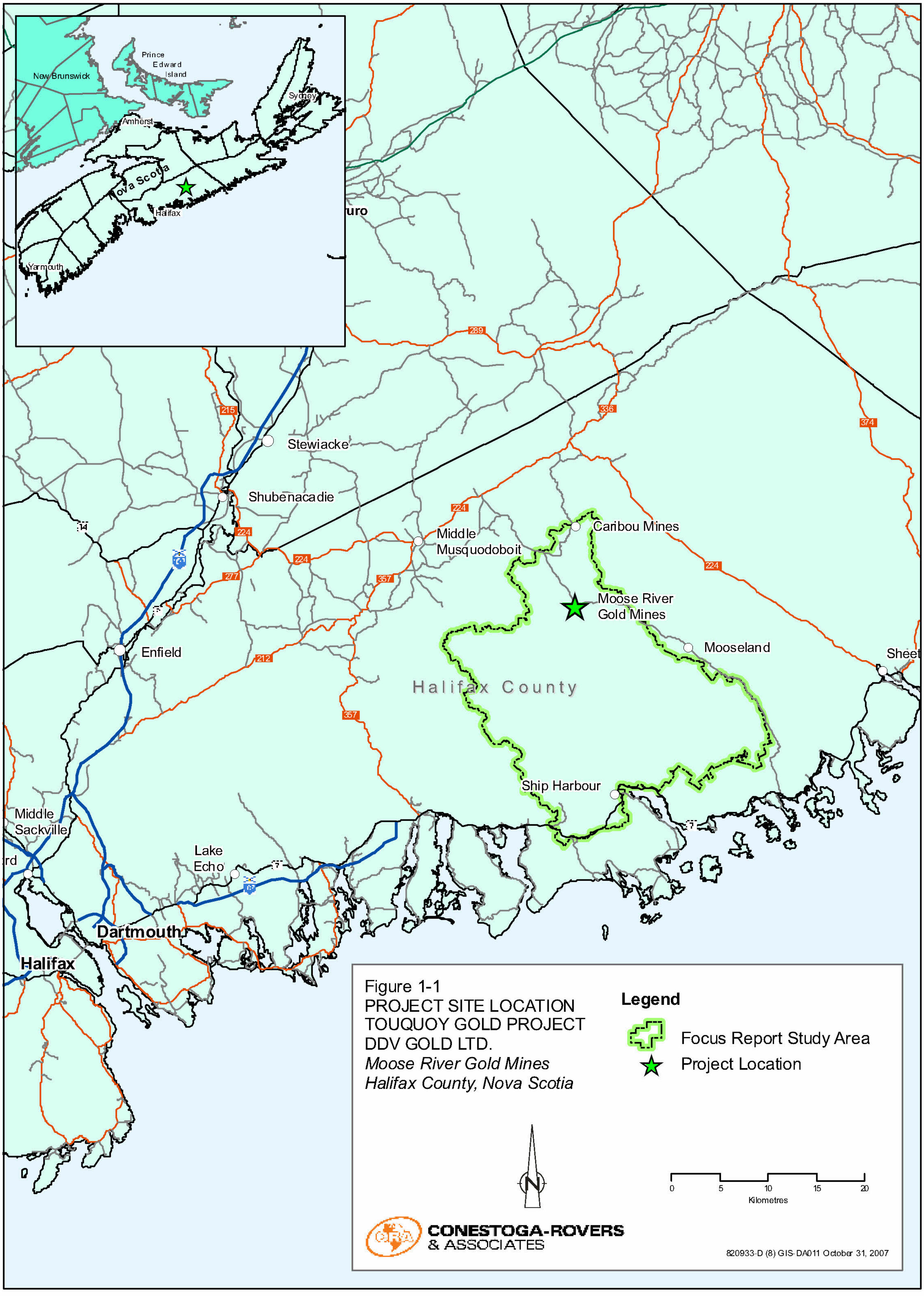


Figure 1-1
PROJECT SITE LOCATION
TOUQUOY GOLD PROJECT
DDV GOLD LTD.
Moose River Gold Mines
Halifax County, Nova Scotia

Legend

- 🟩 Focus Report Study Area
- ★ Project Location

CONESTOGA-ROVERS & ASSOCIATES

820933-D (8) GIS-DA011 October 31, 2007

1.3 PROJECT LOCATION

The Project site is located at Moose River Gold Mines in Halifax County (Figure 1-1). The proposed active surface footprint of the site is approximately 265 ha within a total property area of 400 ha and encompasses the settlement of Moose River Gold Mines, part of a small provincial park and undeveloped forest. It is bounded to the west by the Moose River and surrounded on all other sides by forested land in varying degrees of re-growth due to logging.

1.4 SCOPE OF THE FOCUS REPORT

The Focus Report Study Area (FRSA) was designated by the government of Nova Scotia and encompasses an area of 54,337 ha in the general area of Moose River Gold Mines in Halifax County. Geographic boundaries extend north to Caribou Mines, south to the community of Lake Charlotte, west to Shaw Little Lake, and east to Snowshoe Lake (Figure 1-2). The FRSA encompasses the Fish River-Lake Charlotte Watershed (in part, the proposed Ship Habour Long Lake Wilderness Area) and the Tangier Grand Lake Wilderness Area (catchment areas 1EL-1, 1EL-2, 1EL-3, 1EL-4 and 1EL-SD9) (Figure 1-2). In addition to the communities mentioned above, Upper Lakeville, Ship Harbour and Markland are located within the FRSA.

1.5 TERMS OF REFERENCE CONCORDANCE

The table below cross references sections of the Focus Report with the Terms of Reference developed by NSEL and other relevant stakeholders.

Table 1.5-1 Table of Concordance

Focus Report Requirement (by section)	Section where Requirement is Specifically Addressed in this Focus Report	Location of Additional Information Related to the Requirement
1.0 Project Description		
Description of project location	Section 1.3	EARD Section 2.3
Identification of project boundaries	Figure 1-2	Not applicable
Assumptions underlying details of project design	Section 2.0	Not applicable
Project temporal and spatial boundaries	Section 1.0	EARD Section 2
2.0 Other Methods for Carrying out the Undertaking		
Description of other methods for carrying out the undertaking	Section 2.0	EARD Section 3.2

Table 1.5-1 Table of Concordance

Focus Report Requirement (by section)	Section where Requirement is Specifically Addressed in this Focus Report	Location of Additional Information Related to the Requirement
Demonstration of how potential impacts were considered in design	Section 2.0	EARD Section 2
3.0 Description of the Study Area		
Flora and Fauna / Rare Species and Species-at-Risk • General characterization of flora and fauna species and potential habitat within the study area	Section 3.1	EARD Section 9.0
Aquatic Resources • Identification of fish and fish habitat in downstream receiving watercourses including species-at-risk and sensitive or critical habitat • Baseline data for mercury concentrations in fish tissue • Baseline data for sediment quality in watercourses downstream of the proposed tailings impoundment	Section 3.2 Section 3.2.1 & 3.2.2 Section 3.2.3 Section 3.2.4	EARD Section 7.1.2 EARD Section 7.0
Atmospheric Conditions • Review of baseline ambient air quality and meteorological data • Discussion of local and regional emission sources and the influence of climate and weather conditions • Description of any potentially sensitive receptors	Section 3.3	EARD Section 5.0
Surface Water and Wetlands • Identification of location, size, class of wetlands in predicted zone of influence • General hydrologic, hydraulic and water quality description of all surface water bodies downstream of mine and tailings management facility • Description of groundwater/surface water interactions • Identification of existing uses, withdrawal capacities and users of the watercourses • Baseline water quality data for arsenic, pH and DO	Section 3.4 Section 3.5 Section 3.5.1 Section 3.5.1 Section 3.2 and 3.5	EARD Section 10.0 EARD Section 7.0
Ambient Light and Noise Levels • Description of existing ambient acoustical environment • Special boundaries of existing noise and vibration levels, locations of recording stations and length of record for data • Description of existing ambient light levels for areas where project activities could have an environmental effect on light levels • Description of night-time illumination levels during different weather conditions and seasons	Section 3.6.1 Section 3.6.1 Section 3.6.2 Section 3.6.2	EARD Section 6.0

Table 1.5-1 Table of Concordance

Focus Report Requirement (by section)	Section where Requirement is Specifically Addressed in this Focus Report	Location of Additional Information Related to the Requirement
Ecological Value • Characterization of study area's ecological value in terms of rare, unique, or provincially under-represented ecosystems, landscapes and wilderness attributes	Section 3.7	EARD Section 9.0
Recreational Value • Description of current and traditional recreational land and water use • Description of methodology and details of stakeholder engagement	Section 3.8 Section 2, 5 and 6	EARD Section 4.0 and 11.0 EARD Section 4.0
4.0 Adverse Effects and Environmental Effects Assessment		
Lighting • Description of potential lighting requirements and range of influence • Description of potential effects on the study area	Section 4.1 Section 4.1	EARD Section 9.0 Not applicable
Noise and Blasting • Quantitative assessment of anticipated project related noise levels, potential effects and comparison with baseline levels • Discussion of blasting locations, frequencies and potential effects on the study area	Section 4.2 Section 4.2	EARD Section 6.0
Air Emissions and Dust • Emission summary of contaminants from project activities and quantitative analysis using dispersion modelling • Description of potential distribution of air emissions and dust within the study area • Description of known or potential impacts of projected sulphur dioxide emissions on the nine species of red and yellow listed cyanolichens known to occur in the mine development area • Description of known or potential impacts of projected sulphur dioxide emissions on the nine species of red and yellow listed cyanolichens and boreal felt lichen within a 100km radius surrounding the proposed development area	Section 4.3 Section 4.3 Section 4.3.1 Section 4.3.1	EARD Section 2.6.7 & 5.0
Visual Impact • Assessment of the visual impact of the mine site on the study area	Section 4.4	EARD Section 3.0

Table 1.5-1 Table of Concordance

Focus Report Requirement (by section)	Section where Requirement is Specifically Addressed in this Focus Report	Location of Additional Information Related to the Requirement
Impacts to Surface and Ground Waters • Description of releases that could occur under normal conditions and under 'worst case scenario' including tailings dam failures, extreme weather events and climate change influence • Description of project related water withdrawal and any interactions with groundwater which may impact the downstream environment and discussion of effects	Section 4.5 Section 4.5	EARD Section 7.0 & 8.0
Soil Contamination • Description of the expected concentrations of arsenic and metals in the tailings post-closure relative to soil quality guidelines • Identification of potential 'hotspots' within the tailings such as locations of disposal of arsenic-rich sludges • Description of expected forms in which arsenic will occur and the expected stability of these forms	Section 3.9 Section 4.6 Section 4.6 and 6.0	EARD Section 2.6.5
5.0 Mitigation Measures and Monitoring		
Description of all measures taken to avoid or mitigate negative impacts and maximize positive environmental effects of the project	Section 6.0, 7.0	EARD Sections 5.2, 6.2, 7.2, 8.2, 9.3, 10.2, 11.2 & 12.2
Description of reclamation plans	Section 7.6	EARD Section 2.7
Description of monitoring programs used to determine whether mitigation measures are adequate and description of how baseline data collection and future monitoring programs relate	Section 6.4.4, 6.6.3, 7.2	EARD Sections 5.2, 6.2, 7.2, 8.2, 9.3, 10.2, 11.2 & 12.2
Description of contingency plans to address accidental releases	Section 6.4.6, 7.4	EARD Section 2.6.8
Description of proposed compensation that will be provided when environmental damage is unavoidable or cannot be adequately mitigated	Section 7.5	EARD Section 2.6.8

1.6 ORGANIZATION OF THE FOCUS REPORT

Section 1 provides an introduction and purpose for the Focus Report., information on the Study Area and Project Description. Section 2 discusses methods for carrying out the undertaking, information on the Project Design, and the numerous ways in which DDV Gold has sought to design the best possible project. Section 3 provides the Study Area Description including specific details required in the TOR on the physical, ecological and recreational features. Section 4 contains the important effects assessment and the ways in which this was completed. Section 5 describes the thorough and extensive consultation process and dissemination of information about the project. Section 6 provides answers to over 250 questions about the project and provides comprehensive detail regarding impact mitigation measures. Section 7 contains the ways in which the identified effects will be addressed and the ways in which potential effects are to be monitored, mitigated and/or compensated. Included in Section 7 is an itemized list of over 300 mitigation and monitoring measures employed in the project design. Section 8 is a brief summary of key results. Section 9 provides references, both cites and personal communications.

The Focus Report text references a large number (30 in total) of appendices (Appendix A to Appendix DD) that provide important back-up information. For the most part the appendices contain specialist consultant reports in their entirety while some contain only information pertinent to the Terms of Reference for the Focus Report or have proprietary information excluded. All appendices have been identified in the Table of Contents and then referenced in the text at least once.

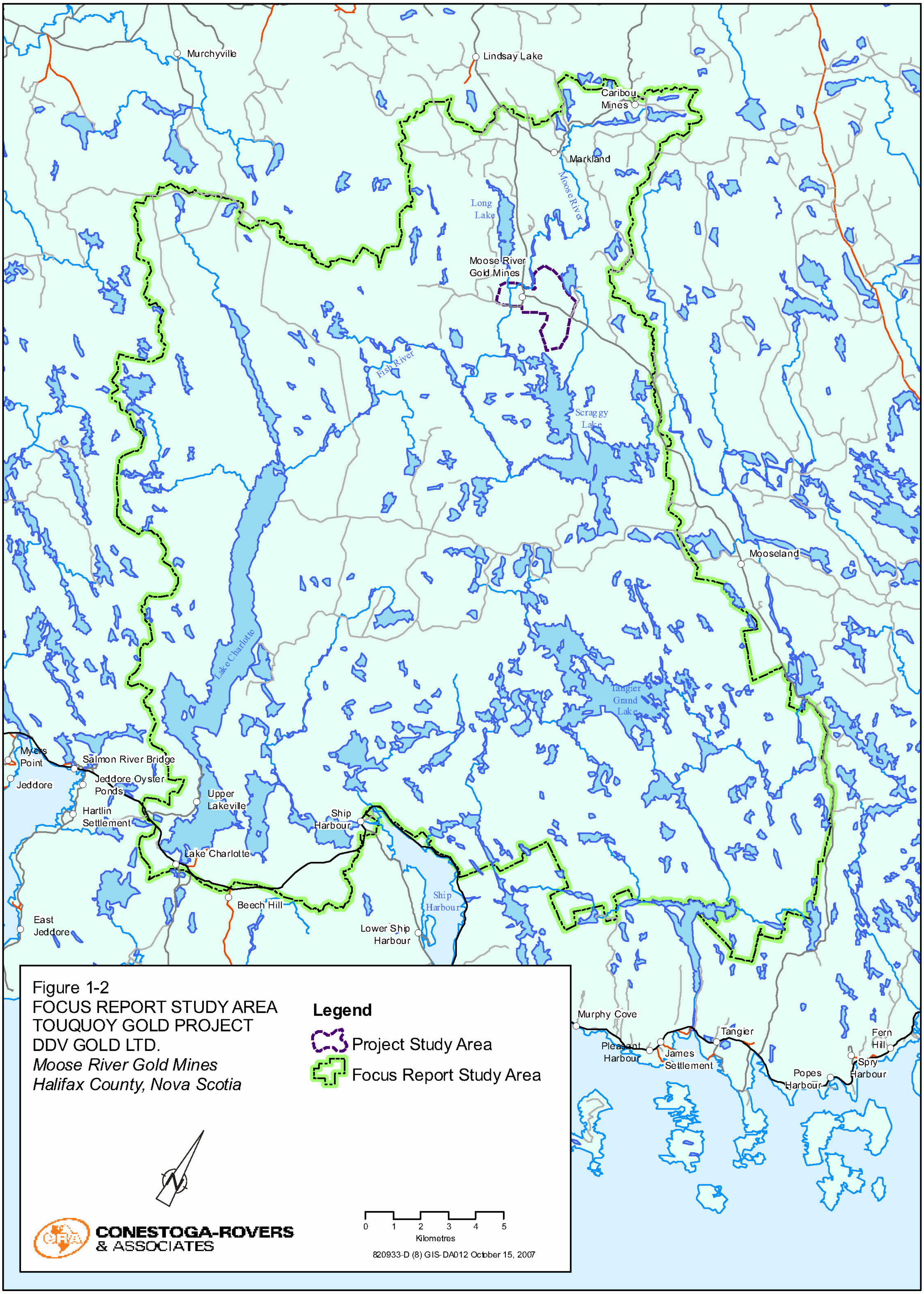


Figure 1-2
FOCUS REPORT STUDY AREA
TOUQUOY GOLD PROJECT
DDV GOLD LTD.
Moose River Gold Mines
Halifax County, Nova Scotia

CONESTOGA-ROVERS & ASSOCIATES

820933-D (8) GIS-DA012 October 15, 2007

2.0 PROJECT DESIGN PROCESS

2.1 OVERVIEW

The Project design process involves several phases as shown in Figure 2.2-1. Development scenarios are first evaluated for technical feasibility. Feasible schemes are then assessed on an economic basis. Finally, social and environmental impacts of the Project plan are considered.

At each stage, an unsatisfactory result may cause the previous basis to be re-evaluated. For example, a technically feasible plan may prove uneconomic causing a new approach to be adopted. Similarly, an environmental impact may have an economic impact or require mitigation which can addressed through modifying the technical plan. The iterative nature of the process ensures that issues are considered in the context of the entire Project and not in isolation.

Technical and economic evaluation occurs prior to addressing environmental and social issues because without a practical, economic plan there is no investment, no reason for development, and no impact. Just as important, however, is the fact that sustainable projects which can meet their environmental and social obligations must have a sound economic basis.

2.2 DESIGN PRINCIPLES

The Project design was based on a number of guiding principles since inception. The TOR for the Focus Report specifically requested ways in which these design principles were used in project design. These are listed as follows:

1. Constrain environmental impacts to the property itself.

2. Minimize impact on fish habitat and wetlands.

3. Use technology to mitigate impacts that would be otherwise unacceptable.

4. Design the mine to co-exist with the proposed adjacent wilderness area.

5. Ensure local workforce will be capable of operating the mine.

6. Foster activities in the community that will be self-sustaining when mining ceases.

7. Leave no long-lived adverse environmental legacy.

8. Return the site to an equal or better state of usefulness when mining ceases.

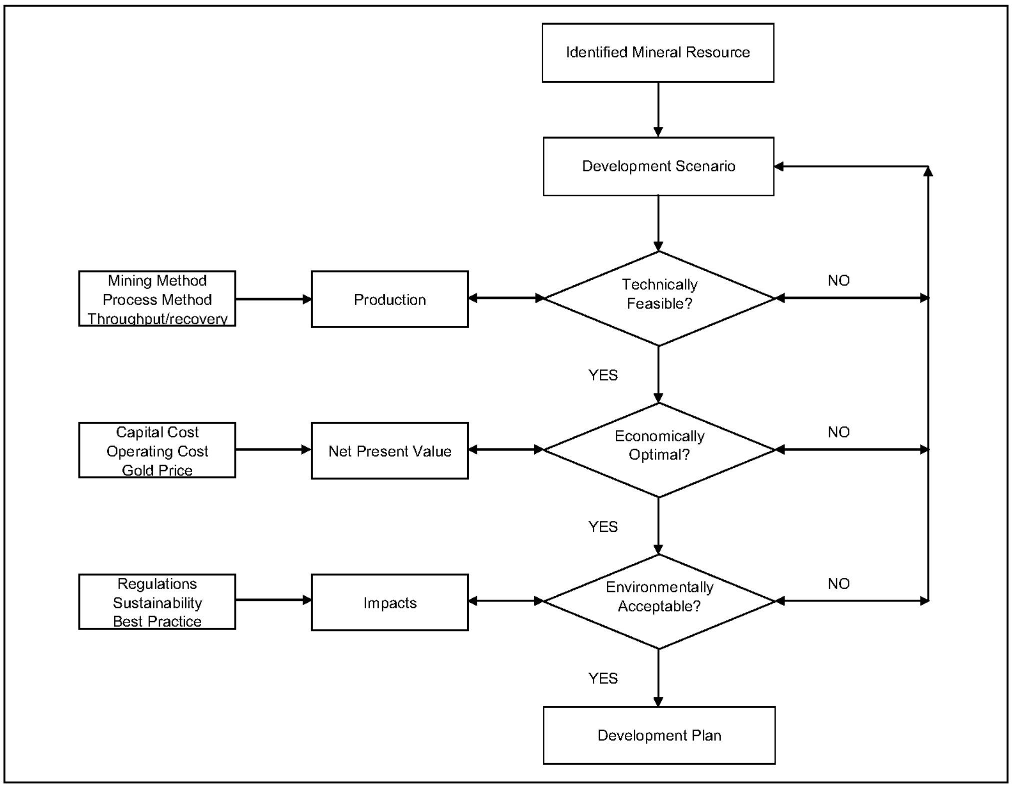


Figure 2.2-1 Project Design Decision Process

2.3 MINERAL RESOURCES

The basis for the process is the identification of a mineral resource with potential economic value. The Touquoy gold deposit hosts mineable resources of 7.6 Mt grading 1.6 g/t gold and an additional 2.9 Mt of "inferred" resources at a similar grade within the open pit boundaries. The inferred resources are expected to be upgraded by in-fill drilling conducted as part of the Project development. Total gold resources are approximately 555,000 oz.

Typically, gold deposits in Nova Scotia are hosted by narrow, steeply dipping, quartz-carbonate vein structures. The veins contain coarse (visible) gold and mineralization is relatively high grade (> 5 g/t). The host rock is hard and generally barren. In contrast, the Touquoy deposit is characterized by both quartz-carbonate veining containing coarse gold and disseminated, low grade (< 2.0 g/t) mineralization in the surrounding host rock, the latter style predominating. Together they comprise an orebody amenable to development by low cost, bulk mining methods.

2.4 TECHNICAL ASSESSMENT

2.4.1 MINING METHOD

This phase of Project design focuses on determining the most practical, economical and lowest risk way to develop the deposit. At Touquoy, the theoretical alternatives are either open pit or underground mining. Open pit mining is significantly less expensive than underground mining as shown in Table 2.4-1 and is usually the method of choice for developing low grade, near surface deposits such as Touquoy. The fact that underground mining may be more attractive in terms of limiting surface disturbance or the size of the waste rock stockpile is addressed in environmental assessment phase of the Project design. However it would be decidedly uneconomic.

2.4.2 PROCESSING METHOD

Processing options include (1) gravity only, (2) flotation with offsite smelting, and (3) gravity and carbon-in-leach (CIL). Gravity only recovery would be attractive because it requires no toxic reagents (cyanide), however, recovery would only be about 60% meaning almost half the gold processed would never be extracted.

Flotation with off-site smelting similarly would avoid the use of cyanide. Flotation recovery for Touquoy ore is high (93%). A concentrate equivalent to about 10% of the volume milled would be collected and shipped to a smelter (nearest in Quebec) for gold extraction. The cost of shipping and smelting with contract penalties for high levels of arsenic in the concentrate would add untenable cost.

The last option is gravity concentration followed by CIL. The coarse gold is removed mechanically, the fine gold is leached with cyanide, and 93% of all gold is recovered on site. This process requires cyanide management in line with the International Cyanide Management Code (Appendix B) and an appropriate waste facility as with the other two options, but these systems are conventional, effective, well-proven, and relatively low cost.

2.4.3 SCALE OF OPERATION

Along with recovery, mill throughput is a key technical driver. At a given grade, the more ore that can be milled annually, the more gold that can be produced in that year. As throughput increases so does capital cost but this can be offset by lower operating costs derived from economies of scale.

Economies of scale cannot continue indefinitely. The mine and process plant cannot be made so big that the orebody is mined so fast that there is insufficient time to depreciate the investment. Generally, for a Project with a reserve of Touquoy's size, five years would be the minimum mine life. Table 2.4-2 shows how throughput affects mine life and economics. All figures are in Canadian Dollars.

Table 2.4-1 Comparison of Indicative Operating Costs for Touquoy Gold Project

Mining method	Open Pit	Open Pit	Open Pit	U/G	Open Pit	U/G	U/G	U/G
Process method	G/CIL	G/CIL	Flotation	G/CIL	Flotation	Flotation	G/CIL	Flotation
Process rate (tpd)	4500	1000	4500	4500	1000	4500	1000	1000
Cost $/t	20.00	29.00	32.00	35.00	41.00	47.00	63.00	75.00

Table 2.4-2 Illustration of Economies of Scale Open Pit Development for Touquoy Gold Project

Reserve	Mt	10	10	10	10	10
Throughput	tpd	1,000	2,000	3,000	4,000	5,000
Operating cost	$/t	28.00	26.00	24.00	22.00	20.00
Minelife	Yrs	30	15	10	7.5	6
Capital cost	$M	65	70	75	80	90

2.5 ECONOMIC ASSESSMENT

2.5.1 CAPITAL COST

Capital cost is the initial investment required to bring the Project into production. The elements associated with the capital cost for the Touquoy Gold Project can be found in Table 2.5-1. As shown, the capital cost for an open pit development would be less than that for an underground mine. It can be seen that the cost of an underground mine at

Touquoy would probably be 50% more than that for a similar sized open pit development.

Underground mining is very capital intensive because prior to mining, access to the orebody must be developed in the surrounding waste rock. Also, underground mining is generally conducted on a smaller scale than open pit mining. Underground development is best suited for the selective extraction of small, high grade ore zones using small equipment in limited working areas. An underground mine generating 4,500 tpd would be considered a large operation requiring more equipment and development relative to a similar sized surface mine. Thus it would have a higher capital cost.

Table 2.5-1 Comparison of Indicative Capital Costs for Touquoy Gold Project

	Open Pit 4500tpd	Underground 4500tpd	Open Pit 1000tpd	Underground 1000tpd
Total capital cost ($M)	84	126	66	84

2.5.2 OPERATING COST

Table 2.4-1 compares the cost of various open pit and underground development schemes. Open pit mine development is less expensive than underground mine development regardless of scale. Economies of scale make a larger, 4,500 tpd, operation far more cost effective than a smaller, 1,000 tpd, operation.

Gravity/CIL recovery is the most cost effective form of processing. Flotation concentration is less expensive than gravity/CIL (about 20% less) because it does not use cyanide management systems, elution, or goldroom operations. It must be recognized, however, that flotation only generates an intermediate product, concentrate, which must then be smelted to extract the gold. Shipping and smelting add significant additional cost which makes the option uncompetitive.

2.5.3 FINANCIAL PERFORMANCE

The Project value is assessed on the basis of net present value (NPV). Annual cash flows are calculated for each year of the Project life and discounted back to the present for comparative purposes. The cash flows represent net income and consider capital, revenue, operating costs, interest, and taxes. The development plan with the highest NPV is the most economically attractive.

A simpler approach to quickly assessing the suitability of a development scenario is through the concept of payback. Payback considers how long it takes to repay the original capital investment on an undiscounted basis. The more cash generated from operations in excess of costs, the shorter the payback and the more attractive the Project is as an investment.

Table 2.4-2 shows that a very small scale operation (1,000 tpd) would last for almost 30 years. The size of the development would have lower capital cost ($65 M v. $85 M) than the design and could potentially lessen environmental impact but the payback period would be so long (about 15 years) that such a development scheme would be financially unattractive.

It can be seen that as the production level increases so does capital cost. This added burden is offset by economies of scale which reduce operating costs and Project life but speed payback. Table 2.4-1 shows that for the Touquoy deposit, open pit development using gravity/CIL processing at a rate of 4,000-5,000 tpd provides the optimal trade-off between capital investment, mine life, and payback.

2.6 ENVIRONMENTAL ASSESSMENT

2.6.1 ASSESSMENT PROCESS

Once a technically feasible and economically attractive development plan has been identified, the design process assesses the impact on valued environmental components (VEC) on the Project site and in the surrounding area. For the Touquoy Gold Project, these elements are identified as:

- Aesthetics: Noise and Visual impact
- Air and Water Quality
- Recreational Value and Wilderness Experience
- Flora/ Fauna and associated Habitat
- Access and Community

The design process assesses the impact of the development on each of these elements in the context of (1) regulatory standards, (2) best practice, and (3) sustainability. For example, noise from operations would be considered in terms of:

- Does it meet applicable standards?
- Is the proposed operating plan the best way to manage impacts for this development?
- Is the proposed operating plan sustainable (as opposed to one which results in ongoing, cumulative impact)?

2.6.2 IMPACT MANAGEMENT

Impact is qualitatively described in terms of none, low, moderate, and high. The goal of the Project design process is to formulate a development plan which minimizes impact. Impact can be minimized through design, mitigation, or compensation.

Design offers the opportunity to eliminate impact by designing facilities, processes, and procedures which eliminate the opportunity for impact to occur. For example, the Project facilities were sited to avoid disturbing fish habitat and avoiding wetlands. As a result, no fish habitat on the site is impacted and wetland disturbance is minimized.

Mitigation includes all measures which are designed to limit or nullify a potential, unavoidable impact. The fact that water must be discharged from the site contributes to the use of three complementary water treatment systems, cyanide destruction, settlement and natural degradation, and effluent treatment, to mitigate the impact on the downstream receiving waters (see Appendix C - Effluent Treatment Design Report).

Compensation entails payment for or replacement of VECs which are unavoidably impacted by development or due to a failure of operating safeguards. An example of unavoidable impact would be replacement of 4.3 ha of wetlands destroyed during construction of the tailings facility. These will be replaced by the company at a ratio agreed with NSDNR. An example of compensation due to a failure of operating safeguards would be insurance carried by the company to address the impacts of a dam failure.

2.7 PROJECT DESIGN REVIEW

The technical and economic assessment concluded that the optimal development plan for the Touquoy Gold Project was an open pit mine and process facility employing gravity and CIL gold extraction. The associated infrastructure would include a waste rock stockpile and tailings management facility (see Appendix D – Tailing Dam Design Document.

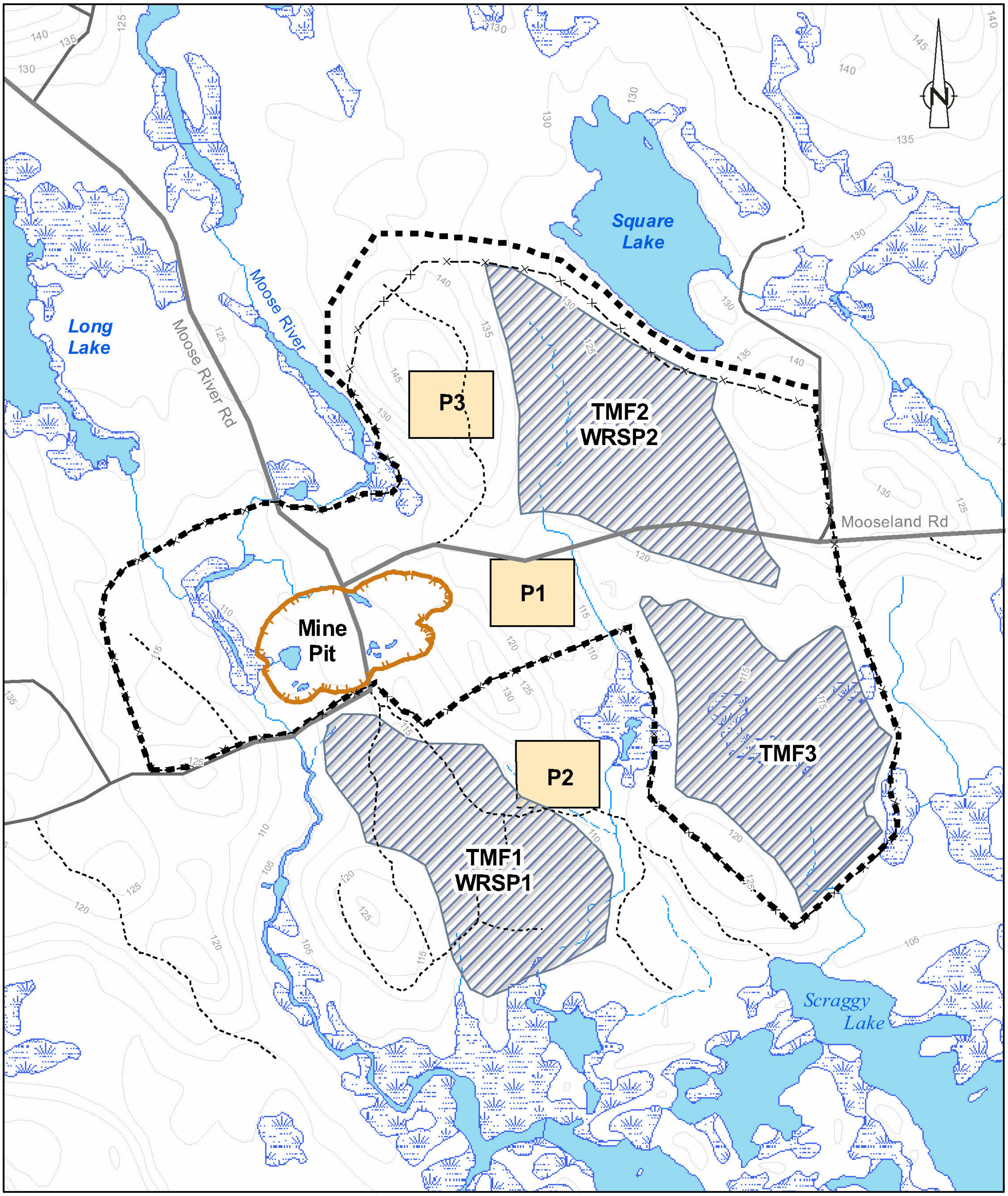


Figure 2-2
MINE LAYOUT OPTIONS
TOUQUOY GOLD PROJECT
DDV GOLD LTD.
Moose River Gold Mines
Halifax County, Nova Scotia

Options

🟨 Plant Locations

▨ Tailings Management Facility
Waste Rock Storage Pile

0 0.2 0.4 0.6 0.8
Kilometres

CONESTOGA-ROVERS
& ASSOCIATES

820933-D (8) GIS-DA022 October 29, 2007

Several possible arrangements were considered for the facilities to determine the optimal location for each. These layouts are shown in Figure 2-2. In some cases, the position of a facility was independent of other infrastructure while in others the locations were linked. The results of the Project design review with respect to VECs are summarized in Table 2.12-1. The following sections provide a detailed discussion of the impacts resulting from each facility given various design assumptions.

2.8 OPEN PIT

2.8.1 Location

The open pit size and location is a function of the orebody. There are no alternatives to relocating the open pit.

2.8.2 Visual Impact

The open pit will be screened from the public road by trees. It will not be visible from Scraggy Lake, 1 km to the south due to topography and intervening forest. At night, equipment will use headlights for visibility. Every 10 minutes one truck will travel to the crusher and two to the waste rock stockpile. These vehicles will be occasionally visible from the public road and from the north end of Scraggy Lake.

2.8.3 Noise

Equipment noise will be 80-100 dB, attenuating to background, 40 dB, over a distance of 500 metres. As the open pit is 1 km from Scraggy Lake, mining activities will not have a noise impact there. Occasionally, equipment will be working on the dam; in these instances noise reaching the north shore of Scraggy Lake will be 60 dB.

Blasting noise will be heard up to 1 km away (north end of Scraggy Lake). Blasting noise will be momentary, once a day, five days a week. Blasting noise at the north shore of Scraggy Lake will be similar to a car door slamming.

The nearest regular seasonal human receptors are the fishing/hunting camps on Scraggy Lake 2 km south of the mine and Camp Kidston, 3 km north of the mine. Bands of trees left throughout the Project site will assist in dampening sound generated by operating activities.

2.8.4 Air Quality

The mining fleet is composed of 10 units of heavy equipment and various light vehicles. Greenhouse gas emissions will be 7,000 tonnes per year which will have negligible effect on air quality in the Project area. Gases generated by blasting will dissipate in the atmosphere within minutes of shooting without any harmful effects.

Moisture content of the material is considered high at 4% inhibiting dust generation. Dust produced from excavation and blasting will be confined to the open pit area. Roads will be watered as required to prevent generation of dust. A complete listing of measures can be found in the Project Fugitive Dust Management Plan (Appendix E).

2.8.5 Water Quality

All water from the open pit will be pumped to the tailings facility where it will either be re-cycled for processing or treated and discharged. The impact of water discharged from the TMF is covered under Tailings Management Facility (Section 6.4).

Hydrogeologic investigations supported by drilling and packer testing indicate that there is no transfer of water between the Moose River and subsurface areas of the pit. Appropriate blasting practices are not expected to encourage transfer of water between the pit and the river.

2.8.6 Recreational Value

Recreational activities will (obviously) not be permitted within the area of the open pit. This land use will probably reduce the use of off-road recreational vehicles in the area. Canoeing on the Moose River would be interrupted briefly during times of blasting. However there has been little evidence of such activity, due in part to the shallow nature of the river in summer, and any canoeists put in further south to access the Fish River system.

The recreational value of the adjacent wilderness area will not be reduced by noise, light, air emissions, or mine water discharge. The enjoyment of hunting, fishing, camping, or canoeing in the adjacent wilderness area will not be affected. The presence of the mine may deter poachers who previously used Moose River Gold Mines as a point of access to the adjacent wilderness area.

2.8.7 Wilderness Experience

The wilderness experience of anyone on the north shore of Scraggy Lake would be occasionally diminished by noise generated from activities on the tailings dam 300 m to the north. The only indication on the north shore of Scraggy Lake of recreational use is three boathouses in various states of disrepair. The wilderness experience of canoeists on the Moose River would be marginally diminished by the sound of equipment from the open pit and interruptions due to blasting if these occur when they are passing the mine site area.

2.8.8 Flora & Fauna

The open pit is located west of the area identified to contain rare cyano-lichens. The open pit area was clear cut within the last 10 years and is in various stages of regrowth. The area is not considered prime moose habitat due to the ongoing human presence on the site.

The open pit will be fenced to prevent entry by animals. The open pit does not present a barrier to migratory or wide-ranging species. Animals will be able to pass through the shelter barriers along watercourses or easily bypass the site altogether.

2.8.9 Habitat

The open pit does not contain any unique or special habitats. The open pit will be 75 m from the Moose River at its nearest point. The riparian habitat along the Moose River has been degraded by human activity. Affected areas will be regenerated in consultation with authorities to ensure a minimum 30 m buffer exists along the river edge. Development of the open pit does not impact habitat in any way in the adjacent wilderness area to the south.

2.8.10 Landscape

The development of the open pit does not disturb any unique landforms or landscapes. At closure the open pit will flood creating a lake similar to those scattered throughout the area. The flooded mini-pit, excavated in 1989, shows that even without any reclamation efforts the mine will return to a natural state over time.

2.8.11 Access

The public road which currently runs through the proposed open pit will be relocated 200 m to the north. A fence will prevent unauthorized access into the pit area from the public road.

Mining activities will neither increase nor diminish access to Scraggy Lake. Access to the area west of Moose River will be disrupted by pit development. New access to the west side of Moose River will be established from north of the community by upgrading an existing logging track.

2.8.12 Community

A large portion of the community site falls within the open pit. All structures will be removed prior to development. Hydro-carbon contamination from the old town site will be disposed of at an approved facility. More than half the pit area has been subjected to some form of human disturbance due to the community, historic mining, or forestry activities.

At least two areas in and around the open pit have been identified to contain tailings from historic mining. These will be cleaned up as a part of the pit development. A risk assessment will be done to ensure that remediation of historic tailings outside the pit boundaries does not mobilize contaminants that could affect downstream areas.

The open pit will encompass the area currently occupied by the provincial park. The charter for the park provides for mining within its boundaries as its purpose is to commemorate both the mine rescue of 1936 and the long mining history of Moose River Gold Mines. Subject to consultation with stakeholders and to public safety and environmental considerations the park will be relocated to a position overlooking the pit where an interpretative centre will be established to preserve the history presently housed in the aging museum.

2.9 WASTE ROCK STOCKPILE

2.9.1 Location

The Waste Rock Stockpile (WRSP) could be located in the large clear cut area south of the open pit or to the east, between Square Lake and the public road. Establishment of the WRSP south of the open pit would be operationally most desirable as it provides the shortest haul, the land has been cleared, and regrowth is not well advanced. However, this area contains a stream classified as fish habitat which would be destroyed.

Also runoff from the WRSP would have to collected and pumped to the tailings management facility (TMF). The area east of the open pit between the public road and Square Lake is partially cleared. It is an extra 1 km away from the open pit making for a longer haul which adds cost and emissions in the form of vehicle exhaust from additional equipment hours. The WRSP in this location can be sited to avoid the fish habitat to the west and is ideally located to drain runoff to a TMF sited south of the public road.

2.9.2 Visual Impact

The WRSP will be approximately 40 m high at completion. The final crest elevation will be 166 m ASL compared to 152 m ASL for the mill hill 500 m to the west. As the surrounding hills will be fully treed the relative heights will appear similar. The first two lifts (20 m) will be screened from the public road by trees. Each 10 m lift will be re-sloped to 2.5:1 (h:v), covered with topsoil, and seeded as it is completed. The slopes will be vegetated with native grasses and shrubs. At the finish of mining, 80% of the stockpile will already be returned to a natural state leaving only the remainder to be reclaimed within one to two years of mining cessation.

The upper lifts (3 and 4) of the WRSP will be visible from locations on the property and from the few locations in the adjacent wilderness areas which are treeless. At night, headlights from equipment may be occasionally visible on the upper lifts from the property and only rarely from the adjacent wilderness area.

2.9.3 Noise

No more than one truck and one bulldozer are anticipated to be working on the stockpile at any given time. Waste dumping activities will generate sound on the order of 80 dB which will attenuate to background levels within 500 metres. Activities on the WRSP will not be heard above guidelines at Scraggy Lake or in the adjacent wilderness area.

2.9.4 Air Quality

Dust from waste dumping will be inhibited by the high, 4%, moisture content in the material. Roads on the dump will be watered as required. The progressive reclamation described previously will minimize the amount of exposed rock on the dump at any given time. The moist climate will further inhibit generation of dust on the dump. The Project Fugitive Dust Management Plan details all dust control measures.

2.9.5 Water Quality

Runoff from the WRSP may contain arsenic leached from the surface of exposed rock. All runoff will be directed by ditches employing gravity flow to the TMF where that water will be either re-cycled for processing or treated and discharged.

2.9.6 Recreational Value

The WRSP will not significantly reduce the value of surrounding lands for hunting, fishing, camping, or canoeing.

2.9.7 Wilderness Experience

The upper lifts of the WRSP will only be visible from treeless sites (clear cuts or bogs) in the adjacent wilderness area. Also, noise and dust effects will not extend beyond the property boundaries. As such, the presence of the WRSP will not significantly diminish the wilderness experience of those using the surrounding lands in the FRSA.

2.9.8 Flora And Fauna

The WRSP does not present a barrier to the movement of migratory or wide-ranging species. Waste dumping does not present a hazard to wildlife, and the noise and human presence will encourage most animals to stay away.

2.9.9 Habitat

The WRSP located at Site (1) will destroy fish habitat while locating the structure at Site (2) does not. At both locations the WRSP will result in direct loss of the terrestrial habitat (clear cuts and re-growth forest) it occupies. This habitat is not highly valued, except the fish habitat at Site (1).

2.9.10 Landscape

As mentioned, the WRSP will blend into the existing landscape based on its size, shape, and plans for re-vegetation. The WRSP does not affect landforms or landscapes in surrounding wilderness areas. Narrow landings of exposed rock will be left between lifts to prevent soil erosion until re-vegetation takes hold.

2.9.11 Access

The WRSP has no effect on access to the adjacent wilderness areas. It does not encroach on the track to Square Lake to the east.

2.9.12 Community

The WRSP has no effect on the existing Moose River Gold Mines community or the nearest other community, Mooseland, 10 km to the southeast.

2.10 PROCESS PLANT

2.10.1 Location

Three plant locations were considered (1) 200 m east of the pit, (2) 500 m south of the pit, and (3) 700 m north of the pit on a low hill. Figure 2-2 shows these layouts.

Site (1), 200 m east of the pit is close to the pit providing for a short ore haul. Overburden is < 1 m thick in the area making it easy to found the mills on bedrock. The site is easily accessible from the main road. Tailings would be pumped to the TMF.

Site (1) is, however, too close to the pit for blasting safety and was located in a drainage that has been classified as fish habitat. Construction in the low ground near the drainage would be problematic as would runoff management. Disturbance of the fish habitat would be unavoidable.

Site (2), 500 m south of the pit, is a safe distance from the open pit for blasting. Overburden is of moderate depth, < 10 m. Access to the plant and offices would require employees and private vehicles to drive through the operating area in order to get to the workplace. This is undesirable from a safety and security standpoint.

Site (2) would also have runoff management issues as it is situated on high ground above the same fish habitat as Site (1). Tailings would have to be pumped to the tailings management facility (TMF) which is less desirable than gravity drainage operationally.

Site (3), 700 m north of the pit is safe for blasting and provides a moderately longer haul to the crusher than Sites (1) or (2). Overburden is deep, up to 30 m. Pilings will add cost to foundation construction for the mills although all other structures can be erected without significant additional cost. Access is easily controlled via an improved road running up the hill west of the waste dump from the NW corner of the TMF. Site (3) will necessitate crossing of the public road by haul trucks.

Runoff from Site (3) can be directed into containment away from the fish habitat but still in the same watershed. Tailings flow will be assisted by gravity.

2.10.2 Visual Impact

Site (3) offers the opportunity to use existing clear cuts to locate the plant and service facilities in already disturbed areas. This means disturbance can be minimized and the view-shed will not be impacted. The ROM pad will be partly visible from the public road but not from other areas in the FRSA. It too will be screened with existing forest that will be left undisturbed. Access to the ROM pad will be via a haul road up the south slope of the hill. Trees will be left in place to screen the road from view.

Site (1) will be visible from the road regardless of trees left to screen it from view. Site (2) would not be visible from the public road or the surrounding areas except across the clear cuts extending to the south.

2.10.3 Noise

The largest source of noise at the plant site is the crushing circuit which is located outdoors. Lesser sources of noise at the plant site are the agitator motors on the CIL circuit and service vehicles. All other process activities are indoors and do not generate significant sound traveling beyond their enclosures.

The maximum sound generated at the plant site is 80 dBA which attenuates to the background of 40 dBA over a distance of 500 metres. Regardless of plant location, noise impacts are limited in the FRSA.

2.10.4 Air Quality

Dust will be generated on the ROM pad by vehicles and at the crushing circuit. The crushed ore stockpile and reclaim facilities will be enclosed. Dust will be minor and will be controlled by the moisture in the ore, precipitation, and water sprays on equipment as required.

Minor air emissions will occur from the process plant. These include carbon dioxide from the kiln, solution heater, and smelting furnace, minor amounts of ammonia from the electro-winning cells, off-gassing of hydrogen cyanide from the CIL circuit, and oxides of nitrogen during smelting. All contaminants are dispersed in the atmosphere to harmless concentrations immediately following release. Airborne contaminants do not pose a health risk to flora or fauna on or off the site.

2.10.5 Water Quality

All runoff from the site will be collected and sent to the TMF for re-use or treatment prior to discharge. Areas designed for reagent storage and use will be concreted with containment provided.

The plant may draw water during start-up from Square Lake, although it is probable that runoff collected during construction will eliminate this need as described in Section 6. In the driest year, the volume in Square Lake will be reduced by 6% which will have nominal effect on lake level. During operations, the plant will draw 20 m^3/hr from Square Lake which is far less than recharge under the driest conditions.

2.10.6 Recreational Value

The plant location does not impact hunting, fishing, camping, or canoeing in any of the adjacent FRSA. No recreational activities will permitted in the actual plant area due to safety concerns.

2.10.7 Wilderness Experience

The ROM pad area will not be visible from the adjacent wilderness area thus the wilderness experience of those in the surrounding countryside will not be affected. Dust and noise will not extend beyond DDV Gold's property boundaries.

2.10.8 Flora And Fauna

The plant will not directly impact any species at risk or other flora and fauna. The plant site is not identified as a habitat for cyano-lichens or moose. No moose sightings or sign have been reported in the plant site area. The plant site does not restrict the movement of moose or other migratory or wide-ranging species. The site will be fenced to prevent entry by animals for their safety. The connectivity of the region's habitat types is not affected by the presence of the plant.

2.10.9 Habitat

The plant is not located in any highly valued or unique habitat. As stated, it will be built into the existing clear cuts on the proposed site with as little additional disturbance as possible. The presence of the plant may make the area less desirable for large mammals. The footprint of the plant site will no longer be available as wildlife habitat, however, the areas adjacent to it will still be populated by flora and fauna tolerant of human presence as is the case of the community of Moose River Gold Mines now and historically.

2.10.10 Landscape

The plant site is located on a drumlin, a common topographic feature formed from glacial till similar to the many low hills in the area. The plant will not affect the shape of the hill and, following closure and reclamation, all of the facilities will be removed.

2.10.11 Access

The plant has no effect on access to the adjacent areas. As mentioned, access to the plant will be by a road leading from the NW corner of the TMF, north past the waste dump and west up the hill. Haul truck access to the ROM pad will be via a haul road constructed up the south slope of the hill. Access to forestry operations, recreation areas and properties to the west of the plant site will be maintained.

2.10.12 Community

The plant site has no effect on the existing Moose River Gold Mines community or the nearest other community, Mooseland, 10 km to the southeast.

2.11 TAILINGS MANAGEMENT FACILITY

In order to assess the impacts of the tailings facility on the VECs at the site and in the surrounding area it is necessary to understand the nature of the Tailing Management Facility (TMF) design and operating plan. Both are based on a risk management plan which seeks to reduce the probability of a loss of containment to as near zero as practicably possible.

2.11.1 TMF Risk Management

The ability to manage risk associated with the TMF is based on a series of fail-safe mechanisms. These measures include (1) design, (2) operating procedures, (3) monitoring, and (4) emergency procedures which are both redundant and complementary. Each risk management measure is backed up by another system with the resulting probability of total failure so small that risk can be managed with a high degree of certainty.

Risk management design features of the TMF include:

- Earthquake resistant structure
- Designed to withstand 80% of the 1/10,000 year seismic event
- Multiple (4) barrier dam design
- Low permeability clay core
- Core cemented into bedrock to retard seepage

- Seepage collection ditches
- Surge capacity sufficient for the 1 in 200 year storm (see Appendix F)
- Spillways to maintain dam stability in the event of an overflow

Risk management operating features of the TMF include:

- Tailings discharged against dam walls to provide an additional barrier to seepage
- Recycle water system allows pond level to be controlled
- Excess water subject to effluent treatment
- 60 day retention time that ensures settling and natural degradation of residual cyanide
- 30 day holding capacity in polishing pond
- Seepage or treated water not meeting quality standards to be pumped back into pond

Risk management through monitoring includes:

- Visual inspections (daily/monthly/quarterly)
- Pond level measurements (daily)
- CN destruct performance (hourly)
- Effluent treatment performance (hourly)
- Discharge water quality (daily)
- Groundwater wells (weekly)
- Structural settlement surveys (monthly)
- Environmental effects (monthly/quarterly)

Risk management for emergency procedures includes:

- Protocols to respond to increased levels of inflow
- Increased monitoring frequency
- Deployment of siltation barrier
- Notification procedure
- Contingency plans to pump TMF water to the open pit if needed
- Contingency plans to build up dams or provide containment using mine equipment

2.11.2 Location

Three possible locations for the TMF were examined.

- Site (1) South of the open pit
- Site (2) East of the pit between Square Lake and the public road
- Site (3) East of the pit between the public road and Scraggy Lake

Site (1) is judged unsuitable due to its proximity to the Moose River and its conflict with the fish habitat in drainage south of the pit. Discharge to the Moose River would be problematic because in dry years it is reduced to a series of sluggish pools. Gravity drainage of runoff from the WRSP is not possible without facilities directly impacting wetlands or fish habitat. This site would require the longest length of tailings line to TMF which adds cost and risk and could be subject to additional risk if the Moose River were to flood.

Site (2) is practical. It too however would conflict with fish habitat and impose on the wetlands surrounding Square Lake. As the ground slopes north to south the TMF would threaten the public road if, as is highly unlikely, it failed. The cost of earthmoving necessarily required to slope the TMF towards Square Lake as the receiving waters, would impair Project economics.

Discharge into Square Lake may impact aquatic life there due to the small volume of the lake (640,000 m^3) relative to the average annual discharge volume of the TMF (1.5 M m^3). If a total dam failure occurred, Square Lake would not contain the bulk of the tailings which would flow south by gravity. <u>If the TMF were prone to failure</u> then directing the potential outflow towards Square Lake would protect the downstream watershed but the lake would be severely harmed by operations.

Use of Site (2) for the TMF would preclude use of Square Lake as a source of raw water. The length of tailings line to the TMF would be minimized but gravity drainage of runoff from the WRSP would not be possible, since, because of areal constraints, the WRSP would be located downslope of the TMF.

Site (3) has sufficient area to accommodate the TMF without imposing on the fish habitat to the west and makes use of a natural basin which facilitates containment. It contains 4.3 ha of wetlands which can be readily replaced at agreed ratios elsewhere on the site or local area.

The location is proximate to Scraggy Lake which provides a large volume of receiving waters (21 M m^3) that would mitigate impacts to resident aquatic life. The geography of

Scraggy Lake makes the lake easily sealed 2 km south of the north shore in the highly unlikely event of a dam failure. Locating the WRSP to the north makes it possible to drain runoff to the TMF by gravity. At this site the TMF will readily capture all run-off from the entire mine site. The tailings line is of moderate length and readily managed.

2.11.3 Visual Impact

The TMF is comprised of a series of rockfill dams. The main impoundment is approximately 100 ha in area with dams on three sides totaling about 3000 m in length. Directly south of the tailings impoundment is the polishing pond which occupies an additional 30 ha. The height of the main and polishing pond dams at closure will be 14 m and 6 m respectively.

Site (1) will not be visible due to its remote location. Site (2) may be visible from the public road if the downstream side of the facility faces the road. At site (3) the TMF will be screened from the public road by a barrier of trees a minimum of 30 m wide and from Scraggy Lake by a band of forest 200 m in width. As such, the facilities will only be visible by driving directly onto the dams themselves. The discharge into Scraggy Lake will make use of an improved natural channel and be blended into the shoreline.

2.11.4 Noise

The only significant noise at the TMF will come from equipment engaged in raising the dam. This will occur periodically, primarily in the summer. Equipment noise reaching a canoeist or other recreational user of the area located on Scraggy Lake will be no more than the ambient 40 dBA measured elsewhere on site.

2.11.5 Air Quality

Off-gassing of HCN gas due to the natural breakdown of free cyanide in the tailings water will be undetectable 1 m above the surface of the pond. Cyanate, the product of the cyanide destruction process, decomposes into CO_2 and ammonium. The generation of ammonia is inhibited by a mildly alkaline pH in the facility and discharge into low pH receiving waters.

Dust from the tailings beach will be minimized by frequent moves of the discharge point to maintain a wetted beach. Details can be found in the Project Fugitive Dust Management Plan (Appendix E).

2.11.6 Water Quality

Tailings are subject to cyanide destruction at the process plant before flowing to the TMF in a 250 mm HDPE double-contained pipeline. SO_2/Air cyanide destruction is proven 99.5% effective in destroying CN_F and CN_{WAD} into cyanate which decomposes harmlessly. Laboratory testing shows that CN_{WAD} in the tailings impoundment will be about 1.5 ppm.

All water entering the TMF is subject to settlement over a period of 30-60 days during which time residual CN_F and CN_{WAD} undergo natural degradation due to the effects of oxidation and sunlight. All runoff from the WRSP, plant site, and mine water from the open pit is also directed to the TMF. 90% of the process water used is recycled from the tailings pond with the excess (1.5 M m^3/yr) subject to treatment and discharge.

Treatment of tailings effluent at the polishing pond removes dissolved arsenic and other metals. Treated water is held in the polishing pond for up to 30 days to ensure quality before discharge. At discharge arsenic concentration is 0.04 ppm and CN_T concentration is < 0.1 ppm compared to MMER standards of 0.5 ppm and 1 ppm respectively.

At closure, runoff will be diverted away from the TMF. Water draining through the sites will continue to be treated until it is shown to have returned to pre-development quality. Waste from effluent treatment will be stored in clay-lined containment cells within the TMF and will remain there in a chemically stable condition permanently (see Appendix G - Containment Cell Design Report).

2.11.7 Discharge

Effluent could be piped to Moose River for discharge from Site (1). The average flow in Moose River is significant, 6000 M m^3/yr. Moose River may host a small salmon population. Some years, however, Moose River dries up into a series of pools. Sufficient dilution could not be guaranteed in this event, possibly resulting in impact.

Discharging into Square Lake from Site (2) would introduce an annual volume of effluent three times that of the lake. Relatively low inflow and outflow would result in limited dilution of effluent. Discharge would probably have a significant effect on aquatic life.

Discharge from Site (3) to Scraggy Lake would benefit from the large lake volume of 21 M m^3. Sufficient inflow exists to ensure that effluent will be diluted to CCME levels. No impact on aquatic life is anticipated. It is concluded that Scraggy Lake provides the best opportunity to discharge without impact to the receiving environment (see Appendix H - Water Quality Report).

2.11.8 Recreational Value

None of the proposed sites affect recreation outside the property boundary. All site locations would restrict recreation in the facility area.

2.11.9 Wilderness Experience

None of the proposed sites would impinge on the wilderness experience enjoyed in the adjacent lands. Noise and air quality are not impacted, the structure is not visible, and water quality is managed to protect aquatic life. Careful construction and siting of the discharge point into Scraggy Lake will promote the natural appearance of the shoreline.

2.11.10 Flora And Fauna

A lichen survey of the potential TMF sites resulted in no additional discoveries of rare lichens. Moose will be able to move past the facilities without hindrance. All sites will be fenced to prevent access by large mammals.

2.11.11 Habitat

Site (1) and (2) both destroy fish habitat. Site (3) destroys 4.3 ha of wetlands which can be readily replaced as required. No other significant habitats exist on the three sites.

2.11.12 Landscape

None of the potential sites impact unique or poorly represented landscapes. At closure the facility will be drained, the dam slopes flattened, and the impoundments re-vegetated.

None of the proposed sites will restrict access to surrounding areas. Signs will be posted so that those approaching the north end of Scraggy Lake from the track to the west do not enter the operating area.

2.11.13 Community

None of the TMF sites impact any existing communities. The possibility of well impacts on the Eastern Shore as a result of contaminated ground or surface water transfer is negligible. The company will carry insurance to address harm resulting from a failure or other sudden event resulting in an uncontrolled release of contaminants.

2.11.14 Failure Consequences

A worst case failure analysis indicates that a mudflow resulting from a total dam failure would result in the release of 500,000 m^3 of tailings and 2.5 M m^3 of water. This is about 10% of the total final stored tailings volume. Such an event has a probability of 0.0001 in a given year and could only be precipitated by a magnitude 8 earthquake of which none has ever occurred in Nova Scotia.

At Site (1) this mudflow would bury the Moose River. At Site (2) it would bury Square Lake or, depending on the TMF configuration, flow across the Mooseland Road creating a hazard to public safety. At Site (3) the tailings would be contained in the north end of the bottom of Scraggy Lake with a siltation barrier positioned across the narrows ensuring that little sediment made its way downstream.

From Sites (1) or (2) significant flooding would occur in Square Lake or the Moose River. From Site (3), Scraggy Lake the lake level would rise only 0.35 m. In all cases, the 2.5 M m^3 of untreated effluent would flow downstream through the Fish River and into Lake Charlotte.

There would be impacts on aquatic life but sub-lethal effects would be confined to Scraggy Lake during the initial inflow when mixing is incomplete. The most significant mitigating effect is that untreated water in the TMF will already meet discharge standards **prior to failure**. Downstream water quality would be expected to return to levels below CCME standards in 1-2 years.

2.12 CONCLUSIONS

The project development scheme is dictated by the physical nature of the deposit in terms of size, location, geology, and metallurgy. The implications of these factors on the adopted development plan can be summarized as follows:

- At least half the value in the deposit presents as near surface, low grade, disseminated mineralization suggesting that development will be dependent on low cost open pit methods.
- Sufficient tonnage and grade exists to support bulk mining extraction reinforcing the need to develop the orebody using surface mining methods.
- Grade and style of mineralization is not concentrated enough to bear the capital and operating costs associated with underground development.
- Flotation and direct cyanidation both offer similar recoveries.
- Smelter penalties and transportation costs make it uneconomic to generate a flotation concentrate and ship it to a smelter for gold extraction.
- A process plant milling 4,000-5,000 tpd employing gravity/CIL gold recovery would provide the best trade-off between throughput and capital cost.

Based on the above, a relatively small open pit supplying a 4,000-5,000 tpd process plant employing gravity/CIL gold recovery is the most viable means of developing the property. Assessment of the environmental impacts for the various options available leads to the following conclusions:

- The most significant impact from the development of the open pit is the removal of the existing community.
- The WRSP2 location avoids impact to fish habitat and facilitates effective management of site runoff, albeit at a higher operating cost than the alternative.
- The P3 plant location best addresses safety issues with regard to the proximity of the facility to the open pit and offers site specific opportunities to minimize disturbance and manage runoff, albeit at higher capital cost.
- The TMF3 tailings facility location is superior to the alternatives as it presents no risk to Moose River, Square Lake, and the public road while avoiding destruction of fish habitat on site.
- Given the proposed operating plan and design standards, discharge to Scraggy lake does not present an undue risk for downstream impact nor diminish the value of the adjacent lands.
- The final facility layout is not the lowest cost but represents the design which best mitigates environmental impacts for the chosen development scheme.

These conclusions are summarized in Table 2.12-1 which shows that the chosen development scheme is most desirable in terms of minimizing both on and off-site environmental impacts.

	On-Site Impacts								
Factor	Open Pit	WRSP Site 1	WRSP Site 2	TMF Site 1	TMF Site 2	TMF Site 3	Plant Site 1	Plant Site 2	Plant Site 3
Technical	1	1	1	1	3	1	2	1	2
Economic	1	1	2	2	3	1	0	1	2
Security	0	0	0	1	1	1	2	2	1
Safety	1	0	0	2	3	1	3	3	1
Visual	1	1	2	1	1	1	2	1	1
Noise	1	1	1	1	1	1	1	1	1
Air	1	1	1	1	1	1	1	1	1
Water	1	2	1	3	3	1	1	1	1
Recreation	2	3	3	3	3	3	3	3	3
Wilderness Exp	1	3	3	3	3	3	3	3	3
Flora & Fauna	1	3	1	1	1	1	1	1	1
Habitat	1	3	1	3	3	2	1	1	1
Landscape	1	1	1	1	1	1	0	0	0
Access	1	0	0	3	1	1	0	2	0
Community	3	0	0	0	0	0	0	0	0
Subtotal	17	20	17	26	28	19	20	21	18

	Off-Site Impacts								
Factor	Open Pit	WRSP Site 1	WRSP Site 2	TMF Site 1	TMF Site 2	TMF Site 3	Plant Site 1	Plant Site 2	Plant Site 3
Technical	0	0	0	0	0	0	0	0	0
Economic	0	0	0	0	0	0	0	0	0
Security	0	0	0	0	0	0	0	0	0
Safety	0	0	0	3	1	1	0	0	0
Visual	0	1	1	1	0	0	0	0	1
Noise	1	1	1	1	1	1	0	0	0
Air	1	0	0	0	0	0	0	0	0
Water	0	0	0	2	3	1	0	0	0
Recreation	1	0	0	0	0	0	0	0	0
Wilderness Exp	1	1	1	1	1	1	0	0	0
Flora & Fauna	1	0	0	1	1	1	1	1	1
Habitat	1	0	0	0	0	0	0	0	0
Landscape	0	0	0	0	0	0	0	0	0
Access	1	0	0	0	0	0	0	0	0
Community	0	0	0	0	0	0	0	0	0
Subtotal	7	3	3	9	7	5	1	1	2

Total	24	23	20	35	35	24	21	22	20

Table 2.12-1 Ranking of Project Design Options by Technical, Economic and Environmental Criteria
Note: 0 = Most desirable, 3 = Least Desirable

3.0 DESCRIPTION OF THE FOCUS REPORT STUDY AREA

In concordance with the Terms of Reference for the Preparation of a Focus Report, Section 3 provides a detailed description of the Valued Ecosystem Components (VECs) within the Touquoy Gold Project site and the greater Focus Report Study Area (FRSA). This section characterizes the flora and fauna/rare species and species-at-risk, aquatic resources, atmospheric conditions, surface waters and wetlands within the FRSA. Ambient light and noise levels, ecological value, and recreational value are also addressed in this section.

3.1 FLORA AND FAUNA/RARE SPECIES AND SPECIES-AT-RISK

3.1.1 Vascular Plants

The vegetation communities within the FRSA cover a range of environments, ranging from forested areas and river intervals to granite barrens and wetlands. Soils in this area tend to be acidic and thin, although some intervale-type habitat also occurs along rivers. Wetland, particularly bog, habitats are common. The vegetation in the FRSA is dominated by coniferous forests, which cover over 58% of the study area. Mixedwood forest also occurs, and there are some small patches of hardwood forest. As the FRSA extends to the shores of Ship Harbour, some seashore species may also occur within the FRSA.

Vascular Plants of Special Status

An updated review of the Atlantic Canada Conservation Data Centre (ACCDC) database of uncommon to rare species records resulted in a list of 234 species within 100 km of Moose River Gold Mines. As the FRSA does not extend more than 25 km in any direction from the proposed Project site, all species records which were more than 25 km from Moose River Gold Mines or which have not been given a status ranking by Nova Scotia Department of Natural Resources (NSDNR) were excluded from the potential uncommon to rare plants list for the FRSA. A 2007 Nova Scotia Museum of Natural History (NSM) Environmental Screening resulted in a list of forty species known from the FRSA. A total of 47 species listed by NSDNR were obtained from these sources. Eleven of these are red-listed, while 35 are yellow-listed. These species, along with their habitat requirements, are listed in Table 3.1-1.

Table 3.1-1 Uncommon to Rare Vascular Plant Species Reported from the Region of the FRSA (NSM data) or from within 25 km of the Project Site (ACCDC data)

Binomial	Common Name	NSDNR RANK	ACCDC RANK	Source	Potential Presence In FRSA	Preferred Habitat (Zink 1998)
Anemone quinquefolia	Wood Anemone	YELLOW	S2	NSM 2007	Possible	Wooded riverbanks and shaded intervales.
Minuartia groenlandica)	Mountain Sandwort	YELLOW	S2	NSM 2007	Possible	Granitic ledges and gravel, on coasts at higher elevations
Betula michauxii	Michaux's Dwarf Birch	YELLOW	S2	NSM 2007	Possible	Peat and sphagnous bogs.
Bidens connata	Purple-Stem Swamp Beggar-Ticks	YELLOW	S3	NSM 2007	Possible	Boggy swales, and the borders of ponds, thickets and in ditches behind brackish shores
Botrychium lunaria	Moonwort Grape-Fern	RED	S1	NSM 2007	Possible	Open, turfy or gravelly slopes, shores, and meadows. Usually on basic soils
Botrychium simplex	Least Grape-Fern	YELLOW	S2S3	NSM 2007	Possible	Usually on lakeshores or the mossy edges of streams or waterfalls although it has been reported in a wide variety of habitats.
Carex hirtifolia	Pubescent Sedge	YELLOW	S1S2	NSM 2007	Possible	Calcareous regions, in meadows and thickets, forest slopes.
Carex pellita	Woolly Sedge	RED	S1	ACCDC 2007	Not likely	Wet to dry meadows, marshes, stream banks, lakeshores, open areas and woodlands, low dunes, ditches, and other usually moist, success ional habitats, especially in regions of calcareous soils
Caulophyllum thalictroides	Blue Cohosh	RED	S2	NSM 2007	Possible	Deciduous and intervale forest
Cypripedium reginae	Showy Lady's-Slipper	RED	S2	ACCDC 2007, NSM 2007	Possible	Alkaline swamps and bogs.
Dirca palustris	Eastern Leatherwood	RED	S1	NSM 2007	Possible	Rich deciduous or mixed woods
Eleocharis olivacea	Capitate Spikerush	YELLOW	S2	NSM 2007	Possible	Peaty much of bogs, wet sandy shores, and swales
Elymus wiegandii	Wiegand's Wild Rye	RED	S1	NSM 2007	Possible	Rich streambanks and meadows
Empetrum eamesii	Purple Crowberry	YELLOW	S2S3	NSM 2007	Possible	Exposed headlands on top of lichen bearing rocks with thin soil
Epilobium strictum	Downy Willow-Herb	YELLOW	S3	NSM 2007	Possible	Boggy areas and meadows
Erigeron philadelphicus	Philadelphia Fleabane	YELLOW	S2	ACCDC 2007	Possible	Old fields, meadows and springy slopes
Eriophorum gracile	Slender Cotton-Grass	YELLOW	S2	NSM 2007	Possible	Wet peat and inundated shores
Euthamia caroliniana	Grass-Leaved Goldenrod	YELLOW	S3	ACCDC 2007, NSM 2007	Possible	Dry sandy soils, and beaches
Fraxinus nigra	Black Ash	YELLOW	S3	NSM 2007	Possible	Low ground, damp woods and swamps.
Geocaulon lividum	Northern Comandra	YELLOW	S2S3	NSM 2007	Possible	Sterile soils and damp sands, in acid or peaty

Table 3.1-1 Uncommon to Rare Vascular Plant Species Reported from the Region of the FRSA (NSM data) or from within 25 km of the Project Site (ACCDC data)

Binomial	Common Name	NSDNR RANK	ACCDC RANK	Source	Potential Presence In FRSA	Preferred Habitat (Zink 1998)
						locations, drier bog areas and mesic lichen barrens
Hedeoma pulegioides	American Pennyroyal	YELLOW	S2S3	ACCDC 2007	Possible	Characteristic of stony soils and upland pastures in northern part of NS, occasionally near seashores
Hepatica nobilis	Round-Lobe Hepatica	RED		ACCDC 2007, NSM 207	Possible	Dry, usually mixed deciduous forest
Hudsonia ericoides	Golden-Heather	YELLOW	S2	NSM 2007	Possible	Dry, rocky, and sandy barrens. Recently disturbed areas or on open sandy soils
Hypericum majus	Larger Canadian St. John's Wort	RED	S1	NSM 2007	Possible	Wet or dry open soil
Juncus greenei	Greene's Rush	RED	S1S2	NSM 2007	Possible	Coastal sandy soils and dune hollows
Lilium canadense	Canada Lily	YELLOW	S2S3	NSM 2007	Possible	Rich river or stream intervale meadows and forest
Limosella australis	Mudwort	YELLOW	S2S3	ACCDC 2007	Possible	Low areas by ponds, gravel lakeshores, the muddy edges of ponds behind barrier beaches and muddy river margins.
Listera australis	Southern Twayblade	RED	S1	NSM 2007	Possible	Among the shaded sphagnum moss of bogs or damp woods.
Megalodonta beckii	Beck Water-Marigold	YELLOW	S3	NSM 2007	Possible	Shallow, quiet waters, slow-moving streams, and ponds
Ophioglossum pusillum	Adder's Tongue	YELLOW	S2S3	NSM 2007	Possible	Sterile meadows, grassy swamps, and damp, sandy, or cobbly beaches of lakes.
Polygala sanguinea	Field Milkwort	YELLOW	S2S3	NSM 2007	Possible	Poor or acidic fields, damp slopes, and open woods or bush.
Potamogeton zosteriformis	Flatstem Pondweed	YELLOW	S2S3	ACCDC 2007	Not likely	Lakes and deep rivers in less acid regions.
Rhamnus alnifolia	Alderleaf Buckthorn	YELLOW	S3	NSM 2007	Possible	Calcareous bogs , swamps, swampy woods and meadows, marl bogs in rich alluvial soils
Rudbeckia laciniata	Cut-Leaved Coneflower	YELLOW	S2S3	NSM 2007	Possible	Swales, the edges of swamps, or in gullies - in small colonies
Salix candida	Hoary Willow	RED	S1	NSM 2007	Possible	Calcareous bogs and thickets.
Salix pedicellaris	Bog Willow	YELLOW	S2	ACCDC 2007	Possible	Acid bogs and sphagnous lake shores.
Salix sericea	Silky Willow	YELLOW	S2	NSM 2007	Possible	Low thickets and stream banks
Senecio pseudoarnica	Seabeach Groundsel	YELLOW	S2	NSM 2007	Possible	Gravelly seashores
Spiranthes ochroleuca	Yellow Nodding Ladies'-Tresses	YELLOW	S2	NSM 2007	Possible	Characteristic of the driest sand barrens in southwestern counties. Also near rivers and in dry

Table 3.1-1 Uncommon to Rare Vascular Plant Species Reported from the Region of the FRSA (NSM data) or from within 25 km of the Project Site (ACCDC data)

Binomial	Common Name	NSDNR RANK	ACCDC RANK	Source	Potential Presence In FRSA	Preferred Habitat (Zink 1998)
						habitats such as roadsides and fields
Stellaria humifusa	Creeping Sandwort	YELLOW	S2	NSM 2007	Possible	Around salt marshes
Stellaria longifolia	Longleaf Stitchwort	YELLOW	S3	ACCDC 2007, NSM 2007	Possible	Damp or wet grassy places, in sandy or mucky soils
Symphyotrichum ciliolatum	Lindley's Aster	YELLOW	S2S3	ACCDC 2007	Possible	Open fields, lawns and the edges of woods
Tiarella cordifolia	Heart-Leaved Foam-Flower	YELLOW	S2	ACCDC 2007, NSM 2007	Possible	Rich deciduous and mixed woods
Triosteum aurantiacum	Coffee Tinker's-Weed	YELLOW	S2	NSM 2007	Possible	Rich soils of river intervales, or rich forest on limestone
Utricularia gibba	Humped Bladderwort	YELLOW	S2	ACCDC 2007, NSM 2007	Possible	Shallow lake margins, small pools and small ponds in quagmires or peaty situations.
Viola nephrophylla	Northern Bog Violet	YELLOW	S2	ACCDC 2007, NSM 2007	Possible	Cool mossy bogs, the borders of streams, and damp woods.
Zizia aurea	Common Alexanders	YELLOW	S1S2	ACCDC 2007, NSM 2007	Possible	Meadows, shores, damp thickets and wet woods. Generally in relatively rich sites

None of the above plant species has been reported from the actual Project site.

Of the red-listed species, four (hoary willow (*Salix candida)*, showy lady's slipper (*Cypripedium reginae*), moonwort grape fern (*Botrychium lunaria*), woolly sedge (*Carex pellita*) species prefer basic or calcareous soils. Potential habitat for these species is extremely limited within the FRSA, as there are no known calcareous areas. Other red-listed plants are species of rich woods or intervales such as Leatherwood (*Dirca palustris*) , blue cohosh (*Caulophyllum thalictroides)* and Wiegand's wild rye (*Elymus wiegandii)*, and thus potential habitat for these species is also quite limited within the FRSA. Round-lobed hepatica (*Hepatica nobilis*) prefers dry, usually mixed deciduous woods, of which little exists within the FRSA. Larger Canadian St. John's wort (*Hypericum majus*) prefers dry or wet open soils, and is known from very few localities in Nova Scotia (Zinck 1998). The final species, Green's rush (*Juncus greenei*) is found in coastal sandy soils and dunes. There is very little of this habitat present within the FRSA. Southern twayblade (*Listera australis*) is found in sphagnum mosses in wet woods or bogs and thus potential habitat exists within the FRSA. This is the only red-listed species which may be expected to occur within the FRSA.

The remainder of the species are yellow listed, or considered sensitive to anthropogenic or natural events by NSDNR. As with the red-listed species, some of these are typical of calcareous areas, such as the alderleaf buckthorn (*Rhamnus alnifolia*) and pubescent sedge (*Carex hirtifolia*), and thus, are expected to have very limited potential habitat within the FRSA. Several yellow-listed species, such as northern bog violet, humped bladderwort, Michaux's dwarf birch (*Betula michauxii*), purple-stem swamp beggar-ticks (*Bidens connata)*, bog willow (*Salix pedicellaris)*, slender cotton-grass (*Eriophorum gracile)*, and northern comandra (*Geocaulon lividum)* prefer bogs or peaty areas, and thus potential habitat for these species is also common throughout the FRSA.

Thus one red-listed species and seven yellow-listed species of Plant of Special Status may be expected to occur within the FRSA, though none has been identified within the actual Project site.

For a more detailed discussion of rare plants listed by the ACCDC and the NSM, see Section 9 in the EARD (CRA 2007).

3.1.2 Lichens

Lichens are complex symbiotic organisms which consist of a fungal and an algal partner, which combine to create a lichen thallus. The fungal partner, known as the mycobiont, is an ascomycete or basidiomycete fungus which absorbs nutrients, provides structural support to the lichen and is responsible for respiration. The algal partner, or photobiont, consists of one (or sometimes both) of two main types of algae which are responsible for carbohydrate production via photosynthesis. Most lichens (approximately 90% of total species), contain a green alga (often *Trebauxia*) as the photobiont. The remaining species, known as cyanolichens, contain a blue-green algae (cyanobacterium) instead of (or in addition to) a green alga, as the photobiont. This is often a species of *Scytonema* or *Nostoc*. Cyanolichens are the only group of lichens which have been given status rankings by NSDNR. Lichens occur in several main growth forms. These are the crustose lichens, which are flat crusts, the foliose or leafy lichens, and the fruticose lichens, which are shrubby or filamentous. Lichens are also named according to their preferred substrate: corticolous lichens occupy tree bark, salicolous ones grow on stone, while terricolous lichens are found on soil.

With this wide range of habitats, it is not surprising that lichens are a huge group of organisms which are present in almost every terrestrial habitat on earth (Brodo *et al.* 2001). It has been estimated that lichens cover over eight percent of the Earth's surface. Lichens are also the first organisms capable of colonizing bare rock, which over time can lead to the accumulation of organic material, leading to the establishment of soils, which then allow other species to colonize. Some lichens also play important roles as soil-binders, helping to stabilize soils. Some lichens are capable of capturing atmospheric nitrogen, and so play important roles in nitrogen fixation and nutrient transfer in terrestrial ecosystems. By trapping nitrogen in the air to produce nutrients and photosynthesizing, these lichens are able to produce organic material, which then may fall to the ground and decompose or be eaten by organisms. Lichens provide food for many species, such as caribou, slugs and snails, and habitat for a variety of arthropod species. This in turn provides food for birds, some of which also use lichens for nest construction materials.

The proposed Project site, in Moose River Gold Mines, is located in an area of Nova Scotia which is typified by mature coastal forests, a prevalence of exposed bedrock, and thin soils. This area receives significant precipitation (1400 to 1500mm) annually, mostly in the form of rain, and thus, has relatively high humidity. This habitat extends as a narrow band several kilometres wide along the Atlantic coast of Nova Scotia (NSM 1996). Cyanolichens can be particularly abundant in such humid mature or coastal forests (Nash 1986). Maas and Yetman (2002) have termed these forests suboceanic forests. Common cyanolichens species on the Project Site which are likely common throughout much of the FRSA are *Collema subflaccidum, Leptogium cyanescens, Lobaria pulmonaria, L. quercizans, L. scrobiculata, Nephroma bellum, Parmelliella tryptophylla, Peltigera aphthosa,* and *Pseudocyphellaria perpetua.*

Lichens of Special Status

Some cyanolichen species occur only humid mature or coastal forests, for example, the rare boreal felt lichen *Erioderma pedicillatum,* which is listed under both COSEWIC and the NSESA as an endangered species. Other cyanolichen species found in this habitat in Nova Scotia include *Leptogium corticola, Pannaria conoplea, Moelleropsis nebulosa, Coccocarpia palmicola,* and *Sticta fuliginosa* (Maass and Yetman 2002).

Listed cyanolichen species have been found in three general areas on the Project site, and one site which is now outside the Project site. The first, and most diverse area, is along the unnamed tributary which flows south across the upper portion of the Project site. This is referred to as the North of Mooseland Road area. Species found here are *Leptogium laceroides, Degelia plumbea, Pannaria conoplea, Leptogium corticola, Fuscopannaria ahlneri, Coccocarpia palmicola,* and *Sticta fuliginosa.*

The second area on the site contains just one listed species, *Degelia plumbea.* The third lichen area on the site is within the planned Tailings Management Facility (TMF). Species here include *Pannaria conoplea, Moelleropsis nebulosa, Leptogium laceroides, Coccocarpia palmicola* and *Pannaria rubiginosa.* Individual lichens within the planned TMF will be removed by Project construction activities and therefore, there is no discussion of potential sulphur dioxide effects on these species.

The off-site lichen area lies just south of the Project site, near the planned final pit outline. Listed species found here include *Degelia plumbea, Fuscopannaria ahlneri, Sticta fuliginosa,* and *Pannaria conoplea.*

An additional listed species, *Erioderma pedicellatum*, the boreal felt lichen, is known from within the FRSA, but has not been found on the Project site. This species, and the nine listed above, are usually found in mature humid forests, which are abundant throughout the FRSA. Thus, there is significant habitat for these species within of the FRSA.

Fuscopannaria ahlneri is a corticolous lichen species which usually grows on coniferous trees, although it has been reported on deciduous trees in North America, and in fact was found on a red maple trunk (deciduous species) on the proposed Project site. A species of *Scytonema* is the photobiont (Brode *et al.* 2000). *F. ahlneri* is an extremely water-loving species which is dependent on ravines and north-facing slopes that provide shelter from strong sunlight and desiccating winds (Nature Serve Canada, www.natureserve.org). Globally, this species has a very disjunct distribution. In North America, it is found in the boreal region of both the Atlantic and Pacific (Jørgensen 1978, Goward *et al*. 1998). It is also found in south-west Greenland (Alstrup 1986), northern Japan and Russia, Norway and Sweden. (Jørgensen 1978). Hale (1979) stated this species is known from the Appalachian mountain range of North America.

The global status of this species is G4G5, meaning it is apparently secure to secure. There is no sub-national ranking for this species in Nova Scotia; however, it is listed as S1 or extremely rare and vulnerable to extirpation in New Brunswick. NSDNR ranks this species as red, or at-risk of extirpation. It has not been evaluated by Committee of Species Endangered Within Canada (COSEWIC). This species is known from Halifax, Cumberland, Lunenburg and Queens counties and has recently been detected in Shelburne County (Frances Anderson, NSM, pers.com 2007) in Nova Scotia. This species has been found at three locations which are on the proposed Project site, and one location which is now outside the adjusted Project site. Three of these sites will not be cleared by the Project. *F. ahlneri* was found growing on red maples at each location, and abundance was low.

Moelleropsis nebulosa ssp *frulaniea* is a foliose cyanolichen which is epiphytic on conifers. A species of *Nostoc* is the photobiont (Maass 1986). In Nova Scotia, *M. nebulosa ssp frulaniea* is found is similar habitat as the boreal felt lichen (Maass 1986), in the humid coastal suboceanic forest extending along the Atlantic coast. This species was detected in the province only a few decades ago, and thus, little is known about it in Nova Scotia (Maass 1986). The Nova Scotia population is considered a separate, sterile subspecies (*ssp. frulaniae*) of the typical species (*M. nebulosa*) which occurs in Europe (Maass, 1986).

There is no global, national or sub national ranking available for this species. It has not been evaluated by COSEWIC. This species is red-listed by the NSDNR. This species is known from Halifax, Shelburne and Lunenburg counties in Nova Scotia, and has been found at one location on the proposed Project site. This species was not found during a lichen survey of the Tangier Grand Lake Wilderness Area (Cameron and Richardson 2006).

Degelia plumbea is a gray foliose cyanolichen which is a member of the Pannariaceae family. *D. plumbea* is generally found on deciduous trees. A species of *Scytorema* is the photobiont (Ganslaad Solhaug 1998). It is considered intolerant of bright sunlight and thus grows in well-forested areas (Rose 1988). This species is found in Canada, the United Kingdom, Sweden, France, Spain, Greece, Turkey and Syria (Global Biodiversity Information Facility, online).

This species has not yet been ranked globally or nationally. It does not have a sub-national rank in Nova Scotia, but is listed as S1, or critically imperiled, in New Brunswick. This species is much more abundant in Nova Scotia than in New Brunswick, however, and has been given a general status ranking of yellow (sensitive) by NSDNR (Nova Scotia Status Plants of Wild Species in Nova Scotia, 2007) This species is currently under review by COSEWIC (Mark Elderkin, NSDNR, pers. com. 2007). It is not protected under the *NSESA*. While this species is somewhat widespread in Nova Scotia, it has been listed as yellow due to the fact that most of the *Degelia plumbea* present in North America is found in Nova Scotia (Frances Anderson, NSM, Mark Elderkin, NSDNR, pers. comm. 2007). This species is known to occur in ten counties in Nova Scotia. These are Annapolis, Cape Breton, Cumberland, Halifax, Lunenburg, Shelburne, Victoria, Kings, Colchester (Frances Anderson, NSM, pers.com. 2007). It is known from two locations on the proposed Project site and a third site which is outside the adjusted Project footprint. All occurrences were on red maple. At two locations (one on and one off the site), this species was rather abundant on the host tree, while at the third site, abundance was low (n=3).

Pannaria conoplea is a blue-gray foliose cyanolichen which grows on bark, and sometimes on rock (Brodo *et al.* 2001). Hale (1979) described this species as growing at the base of trees in mature woods. It is usually considered as a circumpolar species; Thomson (1984) stated that it grows on soil and among mosses in the Arctic, but it is also found in more southerly areas such as Arizona and California, where it grows at the base of trees

(Hale 1988). It is present in Alberta and Ontario (www.natureserve.org). McGune and Goward (1995) state that it is known from high elevations in the Rocky Mountains, but that it is mainly known from low elevations in eastern North America. Brodo *et al.* (2001) depict this lichen as occurring in scattered locations throughout North America.

Globally this species is listed as G3 or vulnerable. There is no national rank for this species, nor is there a sub-national rank for Nova Scotia. In New Brunswick it is listed as S2 (rare) and as S3S4 (uncommon to usually widespread and fairly common) in Saskatchewan. It has not been evaluated by COSEWIC. This species is known from seven counties (Annapolis, Colchester, Cumberland, Halifax, Lunenburg, Queens, Shelburne) in Nova Scotia (Frances Anderson, pers. comm., 2007). It has been found at five locations on the proposed Project site, and two locations which are now outside the adjusted Project footprint. Abundance was low and thalli occurred on red maple at all locations. A single thallus of this species was found during surveys in the Tangier Grand Lake Wilderness Area (Cameron and Richardson 2006).

Pannaria rubiginosa is a blue-gray foliose cyanolichen which grows on bark of both hardwoods and conifers in shaded woods in a wide variety of moist lowland habitats (www.natureserve.org, Brodo *et al.* 2001). A species of Nastoc is the phobient (Brode *et al.* 2001). This species has been described as being widespread at the bases of trees and on rocks in mature forests (Hale 1979). It is found in North America form British Columbia to Oregon and from New England to the Atlantic Canada provinces. It also occurs throughout the Appalachians and as disjunct populations in Arizona, mid-coast California, and in the Ozarks region. It is also found in Europe, the British Isles, and South Africa (www.natureserve.org). In the British Isles it is considered an oceanic species, which is now only commonly encountered in the extreme west of Scotland and Ireland. (Dobson 1979, Czeczuga and Richardson 1989).

Globally this species is listed as G4 - apparently secure (www.natureserve.org.) There is no national ranking for this species in Canada, nor is there a sub-national ranking for Nova Scotia. It is listed as S3, uncommon or with a restricted range, in New Brunswick. This species is known to occur in six counties (Annapolis, Cumberland, Halifax, Inverness, Lunenburg, and Victoria) in Nova Scotia (Frances Anderson, pers. comm., 2007). It was found at a single location on the proposed Project site, growing on red maple. It was not reported from a lichen survey in the Tangier Grand Lake Wilderness Area (Cameron and Richardson, 2006).

Coccocarpia palmicola is a slate-grey foliose cyanolichen found mostly on tree bark, occasionally on mossy rocks and soil in shaded situations (Brodo *et al.* 2001). The cyanobacterium *Scytonema* is the photobiont species (Brodo *et al.* 2001). This species occurs in similar habitat to that utilized by the boreal felt lichen, humid coastal forests, and is often used as an indicator of potential boreal felt lichen habitat (Tom Neily, pers comm., 2007). Globally *C. palmicola* is a widespread, common, species with many documented sites, and thus is listed as G5, secure globally (www.natureserve.org). It occurs mostly in the southern hemisphere, both old and new world, extending into the north along marine influences. There is no national rank for this species in Canada. There are no sub-national ranks for cyanolichen species in Nova Scotia; however *C. palmicola* is listed as S1 (extremely rare) in New Brunswick. NSDNR lists this species as yellow, meaning it is sensitive to anthropogenic or natural events. This species is known from six counties (Annapolis, Halifax, Hants, Lunenburg, Queens and Shelburne) in Nova Scotia, and is considered plentiful in Halifax, Hants and Lunenburg counties (Frances Anderson, NSM pers. com, 2007). It is considered rare in Fundy National Park (Gowan and Brodo 88) and elsewhere in Canada (Goward *et al.* 1998). This species has also reported from the Tuckerman workshop in 1998 in southwest Nova Scotia (Richardson, pers. com).

C. palmicola is known from two locations on the Project site. Abundance was low at each site .This species has been found at several sites in the nearby Tangier Grand Lake Wilderness Area, where abundance was also low at each site (Cameron and Richardson 2006). In the Tangier Grand Lake Wilderness Area, this species was found mostly on balsam fir, but occasionally on black spruce, and occurred with *L. scrobiculata, Leptogium laceroides, Parmeliella triptophylla* and *Erioderma pedicellatum* (Cameron and Richardson 2006). At the proposed Touquoy Gold Project site, *C. palmicola* occurred nearest *Fuscopannaria ahlneri* and *Pannaria conoplea*. *Lobaria pulmonaria* was also nearby.

Leptogium corticola is a dark grey foliose cyanolichen which is usually epiphytic. A species of Nostoc is the photobiont (Brodo *et al.* 2001). Brodo *et al.* (2001) list the habitat as being on hardwoods or occasionally white cedar in the north, and sometimes on mossy rocks. *L. corticola* is widespread on the bases of hardwoods and occasionally on rock in moist woods in most of the eastern US (Hale 1979, Flenniken 1999). (Dey 1978 described this species' general distribution as from the southeastern United States, Central America to South America. The more recent Brodo *et al.* (2001) gives the distribution as throughout the eastern half of the United States, and extending north to southern Nova Scotia.

Globally this species is listed as G3-G5, with a rounded global status of G4 or apparently secure. There is no national rank for this species in Canada, nor a sub-national rank for Nova Scotia. It is listed as S1, or critically imperiled, in New Brunswick and Ontario. NSDNR lists this species as yellow, or sensitive. This species is known to occur in four counties (Halifax, Hants, Lunenburg and Shelburne) in Nova Scotia, and occurs at one location on the proposed Project site. Abundance was low and the habitat was red maple bark. This species has been reported from the Tangier Grand Wilderness Area, where abundance was low, and it occurred on red maple in an area dominated by balsam fir and black spruce (Cameron and Richardson 2006). Otherwise, there is little information available on this species in Nova Scotia (Cameron and Richardson 2006).

Leptogium laceroides is a dark grey foliose cyanolichen which is usually epiphytic. A species of Nastoc is the photobroint (Brodo *et al.* 2001)There is very little information available on the habitat of this species. Cameron and Richardson (2006) found it growing on red maple in coastal coniferous forest dominated by balsam fir with some red maple and black spruce in Nova Scotia. They have also observed it growing in forests dominated by sugar maple, yellow birch with some beech. Hale (1979) states it is found in the Appalachians, while Natureserve (www.Natureserve.org) states it is found in North Carolina, New Brunswick and Quebec.

The global status of this species is G5, meaning it is secure globally. There is no national Canadian ranking nor is there a sub-national rank for Nova Scotia. It is listed in New Brunswick as S2, or rare. This species has not been assessed by COSEWIC. NSDNR lists this species as yellow, or sensitive to anthropogenic or natural events. This species occurs in nine counties in Nova Scotia. These are Annapolis, Colchester, Cumberland, Guysborough, Halifax, Hants, Lunenburg, Richmond, Shelburne and Queens. It was found at four locations on the proposed Project site. Three locations are in a wooded buffer zone along a stream which will not be cleared for the Project, while the fourth is within the area of planned Tailing Management Facility.

Sticta fuliginosa is a foliose epiphytic lichen which usually grows on mossy bark, or sometimes mossy rock (Brodo *et al.* 2001). Hale (1979) stated that in North America this species was rare on tree bases and mosses at higher elevations. Other sources describe it as being typically found on bark or wood of hardwoods; occasionally on conifers, and rarely on rock, and common in warm, moist, low-elevation forests (http://gis.nacse.org/lichenair). This species is found in North America on both the east and west coasts, as well as in widely separated localities throughout continental North America (Brodo *et al.* 2001,United State Forest Service http://gis.nacse.org/lichenair).

Globally this species is listed as G4, or apparently secure. There is no national ranking for this species, nor is there sub national rank for Nova Scotia. In New Brunswick, this species is listed as S1, or extremely rare. This species has not been assessed by COSEWIC. NSDNR lists this species as yellow, or sensitive to anthropogenic or natural events. This species is found in eight counties in Nova Scotia. These are Colchester, Cumberland, Digby, Kings, Lunenburg, Queens, Shelburne and Yarmouth. It has been found at one location on the proposed Project site, and at one site which is now outside the adjusted Project footprint. Neither of these sites should be affected by tree clearing activities.

Erioderma pedicellatum, the boreal felt lichen, is an epiphytic lichen which grows on the bark of coniferous trees, mostly balsam fir, *Abies balamsea,* in North America. The photobiont is a member of the genus *Scytonema* (Brodo *et al.* 2001). The boreal felt lichen is restricted to cool, maritime climates and is known from Scandinavia (Jorgenson 1990, Holien *et al.* 1995) and on the Canadian coast from Newfoundland to Nova Scotia and New Brunswick (COSEWIC 2002) It was known from Sweden but is now regarded as extinct there (Aronsson *et al.* 1995, cited in Cameron 2004). Only one location in Scandinavia is still known to exist (Holien *et al.* 1999, cited in Cameron 2004).

Globally, the boreal felt lichen is ranked as G1 or critically imperiled due to the fact that there are less than 20 known localities worldwide where this species is found (www.natureserve.org). It is also ranked nationally as N1, or critically imperiled. There is no sub-national ranking for Nova Scotia. This species is likely extirpated from New Brunswick (Cameron 2004) and is considered very rare in North America (Maass 1980, 1983). NSDNR lists this species as red, or at-risk of extirpation in the province. This species is highly sensitive to acid rain and has experienced dramatic (>90%) declines in occurrences and individuals in the Atlantic (Nova Scotia and New Brunswick) populations over the last two decades and substantial losses in the boreal (Newfoundland) populations as well (COSEWIC 2002). Logging also poses a threat (Cameron 2004). Newfoundland, however, is still home to dispersed and very large populations in some protected areas, and therefore, this population has been considered separately from the Nova Scotia population by COSEWIC (2002).

The Atlantic Canadian population of this species is listed as Endangered by COSEWIC (2002). This species is also listed as endangered, or facing imminent extirpation or extinction, in Nova Scotia under the *Nova Scotia Endangered Species Act* (2003). There are currently twelve known locations of boreal felt lichen in two counties in Nova Scotia (Cameron, pers comm., 2007), up from two in 2004 (Cameron 2004). All but one of the twelve Nova Scotia locations are within a few dozen kilometres of the Project, and one of these is within 10 km. Boreal felt lichen has not been found on the Project site, nor has it ever been reported from the Project site. Possibly suitable habitat for this species was examined in 2004, 2005 and 2007, and the boreal felt lichen was not detected.

One additional listed lichen species has been reported from the FRSA. *Pseudoevernia cladonia*, the ghost antler lichen, is not a cyanolichen species, and thus has not been given a status ranking by NSDNR. However, it has been designated as a Species of Concern by COSEWIC (2006). This species has not been detected on the Project site.

In summary, two red-listed and seven yellow-listed lichen species are known from the Project site. Most of these occur in more than one location on the site. The boreal felt lichen has never been reported from the site. It is likely that the nine listed species also occur in the general area, outside the boundaries of the Project site.

The lack of biologists skilled in identifying cyanolichens in Nova Scotia, and the paucity of comprehensive cyanolichen surveys throughout the province has resulted in gaps in knowledge of the cyanolichen species of Nova Scotia. Considerable new information on species presence and distribution has been gathered in just the last few years. For example, a recent study by McMullin (2007) found 135 syanolichen species in 51 mature forest plots in southern Nova Scotia.

3.1.3 Mammals

In Nova Scotia, legislation protecting mammals is the *Nova Scotia Wildlife Act*. This Act provides for the protection, management and conservation of wildlife and wildlife habitat in Nova Scotia. Field surveys for mammals conducted on the proposed mine development site for the 2007 EARD (see EARD Section 9.1.4) were generally sufficient in detecting the presence of large mammals, however, small mammals, which tend to be very secretive, are poorly surveyed by this method. Fortunately, most rare small mammals have very specific habitat requirements which can be used to predict the likelihood of their presence.

Evidence of larger mammals typical of the area, such as red fox (*Vulpes vulpes*), coyote (*Canis latrans)*, varying or snowshoe hare (*Lepus americanus*), American black bear (*Ursus americanus)*, white-tailed deer (*Odocoileus virginianus)* and eastern moose (*Alces alces americana*) was observed and species such as raccoon (*Procyon lotor),* striped skunk (*Mephitis mephitis)* and bobcat (*Lynx rufus*) may also be present, but were not observed. Small mammals likely to be present in the area include meadow vole (*Microtus pennsylvanicus*), red-backed vole (*Clethrionomys gapperi*), American red squirrel (*Tamiasciursus hudsonicus)*, eastern chipmunk (*Tamias striatus*) and short-tailed shrew. All of these species are expected to breed within the FRSA.

Mammals of Special Status

Four uncommon to rare mammals were listed in the ACCDC 100 km database search. Two red-listed species of rare bat, the hoary bat (*Lasiurus cinereus*) and the eastern pipistrelle (*Pipstrellus subflavus*) and one yellow-listed species, the long-tailed shrew (*Sorex dispar*), were reported within 100 km; however, these bats are not expected to make use of the Project site but may occur within the FRSA. Mine activities will not extend beyond the development and thus will not impact bat population in the FRSA.

The eastern moose (A*lces alces americana*), a red-listed species, was listed on the ACCDC database search for this area. A detailed description of moose presence and potential habitat for moose within the FRSA is provided below.

Moose

The eastern moose, *Alces alces Americana*, one of four sub-species of North American moose, ranges from Nova Scotia and New Brunswick to eastern Ontario and south to Maine, New Hampshire, Vermont and New York. The population of eastern moose in mainland Nova Scotia was listed as "Endangered" under the Nova Scotia Endangered Species Act in 2003. Prior to the arrival of European settlers in the 1600s, moose were the most abundant large mammal in Nova Scotia (~15,000 moose) but have since experienced drastic declines and have a population estimate thought to total 1,000 to 1,200 animals on the mainland (NSDNR 2007). Cape Breton moose population differs from the mainland eastern moose population, in that the Cape Breton population in derived from a heard of northwestern moose (*Alces alces andersonii*) that was introduced to Cape Breton in the 1940s (Parker 2003). The northwestern moose ranges from northern Michigan and Minnesota and western Ontario to central British Columbia and north to eastern Yukon.

In 2007, the NSDNR developed the Recovery Plan for Moose in Mainland Nova Scotia in accordance with the *Endangered Species Act* (1998). The objectives of the recovery plan are to maintain and enhance current population demographics, decrease threats that hinder recovery, conduct research to address knowledge gaps and to maintain and/or enhance moose habitat (NSDNR 2007). Potentially cumulative, long-term loss of moose habitat due to various development types with large geographic footprints was identified in the Recovery Plan for Moose in Mainland Nova Scotia (2007). Recognizing the potential impacts large scale developments pose on eastern moose both individually and collectively, the NSDNR has drafted guidelines for proponents to consider and address when undertaking environmental assessments in moose habitat on mainland Nova Scotia. The guidelines are as follows:

- Discuss the historical importance of the proposed development site as moose habitat.

- Describe seasonal habitat use by moose (*e.g.* over-wintering, calving, foraging) on the proposed development site.
- Describe the known or reasonably inferred travel/connectivity corridors currently or historically known and/or reasonably inferred that are/were utilized by moose across the landscape where the proposed development would take place.
- Document current moose usage of the proposed development site with either winter aerial surveys and/or pellet inventories.
- Describe the current state of vegetation, forests, wetlands and other features of habitat on the proposed site and discuss their importance relative to the surrounding landscape.
- Provide a conservation plan for repatriating natural vegetation communities on the development site during the course of operation.
- Provide a detailed plan for decommissioning the development site if the development ceases to operate.

Historical Significance

Historical records of eastern moose distribution in Nova Scotia are scarce; however moose were abundant across the landscape prior to European settlement (Parker 2003, Snaith and Beazley 2004) and may have used habitats in and around the Project area. Nova Scotia has undergone significant habitat conversion, degradation and fragmentation due to resource extraction and land development. As a result, the small and fragmented moose populations remain at varying densities and may be limited by interspecific competition, habitat alteration/loss, mineral toxicity/deficiency, depredation, disease, and resource availability (Snaith and Beazley 2004).

NSDNR reports that within Halifax County, three areas of elevated moose densities occur (D. Archibald, NSDNR, pers. com. 2006). One of these areas lies within the Focus Report area south of Scraggy Lake and north of Tangier (encompassing the Tangier-Grand Lake Wilderness Area and the proposed Ship Harbour Long Lake Wilderness Area) and east of Lake Charlotte and west of the Tangier/Elmsvale Road (Doug Archibald 2006, pers. comm.). The NSDNR has proposed extending the area for moose potential northward towards the Musquodoboit Valley encompassing the Project area, but is currently under review by the NSDNR (Doug Archibald 2007, pers. comm.). Therefore, for the purpose of the Focus Report, we defer to the EARD for current moose mapping (see EARD Figure 9.5). The second area is north of Sheet Harbour and the third area is on the Chebucto Peninsula (Doug Archibald 2006, pers. comm.). Together these areas likely account for less than 75 individual moose (based on Parker 2003) (see EARD Figure 9.5).

Seasonal Habitat Use

Important habitats for moose tend to be wintering and spring calving (late May) areas. Preferred wintering habitat typically consists of mature conifer or mixed conifer stands where snow tends to be less deep and browse is available, reducing winter energy demands (Parker 2003). Wintering areas may be poorly defined in some areas of Nova Scotia where snow depths are often not excessive; however, suitable wintering areas do contribute to moose survival. The core concentration of moose is not in the Project area and the active Project area provides little of the mature conifer/mixed conifer habitat associated with wintering. Calving areas are often associated with aquatic/wetland areas; however, moose will use a wide range of habitats for calving such as islands in beaver ponds and wetland areas with standing water (Parker 2003). There are no wetland areas with standing water ideal for calving present within the Project area footprint. The low density of moose in the area, small proportion of wetland area on the site, and the very small proportion of available area occupied by the site results in the proposed development having a very low potential to affect calving of moose in the greater FRSA .

Travel/Connectivity Corridors

Use of habitat within the vicinity of the mine may occur year round. Small patches of barrens may be used after snow melt in the spring and the more lush vegetation within the Moose River and Fish River's treed stream corridors are expected to be potentially used in the late spring and summer when moose feed heavily on herbaceous vegetation. Moose movements in a north-south direction are not expected to be impeded by the Project area given the habitat connectivity on the east and west sides of the development, except for the existing road through the Project area. Moose movements in an east-west direction may be impeded by the Project area; however, given the recent large scale clearing to the west of the proposed tailings pond and northeast of Moose River Gold Mines, moose movements have already been impeded and much of the habitat connectivity lost. Although these areas provide good moose browse, they will not provide suitable cover (mature forest) for the duration of the mine development (seven years). Moose will not make use of available forage in large areas created through clear-cutting and void of mature forest patches for 10 to 15 years post-harvest (Monthey 1984, Potvin *et al.* 1999; as cited in Snaith and Beazley 2004) and will not move more than 80 to 200 m from forest cover (Peek *et al.* 1987, Jackson *et al.* 1991, Thompson *et al.* 1995; as cited in Snaith and Beazley 2004). In the event of moose movement in an east-west direction, habitat connectivity will be maintained at the effluent discharge channel between Scraggy Lake and the tailings pond. Habitat connectivity to the north and south of the development site (*e.g.* Square Lake, Scraggy Lake, Tangier Grand Lake Wilderness Area, the proposed Ship Harbor Long Lake Wilderness Area) will not be impacted as road development and forest clearing is not going to be initiated by DDV Gold in these areas.

Habitat fragmentation is not expected to significantly increase in the local area by the Project, given the scale of moose habitat and existing disturbance in the area. The area of the proposed mine site is currently intersected by an existing paved road and by forestry roads which may be used by all-terrain vehicle users. Disruption of movement patterns for moose may include some temporary disruption of seasonal/foraging; however, the area to be affected is a relatively small proportion of the larger similar habitat available in the immediate area and it is expected that foraging habits of moose are somewhat flexible resulting in this effect not being significant. Some loss of habitat, although limited to the Project footprint, will occur. This area represents < 1% of the moose habitat available in eastern Halifax County, and habitat quality on the Project site is marginal. Disturbance and displacement of moose in the vicinity of the site may potentially result from site activities such as use of heavy equipment, blasting or general human activities/presence. Moose are generally tolerant of disturbance and will avoid roads and active areas except possibly during rutting season.

Road development and traffic flow has been raised as an area of concern. Beazley *et al.* (2004) found a statistically significant correlation between road density and moose pellet presence suggesting moose low moose density in areas of with road developments. No major road development will occur within the FRSA by DDV Gold for the purpose of the mine development. A minor road will being created from an old logging road on the west side of Moose River Gold Mines. This road will replace the existing road through Moose River Gold Mines and will not increase road density in the area. Traffic flow (*i.e.* supplies and equipment) is expected to come from the north along Moose River Road from Route 224, therefore, avoiding the higher density of moose to the south of the development site thus, minimizing moose mortality due to vehicle collisions.

Current Moose Utilization of the Project Site

Eastern moose are known to occur in the general area of the Project (Doug Archibald, pers. comm., 2007). Moose tracks were observed in a bog (Wetland 4) on the Project site in September and November 2006 by a CRA biologist. Moose calling exercises, conducted by CRA and representatives of the Confederacy of Mainland Mi'kmaq (CMM), in Wetland 4 in November and December 2006 were unsuccessful, although the November survey did find additional moose tracks. The regional NSDNR biologist for the area has also stated that evidence of moose was often observed in Moose River Gold

Mines during annual deer pellet surveys (Doug Archibald 2006, pers. comm.). Moose were also reported on several occasions in the fall of 2006 from the community of Cooks Brook (~ 27 km west), to the west of Moose River Gold Mines (Doug Archibald 2006, pers. comm.). However, moose numbers are very low and highly dispersed within this extended range. Moose have not been sighted at Moose River Gold Mines in 25 years (Robert Murphy 2007, pers. comm.). Four moose sightings have been observed in the general vicinity of the proposed development area including: (1) Caribou Gold Mines (2 years ago), (2) Camp Kidston (1.5 years ago), (3) near Mooseland on road towards Moose River Gold Mines (2 years ago), and (4) the west side of Moose River Gold Mines (25 years ago). These sightings are all within the FRSA but outside the Project site.

The presence of moose has been negatively correlated with the presence of white-tailed deer (*Odocoileus virginianus*) and is largely attributed to the parasitic nematode, *Paralephostrongylus tenuis*, which is carried by the white-tailed deer and fatal to the eastern moose (Parker 2003, Snaith and Beazley 2004). Eastern moose and white-tailed deer are separated by preferential habitat selection; however, the range of white-tailed deer is expanding northward due to forest conversion associated with the creation of roads and open areas, as well as climate warming (Snaith and Beazley 2004). The Project should not increase the white-tailed deer population in the FRSA.

Current Landscape Importance

Much of the vegetation on the FRSA has been disturbed historically through forestry, road building, housing activities, recreation and fire. As a result, there are a high percentage of coniferous trees as opposed to deciduous. Softwood (coniferous) forest that consist of red spruce (*Picea rubens*), balsam fir (*Abies balsamea*) and white pine (*Pinus strobus*) is the dominant forest habitat type. There are some areas dominated by white spruce (*Picea glauca*) near the Project, while black spruce (*Picea mariana*) tends to dominate in wetter areas. Mixed-wood (coniferous and deciduous) and hardwood (deciduous) are less represented within the FRSA. Mixed-wood forest habitat type consist of red spruce, balsam fir, red maple (*Acer rubrum*), white birch (*Betula papyrifera*) and yellow birch (*Betula alleghaniensis*). The hardwood forest habitat type consist of predominantly red maple, large-tooth aspen (*Populus grandidentata*), trembling aspen (*Populus tremuloides*), white birch, yellow birch and American beech (*Fagus grandifolia*). There are also extensive areas of cutover forest, to the point that it is a common habitat type within the FRSA. Re-growth is predominantly shrub species, such as low-bush blueberry (*Vaccinium angustifolium)* and brambles (*Rubus* spp.), as well as black spruce. Wetlands constitute a large portion of area within the FRSA. (Refer to Section 3.4 for more detailed description of wetlands in the FRSA).

Moose will utilise all of the habitats describes above as part of their seasonal habitat requirements. During spring and early summer, moose require open or disturbed areas with quality forage, forest cover for thermal regulation and predator avoidance, calving areas and wetlands with aquatic vegetation (Snaith and Beazley 2004). In the summer, adequate forest cover for protection from heat stress is paramount and they require forage-rich areas for growth, lactation and fat accumulation (Snaith and Beazley 2004). During the fall and early winter, open and disturbed associated with open canopies and early successional vegetation is preferred. In the late winter, dense cover again becomes critical due to snow accumulation and extreme low temperatures. Ideal winter habitats include a combination of forage-rich area such as small disturbances and forest edges (Snaith and Beazley 2004).

Communications with NSDNR representative Tony Nette regarding moose habitat, were redirected towards Doug Archibald. The area of major concern for moose habitat lies south of the Project site in the Tangier Grand Lake Wilderness Area, as the areas of critical moose habitat are more abundant in this area. Habitat north of Scraggy Lake is moderately suitable habitat for moose but not considered critical. The probability of locating moose is greater in the area south of Scraggy Lake (*e.g.* Tangier Grand Lake Wilderness Area) than the area north of Scraggy Lake (*e.g.* proposed development area) (Doug Archibald 2007, pers. comm.).

Decommissioning Plan

Reclamation Plan requirements in Nova Scotia include the need to submit a Conceptual Plan at the Environmental Assessment stage of the Project (included in this document), submitting a Reclamation Plan as part of the Industrial Approval stage (once the EA is issued) and then a Final Reclamation Plan 6 months prior to the mine closure stage. This process allows for the public and regulators to have a sense of the reclamation details at the EA stage and to provide comments that the Proponent can use in the development of the Reclamation Plan. This Reclamation Plan is used as the basis to decide the Reclamation Bond amounts and requirements. The Final Reclamation Plan is submitted six months prior to mine closure to allow for experience gained on the site by the Proponent and collected site data to be used for final design. As well, public/community input is sought through the Citizens Liaison Committee (CLC) during this stage as the wishes of the public/community on reclamation may have changed since the Project started, in this case six to seven years will have passed from the Reclamation Plan to the Final Reclamation Plan.

Regulators, proponents and the public favor this process as it allows flexibility in the reclamation planning and objectives. In the unlikely event of early mine closer, this

Reclamation Plan will be implemented and ultimately the land will be returned to conditions similar to its original state as a natural wood and wetland habitat used for recreation and forestry. The Reclamation Plan will consider moose in the final design to the greatest extent possible with specific aspects to include consideration of corridors, vegetation and access.

3.1.4 Birds

The FRSA encompassed a wide variety of inland habitats for breeding birds including deciduous, mixedwood and hardwood forests in various stages of succession and wetlands including bogs, fens, marshes and swamps. No designated protected areas for migratory or permanent resident birds, except for the Tangier Grand Lake Wilderness Area, are present within the FRSA. There is some potential for habitat important to individual birds, such as nesting areas, snags, cavity trees within the forested area and edge feeding areas in the proposed Project area; however, these habitat types are well represented in FRSA and will not be disturbed by mine development. Potential impacts to migratory and permanent resident birds could include loss of habitat, habitat fragmentation or disruption of reproduction in the proposed Project site. Mitigation measures associated with habitat losses are not expected to be required.

Migratory birds are protected under the *Migratory Birds Convention Act*. It is illegal to kill migratory bird species not listed as game birds or destroy their eggs or young. Other bird species not protected under the federal act such as raptors are protected under the provincial *Wildlife Act*. In order to avoid contravening these regulations it is recommended that clearing and grubbing activities be conducted outside of the breeding season for most bird species (April 1 to August 1) so that the eggs and flightless young of birds are not inadvertently destroyed. If for some reason clearing activities must occur between April 1 and August 1, a nesting bird survey of areas to be cleared shall be conducted prior to any site disturbance.

Birds of Special Status

Additional information regarding use of the area by rare and endangered birds was derived from a review of ACCDC database for information on rare species and a resulting habitat modeling exercise. Lists of provincially rare or sensitive birds were derived from the General Status of Wildlife in Nova Scotia, and Species at Risk in Nova Scotia while nationally rare species were derived from the COSEWIC list. Results of these reviews are described in the following sections. It should be noted that the NSDNR has revised their rare-species list since the EARD in March 2007 and has been adjusted in the Focus Report. The existing EARD was used to help develop the Focus Report.

A review of the NSDNR General Status of Wildlife in Nova Scotia and the ACCDC database of rare species records revealed fifteen listed species in the region (Table 3.1-2). Three red-listed and twelve yellow-listed bird species were listed by the ACCDC search within 100 km of the revised Project site. Each species' habitat preference was determined based on Erskine (1992), and the likelihood of their presence on site was determined based on the habitat types present on the site. The results of the rare bird habitat modeling are presented in Table 3.1-2.

Table 3.1-2 Rare Bird Modeling Exercise Based on ACCDC Reports within 100 km of Development Site

Common Name	Binomial	Habitat Preference Erskine 1992	NSDNR Status	Potential Presence on Site
Roseate Tern	*Sterna dougallii*	Coast	RED	N/A
Peregrine Falcon	Falco peregrinus	Rocky cliffs	RED	N/A
Piping Plover	*Charadrius melodus*	Sandy Beaches	RED	N/A
Red Knot	*Calidris canutus*	Coast	YELLOW	N/A
Purple Sandpiper	*Calidris maritima*	Coast	YELLOW	N/A
Common Tern	*Sterna hirundo*	Coast	YELLOW	N/A
Arctic Tern	*Sterna paradisea*	Coast	YELLOW	N/A
Barrow's Goldeneye	*Bucephala islandica*	Small clear lakes and ponds	YELLOW	N/A
Northern Goshawk	*Accipiter gentiles*	Mature woods	YELLOW	High
Razorbill	*Alca torda*	Coastal islands	YELLOW	N/A
Eastern Bluebird	*Sialia sialis*	Areas with scattered trees and short ground cover, cavities	YELLOW	Low
Ipswich Sparrow	*Passerculus sandwichensis princeps*	Coastal scrub/Sable Island	YELLOW	Low
Vesper Sparrow	Poecetes gramineus	Areas with short grass or low shrubs	YELLOW	Low
Rusty Blackbird	*Euphagus carolinus*	Spruce woods near water, swamps, wet woodlands.	YELLOW	Moderate
Bobolink	*Dolichonyx oryzivorus*	Grasslands	YELLOW	Low

None of the three red-listed species, Peregrine Falcon (*Falco peregrinus*), Piping Plover (*Charadrius melodus*), and Roseate Tern (*Sterna dougallii*), are expected to be present on the Project site due to the lack of suitable habitat. Possible breeding habitat for Peregrine Falcons may exist in the FRSA (eastern granite uplands); however this area will not be impacted by the mine developments and no breeding records have been recorded by the current Maritime Breeding Birds Atlas for this area (http://www.mba-aom.ca/jsp/map.jsp?lang=en).

Two yellow-listed species listed in the ACCDC request may potentially make use of habitat types on the study site. The Northern Goshawk (*Accipiter gentiles*) prefers heavily wooded mature forests. They will breed in mature hardwoods, or if that is not available, mature softwoods. Goshawks are relatively common in the Moose River Gold Mines area, and have bred there in previous years and are likely still breeding in the general area (F. Lavender, pers. comm. 2007). The Rusty Blackbird (*Euphagus carolinus*) prefers spruce woods near water, swamps or wet woodlands. The Rusty Blackbird has not been reported within area surrounding the Project site in over 15 years and only has moderate potential for breeding habitat within the FRSA.

Arctic Terns and Common Terns, are coastal species, and will not be present on site. The Razorbill, Red Knot, Purple Sandpiper and Barrow's Goldeneye do not breed in Nova Scotia. As well, these species tend to utilize large bodies of water and thus will not use the habitat found on the FRSA for migration.

Vesper Sparrows are a ground-dwelling species that prefers dry grass fields, with some shrubs or similar structure, and is found in open habitats, including old fields, grasslands, and cultivated crop fields (Jones and Cornely 2002). The Vesper Sparrow is often the first bird species to occupy reclaimed mine sites (Jones and Cornely 2002). Such habitat does not exist for them on the Project site, but may be created post-development. Ipswich Sparrows are not expected to breed in the Project area as they breed almost exclusively in coastal areas on Sable Island. Bobolinks are grassland/meadow species and are not expected to be present on the FRSA. One species, the Eastern Bluebird, (*Sialis sialis*) nests in clear-cut areas and in woodpecker cavities and might possibly use some of the habitat on site. However, the low number of Eastern Bluebirds nesting in Nova Scotia in any given year and their lack of nest site fidelity makes it reasonable safe to assume that Eastern Bluebirds would not be expected to use the Project site in any given year (F. Lavender, pers comm. 2006).

Four yellow-listed species not listed in the ACCDC database were observed during either point count surveys or other field surveys in 2007 including the Canada Warbler (*Wilsonia canadensis*), Common Loon, Common Nighthawk, and Barn Swallow. Over the past 40 years, Canada Warbler populations have steadily declined in response to habitat loss (Conway 1999). The Canada Warbler inhabits a variety of forest types during the breeding season but is most abundant in cool, moist forests of mixed-wood, a dense understory and the presence of sphagnum (Conway 1999). These habitat types are well represented outside of the Project area and therefore should have minimal effect on breeding populations. Common Loons were observed in both Square Lake and Scraggy Lake, which lie directly north and south of the proposed Project site, respectively. Common Loons often frequent multiple lakes during the breeding season to acquire food resources. As fish levels are low in both Square and Scraggy Lake (see Section 3.2, Aquatic Resources), it is likely the loons are visiting surrounding lakes during the breeding season, and therefore, disturbance should be negligible. Common Nighthawks breed in a wide variety of habitats including open woodlands, forests, urban areas, meadows and mountains. Many of these habitats are well represented outside of the Project area, and therefore, should have minimal effect on breeding populations. The Barn Swallow has recently been yellow-listed by the NSDNR due to declines across its range (Mark Elderkin 2007, pers. comm.). The Barn Swallow nests under bridges, barns and other farm buildings and culverts. The Barn Swallows were observed in the community of Moose River Gold Mines and were likely nesting on one or more houses or barns within the area. Barn Swallows are generally tolerant of human activity and will likely breed on buildings and bridges within the development site even with moderate disturbance levels; therefore, it is unlikely the Project will have a significant effect of Barn Swallows.

3.1.5 Herpetiles

All species of amphibians require wet, moist habitats for breeding purposes. The loss and destruction of this suitable habitat for amphibians is the greatest cause of species decline, extirpation or extinction worldwide. Within the FRSA, habitats for amphibians are extensive as various types of wetlands (*i.e.* bogs, fens, marshes, swamps) are present throughout the FRSA and thus are not expected to be impacted outside the Project site in the greater FRSA. Habitats for reptiles are equally present within the FRSA given the large forested areas, rivers and wetlands and similarly, are not expected to be impacted outside the development site in the greater FRSA.

Herpetiles of Special Status

The ACCDC request and the environmental screening conducted by the NSM both noted the presence of two species-at-risk herpetiles, the wood turtle (*Glyptemys insculpta*) and leatherback turtle (*Dermochelys coriacea*), within 100 km of the site. Wood turtles are listed as yellow by NSDNR. A wood turtle habitat survey conducted in 2004 on the original Project site by herpetile specialist John Gilhen of the NSM did not reveal any nesting or hibernating sites for wood turtles, as they require deep sections of rivers in which to hibernate, and sandy or gravelly banks for nesting. No evidence of wood turtles or suitable breeding or hibernating habitat was observed in any of the 2005, 2006, or 2007 field surveys. Potential habitat for wood turtles may exist in the FRSA; however, no breeding, hibernating or foraging habitat will be impacted by mine development. The leatherback turtle, a red-listed species, is a marine turtle and there is no marine habitat within the FRSA.

Four-toed salamanders (*Hemidactylium scutatum*) were identified in the ACCDC request and were previously yellow-listed by NSDNR; however, their status has been recently changed to green, indicating they are not considered to be sensitive or at-risk in Nova Scotia.

3.1.6 Odonates

The ACCDC search reported six red-listed and six yellow-listed odonates within a 100 km radius of the proposed Project site. Most odonates (dragonflies and damselflies) lay their eggs in bodies of water, where they hatch and develop through several larval stages before emerging from the water and metamorphosing into the adult form. In most species, this larval stage lasts for about one year. Most rare odonates listed in the ACCDC 100 km search inhabit areas near streams, rivers, ponds or lakes (Table 3.1-3).

Table 3.1-3 Rare Odonate Modeling Exercise Based on ACCDC Reports Within 100 km of Project

Common Name	Scientific Name	Preferred Habitat	Status	Potential Presence in FRSA
Taiga Bluet	*Coenagrion resolutum*	Small ponds with grassy or marshy borders, often shaded	RED	Moderate
Skillet Clubtail	*Gomphus ventricosus*	Slow-moving rivers	RED	Moderate
Brook Snaketail	*Ophiopomphus aspersus*	Open clear streams, brushy banks with sand, gravel, or rocky riffles	RED	Moderate
Twinhorned Snaketail	*Ophiogomphus mainensis*	Streams and small rivers	RED	Moderate
Rusty Snaketail	*Ophiogomphus rupinsulensis*	Large clear flowing streams and rivers	RED	Moderate
Ebony Boghaunter	*Williamsonia fletcheri*	Small pools in sphagnum bogs	RED	Moderate
Little Bluet	Enallagma minusculum	Clear pond and lakes	YELLOW	Moderate
Prince Baskettail	*Epitheca princeps*	Permanent ponds, lakes, streams and rivers, with clear to muddy water	YELLOW	Moderate
Harlequin Darner	*Gomphaeschna furcillata*	Sphagnum bogs and wooded swamps	YELLOW	Moderate
Harpoon Clubtail	*Gomphus descriptus*	Clear, rapid, rocky streams and rivers with sandy bottoms	YELLOW	Moderate
Northern Pygmy Clubtail	*Lanthus parvulus*	Mountain streams with muddy substrate	YELLOW	Moderate
Clamp-Tipped Emerald	*Somatochlora tenebrosa*	Shady forest streams, often dry, and occasionally boggy or swampy	YELLOW	Moderate

One red-listed species reported by the ACCDC, the ebony boghaunter (*Williamsonia fletcheri*), is known to breed in sphagnum bogs. The ebony boghaunter was reported once in the ACCDC 100 km search, from a location 95 km away. No ebony boghaunters were observed during wetland surveys in spring 2007 (see Appendix I - Supplemental

EARD Information). Two yellow-listed species known to bred in bogs and/or swampy areas, the harlequin darner (*Gomphhaeschna furcillata*) and clamp-tipped emerald (*Somatochlora tenebrosa*), were reported in the ACCDC search. The harlequin darner was reported twice with the closest location being 62 km from the Project site and the clamp-tipped emerald was reported three times with the closest being 74 from the Project site. No harlequin darners or clamp-tipped emeralds were observed during wetland surveys in spring 2007 (see Appendix I - Supplemental EARD Information) and are likely not breeding on the Project site. Breeding and foraging habitat may exist within the FRSA.

The other five red-listed species (brook snaketail, *Ophiopomphus aspersus*; Rusty Snaketail, *Ophiogomphus rupinsulensis*; twinhorned snaketail, *Ophiogomphus mainensis*; skillet clubtail, *Gomphus ventricosus*; taiga bluet, *Coenagrion resolutum*) and four yellow-listed species little bluet, *Enallagma minusculum*; prince baskettail, *Epitheca princeps*; harpoon clubtail, *Gomphus descriptus*; northern pygmy clubtail, *Lanthus parvulus*) are steam, river, pond and/or lake species (Table 3.1-3). None of the above species were observed during field surveys and are likely not breeding on the Project site. Breeding and foraging habitat may exist within the FRSA, however, no streams, rivers, ponds or lakes will be physically disturbed during mine development.

3.2 AQUATIC RESOURCES

3.2.1 Fish And Fish Habitat

The Touquoy Gold Project lies within the Moose River watershed which itself lies within the larger Lake Charlotte Drainage Basin within NSEL's FRSA. The FRSA also includes a portion of watercourses that flow into various coastal inlets within Tangier Grand Lake Wilderness Area, however, the southeast boundary line is not dictated by watersheds or drainage basins. In fact this line for the FRSA bisects many rivers and lakes. The hydrology for the Moose River watershed is described in detail in the EARD (CRA 2007).

The watershed of Scraggy Lake includes 20 lakes and their tributaries. Scraggy Lake flows into Fish River (Figure 3.2-1). Besides Scraggy Lake, Fish River receives water from 12 lakes and their tributaries. Fish River discharges into Lake Charlotte. Lake Charlotte's watershed contains 23 lakes and their tributaries. Lake Charlotte drains to Second Lake which flows into Weeks Lake. Weeks Lake has six lakes draining to it.

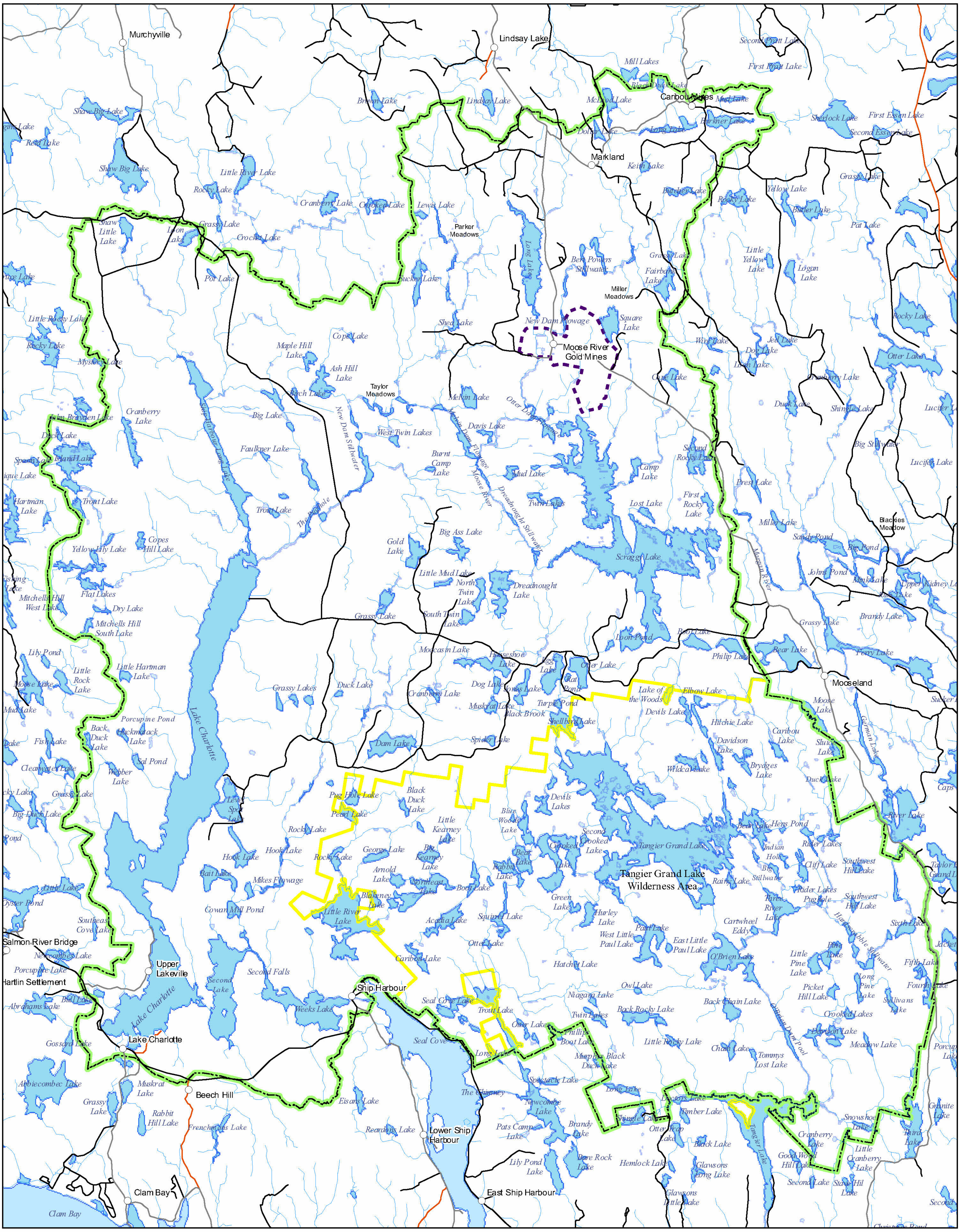


Figure 3.2-1
LAKES & WATERCOURSES
TOUQUOY GOLD PROJECT
DDV GOLD LTD.
Moose River Gold Mines
Halifax County, Nova Scotia

Legend

- Rivers, Streams
- Project Study Area
- Focus Study Area
- Tangier Grand Lake Wilderness Area
- Lakes

Source:
Topographic - Service Nova Scotia &
Municipal Relations

N

0 1 2 3 4 5
Kilometres

CONESTOGA-ROVERS & ASSOCIATES

Weeks Lake flows into Ship Harbour, for a total of 63 lakes in the Lake Charlotte Drainage Basin. The downstream watercourses from the Touquoy Gold Project in order are: Scraggy Lake, Lake Charlotte, Second Lake, Weeks Lake and Ship Harbour.

Outside of this drainage basin, and only within the boundary demarcating the Tangier Grand Lakes Wilderness Area, Ship Harbour receives water from another 22 lakes and their tributaries. Tangier Grand Lakes receives water from 44 lakes and their tributaries and Tangier Lake receives water from six lakes and their tributaries. Again, this list is not based on complete drainage basins in this region of the FRSA. These lakes and watercourses are not downstream of the Touquoy Gold Project.

The Fish River and Lake Charlotte are considered significant recreational fish areas for trout, gaspereau and landlocked Atlantic salmon populations (D. Archibald, NSDNR, pers. com.). The majority of recreational fishing occurs in the lower subwatersheds of Lake Charlotte and Fish River. The stocking history of Scraggy Lake starts in 1994 with fingerling brook trout which continued annually until 1996. Fingerlings of landlocked Atlantic salmon were stocked in 1998 to 2000, 2003 and 2006. Lake Charlotte and Grassy Lake are the only lakes in that area to have records of receiving these released hatchery fish.

A fisheries resource study was undertaken in Scraggy Lake in July 1975 and October 2000 by Nova Scotia Department of Agriculture and Fisheries (NSDAF). In the earlier survey, gill netting and shoreline seining produced white suckers (*Catostomus commersoni*), white perch (*Morone americana*), brown bullheads (*Ameiurus nebulosus*), golden shiners (*Notemigonus crysoleucas*), brook trout (*Salvelinus fontinalis*), American eel (*Anguilla rostrata*), lake chub (*Couesius plumbeus*), banded killifish (*Fundulus diaphanous*) and gaspereau (*Alosa pseudoharengus* and *A. aetivalis*). The latter survey caught the same species, but also Atlantic salmon (S*almo salar*) parr and smolts, smallmouth bass (*Micropterus dolomieu*) and yellow perch (*Perca flavescens*). Atlantic salmon smolts were recorded in a 1979 creel census. A few landlocked Atlantic salmon were recorded being caught from Scraggy Lake last year (T. Owen, DFO Fisheries Officer, pers. comm. 2007).

Fish resource surveys were conducted by CRA using permitted gill nets in August 2007 (one set in Square Lake) and September 2007 (four sets in Scraggy Lake). Figure 3.2-2 depicts the gill net locations. The survey in Square Lake yielded no fish however loons present in the lake may indicate that fish are present. The survey in Scraggy Lake yielded abundant white sucker (over 30 individuals) along with one yellow perch and one brown bullhead. No salmonid species or any other fish were caught in Scraggy and only five fish were detected by a Hummingbird fish finder along a transect through the entire length of the lake. The lack of fish caught reflects the combination of a nonsustainable population due to habitat issues and an indication from the area DFO officer that fishing pressure is high in the lake.

Scraggy Lake is characterized by dozens of small coves and islands resulting in a high shoreline development value with a shoreline length of 52,558 m. The lake outlet is dammed with a low profile wooden slat structure. Historically area rivers and lakes were dammed by these structures to accommodate log driving. Today this dam remains in place to maintain water level above protruding rocks for the cottager's boats. Fish passage is possible through and around the structure. The lake has a surface area of 644.5 ha and a maximum depth of 13 metres. However, much of the lake (562.9 ha) is less than six metres deep and from a bathymetry map appears to be on average three metres deep. The flushing rate is low at 1.8 times per year.

The surface pH in July 1975 was recorded at 6.6, in October 2000 it was 4.4, in July 2007 it was 5.2 and 5.3 with Fish River inputs as low as 4.9. The success of pH sensitive salmonids in Scraggy Lake is questionable. The NSDAF classifies this lake as a C category, meaning it is not good trout habitat. If the lake does not support a successful trout habitat, it will not do so for landlocked salmon either. Water quality data as also collected at that time and the lake limnology was described as high water temperatures, stratified, good to fair dissolved oxygen content, low conductivity, and slightly acidic. Existing data on water temperatures (Inland Fisheries Division, NSDAF, unpublished data) suggests that the waters of many lakes, as well as many of the Province's rivers, warm to levels unsuitable for brook trout during the late summer months.

On behalf of the NSDAF, the Centre of Estuarine Research at Acadia University compiled information on a selection of province-wide lake water chemistry data (Brylinsky 2002) for the purpose of assessing brook trout habitat suitability and stocking programs. Brook trout require cool, well-oxygenated water to survive. The ideal temperature range is 12° to 14°C and they tend to avoid waters warmer than 20°C. Dissolved oxygen (DO) levels must also be high and brook trout are seldom found in waters having DO levels less than 5.0 mg/L which at 20°C is equal to about 50% DO saturation. Of the 1,080 lakes surveyed, 93 were rated, with respect to the presence of coldwater habitat, as "good" and 207 were rated as "poor" lakes based on the level of DO saturation in the bottom waters, 'good' lakes being those having values ≥50% and 'poor' lakes having values <50%. Scraggy Lake was rated as poor trout habitat, with 5 mg/L DO content and 44% oxygen saturation.

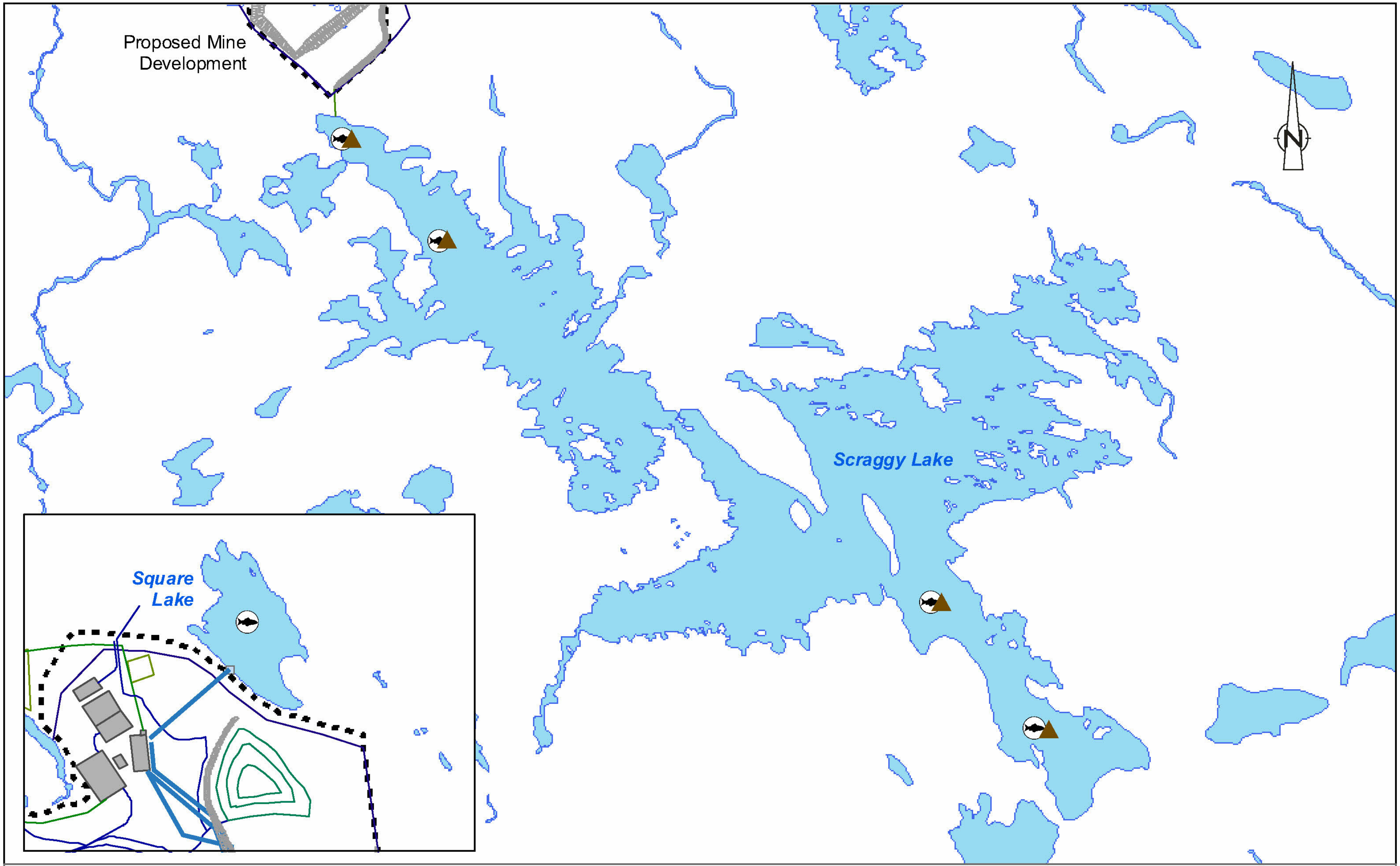


Figure 3.2-2
GILLNET & SEDIMENT SAMPLE LOCATIONS
TOUQUOY GOLD PROJECT
DDV GOLD LTD.
Moose River Gold Mines
Halifax County, Nova Scotia

820933-D (8) GIS-DA322 October 5, 2007

Legend

Gillnet Survey

▲ Sediment Sample

CONESTOGA-ROVERS & ASSOCIATES

3.2.2 Fish Species At Risk, Ecologically Sensitive And Critical Habitat

None of the fish species found in historical or recent fish surveys are listed under the Nova Scotia *Endangered Species Act*. Brook trout and gaspereau (alewife) are listed as sensitive to human activities or natural events. These species are subjected to commercial and recreational fishing throughout the province and are ubiquitous to Nova Scotia.

Scraggy Lake, does not provide critical habitat for either species. NSDNR has not identified areas of critical habitat for these fish species. Alewives may spawn in standing river water, oxbows, coastal ponds, streams or fast river currents. Brook trout spawn in gravel beds in the shallows of streams. The adults require clear, cool well oxygenated streams and lakes. Habitats for spawning and rearing of both species are wide ranging and is abundant throughout the province and the FRSA.

3.2.3 Fish Tissue Body Burden

Muscle tissue from six of the white suckers (WS) and the single yellow perch (YP) collected from Scraggy Lake were submitted to Maxxam Analytical Inc. for mercury analysis of muscle tissue (Table 3.2-1). Each fish was measured (fork length) and weighed for comparison with body burden of analytes.

Table 3.2-1 Mercury in Fish Muscle Tissues (mg/kg) From Scraggy Lake – September 07

Parameter	WS-1	WS-2	WS-3	WS-4	WS-5	WS-6	YP-1
Mercury	0.18	0.22	0.19	0.36	0.34	0.20	0.44
Fork Length (cm)	23.2	20.4	22.2	24.0	22.5	23.0	21.5
Weight (g)	151	105	132	178	143	134	139

Mercury is present in the muscle of white suckers. These fish are benthic feeders, thus are ingesting and exposed to lake sediments. The concentration of mercury ranges from 0.18 to 0.34 mg/kg (ppm) in white suckers. The only midwater, higher trophic level fish caught was a single yellow perch which had a mercury tissue level of 0.44 mg/kg. Environment Canada considers a level of 0.45 mg/kg in fish tissue as an effect from metal mining. Mercury exists in two different forms, the organic and the inorganic. In the aquatic environment, the most prevalent form of mercury is methyl mercury, the organic form, which binds tightly to the proteins in fish tissue. Most fish have trace amounts of methyl mercury. The level of mercury found in a fish is related to the level of mercury in its aquatic environment and its place in the food chain. Mercury tends to accumulate in the food chain, so large predatory fish species tend to have higher levels than non-predatory fish or species at lower levels in the food chain. Health Canada has established a guideline level of 0.5 parts per million (ppm) for mercury in commercial fish. This guideline is enforced by the Canadian Food Inspection Agency (CFIA). It was first set in the 1970s and, based on a recent re-evaluation, is still considered appropriate to ensure that the health of Canadians is protected from the toxic effects of methyl mercury.

3.2.4 Baseline Sediment Quality

A surficial sediment sample was collected by CRA with a stainless steel Eckman grab from Scraggy Lake near each location of the gillnets for a total of four samples. The samples were stored in glass 250 mL jars and submitted to Maxxam Analytical for a suite of total and bioavailable metal analyses including mercury and cyanide. Table 3.2-2 shows the total concentration of heavy metals in the sediments. Raw data results for all metals are provided in Appendix J – Baseline Sediment Quality.

Table 3.2-2 Summary Concentrations of Heavy Metals (mg/kg) in Surficial Sediments of Scraggy Lake

ELEMENTS	Sample Identification				Mean	St.Dev	CCME	
	SED-1	SED-2	SED-3	SED-4			ISQG	PEL
Mercury	0.31	0.54	0.24	0.29	0.345	0.13	0.17	0.486
Total Arsenic	7.5	11	7.4	7.4	8.325	1.78	5.9	17
Total Cadmium	0.19	0.3	0.31	0.41	0.3025	0.09	0.6	3.5
Total Chromium	23	30	37	38	32	6.98	37.3	90
Total Copper	11	14	15	19	14.75	3.30	35.7	197
Total Lead	19	44	61	70	48.5	22.43	35	91.3
Total Zinc	42	47	67	68	56	13.44	123	315
Total Cyanide	<0.5	<0.5	<0.5	<0.5	<0.5	0	---	---

The CCME *Interim Sediment Quality Guideline* (ISQG) is exceeded in mercury, arsenic, chromium and lead in all or half of the four samples. Only the *Probable Effect Level* (PEL) is exceeded by mercury in one sample (Sediment-2) located in the north end of the lake.

3.3 ATMOSPHERIC CONDITIONS

Baseline Ambient Air Quality and Meteorological Conditions

Background ambient air quality in the study area would be typical of most of the forested regions of Nova Scotia. Schedule A of the Nova Scotia Air Quality Guidelines outlines acceptable ground level concentrations for carbon monoxide (CO), hydrogen sulfide (H_2S), nitrogen dioxide (NO_2), ozone (O_3), sulfur dioxide (SO_2), and total suspended particulates (TSP).

National Air Pollution Surveillance Network (NAPS) is a joint federal/provincial monitoring program with 239 monitoring stations gathering data on smog related compounds. The closest monitoring station that collects data on the majority of the compounds outlined in the Ambient Air Quality Guidelines is Station # 030118 at 1657 Barrington Street, Halifax, Nova Scotia.

Outlined in the table below is a summary of data collected and the associated ambient air criteria:

Table 3.3-1 NAPS Monitoring Data-Station # 030118 and Ambient Air Criteria

Parameter	Annual Mean(Year)	Ambient Air Criteria
Nitrogen Dioxide	32.9 ug/m^3 (Aug-Dec 2004)	100(per annum)
Ozone	25.5 ug/m^3 (2005)	160 ug/m^3 in 1 hour
Sulfur Dioxide	18.3 ug/m^3 (2004)	60 ug/m^3 (per annum)
PM(TSP)	11 ug/m^3 (1996)	70 ug/m^3 (per annum)
PM 2.5	6 ug/m^3 (1996)	NAAQS regulation at 15 ug/m^3 (per annum)

Ref: NAAQS-National Ambient Air Quality Standard

Concentrations for these parameters are all below the ambient air quality criteria. This region is not as rural and would have greater contributions from emissions sources than our study area. Given the forest cover and lack of emissions sources in the Moose River Gold Mines area, the above mentioned parameters would also be significantly lower than the ambient criteria. Direct monitoring for TSP was conducted on site in January 2007. TSP values range from 10.5 µg/m^3 to 16.1 µg/m^3. All calculated values were below the maximum permissible ground level concentration of 120 µg/m^3 over a 24 hr period, outlined in Schedule A of the Nova Scotia Air Quality Regulations.

Additional baseline monitoring for particulate (PM 10 less than 10 microns) was conducted for the Touquoy Project (See Figure 3.3-1 for monitoring locations). Monitoring location #1 is approximately 300 m from the proposed open pit area and monitoring location #2 is just south of the Tangier Wilderness Area. Continuous total suspended particulate (TSP) is not possible utilizing high volume samplers, alternatively continuous particulate measurements were obtained utilizing a Beta Attenuation Monitor (BAM), specifically designed for continuous monitoring of particulate matter less than 10 microns in size. The National Ambient Air Quality Standard (NAAQS) Criteria for PM 10 over a 24 hr period is 150 ug/m^3.

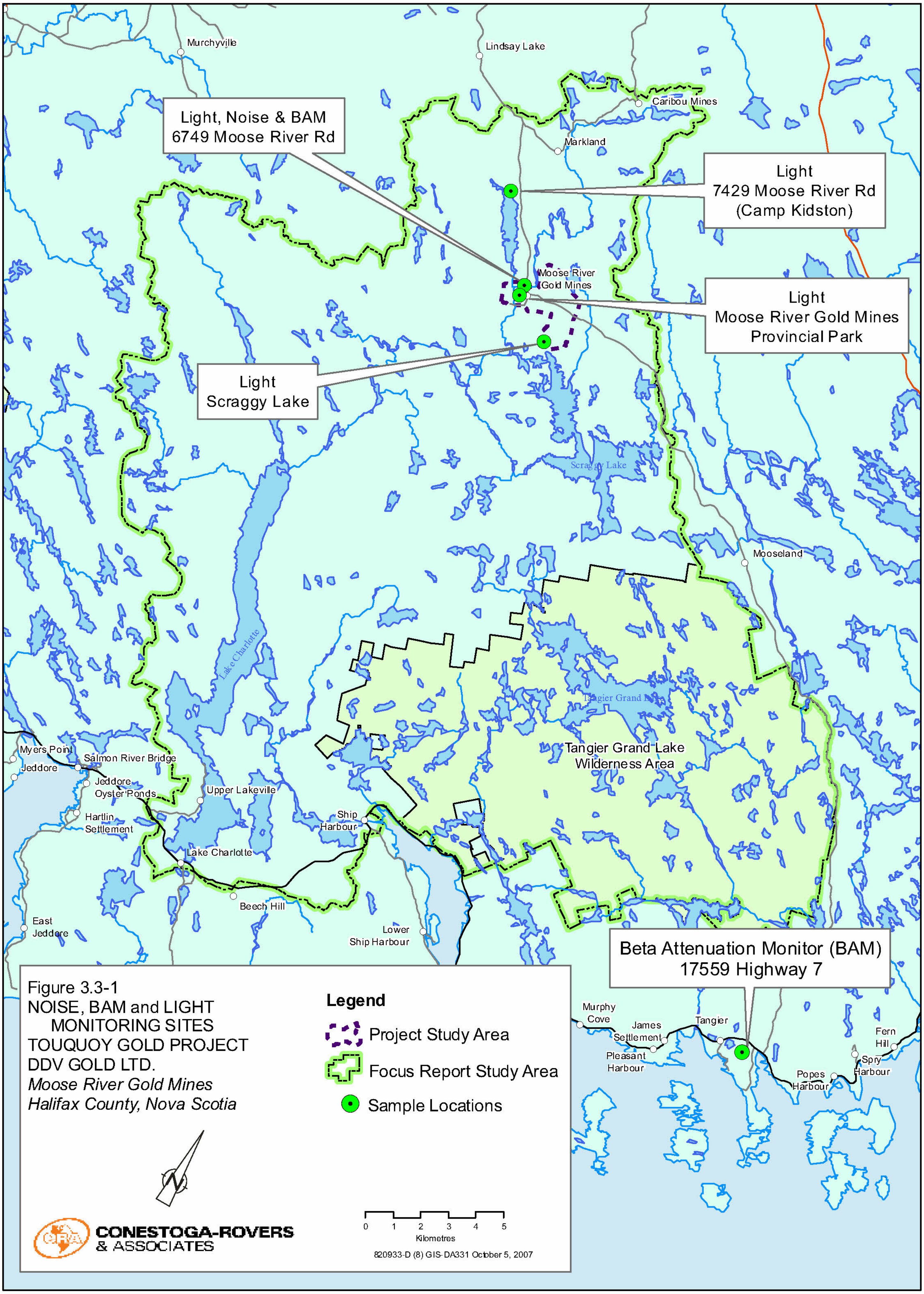


Figure 3.3-1
NOISE, BAM and LIGHT
MONITORING SITES
TOUQUOY GOLD PROJECT
DDV GOLD LTD.
Moose River Gold Mines
Halifax County, Nova Scotia

Average PM 10 values range from 5 -17 µg/m^3 for location #1 well below the NAAQS criteria. Average PM 10 values at monitoring location #2 were elevated due to a construction paving project approximately 2 km from the monitoring location. Daytime average values were elevated when compared to night time values. Values were quite variable, but all below ambient air criteria, except for Sept 8 values measured between 8 and 10 am. PM10 readings at those time intervals ranged from 247-413 µg/m^3. The 24 hr average was 73 µg/m^3, also below NAAQS criteria. The paving project was completed by September 9, 2007. Average PM 10 values collected from Sept 9-11 ranged from 8-11 µg/m^3.

Baseline meteorological data were collected utilizing Environment Canada's Meteorological web site. The nearest climate station with long term data is the Middle Musquodoboit climate station (ID# 8203535) operated by the Meteorological Service of Canada (MSC). The station is located approximately 15 km northwest of the mine site, near Middle Musquodoboit (45° 04'N, 63° 06'N). (Meteorological data sets were provided in the EARD).

The following is a summary of average climate conditions at the Middle Musquodoboit station, based on climate normals published by Environment Canada for the period from 1971 to 2000. Wind data is taken from the Upper Stewiacke climate station (Climate ID 8206200), which is located approximately 25 km north west of the mine site. This is the closest climate station to the site that would be comparable topographically as well as similar land uses and population. Upper Stewiacke is approximately 25 km from the proposed mine site.

Mean annual total precipitation is 1370 mm, which includes 165 cm of average snowfall per year (165 mm water equivalent). Highest precipitation generally occurs in the months of October and November, with lowest precipitation in the month of February. Measurable precipitation occurs on an average of 164 days per year, with 141 days of measurable rainfall and 31 days of measurable snowfall.

The extreme one day rainfall for the station is 173 mm on August 15, 1971 and extreme one day snowfall is 70 cm on February 8, 1981.

Average temperature is 6.2°C, with an average range from -6°C to 18.1°C. Temperature extremes can range from -34°C to 35°C. There is an average of 312 days per year with an average temperature above 0°C.

A review of average wind conditions from August 2006, through to September 2007 (from Upper Stewiacke station) indicates wind directions (blowing from) trending generally westerly to north westerly in the fall to winter months, changing to more southerly winds in the summer or warmer months (see Wind Rose Diagrams for Upper Stewiacke Station, Appendix K). Average wind speeds for the months reviewed ranged from 8.1 km/hr to 14.3 km/hr. Maximum monthly gust range from 28 km/hr to 48 km/hr.

Local and Regional Emission Sources

A review of local and regional businesses in and around the FRSA and region, revealed that there would not be any significant emissions contributions from other operating businesses.

Sensitive Receptors

The nearest sensitive receptor has been considered to be at a point in Scraggy Lake, where a camper may be situated (POR3). The second closest sensitive receptor is a children's overnight camp (Camp Kidston) located at a distance of approximately 3 km northwest from the open-pit area (POR2). The third closest sensitive receptor is a permanent residential dwelling located at a distance of approximately 5 km northwest from the open-pit area (POR3). Figure 4 of the Air Emissions report (see Appendix L) illustrates the locations of these three sensitive receptors relative to the Project site.

Ground-level concentrations for all contaminants were calculated at various averaging times from the air dispersion modeling. These values were compared to available criterion for each of the receptors to determine the off-Site ambient air impacts potentially occurring from the Site operations. The results of this analysis and modeling are discussed below in Section 4.0.

3.4 WETLANDS IN THE FOCUS REPORT STUDY AREA

The FRSA lies within an area of the Province which is characterized by thin soils and exposed bedrock (NSM 1996). Much of the bedrock in this area consists of granite, greywacke, or argillite, and thus is resistant to erosion. Thus, surface waters tend to be quite low in dissolved solids and nutrients, acidic, and high in tannins (dystrophic) (NSM 1996). Lakes tend to be oligotrophic and have low primary productivity. Groundwater is stored and transmitted through fractures and joints and along fault and contact zones in the bedrock, and is generally also low in dissolved minerals (NSM 1996). Drainage patterns in this area tend to be deranged and thus, surface water flows through a confusing series of streams, lakes and wetlands. Shallow rocky lakes also occur (NSM 1996). The low granite ridges common in this area result in small valley depressions where bogs may develop, and the underlying bedrock results in poor drainage, leading to swampy areas. Annual precipitation in this area averages 1400 to 1500 mm annually, mostly in the form of rain (NSM 1996). These conditions combined with the water table close to the surface and excess of annual rainfall are conducive to the formation of wetlands.

Wetlands located within the FRSA were identified using the NSDNR Wetlands database and available mapping. The database was found to contain 1,239 classified wetlands within the FRSA. Wetlands listed in the NSDNR database are classified according to an older wetland classification system. For clarity CRA carefully examined the NSDNR database and wetland have been reclassified according to the more recent Canadian Wetland Classification System (National Wetlands Working Group 1997). Bogs, fens, swamps, marshes, and shallow water wetlands are present within the FRSA, and are discussed in the following sections. Many wetlands are complexes consisting of more than one wetland type. For the purposes of this report, wetlands have been classified based on the predominant wetland type within the complex (Figure 3.4-1).

Bogs

The majority of the wetlands within the FRSA are bogs. Bogs are peatlands which receive their water supply solely through direct precipitation. They do not receive surface runoff, nor are they influenced by groundwater. This reliance on precipitation ensures that bogs are low in minerals and nutrients and are acidic. Bogs are usually dominated by *Sphagnum* mosses and the vascular plant layer may be dominated by trees, shrubs, or ground vegetation. The prevalence of *Sphagnum* mosses results in the accumulation of a peat layer which may be several metres thick. Bog surface, and the bog water table may be level with or raised above the surrounding terrain. Bogs are a very common wetland type in Nova Scotia. There are 910 bogs listed in the NSDNR database for the FRSA, ranging in size from 0.003 ha to 80.35 ha. This wetland class covers 2887.41 ha or 5.31% of the FRSA. The majority (> 58%) of the bogs present in the FRSA are under 2 ha in area, while only 4 % cover an area larger than 10 ha. Bogs or fen-bog complexes are common along the low-lying margins of Scraggy Lake. There are also two large bogs in the western half of the proposed Ship Harbour Long Lake wilderness area; a 90 hectare shrub bog north of Island Lake, and a 160 hectare open bog that straddles the proposed wilderness area's boundary near Bruce Lake.

Fens

Fens are characterized by a fluctuating water table, and often have a groundwater and/or surface water supply. The fen surface is usually level with the local water table. The groundwater supply results in fens having greater nutrient and mineral levels than bogs, as well as higher pH. Fens are also a type of peatland, though the source of the peat differs. The higher nutrient levels allow plants such as sedges and brown mosses to thrive, resulting in the accumulation of a sedge peat layer. The vegetation layer is dominated by grasses, sedges, and rushes, as well as shrubs. Fens with a water supply low in dissolved minerals may contain typical bogs species such as *Sphagnum* and ericaceous shrubs. Fens are common in Nova Scotia. The NSDNR database lists 233 fens within the FRSA. The largest is 30.04 ha, while the smallest is 0.029 ha. Similar to bogs, over 57% of the fens present are less than 2 ha in size, while only 4% are over 10 ha. Fens cover a total of 721.48 ha, or 1.33% of the FRSA. Fen-bog complexes are common along the low-lying margins of Scraggy Lake.

Swamps

Swamps are wetlands which are influenced by groundwater and are vegetated by trees and or shrubs. These trees and shrubs result in the accumulation of peat which is rich in woody debris. The water table is near or at the swamp surface, which tends to be hummocky. Swamps are very common in Nova Scotia. According to the NSDNR databases, there are 21 areas of swamp within the FRSA. These swamps range from 0.28 to 7.71 ha in size and cover a total of 35.45 ha or 0.0065% of the FRSA.

Marshes

Marshes are mineral wetlands which contain shallow surface waters which undergo large fluctuations in depth. Little accumulation of organic materials occurs in marshes. Vegetation is dominated by large emergent vascular plants such as graminoids as well as some floating species. Marshes may be freshwater or saline, depending in the surface water supply. Marshes are quite common in Nova Scotia. For the purposes of this report, the Marsh classification includes the older NSDNR wetland classification of seasonally flooded flats. There are 66 marshes within the FRSA, according to the NSDNR database. The marshes range from 0.006 to 22.03 ha in size, and cover 198.98 ha (0.366%) of the FRSA.

Shallow Water Wetlands

Shallow water wetlands are transitional between wetlands which are seasonally flooded and those which are permanent, deep water bodies. Thus, they are usually found around lakes. Mineral levels, acidity and nutrients are influence by the local geology, hydrology, nutrient fluxes and plant communities. Wetlands classified under the older NSDNR classification of floating leaf wetlands have been treated as shallow water wetlands for the purposes of this summary. Shallow water wetlands are common in Nova Scotia. Within the NSDNR database, there are 55 wetlands occurring in the FRSA which may be considered shallow water wetlands, ranging in size from 0.006 ha to 22.03 ha. This wetland type covers 180.8 ha, or 0.342% of the FRSA. They are predominately found around the many lakes in the FRSA.

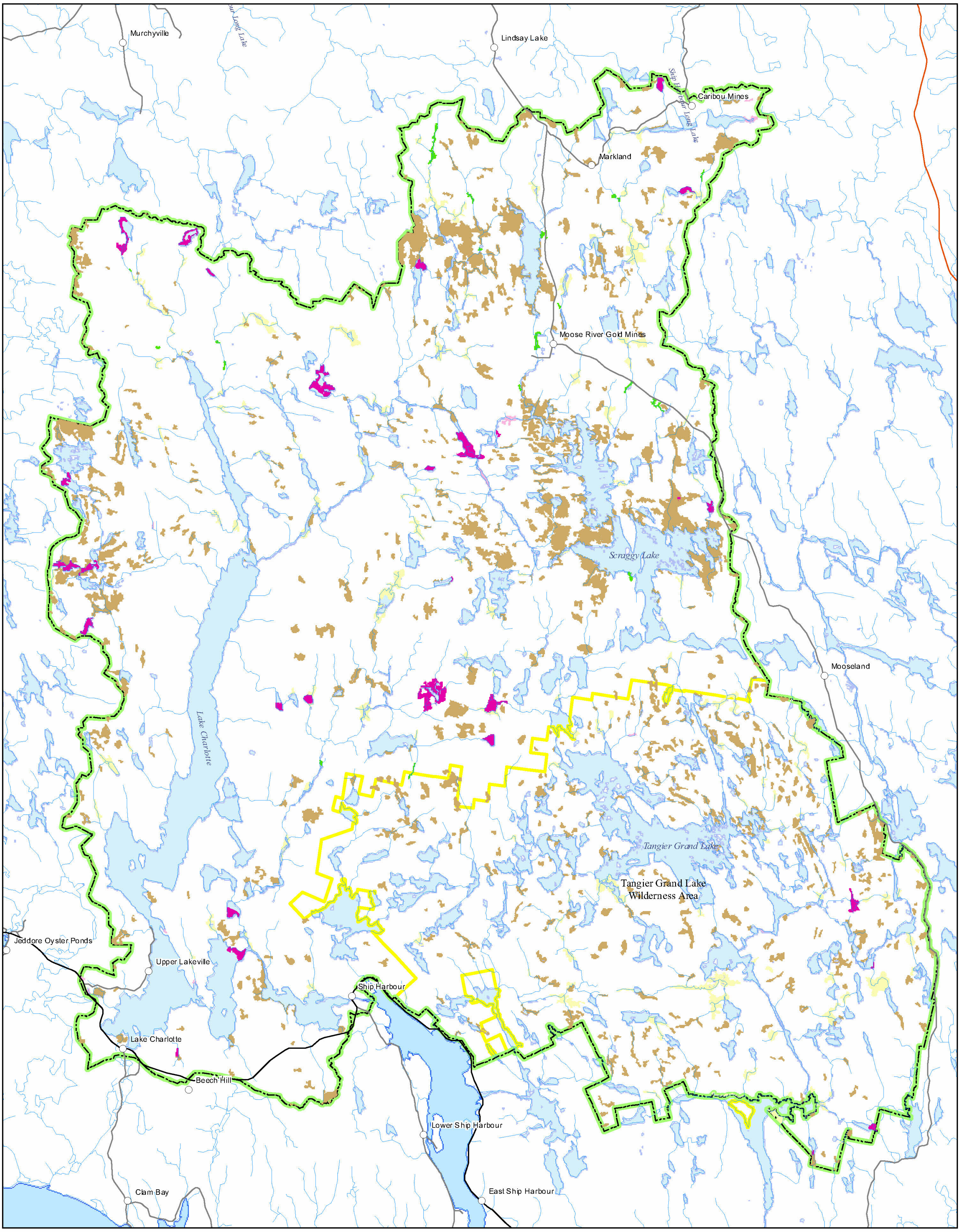


Figure 3.4-1
WETLANDS BY CLASS
TOUQUOY GOLD PROJECT
DDV GOLD LTD.
Moose River Gold Mines
Halifax County, Nova Scotia

Legend

Wetlands

- 🟫 Bog
- 🟨 Fen
- 🟪 Shallow Water Wetland
- 🟩 Swamp
- 🟪 Marsh
- ▢ Focus Report Study Area

Source:
Wetlands - Nova Scotia Enviroment & Labour Wetlands Atlas
Topographic - Service Nova Scotia & Municipal Relations

0 1 2 3 4 5
Kilometres

CONESTOGA-ROVERS & ASSOCIATES

3.5 GENERAL HYDROLOGIC, HYDRAULIC AND WATER QUALITY DESCRIPTION

The FRSA for the Touquoy Gold Mine Focus Report encompasses the area within Nova Scotia Watershed numbers 1EL-5 and 1EL-2 (based on the 1:50,000 Nova Scotia Watershed Area Mapping). The watershed mapping is shown on Figure 3.5-1. Hydraulically speaking, the two watersheds are not connected, with both having separate ultimate outlets. The proposed mine site is located within watershed 1EL-5 and thus the potential for downstream impacts due to surface runoff would only exist within this watershed. The total land area of watershed 1EL-5 is approximately 33,000 ha, approximately 0.6% of the total land area of the province. The proposed mine site is located within the northern headwaters of the watershed, within the lower portion of sub-watershed 1EL-5P. Sub-watershed 1EL-5P has a total drainage area of approximately 4,900 ha and is drained from north to south by the Moose River system, which includes the Moose River and some larger lakes such as Long Lake, Fairbank Lake and Burkner Lake. The Moose River system drains into the Fish River system approximately 4 km south of the proposed mine site.

The Fish River system begins at Square Lake, which is located within sub-watershed 1EL-5M bordering the Moose River sub-watershed (1EL-5P) to the east. The Fish River drains south into Scraggy Lake, along with sub-watersheds 1EL-5K (Cope Lake/Camp Lake), 1EL-5H (Rocky Lake) and the Boot Lake/Philip Lake system within sub-watershed 1EL-5G. In all, the Scraggy Lake basin at the outlet of Scraggy Lake encompasses an area of almost 4,200 ha and drainage flows west via the Fish River toward its confluence with the Moose River as described above. Scraggy Lake itself is fairly shallow with many bays and islands and covers an area of approximately 700 ha. Total lake volume is approximately 21,250,000 m^3. Following the confluence with the Moose River, the Fish River continues west for another 3 km before its confluence with the Stillwater Brook system. The Stillwater Brook system (sub-watershed 1EL-5R) borders the Moose River sub-watershed (1EL-5P) to the west and drainage is from north to south.

The Fish River begins to turn south after the confluence with Stillwater Brook toward Lake Charlotte. Several smaller sub-watersheds also drain into the system along the way, including sub-watersheds 1EL-5D, 1EL-5E, 1EL-5Q, 1EL-5S, 1EL-5T, 1EL-5U and 1EL-5V. The Fish River then empties into the northern tip of Lake Charlotte. By this point, the total drainage area at this inflow point to Lake Charlotte is approximately 16,300 ha. Immediately to the west of this inlet is another inlet to Lake Charlotte, which is the outflow from Ship Harbour Long Lake (sub-watershed 1EL-5X). A third major inlet to Lake Charlotte occurs along its western shore, approximately 1.5 km south of the north tip of the lake. This is the Island Lake/Mill Brook system (sub-watershed 1EL-5Z).

Figure 3.5-1
CATCHMENTS (1EL-5)
TOUQUOY GOLD PROJECT
DDV GOLD LTD.
Moose River Gold Mines
Halifax County, Nova Scotia

Legend

▨	Catchment 1EL-5
▭	Sub-Catchments
∼	Rivers, Streams
▨	Lakes
▭	Project Study Area
▭	Focus Report Study Area
▭	Tangier Grand Lake Wilderness Area

Source:
Catchments - Nova Scotia Enviroment & Labour
Topographic - Service Nova Scotia &
Municipal Relations

0 1 2 3 4 5
Kilometres

CONESTOGA-ROVERS
& ASSOCIATES

The total area draining to the top of Lake Charlotte is approximately 22,700 ha. The lake itself is long and narrow, running north-south for approximately 15 km. The lake has a surface area of approximately 1,540 ha and a total volume of approximately 168,562,000 m^3. The outlet of Lake Charlotte is located near its southern end, where it discharges into Second Lake. The total drainage area above this point is approximately 28,000 ha. Another large sub-watershed connects into the system just downstream of the outlet of Second Lake. This is the Cowan Brook sub-watershed (1EL-5B), which is the eastern edge of the 1EL-5 watershed and borders the separate Tangier River watershed to the east (Nova Scotia watershed 1EL-2). The Lake Charlotte system flows finally through Weeks Lake, before its ultimate discharge into the Atlantic Ocean at Ship Harbour.

As indicated in Section 3.3, the FRSA is generally characterized by high rainfall and cool temperatures. Mean annual total precipitation is 1370 mm while average temperature is 6.2 °C, with an average range from -6 °C to 18.1 °C. Figure 3.5-2 summarizes the typical hydrologic budget for the region for average monthly conditions from 1968–2003. The figure plots the total precipitation, available free water each month (*i.e.* sum of rainfall and snowmelt), evapotranspiration loss for each month (*i.e.* amount of water evaporated or transpired from a vegetated surface), and the net water surplus (*i.e.* excess water remaining after evapotranspiration demands have been met and soil storage is returned to its water holding capacity level). Monthly runoff estimates can be made based on the water surplus for each month. The figure indicates that the amount of available free water is highest in March, which corresponds to the spring melt period. Available water then levels off over the summer months, corresponding to rainfall. Evapotranspiration losses steadily increase during the spring as temperatures rise and days lengthen, to a peak of 120 mm in the month of July. As indicated in Figure 3.5-2, evapotranspiration losses exceed available water (*i.e.* rainfall) between June and August. In these months moisture is drawn from soil storage to satisfy demand. The overall effect of the moisture gains and losses is shown in Figure 3.5-2 as the net water surplus for each month. As would be expected, water surplus is relatively high in the fall, winter and spring, given the abundant precipitation in the region. Surplus falls in the summer as evaporative demands increase, to a minimum surplus of 10 mm over the region in July.

The hydrologic budget described above accounts for evapotranspiration losses which occur over vegetated surfaces. For water bodies such as ponds and lakes, surface evaporation will also be significant during warmer months. Figure 3.5-3 presents average lake evaporation data. The data were obtained from the nearest available MSC climate station that records lake evaporation data, which is in Truro (ID# 8205990), approximately 50 km northwest of the mine site. Figure 3.5-3 indicates that average evaporation losses peak at approximately 112 mm in July. Lake evaporation is approximately equal to evapotranspiration losses, which is typical.

Table 3.5-1 lists estimated average monthly flows for all of the sub-watersheds within the study area shown on the mapping (*i.e.* watershed numbers 1EL-5A through 1EL-5Z and 1El-5AA). The table also indicates total catchment areas and flows for selected key points in within the 1EL-5 watershed: the Moose River sub-watershed outlet, the Flows were calculated based on watershed areas obtained from the mapping combined with the hydrologic budget information and historic flow gauge information from Water Survey of Canada (WSC) gauge No. 01EK001 "Musquodoboit R. at Crawford Falls" (using the period of record 1968 – 1994). Average monthly runoff can be estimated from the water surplus values obtained from the hydrologic budget information by assuming that 50% of the surplus water for any given month is retained in the watershed and contributes to runoff the following month. Thus runoff for any given month is calculated as the sum of 50% of the water surplus for the current month plus 50% of the runoff for the previous month. Runoff depths were calculated for each month and multiplied by the catchment area of each sub-watershed to produce average monthly runoff volumes for the catchment. The monthly volumes were converted to average daily flow rates.

In order to compare runoff estimates generated using the hydrologic budget model, a comparison was made with flow data available for the discontinued Water Survey of Canada (WSC) hydrometric station Musquodoboit River at Crawford Falls (station 01EK001). The station is located approximately 10 km upstream of Musquodoboit Harbour, approximately 25 km southwest of the mine site. The station has data spanning an 81 year period of record from 1915 to 1995. Drainage area upstream of the gauge is 650 km^2. Data was obtained for average monthly flows for the period of record. Monthly data from 1968 to 1994 was averaged, and pro-rated for each sub-catchment based on watershed area. The two estimates were then averaged to produce the final estimates shown in Table 3.5-1.

Also indicated in the table are flows for the major inlets to both Scraggy and Charlotte Lakes, as shown in the attached sketches. Other inflows can be calculated from the catchment data provided if required, as can flows at various points along the drainage network. Total outflows (based on total drainage area to each outlet) are provided for both Scraggy and Charlotte Lake.

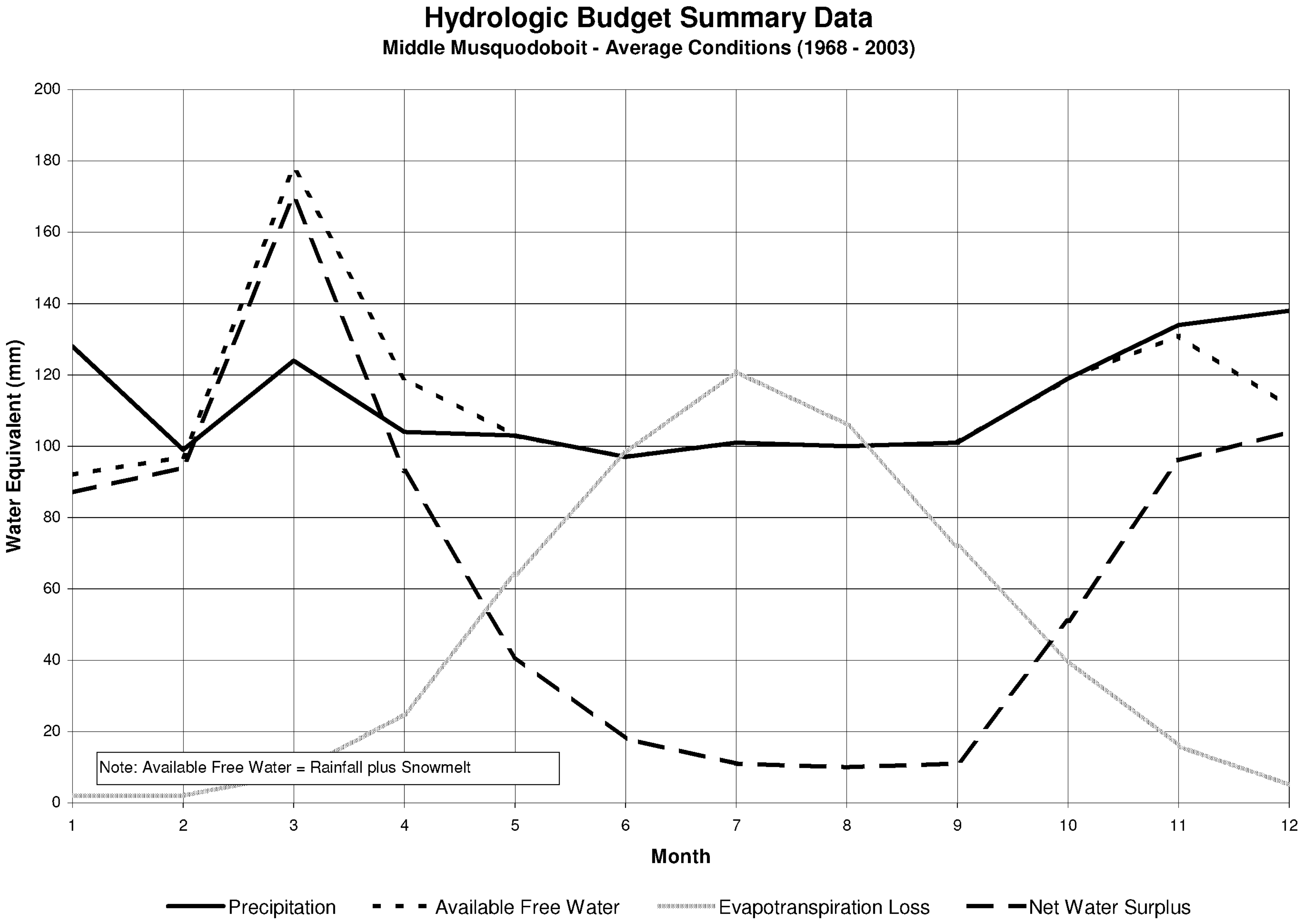


Figure 3.5-2
Hydrologic Budget Summary Data
Touquoy Gold Project, DDV Gold Ltd.
Halifax County, Nova Scotia

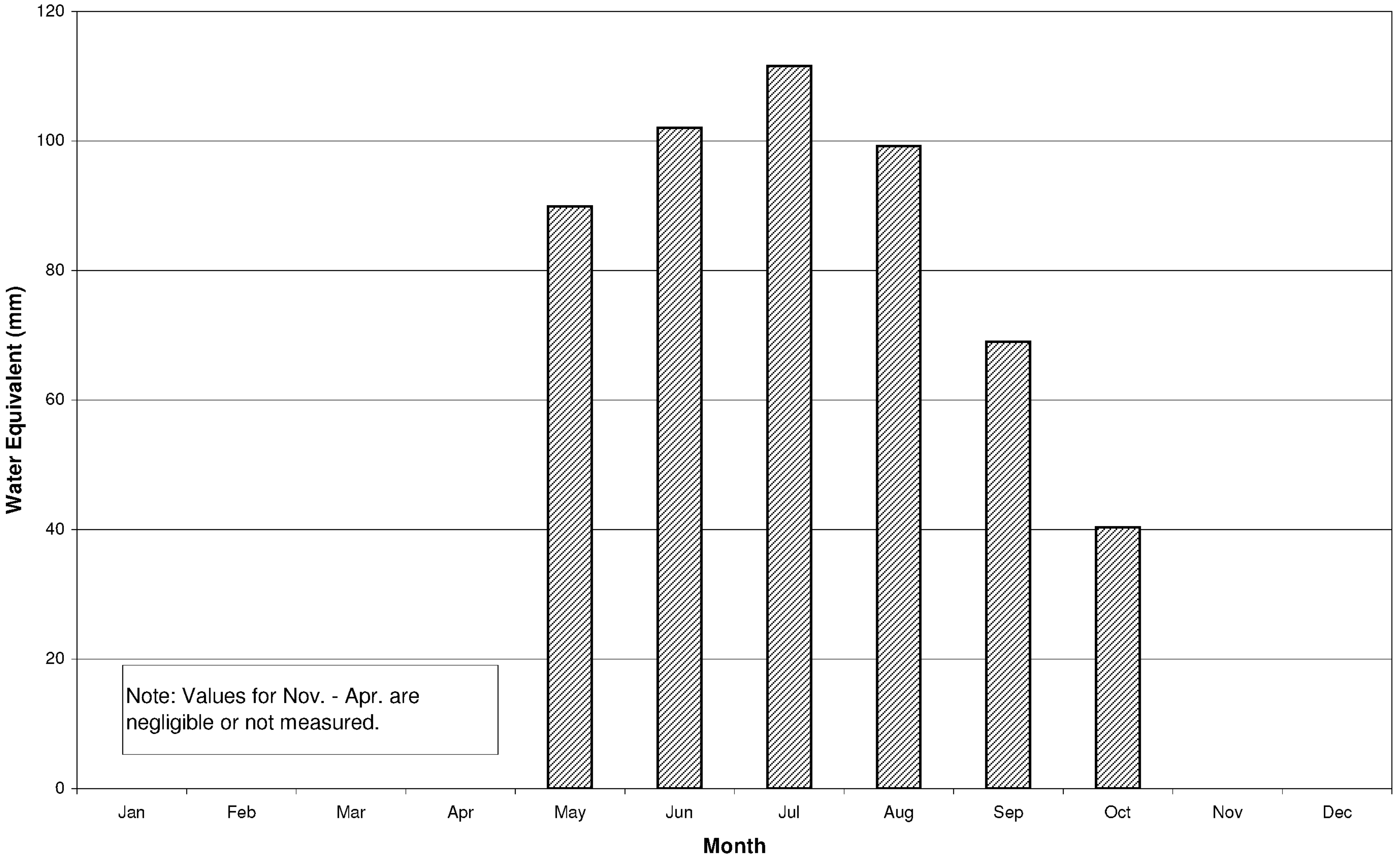


Figure 3.5-3
Average Lake Evaporation Data
Touquoy Gold Project, DDV Gold Ltd.
Halifax County, Nova Scotia

Table 3.5-1 Catchment Flows - Monthly Average Discharge (m^3/s)

Watershed	Area		Discharge (m^3/s)												
	ha	km^2	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Average
1EL-5A	500	5.0	0.17	0.18	0.25	0.26	0.16	0.09	0.06	0.06	0.04	0.09	0.17	0.20	0.14
1EL-5B	3,668	36.7	1.26	1.29	1.81	1.89	1.20	0.69	0.41	0.45	0.29	0.67	1.26	1.48	1.06
1EL-5C	2,956	29.6	1.01	1.04	1.46	1.52	0.97	0.56	0.33	0.36	0.24	0.54	1.01	1.19	0.85
1EL-5D	813	8.1	0.28	0.29	0.40	0.42	0.27	0.15	0.09	0.10	0.07	0.15	0.28	0.33	0.23
1EL-5E	726	7.3	0.25	0.26	0.36	0.37	0.24	0.14	0.08	0.09	0.06	0.13	0.25	0.29	0.21
1EL-5F	424	4.2	0.15	0.15	0.21	0.22	0.14	0.08	0.05	0.05	0.03	0.08	0.15	0.17	0.12
1EL-5G	1,958	19.6	0.67	0.69	0.97	1.01	0.64	0.37	0.22	0.24	0.16	0.36	0.67	0.79	0.56
1EL-5H	429	4.3	0.15	0.15	0.21	0.22	0.14	0.08	0.05	0.05	0.03	0.08	0.15	0.17	0.12
1EL-5J	319	3.2	0.11	0.11	0.16	0.16	0.10	0.06	0.04	0.04	0.03	0.06	0.11	0.13	0.09
1EL-5K	476	4.8	0.16	0.17	0.24	0.24	0.16	0.09	0.05	0.06	0.04	0.09	0.16	0.19	0.14
1EL-5L	34	0.3	0.012	0.012	0.017	0.017	0.011	0.006	0.004	0.004	0.003	0.006	0.012	0.014	0.01
1EL-5M	657	6.6	0.22	0.23	0.32	0.34	0.22	0.12	0.07	0.08	0.05	0.12	0.23	0.26	0.19
1EL-5N	945	9.5	0.32	0.33	0.47	0.49	0.31	0.18	0.11	0.12	0.08	0.17	0.32	0.38	0.27
1EL-5P	4,917	49.2	1.68	1.73	2.43	2.53	1.61	0.93	0.55	0.60	0.39	0.90	1.69	1.98	1.42
1EL-5Q	337	3.4	0.12	0.12	0.17	0.17	0.11	0.06	0.04	0.04	0.03	0.06	0.12	0.14	0.10
1EL-5R	2,012	20.1	0.69	0.71	0.99	1.03	0.66	0.38	0.22	0.25	0.16	0.37	0.69	0.81	0.58
1EL-5S	185	1.9	0.06	0.07	0.09	0.10	0.06	0.03	0.02	0.02	0.01	0.03	0.06	0.07	0.05
1EL-5T	516	5.2	0.18	0.18	0.25	0.27	0.17	0.10	0.06	0.06	0.04	0.09	0.18	0.21	0.15
1EL-5U	185	1.9	0.06	0.07	0.09	0.10	0.06	0.03	0.02	0.02	0.01	0.03	0.06	0.07	0.05
1EL-5V	763	7.6	0.26	0.27	0.38	0.39	0.25	0.14	0.08	0.09	0.06	0.14	0.26	0.31	0.22
1EL-5W	156	1.6	0.05	0.05	0.08	0.08	0.05	0.03	0.02	0.02	0.01	0.03	0.05	0.06	0.04
1EL-5X	4,290	42.9	1.47	1.51	2.12	2.20	1.41	0.81	0.48	0.52	0.34	0.78	1.47	1.73	1.24
1EL-5Y	175	1.8	0.06	0.06	0.09	0.09	0.06	0.03	0.02	0.02	0.01	0.03	0.06	0.07	0.05
1EL-5Z	2,093	20.9	0.72	0.74	1.03	1.08	0.69	0.40	0.23	0.26	0.17	0.38	0.72	0.84	0.60
1EL-5AA	3,753	37.5	1.28	1.32	1.85	1.93	1.23	0.71	0.42	0.46	0.30	0.68	1.29	1.51	1.08
Moose R. Wshed Outlet	4,917	49.2	1.68	1.73	2.43	2.53	1.61	0.93	0.55	0.60	0.39	0.90	1.69	1.98	1.42
Scraggy Lake Wshed Outlet	4,174	41.7	1.43	1.47	2.06	2.15	1.37	0.79	0.46	0.51	0.33	0.76	1.43	1.68	1.20
Fish R. Wshed Outlet	16,327	163.3	5.59	5.74	8.06	8.39	5.35	3.09	1.82	2.00	1.31	2.97	5.60	6.58	4.71
Lake Charlotte Wshed Outlet	28,019	280.2	9.59	9.85	13.84	14.40	9.18	5.30	3.12	3.43	2.24	5.11	9.61	11.29	8.08
Total 1EL-5 Wshed Outlet	33,287	332.9	11.39	11.70	16.44	17.11	10.90	6.29	3.70	4.07	2.67	6.07	11.42	13.41	9.60

3.5.1 GROUNDWATER/SURFACE WATER INTERACTION

Description

The study area hydrology, geology and hydrogeology have been outlined previously in the EARD document and in a separate report prepared by Peter Clifton & Associates (PCA). Additional information is presented in a report prepared by ADI Ltd. (ADI) for DDV Gold.

This study area is located in a region of the province having relatively low relief with hummocky type terrain, characterized by rolling till plains, drumlin fields, extensive rockland, and numerous freshwater lakes, streams, bogs and wetlands. The complex system of surface drainage is a direct result of the underlying bedrock geology of greywacke and slate found in the region. These relatively impermeable and poorly jointed rocks result in slow groundwater recharge and most of the excess surface water runs off or is retained on the surface, in what is often called a 'deranged' drainage pattern.

The site hydrogeology consists of a fractured rock aquifer system which is overlain by a thin aquifer in the till. The degree of hydraulic connection amongst the smaller bedrock fracture systems is considered to be poor to moderate, and the main zones that are capable of storing and transmitting relatively large amounts of groundwater are the larger scale faults. The water table is close to the surface across the study area, reflecting the flat lying terrain, low permeability bedrock and the excess of annual rainfall over evaporation. Thus, the bedrock sequence and part of the overlying tills will be saturated with groundwater under ambient conditions.

The actual volume of groundwater stored in the bedrock aquifer is likely small, and this reflects the relatively small primary porosity of these rocks. Some of the larger bedrock structures may be hydraulically connected to surface water bodies which may become sources of aquifer recharge under a mine dewatering scenario (PCA, 2006).

Four Hydrostratigraphic Units (HUs) characterize the study area including, Podzol (soil horizon) HU, Till (glacial overburden) HU, Metamorphic (bedrock) HU and Structural (faults, anticlinal axes) HU (ADI, 2007).

The mine itself will be positioned primarily within the Metamorphic HU, possibly cross cutting active Structural HU's. Groundwater inflows and outflows will be controlled by these relatively low permeability and fracture controlled units. Given the high water table in the study area and combined with the high water surplus and general low permeability of the area, the groundwater flow system can be characterized as a "Local" system, with topographic highs representing recharge zones that would discharge into the adjacent topographic lows (ADI, 2007). The Till HU is expected to create non-flowing artesian conditions within the Metamorphic HU. Groundwater-stream interaction is expected to be controlled by the thickness, continuity and permeability of the confining Till HU (ADI, 2007).

An analysis of the topography in the study area was carried out to delineate areas with slopes greater than 10%. The mapping is shown in Figure 3.5-4. As would be expected, the mapping indicates that the steeper slopes surround the shores of the lakes and streams. These areas would act as recharge zones which would discharge to the water bodies in close proximity. Under ambient conditions, surface water contribution to groundwater would be very limited given the thickness, continuity and permeability of the confining Till HU and the relative impermeability of the bedrock HU.

During high rainfall events when surface water stage would rise temporarily, increased seepage to groundwater would result, however most surplus water would be discharged via surface runoff. The large storage volumes available in the area will limit changes in stage height of the various lakes and streams. As a result, water exchange between these surface water bodies and the shallow groundwater system is expected to be minimal.

Additional assessment work was completed at Moose River Gold Mines to determine the potential linkage between the Moose River surface water system and the local groundwater regime. This assessment work took the form of a temperature survey of surface water to determine possible areas of upwelling groundwater. The survey was completed in late summer/early fall (September 19, 2006) when shallow groundwater is typically in the 10 to 12 °C range and surface waters are in the 15 to 20 °C range. Dissolved oxygen (DO) readings were also taken at the sample intervals. The survey was completed from the bridge crossing the Moose River Road north of the site to south of the bridge crossing the Moose River south of the site, roughly a distance of 1.25 kilometres. Readings were taken in areas where the river bottom had hollows which would have greater potential for groundwater upwelling. The collected data are summarized in Table 8.3 of the EARD document and indicate no correlation for this assessment. This suggests that groundwater upwelling is not occurring through the portion of the Moose River that lies adjacent to the proposed Touquoy Pit and similar results would be expected over the entire FRSA.

Figure 3.5-4
SLOPES GREATER THAN 10 %
TOUQUOY GOLD PROJECT
DDV GOLD LTD.
Moose River Gold Mines
Halifax County, Nova Scotia

Legend

🟩 Slopes > 10 %
▨ Project Study Area
▨ Focus Report Study Area
▨ Tangier Grand Lake Wilderness Area

Source:
Service Nova Scotia & Municipal Relations

0 1 2 3 4 5
Kilometres

CONESTOGA-ROVERS & ASSOCIATES

820933-D (8) GIS-DA354 October 29, 2007

3.6 AMBIENT LIGHT AND NOISE

3.6.1 Existing Acoustical Environment

Noise measurements at the Moose River Gold Mines site were obtained for the period of January 9, 2007 through to January 12, 2007 (see Appendix M - Acoustic Assessment Report). These values are generally representative for the FRSA. As specified in the Noise Measurement and Assessment Guidelines , Leq values should be ≤65 dBA between the hours of 0700 and 1900 hours, ≤60dBA between the hours 1900 and 2300 hours and ≤55 dBA between the hours of 2300 and 0700 hours. The guidelines specify a minimum of two consecutive hours in each interval to be monitored. Monitoring locations are shown on Figure 3.3-1.

Continuous, one–hour Leq values were observed throughout the above specified time intervals. The lowest measured one-hour Leq values for the monitoring program were:

7:00 – 19:00	40.3 dBA
19:00 – 23:00	40.0 dBA
23:00 – 7:00	39.6 dBA

All measured Leq values were below NSEL regulations. Adverse weather conditions were not experienced during each of these hours. The complete long-term sound level monitoring data set outlining the lowest measured Leq values is provided in the Acoustic Assessment Report. The analysis of impacts is summarized in Section 4.

Different meteorological conditions can have an effect on noise propagation. Temperature inversions as well as cloud cover bend sound waves downward, potentially increasing the sound levels heard at the receptor. Wind causes sound waves to bend in the direction that it blows. If wind blows from the source to the receptor (downwind propagation), sound waves are refracted downwards also potentially increasing sound levels heard. The same observations have been made during or after a rainfall. Wet surfaces enhance wheel noise. Rain water fills the pores of the surface making it acoustically harder reducing ground attenuation leading to increased noise levels.

However, if the wind is blowing towards the sources (upwind propagation) sound waves are refracted upward and audibility can be reduced. A temperature decrease with altitude, during sunny weather or when strong winds are blowing, causes upward refraction reducing audibility. Heavy snow cover can have the same effect. The snow cover on the ground is very soft and ground attenuation is enhanced (New South Wales Mineral Council Ltd. 2006, Institut für Physik der Atmosphäre 2007).

3.6.2 Existing Ambient Light

A background light study was also conducted on August 23, 2007 (see Appendix N – Light Assessment Report). Post curfew measurements (after 11 pm) were conducted utilizing on a Skeonic L-358 flash meter. Measurements were taken in the EV mode, and converted into LUX values. At all locations ambient light measurements were under exposed, indicating ambient light levels were too low to be measured. These values are representative of the FRSA and have been used in the analysis of impacts discussed below in Section 4. Locations for monitoring are shown on Figure 3.3-1.

Weather and meteorological conditions can affect night time illumination levels. When light is emitted upwards by light sources or reflected from the ground, it is scattered by dust and gas molecules in the atmosphere, producing a luminous background often referred to as 'sky glow'. Sky glow varies according to weather conditions, the amount of dust and gas in the atmosphere, the amount of light directed upward, and the direction of viewpoint. In poor weather conditions (fog, rain, sleet, etc.), there are more particles in the atmosphere to scatter the light and sky glow is more pronounced. The reflectivity of the ground can also factor into the level of sky glow present at a site; for example, when the ground is covered with snow it is extremely reflective and sky glow will worsen.

3.7 ECOLOGICAL VALUE

In preparing the ecological value section of this report, various information sources were utilized. These included the Ecological Land Classification of Nova Scotia (NSDNR 2003), Natural Landscape of Nova Scotia (NSEL 2002), the Natural History of Nova Scotia (NSM 1996), NSDNR's online GIS data, and other sources.

Ecological Land Classification

The FRSA covers an area of 54336.51 ha along Nova Scotia's Eastern Shore. It falls within several of Nova Scotia's ecological land classification categories, as described by Neily *et al.* (2003). These correspond quite closely to the natural landscapes of Nova Scotia, as described by NSEL (2002). This section will discuss this area from an ecological perspective, and so will rely primarily on the ecological land classification system. These ecodistricts are shown on Figure 3.7-1.

Nova Scotia has been classified into ecoregions, which are delineated using provincial climate, soils and vegetation (Neily *et al.* 2003). Of the nine ecoregions described for Nova Scotia, two (the Eastern ecoregion and the Atlantic coastal ecoregion) are represented within the FRSA. Ecodistricts are further subdivisions of these ecoregions into distinctive assemblages of relief and geology, all of which can influence biodiversity. Of the 38 ecodistricts mapped for Nova Scotia, four are represented with the FRSA. One ecodistrict, the Eastern Shore, falls within the Atlantic Coastal ecoregion, while three others, the Eastern Drumlins, the Eastern Granite Uplands and the Eastern Interior, fall within the Eastern ecoregion. These ecodistricts are discussed in the following sections.

The FRSA is composed of similar portions of Eastern Drumlins, the Eastern Granite Uplands and the Eastern Interior ecodistrict, with a very small portion falling within the Eastern Shore ecodistrict. Percentages and total areas are summarized in Table 3.7-1.

Table 3.7-1 Ecological Land Types in the FRSA

Ecodistrict	Area Within FRSA (ha)	Percent of FRSA
Eastern Granite Uplands	18531.7	34.10%
Eastern Interior	18121.2	33.35%
Eastern Drumlins	15934.5	29.33%
Eastern Shore	1741.3	3.20%

A large portion, approximately 34.10% of the FRSA, falls within the Eastern Drumlins (roughly equivalent to Natural Landscape #36a, the Eastern Shore Drumlins (Tangier River sub landscape (NSEL 2002). 15934.5 hectares of the FRSA are located with this ecodistrict. This landscape is 34708 ha and consists of a drumlin field positioned atop an undulating plain. Vegetation is characterized by mixed forest types. Portions of several mid-sized rivers occur in this landscape, and lakes are common. Bedrock is dominated by greywacke, with some slate, and is overlain by stony to silty till (NSEL 2002). The drumlins are forested with sugar maple, yellow birch and American beech, while less-drained areas are home to red spruce, black spruce and some white pine (NSM 1996, NSEL 2002). American larch is also present in wetter areas within this landscape (NSM 1996). Dominant landscape ecosystems include an imperfectly drained undulating terrain dominated by red and black spruce, with some white pine with a patch or infrequent stand initiating natural disturbance regime, as well as well drained sugar maple , yellow birch, and American beech drumlins with a natural gap disturbance regime (Neily *et al.* 2003).

A portion, approximately 33.35% of the FRSA, consists of the Eastern Interior ecodistrict (equivalent to Landscape #30b Central Quartzite Hills and Plains (Fish River sub-landscape (NSEL 2002) . This ecodistrict is one of the largest and most complex in the Province, occupying 3,693 km^2. This area is a complex of hills and rolling terrain which is characterized by Acadian mixed forest. Bedrock is resistant Meguma Group quartzite and slate, overlain by stony or silty till. In some areas, the layer of glacial till is very thin, and the glacially scoured bedrock ridges are exposed. In other areas of thicker till, softwood forests occur. There are many small to moderate-sized rivers and lakes in this area. Lakes occupy 27,312 hectares or 7.4% of the total ecodistrict area. Dominant landscape ecosystems include well drained deciduous forested hills (sugar maple - yellow birch - American beech) with a natural gap disturbance regime, and well-drained red spruce - white pine (eastern hemlock rolling terrain with various natural disturbance regimes.

A portion (33.35%) of the FRSA falls within the Eastern Granite Uplands ecodistrict (roughly equivalent to the natural landscape #34 m the Eastern Shore Granite Ridge (NSEL 2002). This ecodistrict covers 602 km^2 and extends in a narrow strip along the coast just north of the coastal Eastern Shore Ecodistrict. This ecodistrict rises rapidly to 100 m above the nearby coastal area. As such, steep cliffs and narrow river gorges are present. This rugged and variable terrain is dominated by parallel ridges dominated by Acadian coniferous forest (NSEL 2002). Drainage patterns may be parallel or dendritic and are defined by various portions of a few major rivers and many small streams. Bedrock is entirely granite, overlain by stony till, and is exposed in up to 15% of the ecodistrict. Some areas contain huge scattered boulders deposited by glaciers. Some areas which have deep, well-drained soils are home to stands of red spruce. Scrubby forests of black spruce and white pine with scattered red pine in areas of shallow soils indicate that this area has been disturbed by fire in the past. In the shallow soils atop the ridges, jack pine (*Pinus banksiana*) may be present, while hemlock may occur on slopes alongside rivers and streams. There are a few scattered drumlins in this area, and some hardwoods may be found on these. Dominant landscape ecosystems consist of coniferous forest with varying disturbance regimes. Lake ecosystems also occur, as freshwater lakes of various sizes are abundant (NSEL 2002) and cover 11.1% of this ecodistrict.

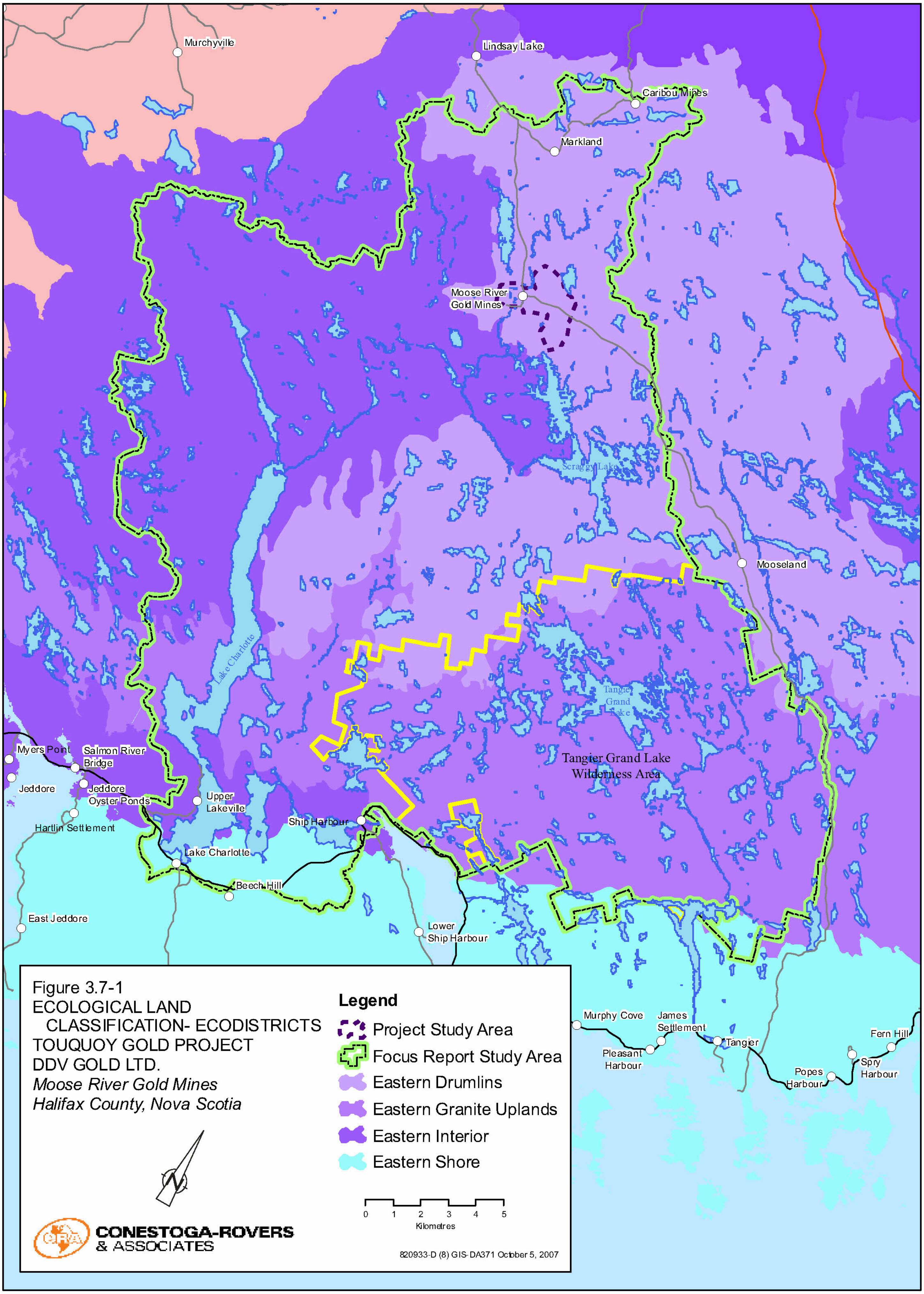


Figure 3.7-1
ECOLOGICAL LAND CLASSIFICATION- ECODISTRICTS
TOUQUOY GOLD PROJECT
DDV GOLD LTD.
Moose River Gold Mines
Halifax County, Nova Scotia

The least-represented (3.20%) ecodistrict within the FRSA is the Eastern Shore ecodistrict (roughly equivalent to #33, the Eastern Shore Beaches). This ecodistrict is characterized by a variety of landforms ranging from the granite barrens of the Halifax and Canso peninsulas, to sand beaches, dunes, and offshore islands (many of which are actually drumlins), and the coastal headlands of Guysborough County (Neily *et al.* 2003). This landscape's proximity to shore indicates that lower reaches and estuaries of several moderate-sized rivers are present, as are many lakes. The coast in this landscape consists of eroding drumlin headlands and long bays which alternate with barrier beaches and extensive estuaries and salt marshes. Bedrock is dominated by greywacke with some slate, overlain by mostly stony till. This bedrock is exposed in 21.6% of the ecodistrict (36,350 hectares). Drumlins consist of silty till and support Acadian and boreal coniferous forest. Balsam fir occurs in areas where soils are well-drained and sheltered from the coastal environment. The coastal influence extends inland to the 60 m contour for mush of this ecodistrict. Evidence for this coastal influence comes from the lack of red spruce, white pine, sugar maple and American beech (Neily *et al.* 2003). Typical coastal forest here is composed mostly of balsam fir, black spruce and scattered white spruce. In very exposed areas a very stunted (krummholz) forest of white spruce may occur. These coastal forests are short-lived, and are renewed constantly by factors such as blow down, insects, disease and sometimes fire. A total of 9,334 hectares or 5.6% of the ecodistrict covered in freshwater lakes. Dominant landscape ecosystems consist of coniferous forest with varying disturbance regimes, as well as lake and salt marsh ecosystems.

Forest Cover

The proposed Project site covers an area of 405 ha and represents less than 0.75% of the FRSA as a whole. At the present time Project site is dominated by softwoods, which cover over 52% of this area. Mixedwood forest covers over 10% while hardwoods account for 6.1% of the total area. Clearcuts and brushy or barren areas cover almost 21.8%. Lakes and rivers cover 12% while wetlands cover less than 3% of the Project site. Residential development covers over 4% of the Project site. Figure 3.7-2 shows forest by type for the FRSA.

This is comparable to the FRSA as a whole, in which 58% of this area is covered by softwoods. Mixed wood forest covers over 9% while hardwoods account for 3.7 % of the total area. Clearcuts and brushy or barren areas cover almost 9%. Lakes and rivers cover 12% while wetlands cover 7%. The forested areas may be slightly smaller now, as the NSDNR GIS layer does not include logging activities since 2004. Less than 0.3% of the FRSA is occupied by residential developments. Thus, the Project site represents an area which is similar to the FRSA as a whole, though it has considerably more area cleared

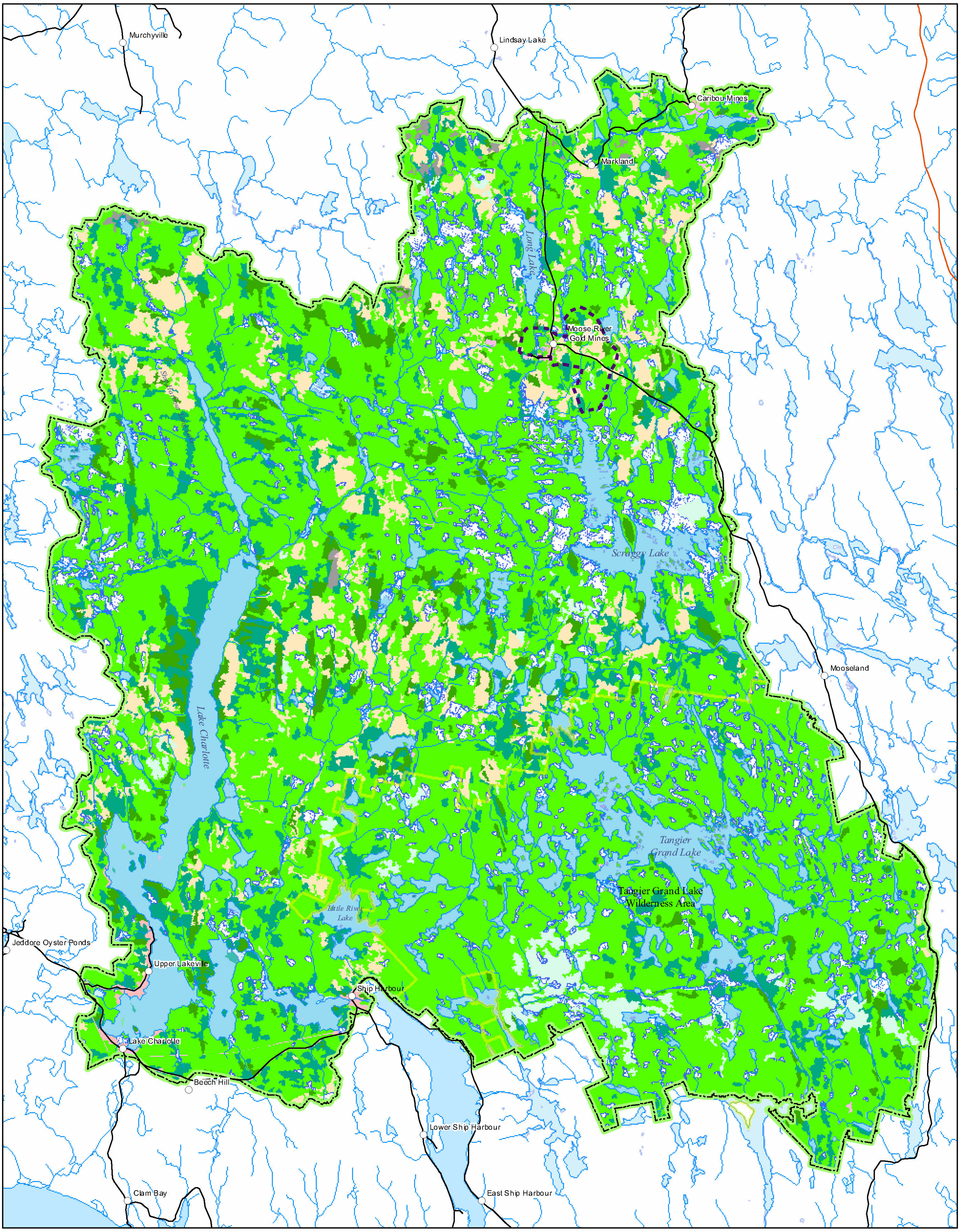


Figure 3.7-2
FOREST STANDS BY TYPE
TOUQUOY GOLD PROJECT
DDV GOLD LTD.
Moose River Gold Mines
Halifax County, Nova Scotia

Legend

Forest Types

- 🟩 Mixed Wood
- 🟩 Softwood
- 🟩 Hardwood
- ⬜ Unclassified Species
- ⬜ Brush / Barren
- 🟨 Clear Cut
- 🟪 Miscellaneous
- 🟥 Residential
- 🟦 Water
- 🟦 Wetland
- 🟨 Tangier Grand Lake Wilderness Area
- 🟪 Project Study Area
- 🟩 Focus Report Study Area

Source:
NS Natural Resources - Forestry Database
Halifax East & West - 0riginal data 1992
with biennial updates to 2003-2005

0 1 2 3 4 5
Kilometres

CONESTOGA-ROVERS & ASSOCIATES

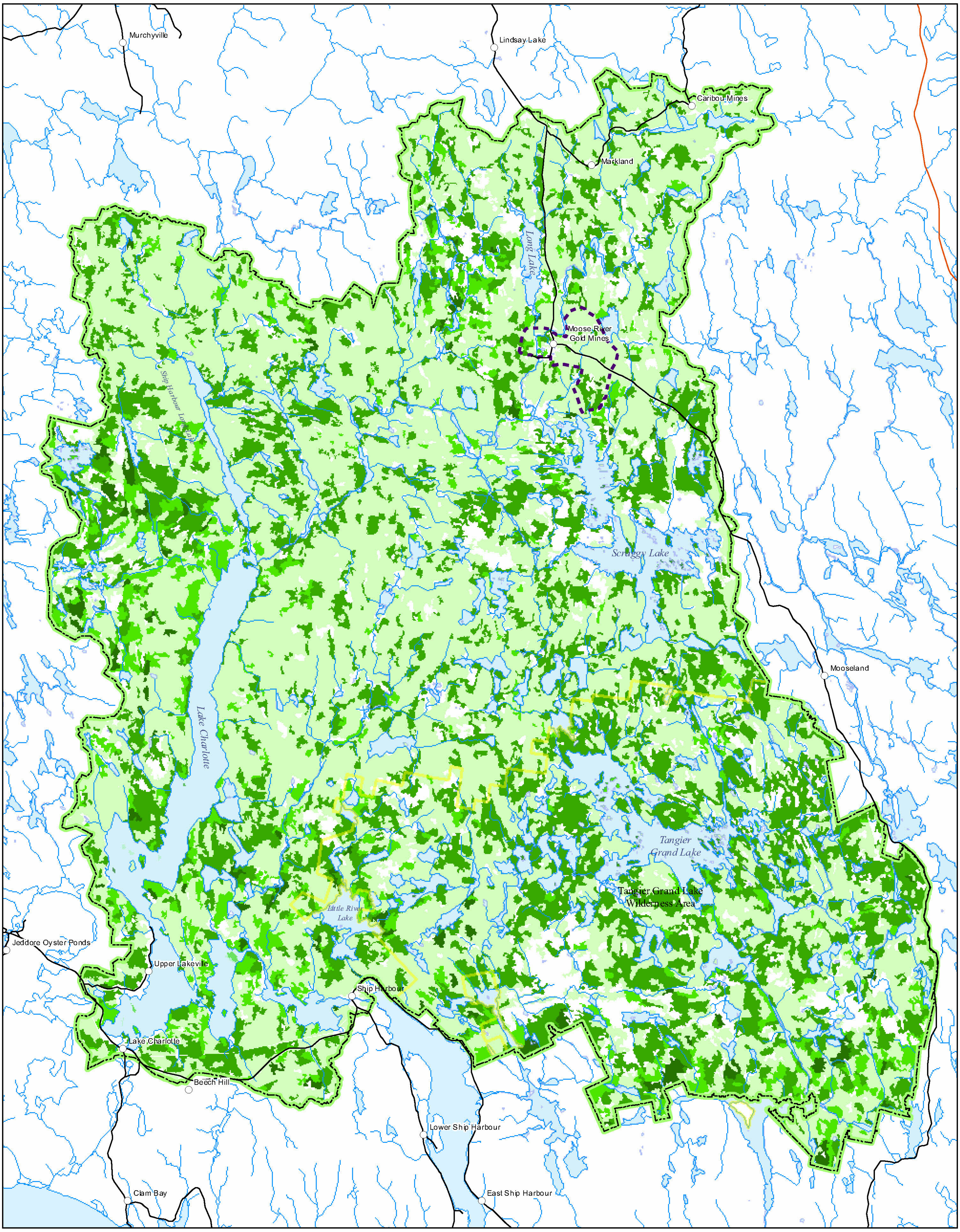


Figure 3.7-3
FOREST STANDS BY MATURITY
TOUQUOY GOLD PROJECT
DDV GOLD LTD.
Moose River Gold Mines
Halifax County, Nova Scotia

Legend

Maturity
- Non-Forested
- Immature
- Mature
- Overmature
- Multi-aged

- Project Study Area
- Focus Report Study Area
- Tangier Grand Lake Wilderness Area

Source:
NS Natural Resources - Forestry Database
Halifax East & West - 0riginal data 1992
with biennial updates to 2003-2005

CONESTOGA-ROVERS & ASSOCIATES

820933-D (8) GIS-DA373 October 29, 2007

due to forestry and residential developments, and less wetlands when compared with the FRSA. Forested areas throughout the FRSA may be slightly smaller now, as the NSDNR GIS layer (used to calculate percentage cover) does not include logging activities which may have occurred since 2004.

In terms of forest age classes within the FRSA, over 17% is in some stage of regrowth (this includes forest age classes such as regenerating, young, and immature). Almost 32 % is considered middle-aged (< 40 years), while slightly less than 6% is considered mature forest (<60-70 years of age). A very small fraction (1.2%) is considered overmature (> 70 years). 22% of the forested areas are considered to be multi-aged, *i.e.* covered by trees of varying ages. These numbers are based on analysis of NSDNR's forestry database from 2003 and are depicted on Figure 3.7-3. Again, additional harvesting in the area has occurred since that year and thus these numbers may slightly over – or under represent the proportion of each forest age class present.

3.8 RECREATIONAL VALUE

The FRSA is a broad area of diverse landscapes with varying degrees of present day and historical human activities that have modified what we see currently. The FR Terms of Reference specified several items relative to wilderness recreational value that DDV Gold has addressed in this Focus Report. This section provides an overview of the work completed relative to wilderness recreational value and the results obtained. A considerable body of work has been completed which, along with other items such as lichen surveys and moose studies, represent good information for use by a number of parties in gaining a better current understanding of the current features and ways in which the FRSA is used by humans.

3.8.1 Previous Work

Previous work on characterizing the FRSA was completed by a number of parties most notably the report "Ship Harbour Long Lake Wilderness Area "Assessment of Protected Area Values" by Kermit deGooyer for Eastern Shore Forest Watch in 2006. This report represents the most complete picture of the FRSA and should be consulted. A copy of this document has been provided as Appendix O. It should be generally noted that the work completed by DDV Gold for the EARD and the Focus Report offers no tangible variations from the conclusions reached in that report. Based on DDV Gold's work described in this report, conditions and activities within the FRSA are not different in any significant way now from those reported in May 2006.

Table 3.8-1: Assessment of Recreational Value - Focus Report Study Area

Project Component	**Scraggy Lake - North**				**Scraggy Lake - South**				**Tangier Grand Lake Wilderness Area**				**Lake Charlotte**				**Fish River - South of Site to Lake Charlotte**			
	Canoeist/Boater	Overnight Camper	Hiker/Fisher/Hunter	Cottager	Canoeist/Boater	Overnight Camper	Hiker/Fisher/Hunter	Cottager	Canoeist/Boater	Overnight Camper	Hiker/Fisher/Hunter	Cottager	Canoeist/Boater	Overnight Camper	Hiker/Fisher/Hunter	Cottager	Canoeist/Boater	Overnight Camper	Hiker/Fisher/Hunter	Cottager
Tailings Dam																				
light	0	2	0	2	0	1	1	1	0		0	0	0	0	0	0	0	0	0	0
noise	2	1	2	1	0	0	1	0	0		0	0	0	0	0	0	0	0	0	0
emissions	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
visibility	2	2	2	2	0	0	0	0	0		0	0	0	0	0	0	0	0	1	0
Waste Rock Pile																				
light	0	2	0	2	0	1	0	0	0	1	1	1	0	0	1	1	0	0	0	0
noise	2	2	1	1	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
emissions	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0
visibility	1	2	2	2	1	1	1	1	0	1	1	0	0	0	0	0	0	1	1	1
TMF																				
light	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
noise	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
emissions	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
visibility	2	2	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Processing Plant																				
light	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
noise	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
emissions	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
visibility	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Site Mobile Equipment																				
light	0	2	0	2	0	1	0	0	0	1	0	0	0	0	1	1	0	0	1	0
noise	1	2	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
emissions	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
visibility	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Employee Traffic																				
light	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
noise	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
emissions	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
visibility	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Suppliers Traffic																				
light	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
noise	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
emissions	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
visibility	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTALS	13	19	13	17	2	4	3	2	0	3	2	1	0	0	2	2	0	2	3	1

Assessment
0 - no additional impacts identified from project activities
1 - limited (short term or nominal) additional impact from project activities and impacts do not affect selection of area
2 - limited additional impacts from project activities but measurable impacts that may affect selection of area and experience
3 - severe additional impacts from project activities and impacts do affect selection of area and experience

3.8.2 Work Completed For Focus Report

Specific work completed relative to the FSRA and Project site that provided information on wilderness recreational aspects include the following:

Field Surveys

A survey of Scraggy Lake by Boat was completed by DDV Gold staff of the entire Scraggy Lake and including visits to all structures visible from Scraggy Lake and an interview of a camp owner on lake and surrounding area use.

Lake Charlotte, Square Lake and Scraggy Lake Baseline Surveys – completed by CRA staff from 2006 to present included observations on recreational use of lake and surrounding lands.

Tangier Grand Wilderness Area Light Survey – completed by CRA in 2007 and included observations on area recreational use.

Moose River Residents Interviews

DDV Gold Interviews – DDV Gold has a 4 year history with the community of Moose River and have often engaged in discussions about Project site and FRSA wilderness recreational use.

Focused Consultation with Organizations with a Recreational Aspect

Meetings have been held with the following organizations where information relative to wilderness recreational use of the Project site and FRSA has been obtained:

- Trout Nova Scotia
- Eastern Shore Forest Watch
- Salmon Nova Scotia
- Residents of Musquodoboit Valley and Eastern Shore
- Atlantic Salmon Federation

Review of Past Studies and Published Information

The Project site and FRSA have some published information on wilderness recreational use and value and website information. The following specific studies, reports, guides, maps, etc., and websites were used and sourced.

- Canoe Routes of Nova Scotia by C. Dill
- Ship Harbour Long Lake Wilderness Area "Assessment of Protected Area Values" by Kermit deGooyer for Eastern Shore Forest Watch
- Discover Nova Scotia – Sportfishing by Don MacLean
- Hiking Trails of Nova Scotia by Michael Haynes (8th Edition)
- Waterfalls of Nova Scotia by Allan Billard
- website searches

Consultation with Regulatory Agencies

The following agencies were consulted on information relative to wilderness recreational use of the Project site and FRSA.

- NSDNR
- NSEL
- DFO

3.8.3 Historic Land Use

Historic land use of the Project site and relevant for the FRSA was detailed in the Confederacy of Mainland Mi'kmaq in their Mi'kmaw Knowledge Study (provided in the EARD) and by Cultural Resource Management Group in their Archaeological Report that was also provided in the EARD. Human activity in the area has been focused on game harvesting, forestry, mining and recreational use for the majority of post-Contact times. The well established current road network has been established along traditional routes for movements of humans by land through the area.

3.8.4 Current Land Use

Documented and Anecdotal Recreational Use

Hunting, Trapping and Fishing

The Project site and FRSA is used for a variety of recreational game and fish harvesting as well as limited commercial in the form of eel harvesting and trapping for furbearers. Data exists from NSDNR on Deer Harvesting with the FRSA and Project Area being in Deer Management Zone #5. Data from 2006 indicates that Halifax County as a whole, of which the Project site and FRSA are within, the deer harvests account for approximately 7% (648 or 9491 deer harvested) of the province's total. Furbearing animal harvest is comparable in terms of percentage that the FRSA is of the provincial harvest as well. Excellent data is contained at www.gov.ns.ca/natr/wildlife. Anecdotal information from discussions with locals and DDV Gold staff that have had a presence in the area since 2003 indicate that hunting and trapping use of the area is widespread and common.

All lakes and watercourses within the FRSA have fish species that offer some sport fishing opportunities. Fish species present in the Project site and nearby waterbodies and courses have been previously described in Section 3.2. Anecdotal information from DFO, DDV Gold and local residents suggests that the FRSA is heavily used with regular catches of salmonids, bullhead, perch, gaspereaux and other species by persons fishing from boats and by foot. Scraggy Lake is accessed on the south end for recreational fishing due to road access more than other access routes (to the north of Scraggy Lake from Mooseland Road) requiring a longer hike or poorer access requiring ATV's. Landlocked salmon are caught in Scraggy Lake but were noted by several camp owners there as being poor quality for eating and thus of reduced value for sportfishing. Fishing activity in Scraggy Lake is said to have declined in the last 10-15 years, presumably owing to a relative paucity of fish.

Canoeing

Canoeing in the FRSA is well documented and an important use of local waterways. Specific areas for canoeing in and near to the Project site are Moose River, Fish River, Square Lake and Scraggy Lake. Moose River and Fish River offer good opportunities with some restrictions relative to low water levels and rough terrain (boulders and abrupt elevation changes making portages commonplace). Scraggy Lake to Ship Harbour is noted in the Canoe Routes of Nova Scotia as a 33.55 km trip that requires "several days" and an "advanced" rating for the canoeist skill level required. Scraggy Lake is a lake of common use with some restrictions/cautions noted about boulders below surface of the water, low water in the summer and extreme wind exposure in some areas. Multi-day trips are common with portages being a routine part of a trip as the summer presents low water situations and access through boulder rich areas with a canoe is often more difficult than a portage. Camp owners on Scraggy Lake noted that the majority of canoeists and boaters access the lake from the south end via existing logging roads.

Camping and Cottage Use

Recreational camping is widespread and on lands that the campers may or may not own. There are many structures that are built on lands that are not owned by private individuals that appear to be used by multiple parties throughout the FRSA. Scraggy Lake has a number of private land holdings on its shore that have some type of cottage and outbuildings. A total of 12 cottages/camps were noted during the survey in July, 2007 of which 6 were either occupied or showed evidence of being used that weekend. Scraggy Lake camp owners have seen very limited canoe use and mainly in the spring if any as low water levels in the summer present extra challenges for navigability (rocks). Lake Charlotte is well known provincially for cottage use.

Existing Parks and Protected Areas in FRSA

The Tangier Grand Wilderness Area (29.5% of the FRSA) and the Moose River Gold Mines Provincial Park (less than 0.1% of the FRSA) is existing parks within the FRSA. The Tangier Grand Lake Wilderness area features have been previously described in Section 3.7, information on Moose River Gold Mines Provincial Park is below.

Moose River Gold Mines Provincial Park

There is an existing picnic park in Moose River Gold Mines that occupies an area of approximately 4.3 hectares. The park is within the footprint of the pit and is underlain by ore that will be processed. The park is used on an infrequent basis by visitors and residents of the area for picnicking and does have value to those present and former residents of Moose River Gold Mines and area. Visits to the park have been estimated as being less than 10 persons per day through the summer and much less through the remainder of the year. The park is equipped with several picnic tables and a open roofed structure (less than 20 metres square) that is used for picnicking, a small parking lot (less than 20 vehicles), several open grassed spaces (less than 100 square metres total) a pond (roughly 0.3 hectares), a cairn erected to commemorate the 1936 Moose River Gold Mines Mine rescue and forested lands of varying sizes, species and re-growth. NSDNR and NSM have both indicated that the park currently has a low interpretive value as the signage and visuals do not provide a full account of the historical significance of gold mining to the area.

Assessment of Potential Project Effects on Recreational Value

An assessment of potential effects to existing recreational values and use within the FRSA was completed and the assessment methodology and results are summarized on Table 3.8-1, Assessment of Recreational Value Effects. This assessment was completed to determine possible effects from the development of the Touquoy Project on the current and future recreational use of the area. The assessment was completed using data from the noise, blasting and visual assessment work and predicted impacts previously described and outlined further in this Focus Report. As well the assessment was completed by CRA staff that has spent considerable time in the area and is familiar with the landscape and use of the area for recreational pursuits.

The assessment took components of the Project (eg. Light from the Processing Plant) and examined potential effects on different types of recreational users (eg. Canoeist/boater) in various areas of the FRSA (eg. South End of Scraggy Lake). The project components are known, the types of recreational users are based on known use of the area and observations made during field surveys and the areas of the FRSA are those that have documented use and offer good recreational value currently.

The assessment indicates that the vast majority (over 95%) of the FRSA should not have effects that result in a reduction in the enjoyment of a wilderness experience by recreational users. It should be noted that some of the identified effects are only potential and that DDV Gold will use the advice of local users and land owners as well as the CLC and regulatory agencies in limiting effects to the minimum level possible through practical mitigative measures.

In summary the assessment results show that there is the potential for limited effects that may affect selection of the area or a person's wilderness recreation experience on the north end of Scraggy Lake. An example of this would be the potential for someone to see light from operations on the waste rock pile, at full height, if the weather is clear and the person is completing an overnight camping trip and is looking in the direction of the waste rock pile when equipment is there. Whether this reduces a persons experience is also subjective and very person dependent. Another example would be someone boating on the north end Scraggy Lake that may hear noise from the facility slightly (2dBa) above baseline noise, if the wind is not blowing and the person is not talking or paddling or using a boat motor and no birds are calling at the time that noise is generated at the site.

3.8.5 Summary

- The FRSA contains existing parks and Wilderness areas that are valued in Nova Scotia and present abundant opportunities for recreational activities.
- Recreational opportunities presented in the FRSA are widespread in Nova Scotia and the FRSA does not present any unique recreational attributes that are not found elsewhere on the Eastern Shore.

Special Note:
DDV Gold recognizes that the proposed development may influence recreational land use patterns in the lands directly adjacent to the Project. Therefore, DDV Gold is committed to providing meaningful funding, once the Project is operational, to a relevant organization, or organizations, to assist in the acquisition of selected lands in Nova Scotia for conservation purposes and has undertaken preliminary exploratory discussions directly with representatives of several organizations in this respect. The Company appreciates that such land acquisition would assist the Province in achieving its goal of legally protecting 12% of its total land mass by 2015 in accordance with the Environmental Goals and Sustainable Prosperity Act (Bill 146) Section 4(2)(a).

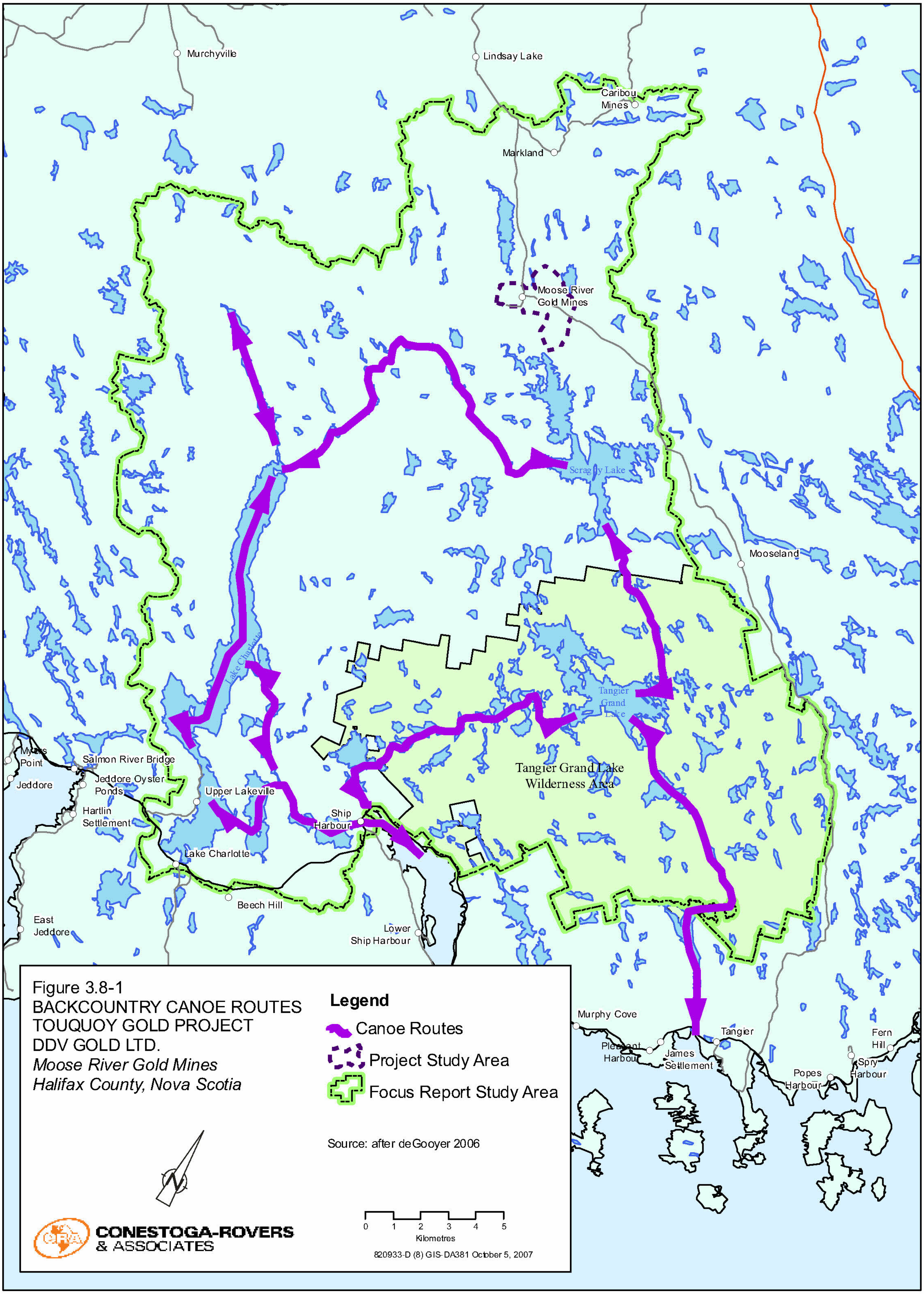


Figure 3.8-1
BACKCOUNTRY CANOE ROUTES
TOUQUOY GOLD PROJECT
DDV GOLD LTD.
Moose River Gold Mines
Halifax County, Nova Scotia

Legend

Canoe Routes

Project Study Area

Focus Report Study Area

Source: after deGooyer 2006

CONESTOGA-ROVERS & ASSOCIATES

820933-D (8) GIS-DA381 October 5, 2007

3.9 BASELINE BEDROCK AND SOIL CONDITIONS

An environmental baseline assessment of site bedrock and soil/till conditions in the Focus Report Study Area, and historic tailings of the project was conducted. A regional compilation of the soil, till and lake sediment was investigated as a comparison for the assessment. The baseline assessment indicates the concentration of chemicals that might be naturally present as well as, introduced chemicals (*i.e.* mercury) identified in the relatively small quantities of historic tailings on site. Data used in this assessment is representative of the Focus Report Study Area.

3.9.1 Soil Environmental Baseline

Bedrock at the Project site is composed primarily of Goldenville Formation greywackes with minor interbedded argillites. The surficial geology consists of a mainly sandy matrix, stony (quartzite) till derivative of local geology, and drumlins with a silty matrix developed from a mixture of older materials of local and foreign components. The quartzite till is a bluish-grey, loose, cobbly silt-sand till which grades into a sandier, coarser till and sometimes contains red clay inclusions (matrix: sand 80%, silt 15%, clay 5%). The average thickness of the till in this area is approximately three metres.

Soil samples collected from three site locations, by CRA for DDV Gold in December 2006 (CRA Report 820933(3), 2007), were analyzed for metals, including mercury. The results obtained are outlined in Table 3.9-1. This data and metal concentration analysis from soils discussed in the "Geological Map of the Province Nova Scotia" (NS Dept. of Mines, 1965) were used to help define the metal concentration baseline in the study area.

Table 3.9-1 Available Metal Concentrations in Surface Soil Samples from the Touquoy Gold Project Site

	DL[1]	Units	CCME Soil Guidelines[2]	BH06-02 SS1[3]	BH06-05 SS1[3]	BH06-09 SS1[3]
ELEMENTS (ICP-MS)						
Available Aluminum (Al)	10	mg/kg	NA	13000	2900	14000
Available Antimony (Sb)	2	mg/kg	40	<2	<2	<2
Available Arsenic (As)	2	mg/kg	12	11	6	10
Available Barium (Ba)	5	mg/kg	2000	59	10	19
Available Beryllium (Be)	2	mg/kg	8	<2	<2	<2
Available Boron (B)	5	mg/kg	NA	<5	<5	<5
Available Cadmium (Cd)	0.3	mg/kg	22	<0.3	<0.3	<0.3
Available Chromium (Cr)	2	mg/kg	87	17	2	16
Available Cobalt (Co)	1	mg/kg	300	17	<1	9

Table 3.9-1 Available Metal Concentrations in Surface Soil Samples from the Touquoy Gold Project Site

	DL[1]	Units	CCME Soil Guidelines[2]	BH06-02 SS1[3]	BH06-05 SS1[3]	BH06-09 SS1[3]
Available Copper (Cu)	2	mg/kg	91	28	2	31
Available Iron (Fe)	50	mg/kg	NA	27000	4800	21000
Available Lead (Pb)	0.5	mg/kg	260	16	6.1	22
Available Manganese (Mn)	2	mg/kg	NA	1400	74	530
Mercury (Hg)	0.01	mg/kg	24	0.01	0.06	0.02
Available Molybdenum (Mo)	2	mg/kg	40	<2	<2	<2
Available Nickel (Ni)	2	mg/kg	50	24	<2	22
Available Selenium (Se)	2	mg/kg	3.9	<2	<2	<2
Available Silver (Ag)	0.5	mg/kg	40	<0.5	<0.5	<0.5
Available Strontium (Sr)	5	mg/kg	NA	<5	<5	9
Available Thallium (Tl)	0.1	mg/kg	NA	<0.1	<0.1	<0.1
Available Uranium (U)	0.1	mg/kg	NA	1.2	0.1	0.9
Available Vanadium (V)	2	mg/kg	130	16	9	13
Available Zinc (Zn)	5	mg/kg	360	55	8	40

[1] Detection Limit
[2] CCME Soil Guidelines for Commercial Properties, 2006
[3] Collected December 2006
Source: Report No. 820933 (3), prepared by Conestoga-Rovers & Associates for DDV Gold Limited, March 2007

Mercury was detected in all three CRA surface soil samples, at levels ranging from 0.01 to 0.06 mg/kg. As is typical of surface soils in NS, iron and aluminum levels were high, ranging from 4,800 to 27,000 mg/kg for iron and 2,900 to 14,000 mg/kg for aluminum.

Arsenic was also detected in three sediment samples, at levels ranging from 6 to 10 mg/kg, just below the CCME soil guideline for commercial properties. This data is shown on Figure 3.9-1.

Metals analysis for six soil samples recovered in the Touquoy Gold Project area (NS Dept. of Mines, 1965) were retrieved from Map Sheet No. 3 of Pleistocene Geology for Central Nova Scotia (Canada, Regional Economic Expansion, 1977). The samples and are presented in the following Table 3.9-2. These results show similar values as other sampling programs. These results are shown on Figure 3.9-2.

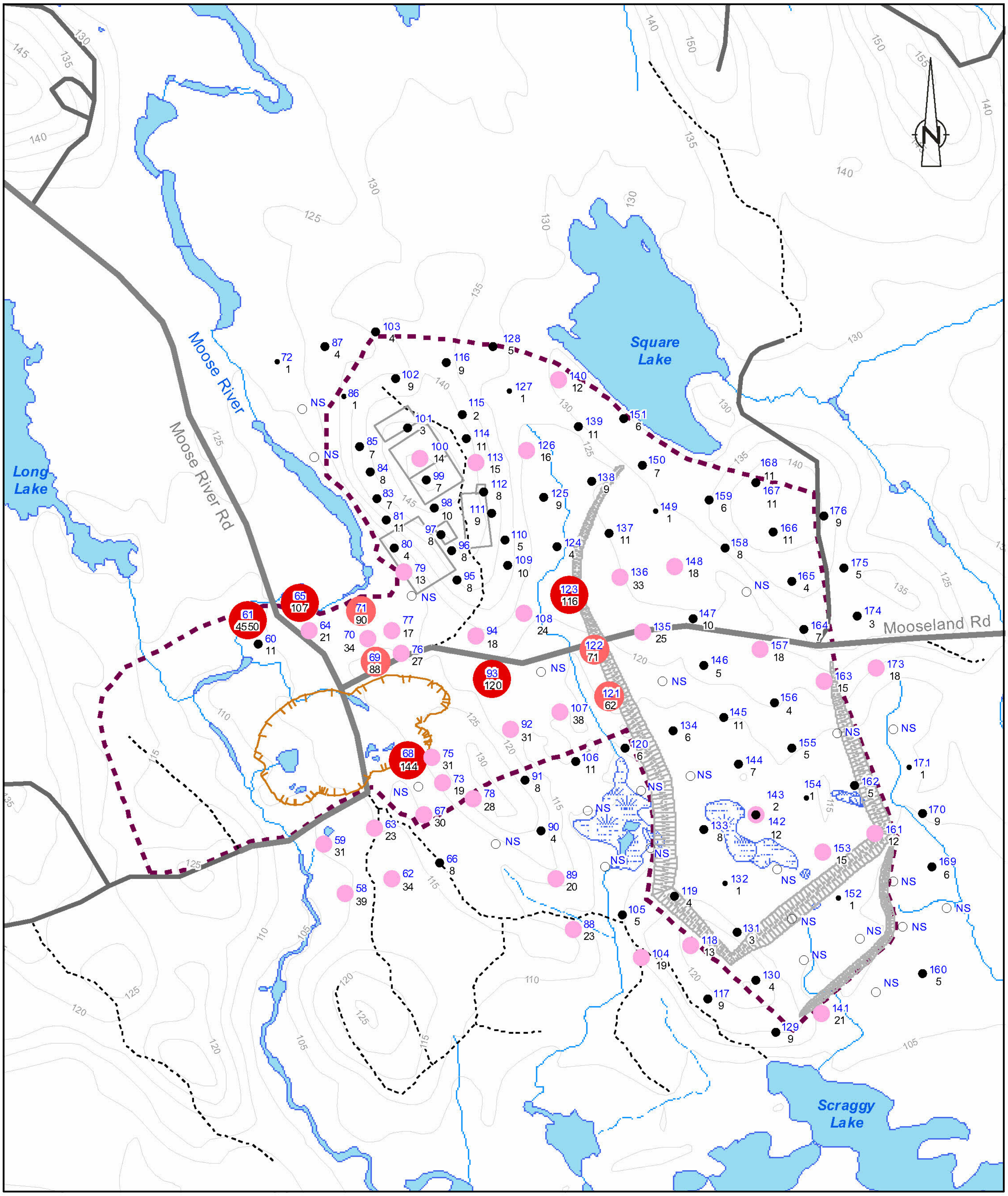


Figure 3.9-1
BASELINE SITE SOIL GEOCHEMISTRY
ARSENIC PLOTTED (As - ppm)
TOUQUOY GOLD PROJECT
DDV GOLD LTD.
Moose River Gold Mines
Halifax County, Nova Scotia

820933-D (8) GIS-DA391 October 22, 2007

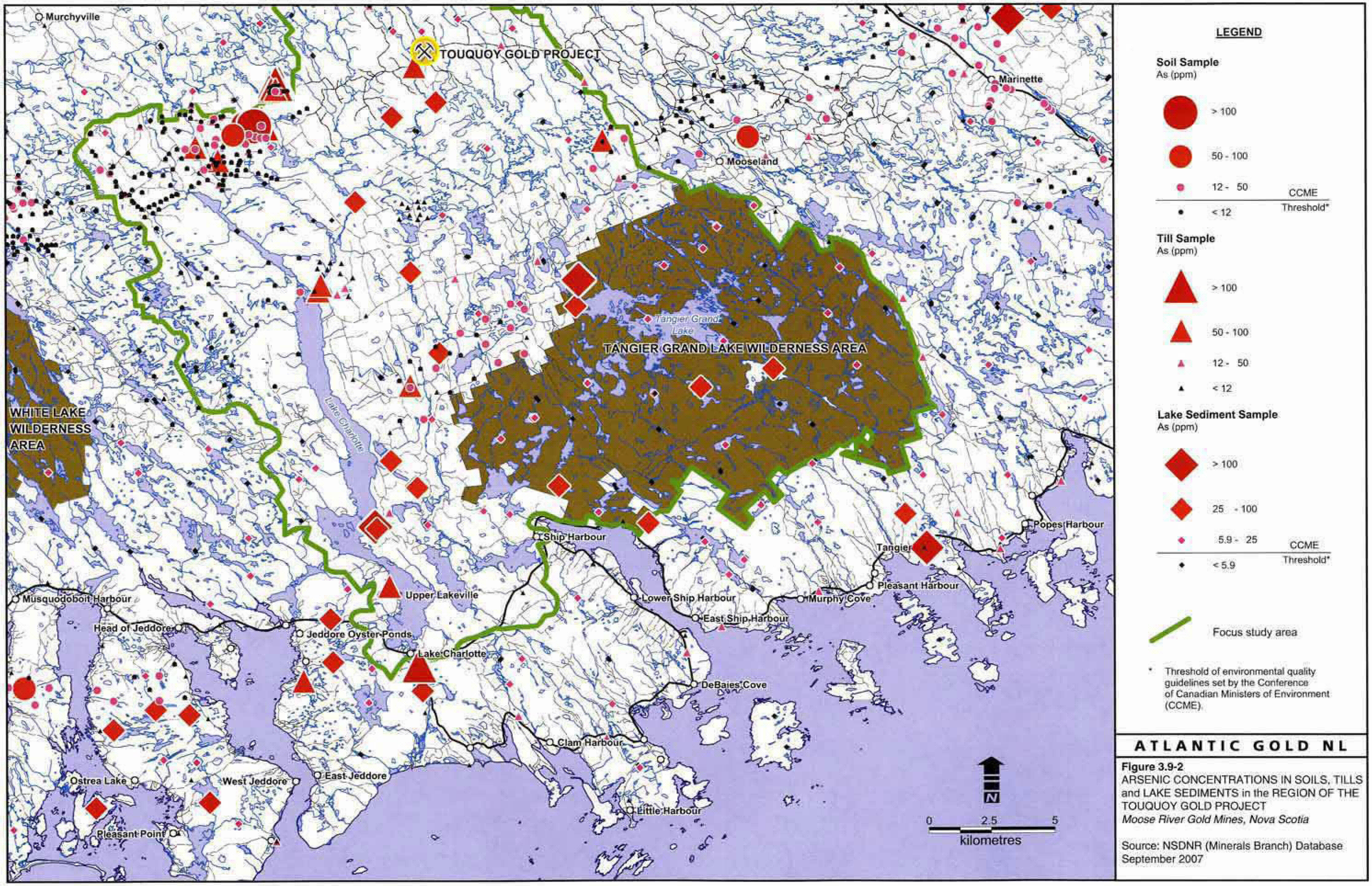
Soil Samples - As (ppm)

●	> 100
●	51 - 100
●	12 - 50
●	< 12 CCME Threshold
•	< 2 Detection Limit

135 - Sample ID
25 - Arsenic value (ppm)
o NS - No Sample (Lack of B Horizon)

0 0.1 0.2 0.3 0.4 0.5
Kilometres

CONESTOGA-ROVERS & ASSOCIATES



ATLANTIC GOLD NL

Figure 3.9-2
ARSENIC CONCENTRATIONS IN SOILS, TILLS and LAKE SEDIMENTS in the REGION OF THE TOUQUOY GOLD PROJECT
Moose River Gold Mines, Nova Scotia

Source: NSDNR (Minerals Branch) Database
September 2007

Table 3.9-2 Available Metal Concentrations in Soil Samples (mg/kg) from the Vicinity of the Touquoy Gold Project Site

Sample	351A	352A	353A	354A	356A	357A
Location	7 km	5 km	1.5 km	3.5km	6 km	5 km
Direction	E	NEE	NW	NNW	N	NE
Depth	1.5	1.0	1.0	2.0	2.0	2.0
Ag	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Cd	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Cu	69.8	75.8	65.2	96	65.6	185.4
Ni	53.4	56.2	46.8	70.0	42.2	84.8
Pb	32	32	38	52	20	52
Zn	176	244	206	172	160	238
Co	23.2	26.0	25.2	25.0	13.6	47.0
Fe%	6.30	6.74	7.92	8.80	6.92	7.44
Mn	2340	2760	2820	4020	1480	4960
Ca	104	198	78	58	62	288
Mg	8500	7980	9200	6360	6140	9300
Mo	1.1	1.2	1.3	2.2	1.1	-
Hg	0.14	0.20	0.20	-	0.09	-
U	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
As	16.2	28.0	55.0	35.2	11.0	-

Source: Pleistocene geology by R. R. Stea and J. R. Dickie, 1977.
Bedrock geology adapted from "Geological Map of the Province of Nova Scotia", Nova Scotia Department of Mines, 1965.
Note: Fe is in % in this table.

3.9.2 Detailed Project Site Conditions

Soil characterization studies were undertaken in 2006 and presented in the EARD. As a detailed baseline follow-up, a total of 119 B horizon soil samples (SS-07-058 to 176) were collected in September 2007 on a grid-based pattern on 200 m centres (with denser sampling over the proposed plant site) over an area measuring roughly 2km square to cover the Project site. Several sites were not sampled as suitable B horizon sample could not be obtained. Samples were analyzed for 36 elements and results plotted for arsenic in Figure 3.9-1.

Arsenic is shown to be present at numerous sample sites in excess of CCME Guidelines for soil (12ppm) throughout the Project site area. Nine samples with as concentrations in excess of 60 ppm are located in the vicinity of the proposed extraction area. The rest of the site is characterized by arsenic concentrations ranging from 19 to 39 ppm south of the pit with a few samples giving results below the CCME Soil Guidelines Threshold (< 12 ppm). The area north of the proposed pit is characterized by arsenic concentrations below the threshold with only five values exceeding the threshold to a maximum of 16 ppm. The waste rock storage pile and tailings management facility will be located east of the proposed mine pit. The soil arsenic concentrations in this area range from non-detect to 33 ppm, but with a predominance of values below the CCME Soil Guidelines.

One sample (61) is notable, and that is the westernmost sample that was taken within the McGregor Stamp Mill tailings area near Moose River, west of the Moose River Road. This sample contained elevated arsenic (4550ppm) and mercury (19ppm). These tailings are discussed in Section 3.9.3.

Other metals of interest (aluminum, cadmium, chromium, copper, lead, mercury and zinc) are either below their CCME Guidelines or have no guidelines. Background lead concentrations across the site suggest that the single anomalously high lead response in stream sediment at the north end of Scraggy Lake (1100ppm in sample SED9) identified in January 2007 during the course of broader baseline characterization for the EARD (refer EARD Table 7.2 and Figure 5.1) is either a cultural effect (eg. battery, fishing sinker) or a laboratory error. Reconnaissance of this site undertaken by DDV Gold staff failed to identify any apparent reason for this response.

3.9.3 Historic Tailings Characteristics

DDV Gold undertook an assessment of historic tailings at the Project site. The results of the assessment can be found as an attachment to the Historic Tailings Management Plan, Appendix P.

Six historic stamp mills are understood to have existed within or adjacent to the proposed Touquoy open pit. Tailings associated with the Moose River Gold Mine Stamp Mill and the G&K Stamp Mill have been located within the Touquoy pit perimeter. The site of the Colonial Mining Company Stamp Mill has been located within 10 m of the current bridge crossing Moose River, near the Moose River Gold Mines Provincial Park. No tailings remain at the site. It is believed that they were discharged into the river. The site of the McGregor Stamp Mill until recently had not been located, however it is believed that the mill was water driven and therefore likely that the tailings were also discharged into the river. After an extensive search, the location of the Reynolds Stamp Mill and associated tailings has not been located near the Touquoy site.

The tailings of the Moose River Gold Mine Stamp Mill are located adjacent to the south western border of the Touquoy open pit perimeter and they cover an area of approximately 3,000 m^2 with an average thickness of 0.2 to 0.3 metres. This represents a volume of 600 to 900 m^3, which corresponds to 800 to 1,200 tonnes. The sandy tailings, consistent in grain size, are typically mottled brown and grey and, in places, display distinct stratification. They overlie grey clays or soils developed on the underlying bouldery-tills. In some areas of the tailings a silt layer, up to 10 cm thick, has been deposited on top of the sandy tailings.

The G&K Stamp Mill was located on the southwest side of the proposed open pit. The tailings area extends southwest to a low-lying swampy area, west of a Provincial Park access road that goes from the stamp mill to Moose River. The area has been disturbed recently by the construction of the access road and drainage excavated on the west side of the road is likely to have directed part of the tailings to Moose River. The tailings impoundment area is estimated at 6300 m^2 with a thicknesses of 0.3 to 0.4 metres. This represents a volume of 1,900 to 2,500 m^3 equivalent to 2,450 - 3,350 tonnes of tailings.

DDV Gold analysed eight tailings samples collected from both the Moose River Gold Mines and the G&K Stamp Mill tailings areas as well as from the Touquoy Stamp Mill located directly on the bank of the Moose River to the south-west. Analyses for 36 elements were undertaken with results presented in Appendix J. Certificates VO07055647, VO07046023 (detailed As), VO07046024 (detailed Hg)) and those for mercury given in the following table.

Table 3.9-3 Mercury Analysis of Historic Tailings at Moose River Gold Mines

Stamp Mill	Sample ID	Hg (ppm)
Moose River Gold Mine	MRT-07-01	5.1
	MRT-07-02	7.03
	MRT-07-03	6.4
G&K Gold Co.	MRT-07-04	60.2
	MRT-07-05	9.38
	MRT-07-06	4.36
	MRT-07-07	16.9
Touquoy	MRT-07-08	3.85

Source: Moose River Gold Mines Historic Mine Tailings DDV Gold. Included in Appendix J.

For comparison CCME Guidelines for mercury in soils are 6.6ppm for agricultural and residential/park sites, 24 ppm for commercial sites and 50 ppm for industrial sites.

Since the average mercury content of the Touquoy gold ore, as determined from analyses of the metallurgical composites representing the orebody as a whole, is 0.007ppm it is apparent, as expected, that these elevated mercury levels in the historic tailings result from the amalgamation process used a century ago to extract the gold.

A recent site soil geochemical characterization survey undertaken subsequent to the historic tailings identification described above enabled identification of the McGregor Stamp Mill tailings located along Moose River just west of the Moose River Road. The distribution of these tailings were mapped and five samples taken for analysis (see Appendix J – Certificate VO07104119). Mapping (Appendix J) indicates about 1950m^3 (2500 tonnes) remain along the banks of Moose River and the five samples average 21ppm mercury (max. 52ppm) and about 4,000ppm arsenic (max >10,000ppm – pending final analysis).

Thus approximately 6,500 tonnes of historic tailings have now been identified within the footprint of the Project site.

To provide a background context for naturally occurring mercury (Hg) in bedrock at the project site the master ore composite and 12 sub-composites previously assembled to represent the orebody were analysed for mercury. The results (Appendix J – Certificate BR07079766 and Metcon report M1496) show very low Hg (from <5 to 12 ppb with an average of 7 ppb) occurring in the composite samples. This suggests that other geologically similar areas within the FRSA will have similar low levels of naturally occurring mercury.

3.9.4 Regional Bedrock And Soil Characteristics

The Focus Report Study Area is located entirely within the Meguma Group, a series of Cambro-Ordovician greywackes and argillites that underlie about half of the province of Nova Scotia. The Meguma Group comprises the greywacke-dominated Goldenville Formation and the argillite-dominated Halifax Formation. The Meguma Group is metamorphosed to schist and gneiss in places and intruded by granites. The Goldenville Formation is host to most of the many gold deposits in the Meguma Group. Elevated arsenic concentration is a natural, common and widespread occurrence within both Formations but particularly within the Goldenville Formation, where arsenopyrite (the main arsenic containing sulphide mineral) is often associated with quartz veining and gold mineralization. The arsenopyrite-gold association applies, as is typical, at Touquoy. It is also the prevalent arsenic sulphide mineral at the historic Lake Charlotte gold workings at the northern end of Lake Charlotte.

The NSDNR maintains a geochemical database of terriginous sample media collected and analysed for a range of elements by various government and private agencies over the last several decades. This database is used primarily for mineral exploration purposes. Sampled media include till, soil, stream and lake bottom sediments. Figure

3.9-2 is a plot of the arsenic content – arsenic being an element of interest in the present context – in these four media types throughout and somewhat beyond the Focus Report Study Area. Arsenic levels are shown to be generally elevated throughout this region and in many instances well in excess of CCME Guidelines. The Project site by no means stands alone in terms of arsenic content such that natural arsenic contamination of surface waters and groundwaters in the region is expected to be a widespread phenomenon unrelated to soil and bedrock conditions at the Project site.

4.0 ADVERSE EFFECTS AND ENVIRONMENTAL EFFECTS ASSESSMENT

In concordance with the Terms of Reference for the Preparation of a Focus Report, Section 4 provides a detailed description of adverse effects and environmental effects on Valued Ecosystem Components (VECs), including socio-economic, community and bio-physical environmental impacts, within the Touquoy Gold Project site and the greater FRSA. This section characterizes potential effects of lighting, noise and blasting, air emissions and dust on the FRSA. This section also addresses visual impacts, impacts to surface and ground water and potential soil contamination. Impacts to flora and fauna/rare species and species-at-risk including mitigation measures are discussed in section 7.5.1.

4.1 LIGHTING

A light impact assessment was conducted for the proposed mine site, focusing on light sources and emissions and the effects, if any, they will have on native species and migrating birds in the study area as well as potential sensitive receptors including; Kidston Day Camp (3 km from proposed open pit), nearest full time resident (5 km from proposed open pit), and the Scraggy Lake area. The impacts of the proposed lighting installations were quantified and compared with guidelines published by The Institution of Lighting Engineers (ILE) in the document entitled "Guidance Notes for the Reduction of Obtrusive Light".

As outlined in the light impact assessment report (Appendix N) the calculated light levels at each sensitive receptor are significantly below the limits recommended by the ILE guidelines (See Table 2 of Appendix N for summary of results and limits). Illuminance values ranged from 5.87 E-02 lux to 2.94 E-01 lux which is well below the Post Curfew value of 1 lux.

In addition to the impact assessment, a background light study was also conducted on August 23, 2007. Post curfew measurements (after 11 pm) were conducted utilizing on a Skeonic L-358 flash meter. Measurements were taken in the EV mode, and converted into LUX values. Monitoring locations are outlined in Figure 3.3-1. At all locations ambient light measurements were under exposed, indicating ambient light levels were too low to be measured.

Outlined below in Table 4.1-1 are some typical illuminance values for various light sources.

Table 4.1-1 Illuminance Values of Various Light Sources

Illuminance Value	Light Source
1 lx	full moon
10 lx	street lighting
100-1'000 lx	workspace lighting
10'000 lx	surgery lighting
100'000 lx	plain sunshine

Source- http://www.schorsch.com/kbase/glossary/illuminance.html

Background ambient light was not measurable, therefore Project light sources will have an impact on the existing environment. However predicted Project sources in actuality will be well below ILE guidelines at all three sensitive receptors and in essence will have illuminance values less than that produced by a full moon. The surrounding forest area will further inhibit the spread of light. Impacts from proposed lighting sources will therefore not negatively impact migrating birds, native species or other sensitive receptors (as outlined above) in the FRSA.

In summary:

- Background light levels were below detection at the Project site.
- Predicted light levels are all below applicable guidelines.
- The surrounding forest will inhibit light migration.
- Sensitive receptors in the FRSA will not be negatively affected.

4.2 NOISE AND BLASTING

Noise and Blasting Assessment reports were prepared for the Touquoy Project that focused on possible effects on the Project site and the FRSA. These assessments were specifically designed to predict possible effects relating to known site activities and known and possible recreational land uses in the FRSA.

Blasting impacts were also examined for Fauna and Fish with the results of these assessments described below in this section.

Noise

An acoustic assessment was conducted for the proposed mine site, focusing on sound emissions from noise sources identified at the facility and determining effects on sensitive receptors including; Kidston Day Camp (3 km from proposed open pit), the nearest full time resident (5 km north from proposed open pit) and the Scraggy Lake area. Outlined in Appendix M is a complete report for the Acoustic Assessment Report. Sound level impacts were compared to the Nova Scotia Guidelines for Environmental Noise Measurement and Assessment.

Outlined in the above referenced report is a noise source summary and associated sound level measurements (Appendix M - Acoustic Report, Table 1) . Table 2 is a summary table of the same noise sources as outlined in Table 1 including the predicted unattenuated sound levels (no engineering controls in place) for each source at each receptor. An estimated worst case facility sound level measurement for a 1 hour period was estimated for each receptor and presented in Table 3 in Appendix M. Predicted values range from 34.6 dBA to 42.3 dBA. dBA scale measurements are based on sounds in the human range of hearing. All estimated values are below the NSEL daytime sound level criteria on the dBA scale.

Additional modeling was also conducted to estimate the effects of additional equipment on the dam of the tailing management system as work is conducted to rebuild the dam surface. An overall increase in noise levels of 0.6 dBA will be experienced at POR3. Values will still be below NSEL criteria.

Baseline measurements were conducted approximately 300 m from the open pit area and are summarized in section 3.5.1. Predicted noise levels at Scraggy Lake and Camp Kidston are approximately 2 dBA greater than daytime values measured in the baseline study. The predicted sound level at POR1, the farthest sensitive receptor from the proposed site is 34.6 dBA which is below the baseline value measured.

People generally perceive a 10 dBA increase in a noise source as a doubling of loudness. For example, a 70 dBA sound level will be perceived by an average person as twice as loud as a 60 dBA sound. People generally cannot detect differences of 1 to 2 dBA between noise sources; however, under ideal listening conditions, sound level differences of 2 or 3 dBA can be detected by some people. A 5 dBA sound level change would probably be perceived by most people under normal listening conditions. Outlined below in Tables 4.2-1 and 4.2-2 are typical noise levels for some construction equipment and typical ambient sound levels for outdoor locations (Supplemental reference materials are supplied in Appendix M). The A weighted sound level scale begins at zero, the quietest perceivable sound, and ranges to ~140 dBA which the pain threshold.

Table 4.2-1 Some Typical Sound Levels at 15 m

Noise Generator	Noise Level(dBA)
Military Jet taking off	130
Chain Saw	105-115
Front Loaders	70-85
Backhoes	70-95
Scrapers, Graders	80-95
Pavers	85-88
Trucks	80-95
Power Lawn Mower	80-95
Passenger Train	75-90
Compactors (Rollers)	75
Some Additional References	
8m from Passenger Car Traveling 65 mph	70
Speaking Voice	67
Bird Calls	44
Whisper	30

Source: Colorado State University-Typical Construction Noise Levels League of Handbook and Hearing Handbook of Noise Control Cyril Harris, 1979

Table 4.2-2 Sound levels of Typical Outdoor Locations

Location	Sound Level (dBA)
Apartment Next to Freeway	88
Downtown with Some Construction	79
Urban Row Housing on Major Avenue	68
Old Urban Residential	59
Wooden Residential	51
Agricultural Crop Land	49
Rural residential	39
Wilderness Ambient	35

Source: US EPA-EPA Report NTID73.4

Typical background noise levels for wilderness areas is 35dBA, and rural residential areas are typically in the range of 39dBA (US EPA "Impact Characterization of Noise Including Implication of Identifying and achieving levels of Cumulative Noise Exposure-EPA Report NTDI73.4,1993). Background measurements at Moose River Gold Mines were approximately 40 dBA, which compares well to the US EPA value of 39 dBA for rural residential areas. This value is also expected to be typical for much of the FRSA as activities and surface features are similar as in the Moose River area. As discussed above the overall impact existing background noise levels to receptors POR2 and POR3 is approximately 2 dBA, an increase that will be noticed by some people. Figure 4.2-1 is a contour map of noise attenuation from the proposed open pit. At Scraggy lake (~200

m) south of the polishing pond, and at Camp Kidston (3 km from facility) background noise levels are predicted to be 42 dBA, 2 dBA above measured background levels. Areas outside the 3 km range are considered to have zero affect and therefore the proposed activities associated with the Touquoy Project will not have a significant affect on the existing environment.

Noise level measurements and modeling is very weather and topographically dependent. Different weather conditions as well as different land masses, tree cover, hills and valleys can all influence noise propagation. In relative terms, the predicted noise levels in and around the proposed Project will not be louder than a moderate gust of wind blowing through the trees at 13 metres , quieter than a chain saw starting, or more quiet than a normal speaking voice. Predicted noise levels will vary depending on wind direction and other meteorological conditions, but noise related impacts will have very little effect if any on the existing environment adjacent to the Project site and in the FRSA.

Blasting

A blasting impact assessment was conducted to provide an evaluation of the potential air blast overpressure and ground vibration impacts from the proposed blasting operations within the open pit mine on sensitive receptors located nearest to the Site. The Assessment was prepared consistent with the Nova Scotia Department of Environment and Labour (NSEL) Pit and Quarry Guidelines (1999) which do not apply to mining operations but were used as a guide. Presented in Appendix Q is a copy of the blast impact report.

The NSEL specifies that no blasting operations shall occur within:

- 30 m of the boundary of any public or common highway;
- 30 m of the bank of any watercourse or the ordinary high water mark;
- 800 m of the foundation or base of a structure located off site; or
- 15 m of the property boundary when a structure on the abutting property is not involved.

Based on the Site Plan provided as Figure 1 in the Blast Impact Report, the open pit mine (where all blasting occurs) is suitably sited to ensure that the above minimum separation distances are maintained.

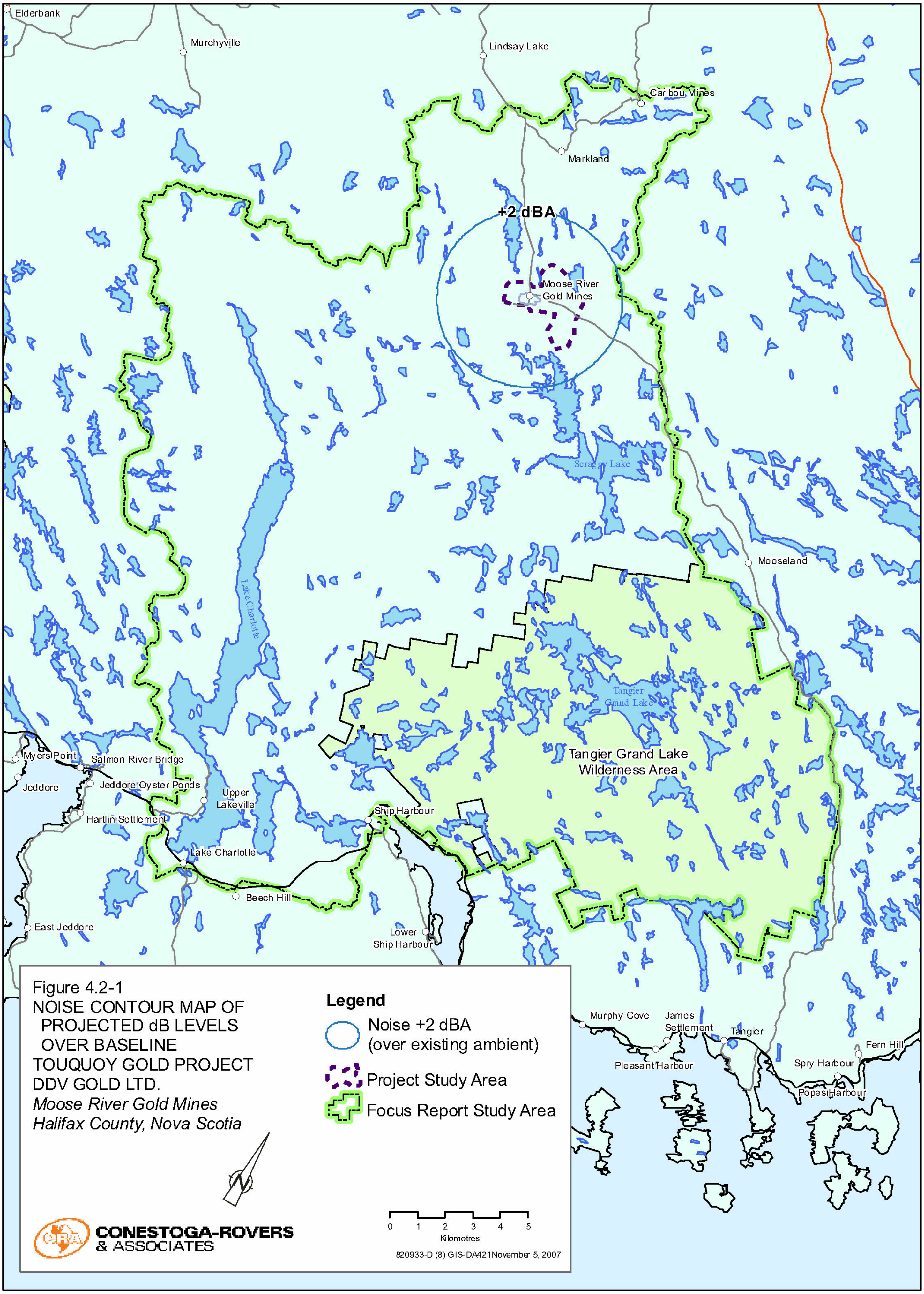


Figure 4.2-1
NOISE CONTOUR MAP OF
PROJECTED dB LEVELS
OVER BASELINE
TOUQUOY GOLD PROJECT
DDV GOLD LTD.
Moose River Gold Mines
Halifax County, Nova Scotia

Outlined in Section 3 of the Blast Impact Report is the proposed blast design. Discussed in Section 4 are the effects and impacts of the blasting operations as well as the process followed for calculating the maximum allowable weight of explosives per delay. Theoretical values for a maximum allowable weight of explosive per delay for ground vibrations and air blasts were calculated as 900 kg/delay and 3,900 kg/delay respectively.

There are two main impacts from a blast, overpressure and ground vibrations. Overpressure travels as an air wave and can cause vibrations in structures. The overpressure is measured with a sound level meter, reported in decibels, but often has components in lower frequency ranges that are not audible by the human ear. Ground vibrations are transmitted through the ground and are measured with a blast monitor.

The proposed blast design for the site utilizes a maximum of 206.8 kg/delay and the concussion air blast noise is predicted to be 122 dB at the nearest sensitive receptor (Scraggy Lake - 1800 m). Given the low weight of explosives per delay, and that the estimated blast noise will not be greater that 122 dB, it is reasonable to predict that the ground vibration for the blast will also be lower that the NSEL Pit and Quarry criteria of 12.5 mm/s. The value of 122 dB as an instantaneous sound will be similar to other sound experiences in the Project site and FSRA such as muffled thunder, car door slamming, gun shot in the distance, splitting dry hardwood with an axe or a beaver tail slapping on a calm day. This type of sound will be a short term (less than a few seconds) and heard by humans as a clear to a muffled sound depending on individual hearing and the location where the sound is heard and weather conditions at the time. Windy conditions will greatly reduce the likelihood of actually hearing anything. Actual measured conditions at the Touquoy Gold Project will be subject to strict monitoring and documentation of results for viewing by the CLC and NSEL.

Table 4.2-3 Noise Attenuation of Typical Blasting Event (A Scale)

Distance From Blast(meters)	Sound Level Reading(dBA)
15.2	94
30.5	88
61	82
122	75
183	71
244	69
305	66
457	62
610	59
762	56
914	53
1,219	49
1,609	45
2,286	38

Source: Hoover and Keith 1996, http://www.waterrights.ca.gov/EIRD/text/Ch11-Noise.pdf
The following assumptions were used: Basic sound level drop off rate- 6.0 dB per doubling of distance
Molecular absorption coefficient-0.7 dB per 1,000 ft Reference Sound level-94dBbA

The table above (4.2-3) give an example of a blasting event and noise attenuation. Noise impacts are from typical mine blasting are experienced over a very limited period of time, typically one to two seconds. Spikes in noise levels could be observed at this time; however, blasting will be confined to the open pit area and below grade. The design of the pit itself will aid in further reducing noise propagation as well as natural topography, ground cover and forested areas. Due to the short term nature of blasting events and natural attenuation factors, noise levels from blasting events will not have a significant affect on the existing environment. Temporary spikes in noise levels once they reach sensitive receptors will not be much louder than previously mentioned existing sound experiences. See as well Table 4.2-1 for other natural and man-made sound reference values.

The second factor of a blasting event is the ground vibration. Tolerance and reactions of humans to vibrations (sound, air overpressures, or air blast) are important when standards are based on annoyance, interference, work proficiency, and health. Humans notice and react to blast-produced vibrations at levels that are lower than the damage (*i.e.* cracking) thresholds. During blasting energy is lost in the form of noise and ground vibration. In general the amount of vibration increases with the amount of explosives used but decreases with the distance between the blast and receptor. The higher the frequency of the vibration (controlled by delay times) the less effect the vibrations will have on buildings. Vibrations that are accompanied by noise will appear to be stronger than the same vibration would be without noise. Human activities such as walking, door slamming, closing windows or children running through the house can stress individual building components more so than safe blasting levels.

Predicted ground vibrations are also expected to be below the NSEL criteria of 12.5 mm/s. As a reference point, a door slammed at the opposite end of a typical house can produce a vibration of 12 mm/s.

(http://www.nswmin.com.au/__data/assets/pdf_file/0006/6945/Blasting_the_NSW_Minerals_Industry_Fact_Sheet__text_box__.pdf).

Ground vibrations from blasting events are not expected to significantly impact the existing environment.

Modeled values meet Provincial guidelines, and did not take into consideration any attenuation measures that would further reduce blast-related impacts. Therefore, based on this Focus Report, there is no potential for adverse effects due to ground vibration or air blasts to nearby receptors resulting from the blasting operations to be conducted on-site.

Fish

Blasting Calculations

The proponent's blasting plan includes 100 holes per blast session. Each blast session will consist of a sequence of small blasts of 4 holes per delay, for a total of 25 delays to blast all 100 holes. Each hole will contain 51.7 kg of explosives. Thus each blast delay will involve 4 holes each containing 51.7 kg of explosive, for a total 206.8 kg of explosive per blast.

Calculation of Setback from Fish Habitat

To calculate the minimum setback distance to the stream required to ensure the overpressure in the stream is less than the DFO guideline criteria of 100 KPa, the appropriate K factor of the substrate must be used. As the blasting is occurring in rock and the rock formation extends under Moose River, the K factor for rock (5.03) is used.

Thus the required set back for a 206.8 kg charge set in rock must be calculated using the following equation:

$R = (W^{.5})\ (K)$

Where:

$W = 206.8$ kg

$K_{(rock)} = 5.03$

R= the setback distance in metres

Thus:

$$R = (206.8^{\ 0.5})\ (5.03)$$

$$R = 72\ \mathrm{m}$$

A 206.8 kg charge must be detonated in rock at least 72 metres from a stream to ensure the overpressure in the stream is less than the 100 KPa limit. At full development, the pit will be over 100 metres from Moose River, so this setback limit will be easily met.

Calculation of Setback Distance from Fish Spawning Habitat

To calculate the minimum setback distance to the stream required to ensure that peak particle velocities in spawning bed during the incubation period is less than DFO's guideline criterion of 13 mm/s, the following equation is used.

$$V_R = 100(R/W^{0.5})^{-1.6}$$

$$R = (W^{0.5)}\ (V_R/100)^{-0.635}$$

Where

$V_R = 13$ mm/s = 1.3 cm/s

$W = 206.8$ kg

R= the setback distance in metres

Thus

$$R = (W^{0.5)}\ (1.3/100)^{\ -0.635}$$

$$R = (W^{0.5)}\ (15.09)$$

$$R = (206.8)^{0.5}\ (15.09)$$

$$= 217.05\ \mathrm{m}$$

A 206.8 kg charge must be detonated in rock at least 217 metres from fish spawning habitat to ensure that peak particle velocities in fish spawning beds during the incubation period are less than DFO's guideline criterion of 13 mm/s.

The centre of the current pit is over 500 metres from Moose River. At full development, the edge of the pit will be 100 metres from Moose River. The portions of Moose River within approximately 300 metres of the pit consist of bedrock, which is not fish spawning habitat.

Fauna

Blasting will have no effect on bird habitat, however, nesting birds in the immediate vicinity of the blast may be temporarily impacted. Nesting birds are generally only disturbed from the nest at the micro-site level (within territory) when visual contact with the disturbance (*i.e.* presence of predator) is made. Therefore, disturbance from blasting will only impact birds nesting in the immediate visual vicinity of the Project site (*e.g.* American Robin) and is not expected to impact birds in the greater FRSA.

Moose Calving

Moose calving habitat immediately surrounding the Project site is scarce and blasting will likely not impact moose populations in the FRSA, given the duration and extent of the blast activities.

Summary of points:

- Modeling was completed to predict impacts.
- Results indicate potential increases at sensitive receptors in FRSA to be 2 to 3 dBA which is not detectable to most people.
- Blasting associated impacts are short term (a few seconds) and are not anticipated to affect moose, birds or humans using the FRSA.

4.3 AIR EMISSIONS AND DUST

An Emissions Summary (ES) and Dispersion Modeling (DM) assessment was conducted to assess potential air releases to the atmosphere and their impact on the surrounding receptors in support of a Class 1 Environmental Assessment under the *Nova Scotia Environment Act* and Environmental Assessment Regulations. See Appendix L for the complete ESDM report[1]. The location of the facility is presented in Figure 1 and the locations of the discharges from each source are presented in Figures 2a and 2b.

As Nova Scotia does not have an air dispersion modeling guidance document, the Ontario air compliance regulation (Ontario Regulation 419/05; O. Reg. 419/05) and

---

[1] It should be noted that the assumptions made during the air quality study are extremely conservative. The fact that even with these assumptions air emissions were determined to have no harmful effects speaks directly to the nature of the proposed processes. Monitoring will never-the-less be conducted to determine actual performance. Results of the monitoring will be made available to CLC and regulatory authorities.

dispersion modeling guidance ("Air Dispersion Modeling Guideline for Ontario", July 2005) were referenced to develop the modeling methodology.

A description of Project processes and the associated emissions for each activity is discussed in Section 3 of the ESDM report. A summary of the potential air contaminants being emitted by each of the processing activities in listed in Table 1. Tables 2-8 are emissions rates for each Project process. Table 9 is a facility wide summary of emission rates. Table 10 is a summary of the input parameters used for modeling and Table 11 is a summary of emission rates by contaminant and source.

Presented in Section 7 of the ESDM report is the list of contaminants modeled as well a discussion of the dispersion modeling process. The dispersion modeling was performed using the United States Environmental Protection Agency (USEPA) multi-source dispersion model AERMOD (version 06341). 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.

The maximum GLCs for each air contaminant at each of the sensitive receptors are predicted to be well below the established limits. Table 12 summarizes the maximum concentration predicted for each air contaminant at each sensitive receptor. Table 12 also summarizes the limits used for evaluation, and the percentage of predicted GLC relative to the limit at each sensitive receptor.

Meteorological conditions play an important role in dispersing stack emissions. In general more rapid diffusion occurs during day light hours especially in the lower 1000 ft, but nighttime inversions can inhibit diffusion in the vertical direction. A review of wind direction from Stewiacke station (25 km from the study area) show more westerly to northwesterly winds in the winter months and more southerly winds in the warmer months (see Wind Rose Diagrams Appendix K). Predicted emissions levels show significant reduction from point of reception as well. For instance, emissions levels for carbon monoxide (CO) at Scraggy Lake (~2.8 km south east of the proposed processing plant, 200 m south of the southern most tip of polishing pond were 50.44 $\mu g/m^3$. Predicted concentrations 3 and 5 km north west of the plant were 17 and 16 $\mu g/m^3$ respectively, showing a three fold reduction in emissions. Most other predicted GLC concentrations show similar trends. Southerly winds in the warmer summer months will also minimize emissions levels at the Tangier Grand Lake Wilderness Area. Following similar emissions trends as exhibited at POR's, and considering that the separation distance between the proposed Project location and the Tangier Grand Lake

Wilderness Area is close to 20 km then predicted air emissions will not have a significant affect, if any, on the existing ambient air quality.

Maximum emissions modeled represent a worst case scenario, all emission sources operating simultaneously. Final emissions values are a total of accumulated values for each source at each receptor for a 24 hr period. In reality not all operating sources will be running at the same time and thus the actual emissions factors will be lower than the predicted values.

There will be some greenhouse gas emissions generated from the Project activities. The primary potential greenhouse gas emission from the Moose River Gold Mine development (Site) will be carbon dioxide (CO_2). Carbon dioxide is a colorless, odorless non-flammable gas and is the most prominent Greenhouse gas in Earth's atmosphere.

Carbon dioxide will be emitted from the liquefied petroleum gas (LPG) combustion processes at the Site including the carbon reactivation kiln, elution heater, calcination oven, and smelting furnace. However, the CO_2 emissions from the combustion processes will be small in comparison to vehicle tailpipe emissions and equipment engines and represent about 0.4% of total CO_2 emissions from the site. Additional CO_2 emissions result from decomposition (hydrolysis) of cyanate calculated at 698 tonnes per year. Summarized in Table 4.3-1 below are total estimated CO_2 emissions from the Site.

Table 4.3-1 Estimated CO_2 Greenhouse Emissions

Diesel Fuel Usage: 6,480 kg/d
LPG Usage: 1,036 kg/d

Source	**Compound**	**Carbon Content of Diesel Fuel (1)**	**Density of Diesel (3)**	**% oxidation of Carbon (1)**	**CO_2 Emission Rate (2)**	
		(g/gallon)	**(kg/gallon)**		**(g/s)**	**(tonne/yr)**
Vehicle Tailpipe Emissions	CO_2	2,778	3.24	99%	233.43	7361.42
Combustion Processes	CO_2	See Table 5 in Air Emissions Report (Appendix L)			0.906	28.57
Cyanate Decomposition	CO_2	See Appendix L			22.12	698
TOTAL					256.46	8087.99

Notes:

(1) As provided in the EPA methodology, "Emission Facts: Average Carbon Dioxide Emissions Resulting from Gasoline and Diesel Fuel".

(2) Converted to CO_2 Emission rate using molecular weights of CO_2 and CO.

(3) Assuming average density of No.2 Diesel, 0.85 g/mL.

Carbon dioxide emissions from combustion processes were estimated using an emission factor provided in the USEPA AP-42 document, Chapter 1.5 – Liquefied Petroleum Gas Combustion, for Industrial Boilers. The estimated yearly usage rate of LPG was used along with this emission factor as follows:

CO_2 emission rate = emission factor x LPG usage rate:

$$CO_2 = 1500 \tfrac{kg}{10^3 L}(EF) \times 19.05 \tfrac{10^3 L}{yr} \times \frac{yr}{365\, d} \times \frac{d}{24\, hr} \times \frac{hr}{3600\, s} \times \frac{1000\, g}{kg} = 9.06\text{E} - 1 \tfrac{g}{s}$$

Vehicle tailpipe emissions will be a more significant source of carbon dioxide emissions than the combustion processes. These were estimated using a methodology published by the USEPA in "Emission Facts: Average Carbon Dioxide Emissions Resulting from Gasoline and Diesel Fuel". This method uses the average carbon content of diesel fuel to estimate CO_2 emissions from motor vehicles, along with an assumed oxidation factor:

CO_2 emission rate = *Carbon content of diesel x oxidation factor x molecular weights ratio (CO_2/C) x diesel usage rate*

Where:
Average carbon content of diesel = 2,778 grams/gallon
Oxidation factor = 0.99 (99% of the carbon in fuel is eventually oxidized)
Molecular Wt. of C = 12 g/mol
Molecular Wt. of CO_2= 44 g/mol

$$CO_2 = 2{,}778 \tfrac{g}{gallons} \times 0.99 \times \frac{44 \tfrac{g}{mol} CO_2}{12 \tfrac{g}{mol} C} \times 2070.29 \tfrac{gallons}{day} \times \frac{day}{24h} \times \frac{h}{3600s} = 241.63 \tfrac{g}{s}$$

Using the above methodology, the annual carbon dioxide emissions from the Site are estimated to be 8,088 tonnes/yr. Since 2004, greenhouse gas (GHG) reporting to Statistics Canada is required if a facility exceeds the reporting threshold of 100,000 tonnes/yr of carbon dioxide (CO_2) equivalent. The estimated emissions from the Moose River Gold Mines Site are significantly below this level, and therefore are not considered reportable.

Dust

There will be sources of fugitive dust emissions present at the Site, which are all part of normal operation. These sources are the open-pit operations, unpaved haulroads, and storage piles. As per guidance from the Ontario Ministry of the Environment from the document entitled "Procedure for Preparing an ESDM Report", these sources of fugitive dust can be excluded from the ESDM and subsequent air dispersion modeling if the Site implements a best management practices plan (BMPP) to monitor and control releases of fugitive dust. A brief BMPP is outlined in the ESDM report.

Sulphur Dioxide

In 2004,the most recent year for which data is available, the city of Halifax was found to have mean annual SO_2 levels of 18.3 µg/m³ (7 ppb), the highest levels in Nova Scotia (National Air Pollution Surveillance Network data). Halifax supports many industrial facilities which produce sulphur dioxide, including an oil refinery and a power generating plant. Thus the mean annual background SO_2 levels in the very rural area of Moose River Gold Mines, which is isolated from any major pollutant sources, should be considerably less than this value.

Sulphur dioxide will be emitted from two main sources on the Project site. The main source of SO_2 will be from emissions from mine vehicles working in the mine pit. The second, much smaller source is processing facility north of Mooseland Road. A review of average wind conditions from August 2006, through to September 2007 (from Upper Stewiacke station) indicates wind directions(blowing from) trending generally westerly to north westerly in the fall to winter months, changing to more southerly winds in the summer or warmer months. Extensive emissions dispersion modeling has been conducted for this Project (See full report in Appendix L). Predicted mean annual SO_2 emissions from the Project are depicted on Figure 4.3-1.

In summary based on the estimated maximum emissions scenario presented in this ESDM, the predicted maximum ground level ambient air concentrations of all potential contaminants calculated from the air dispersion modeling are all well below applicable criterion at the three sensitive points of reception (PORs). Prevalent winds, ground cover and forested areas all will aid in further reducing emission levels. The ESDM Report demonstrates that the Site operations under worse-case meteorological conditions will not adversely impact human health or the surrounding environment.

In regards to greenhouse gas emissions Environment Canada publishes the reported tonnes/yr of carbon dioxide emitted by facilities across the country. In Nova Scotia, there are a number of facilities that produce significant amounts of carbon dioxide, ranging up to 4,400,000 tonnes/yr. Typical power generating stations are reporting emissions in the range of 1,000,000 to 4,4000,000 tonnes/yr and oil refineries reporting in the neighborhood of 750,000 tonnes/yr. In comparison with these facilities, the amount of carbon dioxide expected to be emitted from the Site is very small. Carbon dioxide emissions are not considered to be a concern for this Site.

DDV Gold will explore methods for GHG capture through vegetation plantings and other technologies.

4.3.1 Effects On Lichens

Unlike vascular plants, lichens do not have root systems and so cannot access soil water and nutrient reserves. Instead, they rely primarily on air and rain-borne nutrients and thus, are susceptible to air pollution, particularly acidifying or fertilizing sulfur and nitrogen-based pollutants. Cyanolichens are also able to fix atmospheric nitrogen. Lichens also do not have a cuticle layer to protect them (Richardson, 1988) and many have been shown to accumulate pollutants, including tiny particulates (Richardson 1992). They also lack stomata to regulate gaseous exchange and thus, gaseous compounds can absorbed directly into lichen thalli through moist cell walls (Richardson 1992).

Effects of Sulphur Dioxide on Lichens

Sulphur dioxide (SO_2) is a pollutant which has been shown to have a wide range of negative physiological effects on lichens. This compound is a typical by-product of coal and fuel oil combustion, ore reduction, paper manufacture, other industrial processes, and vehicle exhaust. In Nova Scotia, the main sources of air pollution are vehicle exhaust, coal-fired electrical power generation, oil-based domestic heating, and oil refining (NSEL 1998). Background concentrations in North America range from 2.8 to 28 $\mu g/m^3$. SO_2 is a very soluble gas which can easily pass through cell membranes into lichen thalli. It dissolves in water to form sulphurous acid at low pH levels, while at high levels, bisulphate or sulphite ions are produced. All of these forms are very reactive.

The magnitude and nature of the effects of SO^2 on lichens can vary greatly according to factors such as species sensitivity, moisture levels, the duration of exposure and substrate. Some species are more sensitive to SO^2 exposure than others. In general, pendant and nitrogen-fixing epiphytic lichens are most sensitive to air pollution, while medium to large foliose epiphytic macrolichens are intermediate in tolerance; and ground-dwelling lichens and species with comparatively small surface areas, such as crustose and small foliose lichens, are most tolerant to pollution (McCune and Geiser 1997, http://gis.nacse.org/lichenair). Seaward (1987) found that fruticose lichens are generally being more susceptible to SO^2 than many foliose and crustose species in urban areas. In general, species within a genus generally have similar pollution tolerance ranges (McCune et al. 1997, Neitlich et al. 2003), however, there are exceptions (Seaward, pers. comm., 2007).

Photosynthesis and respiration in lichens are dependent on the moisture content of the thallus, so that lichen metabolism can come to a standstill when lichen is very dry. The larger a lichen is, the longer it stays moist, and the longer it can be metabolically active. Thus lichen metabolism is very dependent on both lichen thallus size and environmental conditions. Nieboer *et al.* (1978) showed that damage to lichens is related to the thallus water content, and that dry lichens are resistant to SO_2. Marsh and Nash (1979) demonstrated this with desert lichens, which were unaffected by SO_2 exposure during dry periods.

Increased concentration of SO_2 and greater duration of exposure has been shown to increase the magnitude of negative efects on lichens, particularly on the algal or cyanobacterial partner (Holopainene and Karenlampi 1984). Cyanolichens are particularly sensitive, apparently because the photosynthesizing cyanobacterium is sensitive to SO_2 and to acidic conditions. In addition, the nitrogen-fixing enzyme (nitrogenase) in cyanolichens has been shown to be very intolerant of SO_2 (James 1973). Many of the epiphytic lichens in Nova Scotia are cyanolichens and thus, are sensitive to atmospheric SO_2.

Exposure to SO_2 is considered to be the main cause of the lack of lichens in most urban and industrial areas (Seaward 1987). Some field studies have demonstrated that the more sensitive lichen species can be damaged or killed by annual average ambient levels of SO_2 as low as 8 to 30 $\mu g\ m^3$ (3 to 11.4 ppb) (Johnson 1979, deWit 1976, Hawksworth and Rose 1970, LeBlanc *et al.* 1972, all cited in Blett *et al.* 2003). Hawksworth and Rose (1976) state that corticoulous lichens such as *Lobaria* spp. are now rare or absent in areas in England which have mean winter SO_2 concentrations greater than 65 $\mu g\ m^{-3}$. Very few lichen species are known to be able to tolerate levels higher than 125 $\mu g\ m^{-3}$ (48 ppb) (Johnson 1979, deWit 1976, Hawksworth and Rose 1970, LeBlanc *et al.* 1972, all cited in Blett *et al.* 2003). A study in Sweden found that all but the most pollution-tolerant species were absent at levels of about 65 $\mu g\ m^{-3}$ (Arvidsson and Skoog 1984, cited in Insarova *et al.* 1992).

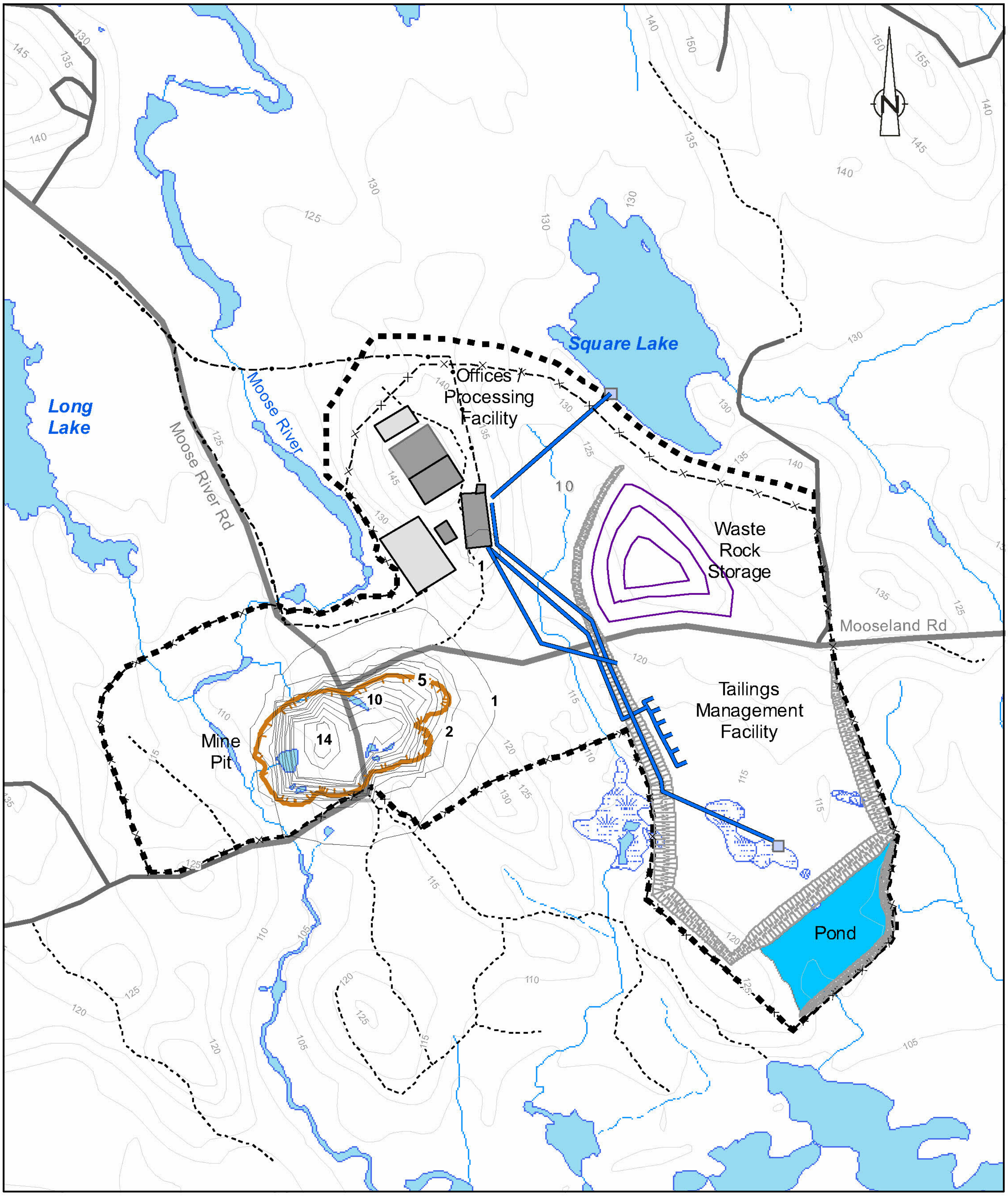


Figure 4.3-1
AVERAGE ANNUAL SULPHUR DIOXIDE
(SO_2) CONCENTRATION (ug/m^3)
TOUQUOY GOLD PROJECT
DDV GOLD LTD.
Moose River Gold Mines
Halifax County, Nova Scotia

5 SO_2 CONCENTRATION

0 0.2 0.4 0.6 0.8 1
Kilometres

ANALYSIS DATE: 10/01/2007
MODELLER: CRA
MODEL: ISC- AERMOD
OUTPUT TYPE: Concentration
PROJECT NO: 820933D

CONESTOGA-ROVERS & ASSOCIATES

820933-D (8) GIS-DA431 October 5, 2007

The high reactivity of SO_2 creates the potential to disrupt metabolic processes in lichens. Exposure to SO_2 has also been shown to cause a variety of macroscopic and microscopic changes in lichens, which may explain some of the physiological ones. A summary of the effects of SO_2 on lichens is provided in the following sections.

Photosynthesis and Respiration

SO_2 has been shown to affect lichen photosynthesis and respiration (Richardson 1992,Sanz *et al.* 1992, Rosentreter and Ahmadijian 1977). Some lichen studies have reported bleaching or discolouration of lichen thalli due to exposure to SO_2 (COSEWIC 2002, Sigal and Nash 1984). This change in colour is due to degradation of photosynthetic pigments (Kauppi 1980, Garty *et al.* 1993).

Holopainen and Karenlampi (1984) found that microscopic effects on chloroplasts are among the earliest consequence of SO_2 fumigation in lichens. These effects on the chloroplasts can lead to negative effects on photosynthesis. A transplantation study in Finland found acute injury (rapid degeneration of cell organelles and plasmolysis) in two species of lichen (Hypgymnia physodes and Bryoria capillaries) in just 2 to 3 weeks after they were moved to a heavily polluted area. However, months or years of chronic exposure were required in less polluted sites before lichens showed macroscopic evidence of damage (Holopainenen 1984).

Nitrogen Fixation

SO_2 exposure has been shown to have negative effects on nitrogen fixation in cyanolichens (Richardson 1992). As mentioned earlier, the nitrogen-fixing enzyme in cyanolichens, nitrogenase, is very intolerant of SO_2 (James 1973), and thus SO_2 exposure will result in decreased nitrogen fixation by the lichen thallus, leading to negative effects on growth.

Growth and Reproduction

Sulphurdioxide exposure can also have negative effects on reproduction of lichens (Sigal and Nash 1983). These effects have been shown to include a decreases in thallus size and fertility (DeWit 1983, Kauppi 1983, Sigal and Nash 1983). Some lichen species fail to produce ascocarps (fruiting bodies) in areas with mean winter SO_2 concentrations above 40 $\mu g\ m^{-3}$, for example the cyanolichen *Lobaria pulmonaria* (Hawksworth and Rose 1976). *Sticta fuliginosa*, also a cyanolichen, has been shown to fail to produce ascocarps when mean winter SO_2 levels are above 30 $\mu g/m^3$. Thus air pollution can give rise to relict populations, in which older thalli may survive but new ones are unable to become established. An example of this is *Lobaria scrobiculata* in Sweden. This species was formerly quite widespread in southern Sweden, but recent surveys have shown its population and range are decreasing, and apothecia have not been reported in this area since 1947 (Hallingback 1989).

Sulphurdioxide uptake can also lead to increased loss of potassium from cells, which may have impacts on lichen growth. Garty *et al.* (1993) have shown a good correlation between the degree of damage and average local SO_2 concentrations.

Sulphur Accumulation

Accumulation of sulphur in the thallus, can lead to a decrease in pH. Elevated sulphur levels have been shown to correlate with chlorophyll breakdown, reduced atenosive triphosphate (ATP) concentrations, reduced photosynthesis and disappearance of species (Puckett and Burton 1981). Lichens have been shown to accumulate sulphur at concentrations up to 3000 μg/mg dry weight (Nieboer and Richardson 1981). Sulphur isotope studies have been used to prove that this accumulation is through atmospheric uptake rather than via substrate (tree) leachates (Takala *et al.* 1991). Atmospheric uptake is through metabolization of dissolved SO_2 or through absorption of sulphate ions from acid rain or sea spray. Some lichens have been shown to be able to fractionate the SO_2 they take up and release some of it. Lichens can also metabolize SO_2 to some extent; however, this leads to SO_2 accumulation and can cause damage due to cell acidification (Lange *et al.* 1989). Cameron (2004) showed a significant difference in species richness in northern Nova Scotia compared with southern Nova Scotia, where since 1990, there has been a higher deposition of acid rain and non-marine sulphate.

Acid Rain

Effects on lichen distribution can also occur due to changes in the environment due to effects of sulphur dioxide. Probably the best-known effect of sulphur dioxide is as a component of acid rain. When it is emitted high into the atmosphere from tall emission stacks, SO_2 combines with ozone and water to form sulphuric acid, which falls as acid rain. The main impact of acid rain on lichens is to acidify their environment, causing leaching of important nutrients from lichen thalli or changes in the buffering capacity of bark and soil (Richardson 1992). In areas exposed to acid rain, sensitive lichens may be limited to substrates with a high pH which can buffer acid rain, such as the bark of certain deciduous trees or calcareous rock outcrops. Cyanolichens are particularly sensitive to acid rain and sulphur dioxide because nitrogen fixation, essential for their survival, is very sensitive to acid rain, even more so than is photosynthesis (Gries 1996).

The cyanobacterial photobiont is also quite sensitive to low pH conditions (Gilbert 1986, Hallingback 1989, Hawksworth and Rose 1970, Sigal and Johnston 1986).

Distribution

Physiological and environmental effects of sulphur dioxide on lichens can result in significant effects on lichen distribution. Studies conducted since the1960s have clearly indicated that the distribution of particular lichen species correlates best with mean winter sulphur dioxide levels in most urban/industrial area of the United Kingdom (Ferry *et al.* 1973, Hawksworth & Rose 1976). Much of this work has focused on non-cyanolichen species, although some research has been conducted on cyanolichens. Since industrialization occurred in the United Kingdom (UK), many of the shrubby and leafy lichens such as *Ramalina, Usnea* and *Lobaria* (a cyanolichen) species now have very limited ranges, often being confined to the parts of Britain with the purest air such as northern and western Scotland and Devon and Cornwall. Hawksworth and Rose (1970) developed a scale which relates lichen diversity on specific substrates (acidic and basic bark) to mean winter SO_2 concentrations. Species such as *Lobaria, Degelia, Usnea,* and *Pannaria* are considered indicative of relatively pure air when growing on acidic, non-nutrient –enriched bark (Richardson 1992). However, it is important to realize that lichen sensitivities to SO_2 can also vary by climate. Richardson (1992) points out that some species listed by Hawksworth and Rose as being sensitive to moderate levels of SO_2 were found to be more sensitive in Ireland. Richardson (1992) suggests this is due to higher levels of precipitation in Ireland, causing the lichens to be wet and therefore metabolically active for a larger proportion of time, leading them to be exposed to higher levels of SO_2 . This concurs with the observation that SO_2 effects appear to be greater in areas having maritime climates than in more continental areas (Hawksworth and Rose 1976).

Effects of Particulates on Lichens

Deposition of particulates containing metals can lead to increased concentrations of these metals in the lichen thallus, which can cause negative impacts on the lichen. Lichens are known to accumulate metals by trapping insoluble particulates containing metals. This trapping occurs when tiny particles are caught within growing fungal strands (hyphae) of the lichen, causing them to accumulate within the lichen thallus (Richardson 1992). Lichens can also take up dissolved metal ions through ion exchange, via bonding to lichen cell walls. Richardson (1992) discusses unreferenced studies in non-industrial areas in which some mineral ratios in lichens were observed to be similar to that measured in rock, indicating entrapment of rock particles. Significant departures from the expected ratios were observed near contaminated sites such as smelters or refineries where iron or tin was emitted (Richardson and Nieboer 1981). Toxicity to lichens depends on the nature and form of the metal. Exposure to metals such as zinc, lead, cadmium, and copper can kill lichens, while iron is less harmful, and lichens may in fact grow on some iron surfaces (Richardson 1992). Nash (1989) and Tyler (1989) have reported levels of some metals of more than 5000 μg/g dry weight in some lichens, without obvious harm to the lichen. Figure 4.3-2 outlines predicted TSP levels.

Lichens on the Proposed Touquoy Gold Project Site

Most of the listed cyanolichen species known from the Project site are members of the cyanolichen family Pannariaceae. This family is composed of several genera, including *Erioderma, Pannaria, Degelia, Fuscopannaria, Moelleropsis*, and *Coccocarpia*. Most of these species are generally considered indicative of clean, non-polluted environments (COSEWIC 2002, Maass 1986, www.lichenair.org., Richardson 1992). The remainder of the listed species belong to the families Collemataceae, which includes the genus *Leptogium*, and Lobariaceae, which includes the genus *Sticta.* A synopsis of the available pollution tolerance information on each sensitive or at-risk species known from the Project site, as well as the at-risk boreal felt lichen known from within the FRSA, is provided below. It is clear that boreal felt lichen and other lichens possessing the cyanobacterial photobiont *Scytonema* are highly sensitive to atmospheric pollution (COSEWIC 2002), as species utilizing *Nostoc* as the photobiont (Hallingback 1989).

Fuscopannaria ahlneri

No specific SO2 tolerance levels could be found for this species in the literature. This is one of the species associated with the E. pedicellatum community which has been shown to be sensitive to air pollution (Gauslaa 1995) As a cyanolichen and a member of the Pannariacaeae family which contains Syctonema as the photobiont, F. ahlneri is likely quite sensitive to SO2 (COSEWIC 2002). It is reasonable to predict that F. ahlneri is also in the sensitive to intermediate category (13.1-91.6 μg m3 or 5-35 ppb) of sulphur dioxide sensitivity.

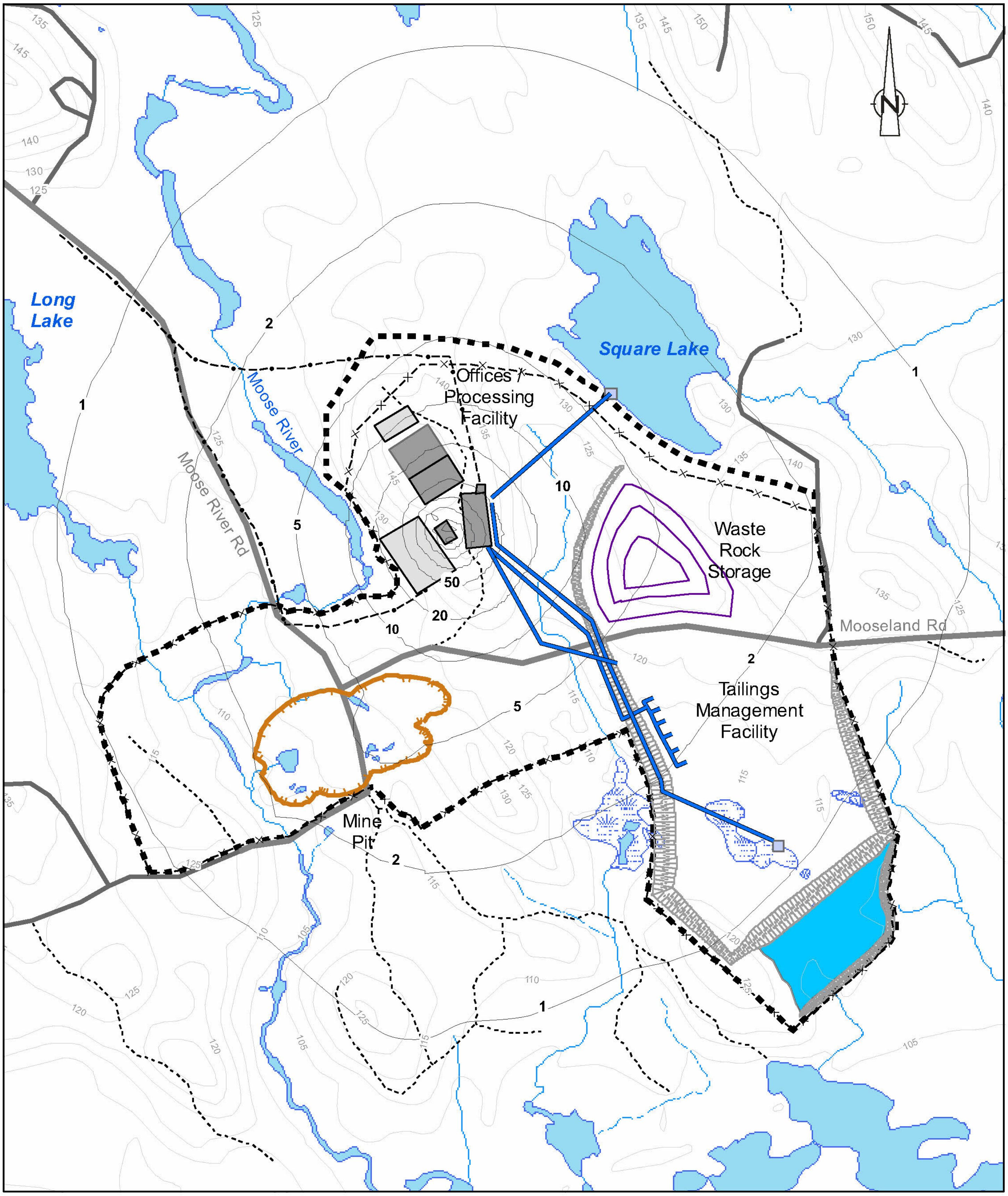


Figure 4.3-2
AVERAGE ANNUAL TOTAL SUSPENDED PARTICULATE MATTER (ug/m^3)
TOUQUOY GOLD PROJECT
DDV GOLD LTD.
Moose River Gold Mines
Halifax County, Nova Scotia

820933-D (8) GIS-DA432 October 5, 2007

⁄ 5 ⁄ Total Suspended Particulate Matter

0 0.2 0.4 0.6 0.8 1
Kilometres

ANALYSIS DATE: 10/01/2007
MODELLER: CRA
MODEL: ISC-AERMOD
OUTPUT TYPE: Concentration
PROJECT NO: 820933D

CONESTOGA-ROVERS & ASSOCIATES

Moelleropsis nebulosa ssp frullaniae

Very little is known of the SO_2 sensitivity of *Moelleropsis nebulosa* ssp *frullaniae*. As a cyanolichen and a member of the Pannariacaeae family which contains *Nostoc* as the photobiont, *M. nebulosa* ssp *frulaniea* is likely quite sensitive to SO_2. It is reasonable to predict that *M. nebulosa ssp frullaniae* is also in the sensitive to intermediate category (13.1-91.6 μg m-^{3} or 5-35 ppb) of sulphur dioxide sensitivity.

Erioderma pedicellatum

COSEWIC (2002) describes the boreal felt lichen, *Erioderma pedicellatum*, as extremely sensitive to atmospheric pollutants (COSEWIC 2002). It has been suggested that this species may be more sensitive to acid rain than other cyanolichens because it inhabits an already acid environment, the boreal coniferous forest (Cameron 2004), where it grows on acidic confer bark. Boreal felt lichen is also subject to habitat destruction through logging, as it often grows on commercial species of trees such as balsam fir (Cameron 2004). Evidence of damage to this species first occurs as evidence of death around the holdfast, followed by the death of the lichen (Moberg and Holmoen, 1982, cited in COSWEIC 2002). This species may be placed in the sensitive category (13.1-39.3 μg.m-^{3} or 5-15 ppb) of sulphur dioxide sensitivity.

Degelia plumbea

As a member of the Pannariaceae which utilizes *Scytonema* as the photobiont, this species is likely quite sensitive to SO_2 exposure (COSEWIC 2002), though no specific tolerance limits could be found in the literature. *D. plumbea* is considered to be rather intolerant of SO_2 exposure, and its presence is considered indicative of clean, non-polluted environments (Richardson, 1992). This species may be placed in the sensitive category (13.1-39.3 μg .m-^{3}or 5-15 ppb) of sulphur dioxide sensitivity.

Pannaria conoplea

Pannaria species in general are considered to be quite intolerant of sulphur dioxide pollution (Richardson 1992). They are listed in the Hawksworth and Rose scale as occurring only under conditions approaching pure air when growing on moderately acid bark (Hawksworth and Rose 1970 1976). However the specimens in Moose River are growing on somewhat basic deciduous (red maple) bark, and thus a direct comparison to concentrations given in the Hawksworth and Rose scale is not possible, although it does suggest that air in the vicinity of the site is currently quite pure. As a member of the Pannariaceae which utilizes *Nostoc* as the photobiont, this species is likely quite sensitive to sulphur dioxide exposure (R. Hallingback 1989). A cyanolichen sensitivity project in the Pacific Northwest has listed three related Pannaria species (*P. leucostictoides, P. meditteranea,* and *P. rubiginosa*) as sensitive to sulphur dioxide, indicating they have a maximum annual mean sulphur dioxide tolerance in the 13.1-39.3 $\mu g.m^{-3}$ or 5-15 ppb range (United State Forest Service, Inasarov 1992, McGune and Geiser 1997). It is likely that *P. conoplea* is also in the sensitive category for sulphur dioxide sensitivity.

Pannaria rubiginosa

As a member of the Pannariaceae which utilizes *Nostoc* as the photobiont, this species is likely quite sensitive to SO_2 exposure (Hallingback 1989, Richardson 1992). In the British Isles, this species appears to be threatened by air pollution as its range is limited to the less-polluted west coast (Dobson 1979). In the Pacific Northwest, this species is considered sensitive to annual mean sulphur dioxide concentrations of 5 to 15 ppb (McGune and Geiser 1997). Insarova *et al.* 1992 gave this species a sensitivity ranking of 10, meaning it is amoung the most sensitive to lichen species. Two related Pannaria species (*P. leucostictoides* and *P. meditteranea*) are also listed as sensitive to SO_2 (*i.e.* having a mean annual sulphur dioxide tolerance limit in the 13.1-39.3 $\mu g\ m^{-3}$ or 5-15 ppb range) (United States Forest Service www.Inasarov 1972, *et al* 1992 McGune and Geiser 1997). Thus this species may be placed in the sensitive category of sulphur dioxide sensitivity.

Coccocarpia palmicola

There is little if any published information on pollution tolerances of *Coccocarpia* palmicola. As a member of the Pannariacaeae family which utilizes *Scytonema* as the photobiont, it is likely quite sensitive to sulphur dioxide (COSEWIC 2002). This is one of the species associated with *E. pedicellatum* habitat which has been shown to be sensitive to air pollution (Gauslaa 1995). Also, as a species which grows preferentially on conifers, which are already somewhat acidic, it is probably more sensitive to acid rain than are species which preferentially grow on deciduous trees, which tend to have more buffering capacity. This species may be placed in the sensitive category (13.1 to 39.3 $\mu g.m^{-3}$ or 5 to 15 ppb) of sulphur dioxide sensitivity.

Leptogium corticola

There is no available information on pollution tolerances of *Leptogium corticola.* A closely related species, *L. cyanescens,* which is also present on the Project site, is categorized in the Pacific Northwest as sensitive to sulphur dioxide at mean annual concentrations of 5-15 ppb. A second related species, *L. saturninum*, has been ranked as sensitive to intermediate, meaning it is sensitive to mean annual SO_2 concentrations between 5-15 and 10-35 ppb (United States Forest Service, www.Insarova *et al.* 1992). It is reasonable to predict that *L. corticola* is also in the sensitive to intermediate category (13.1-91.6 $\mu g.m^{-3}$ or 5-35 ppb) of sulphur dioxide sensitivity.

Leptogium laceroides

No species-specific information on sulphur dioxide tolerances of *Leptogium laceroides* could be found in the literature. A closely related species, *L. cyanescens*, which is also present on the Project site, is categorized in the Pacific Northwest as sensitive to SO_2 at concentrations above 5-15 ppb (13.1-39.3 $\mu g.m^{-3}$) (United States Forest Service www.gis.nacse.org/lichenair, Inasarov *et al.* 1972). A second related species, *L. saturninum,* is ranked as sensitive to Intermediate, meaning it is sensitive to SO_2 concentrations between 5-15 and 10-35 ppb ((13.1-39.3 $\mu g\ m^{-3}$ and (39.3-91.6 $\mu g\ m^{-3}$)) ((http://gis.nacse.org/lichenair, Insarova *et al.* 1992). It is reasonable to predict that *L. laceroides* is also in the sensitive to intermediate category (13.1-91.6 $\mu g\ m^{-3}$ or 5-35 ppb) of sulphur dioxide sensitivity.

Sticta fuliginosa

The *Sticta* genus has been described as very sensitive to sulphur dioxide at levels above 11.1 ppb (Purvis *et al.* 1992, cited in McCune and Geiser 1997) Insarova *et al.* 1992). McCune and Geiser (1997) gave this species a general sensitivity rank of sensitive, meaning it is sensitive to mean annual SO_2 concentrations between 5-15 ppb. *S. fuliginosa* has also been shown to fail to produce ascocarps when mean winter SO_2 levels are greater than 11.5 ppb (30 $\mu g\ m^{-3}$) (Hawksworth and Rose 1976).

Potential Effects on Cyanolichens in the Focus Report Study Area

All nine listed cyanolichen species reported from the site may be considered vulnerable to sulphur dioxide exposure, based on available information for these, or closely related, species. Most species fall within the sensitive to intermediate category of lichen sensitivity (5-35 ppb or 13.1 -91.6 $\mu g\ m^{-3}$), based on comparison with the same or closely related species growing in other regions, such as the Pacific Northwest (McCune and Geiser 1997). While lichen sensitivities may vary with climate, it seems reasonable to conclude that values calculated for species growing in the Pacific Northwest are comparable to actual sensitivities of the same species growing in Moose River Gold Mines, as both areas exhibit humid, coastal climates.

Exposure to sulphur dioxide levels above the tolerance levels of individual species may result in the death of individual lichen thalli and the loss of species from the local area, leading to changes in species distribution. Lichens may also accumulate sulphur, resulting in increased concentrations of this element in the lichen thallus. Potential effects of increased TSP in the area include accumulation of metals within lichen thalli. Negative effects on lichens such as decreased growth rate or changes in colonization and recruitment are very hard to detect due to their slow rate of growth, and thus will likely not be noticeable over relatively short time spans. As the lifespan of the proposed mine is less than a decade, it may be that macroscopic effects on lichens may be not detectable during the mine operation period. If mean annual SO_2 levels are sufficiently high, some species, such as *Sticta fuliginosa* and the common species *Lobaria pulmonaria,* may exhibit decreased production of ascocarps.

Lichens in the North of Mooseland Road area are closest to the processing facility. The modeling predicts that emissions from the Processing facility will drop to less than 1 µg m^{-3} within 75 m of the source. The lichens are over 250 m from the plant. This very low mean annual sulphur dioxide concentration is unlikely to cause adverse impacts on these listed cyanolichens. Sulphur dioxide emitted by mine vehicles is expected to be diluted to less than 1 µg m^{-3} (< 0.38 ppb) before emissions reach this area of lichens. Lichens north of Mooseland Road are predicted to be exposed to mean annual sulphur dioxide levels of less than the lowest level to which cyanolichens may be sensitive (13.1 µg m^{-3} or 5 ppb). Lichens growing north of Mooseland Road will not be affected by sulphur dioxide emissions from the processing facility or from mine vehicle emissions.

Lichens growing in the *Degelia* area will be exposed to negligible levels of sulphur dioxide from the Processing Facility. Emission from the pit are predicted to be approximately 1 µg m^{-3} or less in the area where these lichens are found. This very low mean annual SO_2 concentration is unlikely to cause adverse impacts on the *D. plumbea* at this location.

Lichens occurring in the area just south of the Project boundary will be exposed to negligible amounts of sulphur dioxide from the Processing Facility. Emissions from the pit are predicted to be less than 1 µg m^{-3} in the area where these lichens are found. This very low mean annual sulphur dioxide concentration is unlikely to cause adverse impacts on the listed cyanolichen species at this location.

Only in a very small offsite, south of the property boundary, is the sulphur dioxide level expected to be above 1 µg m^{-3} above ambient. This area is approximately 500 m wide by 200 m long and is located just south of the proposed final pit outline.

In summary, no listed cyanolichen species occurring on the Project site are predicted to be exposed to a mean annual sulphur dioxide concentration of more than 1 µg m^{-3} above background levels. Thus, the nine red and yellow listed species of cyanolichens known to occur on the Project Site are not expected to be adversely impacted by sulphur dioxide emissions from the proposed Touquoy Gold Project. In addition, the boreal felt lichen known from the region will not be impacted emissions from the Project, as sulphur dioxide levels are predicted to be non-detectable against background concentrations within a few hundred metres of the Project site, and the nearest boreal felt lichen location is approximately 10 km from the site. Sulphur dioxide emissions from the proposed Touquoy Gold Project processing facility will not have a significant adverse effect on any listed lichen species in the region.

Background total suspended particulate concentrations in the Moose River Gold Mines area are in the range of 10.5-16.1 µg m^{-3}. Increased suspended particulate levels have the potential to result in some accumulation of metals in cyanolichens on the Project site, due to the metals contained within the particulates. According to ore analysis by Golder Associates (Appendix R), aluminum is the most abundant metal in the ore, followed by titanium, manganese, and barium.

Emissions dispersion modeling has been conducted for this Project (See full report in Appendix L). Particulates will be produced from two main sources on the Project site. The main source of particulates will be from emissions from the pit. TSP from this source will be controlled by standard dust control practices; therefore, particulates from this source were not included in the emissions modeling. The second source is from the processing facility north of Mooseland Road. Predicted mean annual TSP emissions from the Project are depicted on Figure 4.3-2. Predicted average annual TSP concentrations from the processing facility are depicted on Figure 4.3-2. There is very little information available on airbourne particulate concentrations leading to accumulation of metals in lichens; however, these TSP concentrations are considered to be very low.

Lichens to the north of Mooseland Road area are closest to the processing facility and will be exposed to higher TSP annual levels. Based on the emissions modeling, these lichens may be exposed to TSP concentrations of 10 to 20 µg m^{-3}. These levels might result in some accumulation of metals by the cyanolichens; however, the slow growth rate of the lichens and short operational life of the mine (seven years) make it likely that accumulation of metals within these lichens will not be significant.

The *D. plumbea* growing near the southern Project site boundary will be exposed to average annual TSP concentrations of 2-5 µg m^{-3} above background levels. Lichens occurring in the lichen area just south of the Project boundary will be exposed to similar levels. It is unlikely that such low TSP concentrations could result in significant accumulation of metals in these lichens, given the slow growth rate of the lichens and short operational life of the mine.

Summary

In summary, no listed cyanolichen species occurring on the Project site are predicted to be exposed to a mean annual TSP concentration of more than 20 μg m^{-3} above background levels, and most known sites will not be exposed to more than 5 μg m^{-3}. The nine red and yellow listed species of cyanolichens known to occur on the Project site are not expected to be adversely impacted by TSP emissions from the proposed Touquoy Gold Project. In addition, the boreal felt lichen known from the region will not be impacted by TSP emissions from the Project, as TSP levels are predicted to be non-detectable against background concentrations within a few hundred meters of the Project site, and the nearest boreal felt lichen location is approximately 10 km from the site. In conclusion, TSP emissions from the proposed Touquoy Gold Project processing facility will not have a significant adverse effect on any listed lichen species in the region.

4.4 VISUAL IMPACT ANALYSIS

The Focus Report Terms of Reference specifically requested the provision of "a visual impact assessment of the mine site on the FRSA (including visual impacts from Scraggy Lake)", and to "provide mapping to indicate the range of mine site visibility and discuss potential effects".

The visual environment has been identified as a Valued Socio-economic Component (VSC) for this assessment. The proposed mine will result in changes to the landscape, and scenery. The landscape is the visual presentation of an area of land. Scenery refers to the aesthetic qualities of the landscape. Stakeholders are concerned with the potential negative visual effects associated with the extraction area and waste rock stockpile from the proposed mine.

Visual impacts refer to a change in the character and scenic value of the landscape and the effects of those changes on people. The direct visual impacts of any development will affect the landscape through intrusion or obstruction in some manner, the reactions of viewers, and the overall impact on visual amenity (Zhang *et al.* 2000). In the life of a project, many different sources of impact occur at different stages, such as development, operation, decommissioning and restoration. The erosion of scenic value can occur with changes in land use, including rapid or uncontrolled developments (Millward and Allen 1994). The ways in which DDV Gold has addressed this issue is discussed in this section.

4.4.1 Methodology

CRA has completed a visual impact assessment estimate of the potential impact on the visual environment. This assessment is strictly an estimate, given that visual assessment is an individual and subjective experience because it depends on preferences related to social conditioning, personal experience, temperament, sensibilities, and even formal artistic training (NSM 1996).

The visual impact assessment of a proposed development addresses three factors: spatial, quantitative and qualitative.

- *Spatial* includes where the development is visible from or, more specifically, what or whom it is visible to;
- *Quantitative* refers to how much of the development is visible, how much of the surrounding area is affected, and to what degree; and,
- *Qualitative* is the visual character of the development and its compatibility with its surroundings (Zhang *et al.* 2000).

Presently, there are no guidelines for visual impact assessment in Nova Scotia or in Canada. The Province of British Columbia has created a Visual Impact Assessment Guidebook (Government of British Columbia 2001) as a component of their Forest Practices Code. This guidebook primarily applies to forest harvesting activities, planning and development. While not directly relevant to mining projects, the guidebook was used to the extent possible for conceptual design of the assessment.

To address the spatial and quantitative issues with the proposed mine, CRA used Geographic Information System (GIS) software (ESRI ArcGIS© and ESRI Spatial Analyst©) to create reflective mapping of the area. The terrain data used did not include the northern area, the focus of the visual impact analysis was directed to the south. The area near the south end of Lake Charlotte was also not included in the data because this area is of lower elevation and more than 19 km form the site so was not expected to be visible – anything seen form this distance would not be discernable form its surroundings. Reflective mapping was initiated from viewpoints in the surrounding landscape (outside looking in) and has the objective of determining whether and to what extent the development is visible from its surroundings. Projective mapping (inside looking out) was initiated from a viewpoint on the stockpile to reveal the potential extent of visibility of the stockpile to the surroundings, and therefore, inferring from where the stockpile is potentially visible.

The following assumptions were built into the model.

- Removal of vegetative cover within the proposed mine boundaries as indicated;
- Forest cover and vegetation height is assumed to be as per the NSDNR forest data updated to 2004;
- Complete (full height and footprint) mine and stockpile development;
- No progressive reclamation of the mine;
- Observer viewing radius is 360 degrees.

Using these assumptions, the model is intended to be a worst-case scenario, since the mine will be developed in a gradual manner over the Project duration and other factors such as viewing direction and weather can greatly affect what is seen.

Projective mapping (inside looking out) was initiated from a viewpoint on the stockpile to reveal the potential extent of visibility of the stockpile to the surroundings, and therefore, inferring from where the stockpile is potentially visible.

Road access within the FRSA (54,337 ha) is limited. Except for perimeter access from the east (Mooseland Road), south (Highway 7) and north (Moose River and Caribou Roads), the area is only accessible by unnamed loose surface roads and by water. The southeast portion of the area consists of the Tangier Grand Lake Wilderness Area (16,040 ha) and the whole area is littered with lakes of all sizes (12 % of FSA) including the largest - Lake Charlotte (1555 ha, 11 km SW of site), Tangier Grand Lake (698 ha, 10 km S), and Scraggy Lake (700 ha, 150 m S). Considering the recreational potential and documented use of the area, the viewshed analysis was based on viewpoints placed in the following scenarios for reflective mapping shown in Table 4.4-1, Viewshed Senarios.

Table 4.4-1 Viewshed Senarios

Scenario	Location	Activity	Viewer height	Figure No.	Comment
1	Scraggy Lake - 1	Canoeing	0.75 m	4.4-2	Specified in Focus Report TOR
2	Scraggy Lake - 2	Canoeing	0.75 m	4.4-3	Specified in Focus Report TOR
3	Tangier Grand Lake	Canoeing	0.75 m	4.4-4	Analysis based on recreational value
4	Lake Charlotte	Boating	0.75 m	4.4-5	Analysis based on recreational value
5	Moose River	Canoeing	0.75 m	4.4-6	Analysis based on recreational value
6	Mooseland Road	Driving	1.5 m	4.4-7	Additional analysis
7	Tangier Grand Lake Wilderness Area	Camping	1.5 m	4.4-8	Analysis based on recreational value

Viewing heights for the canoeing/boating activity locations were set at 0.75 m (siting in the boat) above the topographic height, and for the vantage point on Mooseland Road, the Tangier Grand Lake Wilderness Area, and the waste rock storage pile, 1.5 m (child or person of average height) was used.

4.4.2 Results

Projective Mapping

From the vantage point of the top of the waste rock stockpile (WRSP) looking out (projective) (Figure 4.4-1), the analysis has determined that much of the surrounding area to the proposed mine site that is visible. However, except for the proposed site and Scraggy Lake, most of what is predicted to be seen from the pile is the tops of the forest canopy (3340 ha) in the immediate vicinity south of the Project area and to the west of Ship Harbour Long Lake and Lake Charlotte. Including the proposed mine site (156 ha visible), 613 ha (< 2% FSA) of open ground or water (115 ha) may be visible from the WRSP.

Reflective Mapping

Figures 4.4-2 to 4.4-6 represent the results of visual impact analysis for a canoeist/boater on Scraggy Lake, Tangier Grand Lake, Lake Charlotte and Moose River. Viewpoints were chosen to give the longest open view across water or a cleared area. In all cases the low vantage point and the height of trees surrounding the lakes and rivers, effectively screen the view.

Scenarios 1 & 2 – Scraggy Lake

A canoeist north of the channel between the two larger sections of Scraggy Lake (Figure 4.4-2) may be able to see some trees within the Project boundary and part of the WRSP on the mine site. Of the 155 ha visible from this vantage point, 69% is lake and 25% of the view is treed or forest canopy.

Moving to the southern body of water in Scraggy Lake (Figure 4.4-3), the vantage point depicted is not visually impacted by the mine development. The areas that may be visible (162 ha) are the lake (85 ha), and some cleared/open areas (35 ha) on the lakeshore and tree canopy (47 ha). No area of the proposed mine site can be seen from this point.

Scenario 3 – Tangier Grand Lake

Tangier Grand Lake, south of Scraggy Lake, shows a viewpoint (Figure 4.4-4) with a long view axis that looks roughly west. The analysis predicts 355 ha will be visible (lake - 203 ha; tree canopy – 149 ha). No visual impact from the proposed Project is predicted for this scenario.

Scenario 4 – Lake Charlotte

Due to the size of Lake Charlotte (1555 ha, <3% of the study area), an extensive portion of the Lake (464 ha) is visible within in a viewshed of 893 ha (Figure 4.4-5). The viewpoint is located in the upper half of the Lake. Given the long linear axis of the lake only tops of trees (419 ha) and nearshore open areas are visible from this viewpoint. The viewpoint is not impacted by the proposed development that is approximately 15 km to the north.

Scenario 5 – Moose River

A canoeist on a wide part of Moose River (Figure 4.4-6) next to the proposed mine development is may have a very narrow view into the site. Of the 4.4 ha viewshed, 31% of the view is of the river and 34% is the surrounding forest. Only 5% of the viewshed is predicted to be within the mine site in the direction of the extraction area. The angle of the vantage point to the surrounding trees has nearly completely insulated the viewpoint and the viewshed is negligible at the depicted scale.

Scenario 6 – Mooseland Road

Mooseland Road (Figure 4.4-7), for the most part, is an open swath in the forest approximately 15 metres wide surrounded by trees. The angle of the viewer with his/her surroundings (*i.e.* to tops of trees) would be steep enough to have a very limited viewscape to the sides and linearly as long as the straightest stretch of road. The viewpoint chosen, south of Mooseland, is not visually impacted by the proposed mine. It is predicted that any viewpoint chosen along this road would warrant the same results.

Scenario 7 – Tangier Grand Lake Wilderness Area

The Tangier Grand Lake Wilderness Area (16,040 ha) is a largely unaccessible area in the southeast end of the FRSA. Only a few cart roads or trails are depicted in the provincial 10,000-scale mapping. For the scenario of a wilderness camper, a viewpoint was located on the highest ground in the largest open area depicted south of Tangier Grand Lake. From this viewpoint (Figure 4.4-8) a person may have an open view (279 ha viewshed) for several kilometres. Very little of the Wilderness Area is open ground or cleared, other than the lakes. While much of the immediate area (33 ha) is visible to this point only tree canopy (246 ha) is visible up to 10 km to the north. This viewpoint, 15 km SE of the site, is not visually impacted by the proposed mine development.

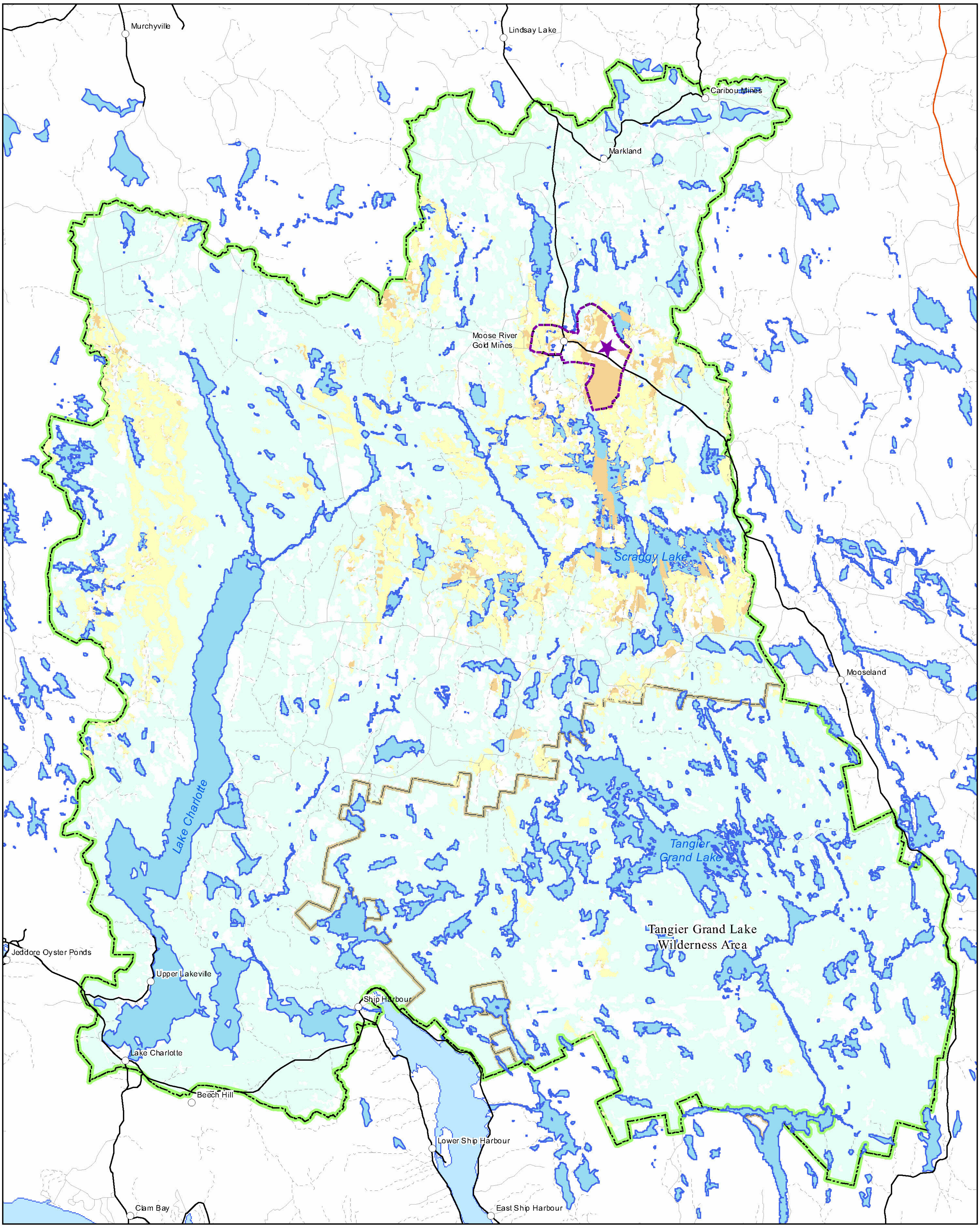


Figure 4.4-1
VIEWSHED ANALYSIS -
WASTE ROCK STORAGE PILE
TOUQUOY GOLD PROJECT
DDV GOLD LTD.
Moose River Gold Mines
Halifax County, Nova Scotia

Legend

★ Viewpoint

Viewplane

🟧 Cleared / Open

🟨 Top of Forest Canopy

▢ Project Site

🟩 Focus Study Area

🟦 Water

Forest Canopy

▢ Cleared (<2 m) / Open

▢ >2 m Height

The visual impact analysis assumes:
- observer height of 1.5 m (5 ft)
- 360° viewing radius.
- 40 m elevation waste rock pile (fully developed)

The visual impact analysis is a snapshot in time based on full mine development (full height and footprint) with no progressive reclamation. As the mine and waste rock stoarge pile is developed and progressively reclaimed views will change.

Viewplanes may only see tops of trees and changing heights of tree canopy through growth or logging may alter the predicted effect.

0 1 2 3 4 5
Kilometres

Source:
Topography - Service Nova Scotia & Municipal Relations
Forestry - Nova Scotia Natural Resources

CONESTOGA-ROVERS & ASSOCIATES

820933-D(8) GIS-DA441 October 22, 2007

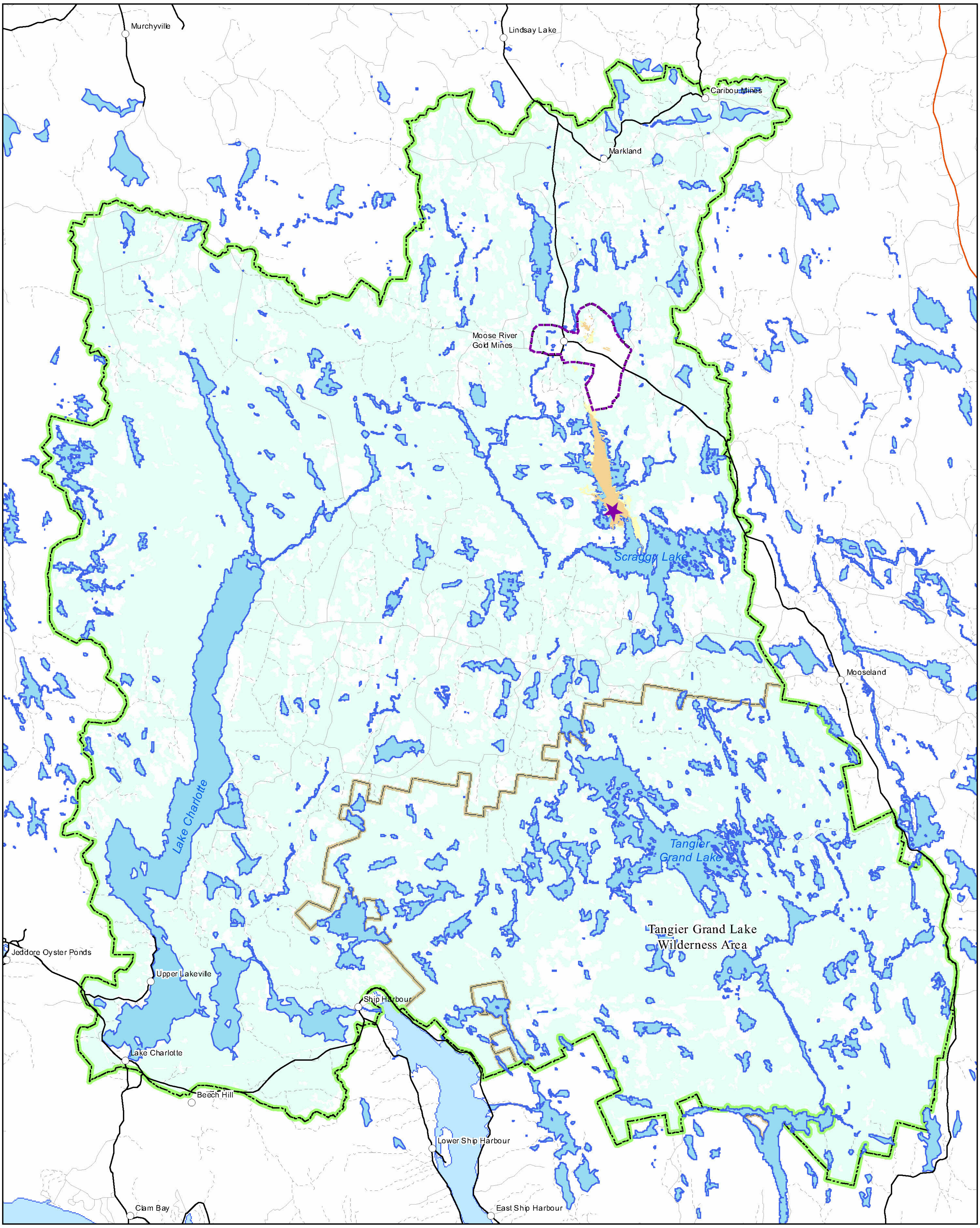


Figure 4.4-2
VIEWSHED ANALYSIS -
SCRAGGY LAKE 1
TOUQUOY GOLD PROJECT
DDV GOLD LTD.
Moose River Gold Mines
Halifax County, Nova Scotia

Legend

★ Viewpoint

Viewplane

🟧 Cleared / Open

🟨 Top of Forest Canopy

▢ Project Site

🟩 Focus Study Area

🟦 Water

Forest Canopy

▢ Cleared (<2 m) / Open

🟩 >2 m Height

The visual impact analysis assumes:
- observer height of 1.5 m (5 ft)
- 360° viewing radius.
- 40 m elevation waste rock pile (fully developed)

The visual impact analysis is a snapshot in time based on full mine development (full height and footprint) with no progressive reclamation. As the mine and waste rock stoarge pile is developed and progressively reclaimed views will change.

Viewplanes may only see tops of trees and changing heights of tree canopy through growth or logging may alter the predicted effect.

0 1 2 3 4 5
Kilometres

Source:
Topographic - Service Nova Scotia & Municipal Relations
Forestry - Nova Scotia Natural Resources

CONESTOGA-ROVERS & ASSOCIATES

820933-D(8) GIS-DA442 October 22, 2007

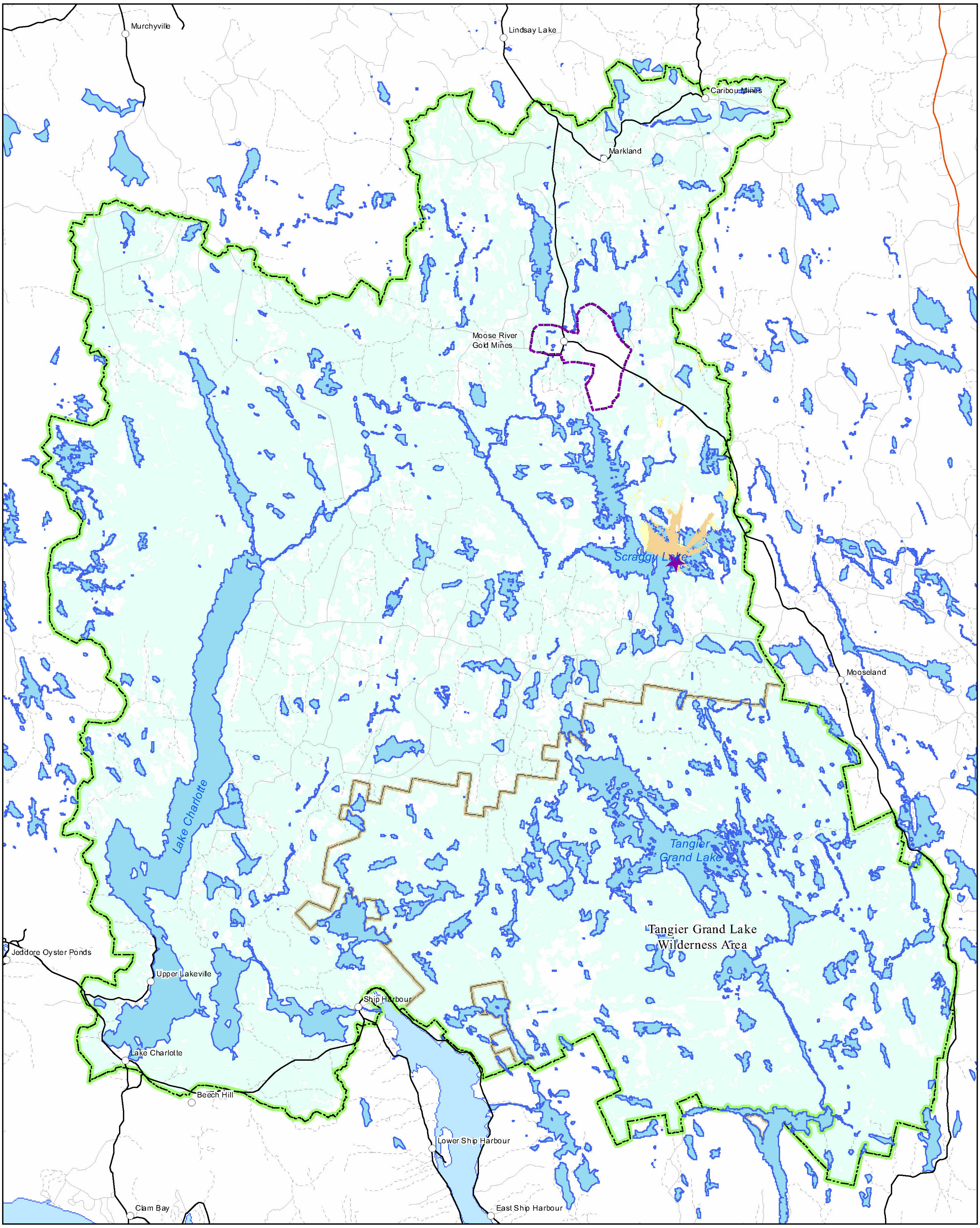


Figure 4.4-3
VIEWSHED ANALYSIS - SCRAGGY LAKE 2
TOUQUOY GOLD PROJECT
DDV GOLD LTD.
Moose River Gold Mines
Halifax County, Nova Scotia

Legend

★ Viewpoint

Viewplane

🟧 Cleared / Open

🟨 Top of Forest Canopy

▢ Project Site

🟩 Focus Study Area

🟦 Water

Forest Canopy

▢ Cleared (<2 m) / Open

▨ >2 m Height

The visual impact analysis assumes:
- observer height of 1.5 m (5 ft)
- 360° viewing radius.
- 40 m elevation waste rock pile (fully developed)

The visual impact analysis is a snapshot in time based on full mine development (full height and footprint) with no progressive reclamation. As the mine and waste rock stoarge pile is developed and progressively reclaimed views will change.

Viewplanes may only see tops of trees and changing heights of tree canopy through growth or logging may alter the predicted effect.

0 1 2 3 4 5
Kilometres

Source:
Topographic - Service Nova Scotia & Municipal Relations
Forestry - Nova Scotia Natural Resources

CONESTOGA-ROVERS & ASSOCIATES

820933-D(8) GIS-DA443 October 22, 2007

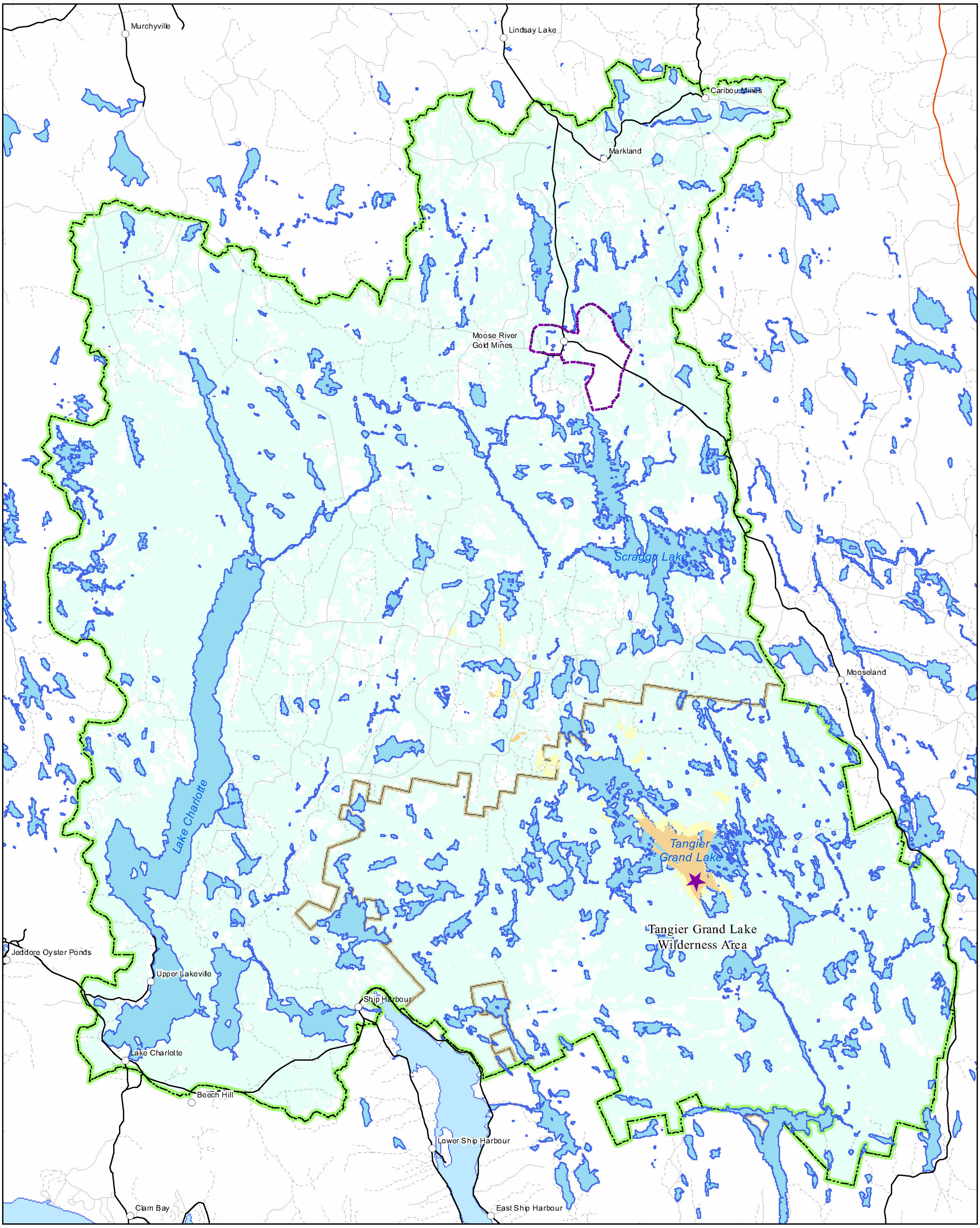


Figure 4.4-4
VIEWSHED ANALYSIS -
TANGIER GRAND LAKE
TOUQUOY GOLD PROJECT
DDV GOLD LTD.
Moose River Gold Mines
Halifax County, Nova Scotia

Legend

★ Viewpoint

Viewplane

🟧 Cleared / Open

🟨 Top of Forest Canopy

▢ Project Site

🟩 Focus Study Area

🟦 Water

Forest Canopy

▢ Cleared (<2 m) / Open

▢ >2 m Height

The visual impact analysis assumes:
- observer height of 1.5 m (5 ft)
- 360° viewing radius.
- 40 m elevation waste rock pile (fully developed)

The visual impact analysis is a snapshot in time based on full mine development (full height and footprint) with no progressive reclamation. As the mine and waste rock stoarge pile is developed and progressively reclaimed views will change.

Viewplanes may only see tops of trees and changing heights of tree canopy through growth or logging may alter the predicted effect.

0 1 2 3 4 5
Kilometres

Source:
Topographic - Service Nova Scotia & Municipal Relations
Forestry - Nova Scotia Natural Resources

CONESTOGA-ROVERS & ASSOCIATES

820933-D(8) GIS-DA444 October 22, 2007

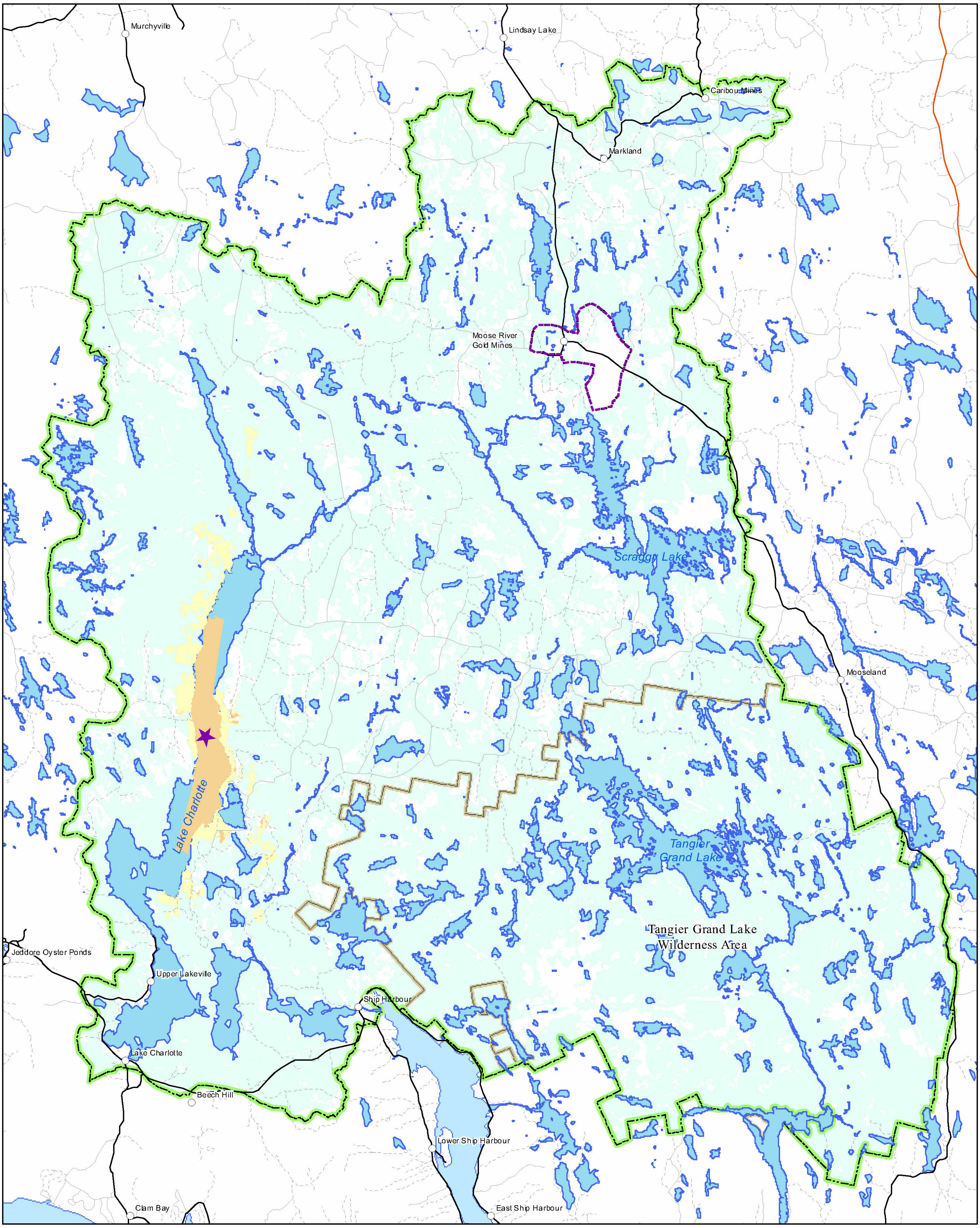


Figure 4.4-5
VIEWSHED ANALYSIS - LAKE CHARLOTTE
TOUQUOY GOLD PROJECT
DDV GOLD LTD.
Moose River Gold Mines
Halifax County, Nova Scotia

Legend

★ Viewpoint

Viewplane

▨ Cleared / Open

▨ Top of Forest Canopy

▨ Project Site

▨ Focus Study Area

▨ Water

Forest Canopy

▨ Cleared (<2 m) / Open

▨ >2 m Height

The visual impact analysis assumes:
- observer height of 1.5 m (5 ft)
- 360° viewing radius.
- 40 m elevation waste rock pile (fully developed)

The visual impact analysis is a snapshot in time based on full mine development (full height and footprint) with no progressive reclamation. As the mine and waste rock stoarge pile is developed and progressively reclaimed views will change.

Viewplanes may only see tops of trees and changing heights of tree canopy through growth or logging may alter the predicted effect.

0 1 2 3 4 5
Kilometres

Source:
Topographic - Service Nova Scotia & Municipal Relations
Forestry - Nova Scotia Natural Resources

CONESTOGA-ROVERS & ASSOCIATES

820933-D(8) GIS-DA445 October 22, 2007

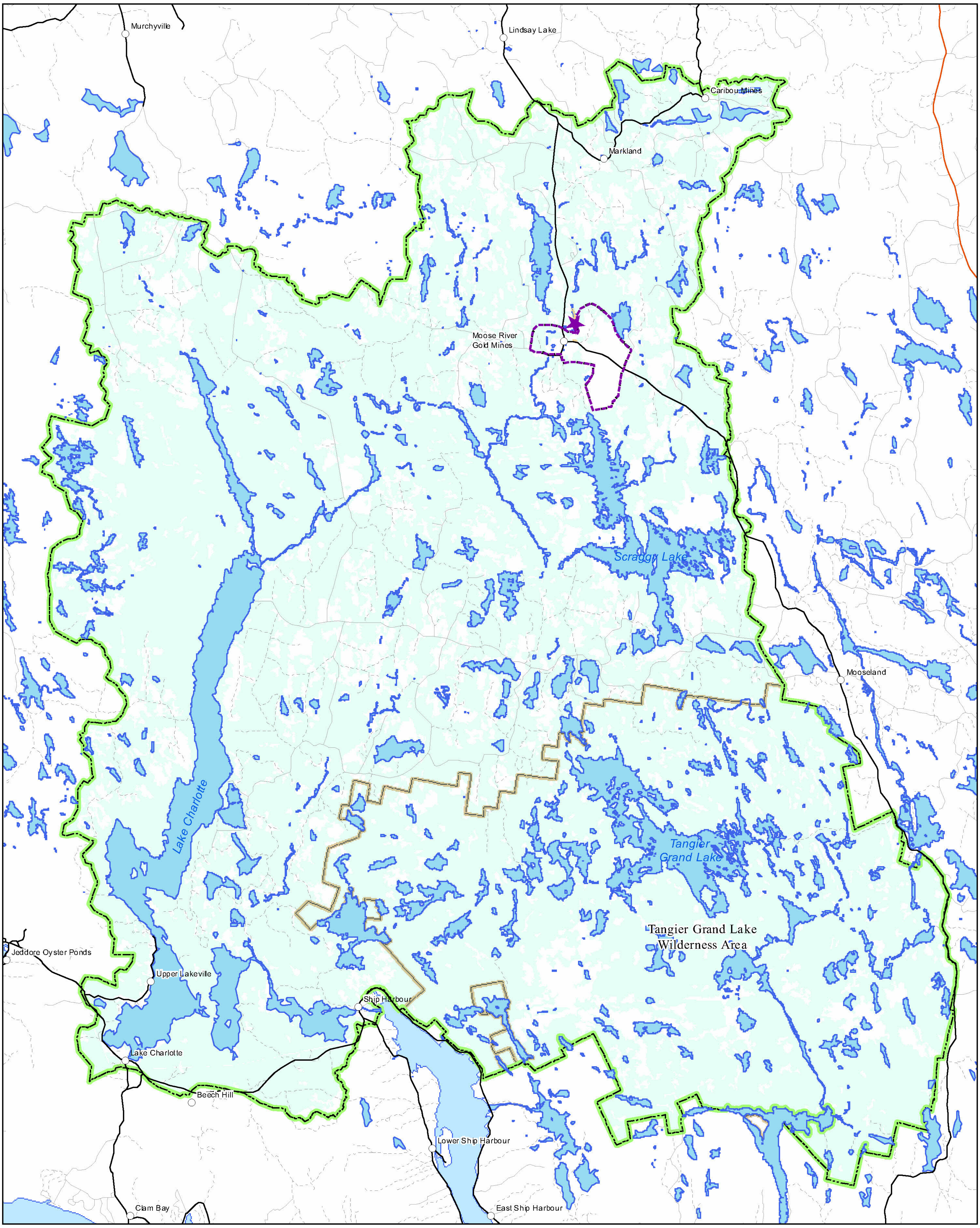


Figure 4.4-6
VIEWSHED ANALYSIS -
MOOSE RIVER
TOUQUOY GOLD PROJECT
DDV GOLD LTD.
Moose River Gold Mines
Halifax County, Nova Scotia

Legend

★ Viewpoint

Viewplane

- Cleared / Open
- Top of Forest Canopy

- Project Site
- Focus Study Area
- Water

Forest Canopy

- Cleared (<2 m) / Open
- >2 m Height

The visual impact analysis assumes:
- observer height of 1.5 m (5 ft)
- 360° viewing radius.
- 40 m elevation waste rock pile (fully developed)

The visual impact analysis is a snapshot in time based on full mine development (full height and footprint) with no progressive reclamation. As the mine and waste rock stoarge pile is developed and progressively reclaimed views will change.

Viewplanes may only see tops of trees and changing heights of tree canopy through growth or logging may alter the predicted effect.

N

0 1 2 3 4 5
Kilometres

Source:
Topographic - Service Nova Scotia & Municipal Relations
Forestry - Nova Scotia Natural Resources

CONESTOGA-ROVERS & ASSOCIATES

820933-D(8) GIS-DA446 October 22, 2007

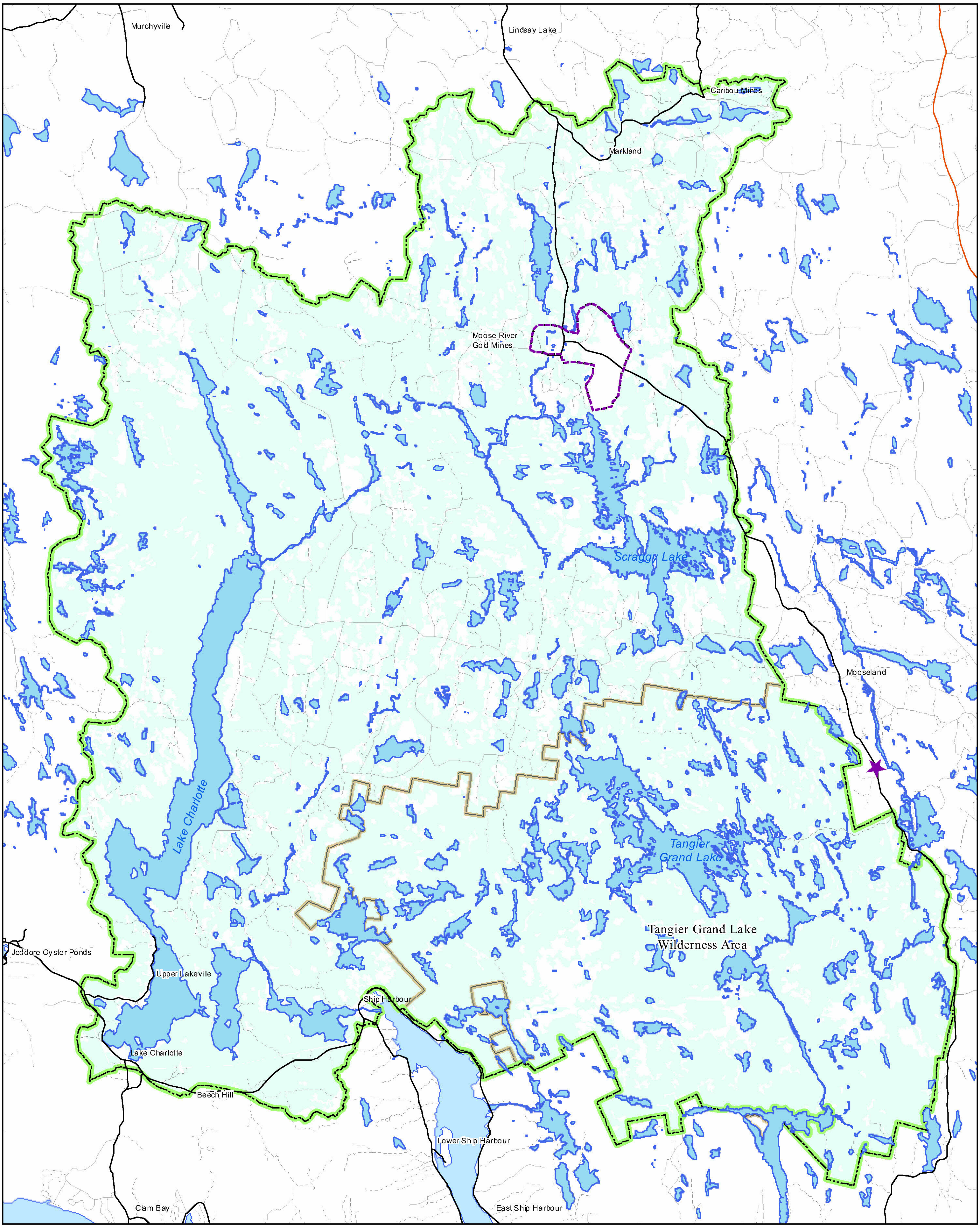


Figure 4.4-7
VIEWSHED ANALYSIS -
MOOSELAND ROAD
TOUQUOY GOLD PROJECT
DDV GOLD LTD.
Moose River Gold Mines
Halifax County, Nova Scotia

Legend

★ Viewpoint

Viewplane

- 🟧 Cleared / Open
- 🟨 Top of Forest Canopy

- ▢ Project Site
- 🟩 Focus Study Area
- 🟦 Water

Forest Canopy

- ▢ Cleared (<2 m) / Open
- ▨ >2 m Height

The visual impact analysis assumes:
- observer height of 1.5 m (5 ft)
- 360° viewing radius.
- 40 m elevation waste rock pile (fully developed)

The visual impact analysis is a snapshot in time based on full mine development (full height and footprint) with no progressive reclamation. As the mine and waste rock stoarge pile is developed and progressively reclaimed views will change.

Viewplanes may only see tops of trees and changing heights of tree canopy through growth or logging may alter the predicted effect.

0 1 2 3 4 5
Kilometres

Source:
Topographic - Service Nova Scotia & Municipal Relations
Forestry - Nova Scotia Natural Resources

CONESTOGA-ROVERS & ASSOCIATES

820933-D(8) GIS-DA447 October 22, 2007

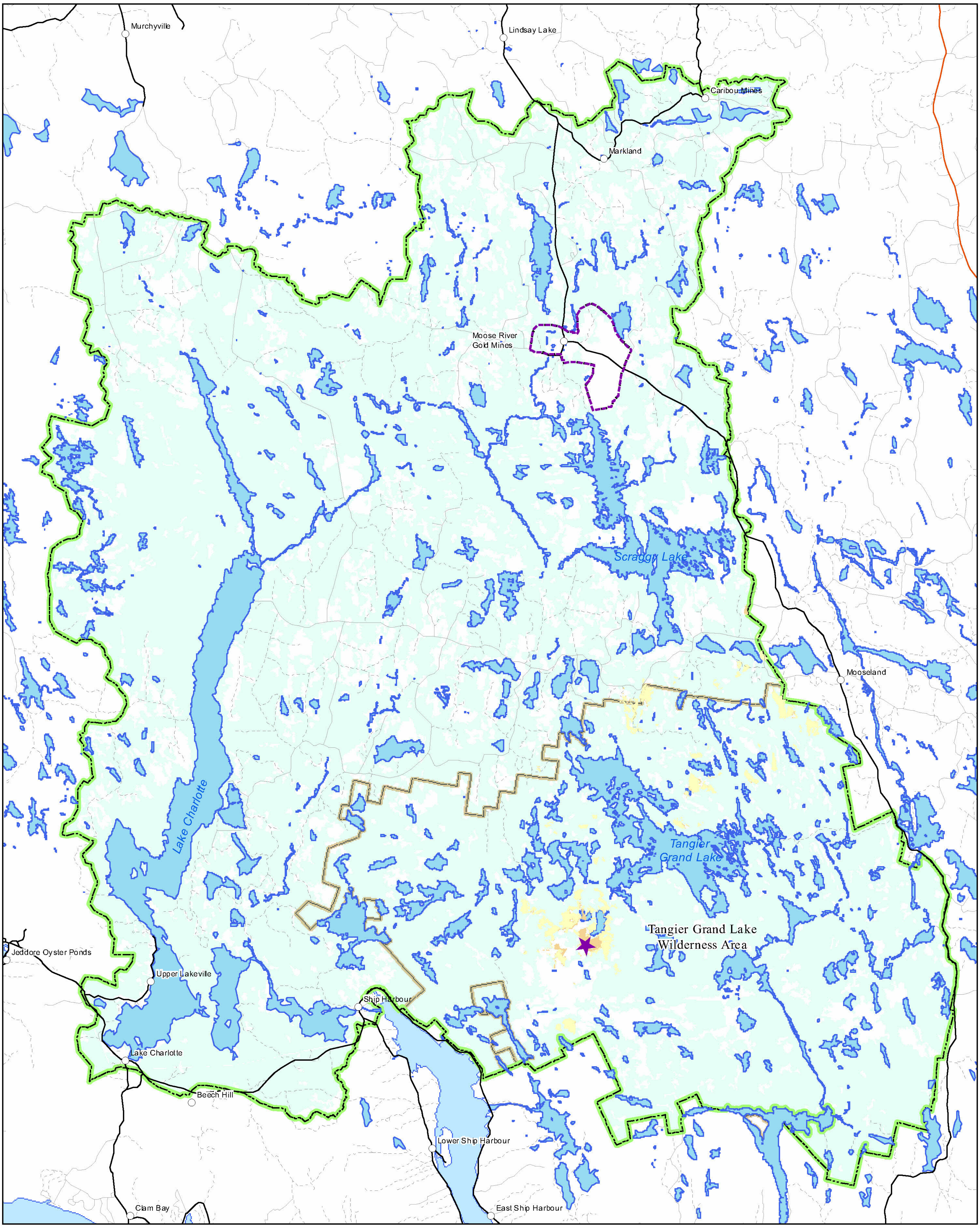


Figure 4.4-8
VIEWSHED ANALYSIS -
TANGIER GRAND LAKE WILDERNESS
TOUQUOY GOLD PROJECT
DDV GOLD LTD.
Moose River Gold Mines
Halifax County, Nova Scotia

Legend

★ Viewpoint

Viewplane

▨ Cleared / Open

▨ Top of Forest Canopy

▨ Project Site

▨ Focus Study Area

▨ Water

Forest Canopy

▨ Cleared (<2 m) / Open

▨ >2 m Height

The visual impact analysis assumes:
- observer height of 1.5 m (5 ft)
- 360° viewing radius.
- 40 m elevation waste rock pile (fully developed)

The visual impact analysis is a snapshot in time based on full mine development (full height and footprint) with no progressive reclamation. As the mine and waste rock stoarge pile is developed and progressively reclaimed views will change.

Viewplanes may only see tops of trees and changing heights of tree canopy through growth or logging may alter the predicted effect.

0 1 2 3 4 5
Kilometres

Source:
Topographic - Service Nova Scotia & Municipal Relations
Forestry - Nova Scotia Natural Resources

CONESTOGA-ROVERS & ASSOCIATES

820933-D(8) GIS-DA448 October 22, 2007

4.4.3 Summary

The analysis assumes the full height and footprint of the WRSP in the current conditions (terrain, tree height). Based on this scenario the waste pile may be visible from very few remote vantage points and may only be in view close to the actual development. The FRSA is heavily forested, and is subject to logging by various factions over time. The viewshed analysis is based on current (NSDNR 2004) forest heights but conditions could change over time as land is cut and the forest regenerates. Viewsheds may only consist of tree canopy and any changes (*e.g.* growth, logging, and other development) may alter the predicted effect.

Given the current conditions, it is expected that the proposed mine development will visually impact less than two percent of the FRSA.

4.5 IMPACTS TO SURFACE AND GROUNDWATER

Physical Effects

The two main Project related water withdrawal activities will be the initial use of water from Square Lake during start-up of mine operation and the on-going Pit dewatering.

Impacts to Square Lake as a result of the planned water withdrawal were outlined in the EARD. Lake drawdown as a result of the planned water use would be minimal, with an estimated maximum loss of 6% of total lake volume for average conditions and a net drawdown of approximately 0.3 m. Lake withdrawal is planned from October thru March, when water levels are typically high. The drawdown would be within the normal range of elevation change over the course of a typical year, as water levels tend to drop during the summer months. Given the minimal interaction with groundwater outlined in Section 3.4, it is not anticipated that the winter drawdown would have any significant effects on the local groundwater table in the vicinity of Square Lake. Also, it is important to note that the collection of run off during construction may eliminate the need to draw water from Square Lake during start-up.

Pit dewatering is also not expected to have a significant impact on the local groundwater table. Square Lake (31 hectares) and Scraggy Lake (approximately 700 hectares) are positioned within 2.5 km to the northeast and 2.7 km to the southeast respectively. A reach of the Moose River is positioned within 100 m west of the mine opening. These form major potential recharge zones for inflowing waters to the mine site and thereby a limitation to extension of the dewatering cone outward from the pit walls.

Groundwater connectivity evaluation between the existing mini-pit and proposed pit expansion and Moose River has shown that Moose River is well protected by the geology and there will be no anticipated risk of dewatering Moose River into the open pit. DDV Gold intends to design and complete a monitoring program to confirm the results of the various hydrologic and hydrogeologic baseline studies relative to the lack of interaction between groundwater and surface water.

The domestic wells in the study area are located some 20 to 25 km from the proposed mine site. They are located to the south of the site and therefore off-set from the strike of the structures which potentially create elevated anisotropy in the east-northeast direction. Over ten lakes are present between the proposed pit and the wells in question. No information is presently available on construction, age, driller or lithology of the wells in question. It is expected they may draw from both the Till and Metamorphic HUs.

Assessment of the existing information suggests that domestic well water supplies in the communities of Lake Charlotte, Upper Lakeville, and Ship Harbour will not be impacted by the proposed mining operation.

Surface Water Chemistry Effects

Regulatory Standards

Surface water quality is governed by two standards: the federal Metal Mining Effluent Regulations (MMER) for discharge of mining effluent and the CCME Water Quality Guidelines for the Protection of Aquatic (freshwater) Life. The MMER is a federal authorization (FA) to discharge to the receiving environment at the prescribed limits.

In 1977, the Metal Mining Liquid Effluent Regulations (MMLERs) were promulgated under the FA to define "deleterious substances" with respect to mine effluent that may be released into the environment. Whereas the FA was comprehensive - no deleterious substances - and so captured any and all substances that could be argued to be deleterious or to destroy fish habitat, the MMLERs defined deleterious very narrowly.

The Metal Mining Effluent Regulations, promulgated under the federal Fisheries Act, came into force in 2002. Regulations amending the Metal Mining Effluent Regulations SOR/2006-239, was gazetted on October 3, 2006. They apply to about 100 metal mines operating in Canada and impose effluent discharge limits for cyanide, arsenic, copper, lead, zinc, nickel and radium-226. They also prohibit the discharge of effluent that is acutely lethal to fish (rainbow trout).

MMER regulations require environmental effects monitoring (EEM) programs to determine whether mine effluent affects fish, fish habitat or the usability of fisheries resources. EEM studies include effluent characterization, receiving water quality monitoring, sublethal effluent toxicity tests, site characterization, fish population surveys, fish tissue analysis and benthic invertebrate community surveys.

Canadian Council of Ministers of the Environment (CCME) is comprised of the environment ministers from the federal, provincial and territorial governments. These 14 ministers normally meet at least once a year to discuss national environmental priorities and determine work to be carried out under the auspices of CCME. The Council seeks to achieve positive environmental results, focusing on issues that are national in scope and that require collective attention by a number of governments.

The CCME levels are established based on the best available information on impact to aquatic life. These levels are guidelines and serve as an indication of whether or not there was potential for downstream impacts. There is no guarantee that exceeding CCME levels will cause harm due to the numerous factors that influence the effect of water quality on aquatic organisms. Conversely, there is a high degree of certainty that if CCME guidelines are not exceeded then no harm will occur. The MMER is regulated and thus, takes precedence over the CCME guideline.

Water Quality Modeling

Water quality modeling was undertaken to demonstrate the impact of discharging treated effluent into Scraggy Lake and subsequent flow downstream. Discharge was envisioned to be direct to Scraggy Lake because the quality of mine effluent before treatment already exceeded MMER standards. Under actual operating conditions, environmental effects monitoring would then determine if there were any harmful effects on aquatic life.

Without the benefit of being able to monitor, CCME guidelines for the protection of aquatic life in receiving waters were adopted to serve as an indication of whether or not there was potential for downstream impacts. CCME guidelines are not definitive. There is no guarantee that exceeding CCME levels will cause harm due to the numerous factors that influence the effect of water quality on aquatic organisms. Conversely, there is a high degree of certainty that if CCME guidelines are not exceeded then no harm will occur.

Water quality modeling took an extremely conservative approach. Undetectable levels of contaminants were arbitrarily assumed to be half the detection limit and precipitation inflow to the TMF was considered to immediately assume the prevailing character of the tailings effluent. This meant that under high flow conditions, contaminant loading was actually increased rather than diluted.

The modeling also took into account existing downstream water quality based on sampling in Scraggy Lake, Fish River, and Lake Charlotte. This showed that areas in the watershed already exhibited relatively high background levels of contaminants, in particular, aluminum, cadmium, and arsenic. Lastly, modeling did not consider any physical or chemical processes other than dilution which might reduce contaminant concentrations.

Initial modeling indicated that of the 25 parameters modeled, five had potential to be problematic. These were aluminum, cadmium, arsenic, copper, and iron. The greatest impacts were projected to occur in Scraggy Lake with effects diminishing as water moved further downstream. A summary of these modeling results are shown in Table 4.5-1

It was recognized that it was not possible to reduce cadmium and aluminum loading as the natural concentrations in receiving waters already exceeded CCME guidelines. As this watershed is considered to be a healthy ecosystem, this serves as an example of how contaminant loading above CCME guidelines does not necessarily mean harm will occur. In fact, the modeling shows that the low level of these elements in the mine effluent actually dilutes the concentration of naturally occurring contaminants.

Potential Short-term Environmental Effects

The water quality model simulates the quality of downstream waters after mixing. In Scraggy Lake, it is recognized that until complete mixing occurs there is a higher potential for impact from the treated, but not yet fully diluted, tailings effluent. The two parameters regulated by MMER of potential concern are arsenic and copper.

The concentration of arsenic in treated effluent at discharge is projected to be 0.17 mg/L. The acute toxicity result of arsenic on trout is at 0.5 mg/L and sublethal toxicity on invertebrates is at 0.3 to 0.5 mg/L. The lowest toxicity is for plants at 0.05 mg/L and the CCME guideline is based on that value with a safety factor of 0.1 (0.005 mg/L). The effluent quality from the polishing pond is below a toxic effect on fish or invertebrates.

The concentration of copper in treated effluent at discharge is projected to be 0.20 mg/L. The average concentration of copper in Nova Scotian lakes is 0.011mg/L with a range of <0.005 - 0.17 mg/L (Hinch and Underwood 1985) and copper is ubiquitous in surface waters in this province. Therefore, the predicted copper level in the effluent is near the natural range.

For parameters not regulated by MMER for which CCME guidelines exist, the polishing pond effluent quality is predicted to exceed the CCME guideline for aluminum, nitrogen, iron, and silver.

As mentioned, aluminum is exceeded in the downstream waters as background exceeds CCME guidelines. Average background lake concentration is 0.145 mg/L with a range of 0.008 to 0.55 mg/L (Hinch and Underwood 1985). These elevated levels are attributed to the abundance of aluminum silicates in the local geology and soils.

Ammonia is a very labile compound and undergoes rapid chemical and or biological transformations. Nitrate, for which there is no CCME guideline level, is within the baseline levels of the area lakes. Ammonia and nitrates result from the incomplete consumption of ammonium nitrate in blasting and the decomposition of cyanate after detoxification. Both represent a source of free nitrogen that can promote the growth of nitrogen-fixing blue-green algae which may lead to eutrophication.

Iron is naturally high in surface waters due to its abundance in the local geology and soils. The predicted concentration is further elevated by the effluent treatment process that will introduce addition iron to receiving waters. The safe exposure of brook trout is between 7.5 and 12.5 mg/L (CCME 1987); therefore, the effluent leaving the polishing pond (4.5 mg/L) will not affect trout in the downstream watershed.

Silver at the polishing pond discharge is predicted to be 0.00032 mg/L, above the CCME guideline of 0.0001 mg/L. This level is set to protect plants, the most sensitive group. The maximum acceptable toxicant concentration with rainbow trout for silver sulphide and silver thiosulphate complexes is greater than 11 mg/L and 16 mg/L, but less than 35 mg/L. The predicted level of silver from the polishing pond is below these levels.

In order to minimize the potential for adverse effects resulting from arsenic, copper, iron, nitrates, and silver, tertiary treatment was added to the treatment flow sheet in the form of an engineered wetland. Wetlands are a proven method to reduce contaminant metal and nitrate concentrations in industrial waste water. A discussion of the expected effects of "polishing" treated effluent in an engineered wetland follows.

Parameters	Units	Water Quality Model Inputs				Simulation Results			Water Quality Guidelines	
		Scraggy Lake Baseline Water Quality	Fish River Baseline Water Quality	Lake Charlotte Baseline Water Quality	Polishing Pond Water Quality (1)	Scraggy Lake Outlet	Fish River Outlet	Lake Charlotte Outlet	Federal Canadian Metal Mining Effluent Regulations (2)	Canadian Water Quality Guidelines for the Protection of Aquatic Life (3)
Aluminum	mg/L	0.19	0.17	0.17	0.040	**0.18**	**0.17**	**0.17**	–	0.005 (4)
Ammonia (Total)	mg/L as N	<0.05	<0.05	<0.05	17	0.23	0.079	0.057	–	2.2 (5)
Antimony	mg/L	<0.002	<0.002	<0.002	0.011	0.0014	0.0011	0.0011	–	–
Arsenic	mg/L	<0.002	0.005	0.004	0.17	**0.0082**	**0.0058**	**0.0051**	0.5	0.005
Cadmium	mg/L	0.00002	<0.000017	<0.000017	<0.000003	**0.000019**	0.0000072	0.0000077	–	0.000017
Calcium	mg/L	1.0	1.3	1.2	215	10	3.6	2.6	–	–
Chloride	mg/L	4.0	4.0	4.0	24	4.8	4.2	4.1	–	–
Chromium	mg/L	0.005	<0.002	<0.002	<0.0005	0.0046	0.0020	0.0016	–	0.0099
Cobalt	mg/L	<0.0004	<0.0004	<0.0004	0.22	0.0094	0.0026	0.0016	–	–
Copper	mg/L	<0.002	<0.002	<0.002	0.20	**0.0095**	**0.0032**	**0.0023**	0.3	0.002 (6)
Cyanide (Total)	mg/L	<0.002	<0.002	<0.002	0.44	0.020	0.0059	0.0039	1	– (7)
Iron	mg/L	0.24	0.22	0.21	4.5	**0.41**	0.27	0.24	–	0.3
Lead	mg/L	<0.0005	<0.0005	<0.0005	0.0018	0.00037	0.00028	0.00027	0.2	0.001 (8)
Magnesium	mg/L	0.43	0.50	0.50	10	0.84	0.59	0.55	–	–
Manganese	mg/L	0.046	0.052	0.048	0.13	0.049	0.052	0.050	–	–
Nickel	mg/L	<0.002	<0.002	<0.002	0.0071	0.0013	0.0011	0.0010	0.5	0.025 (9)
Nitrate	mg/L as N	0.05	0.16	0.13	0.12	0.25	0.18	0.16	–	– (10)
Phosphorous	mg/L	0.015	<0.02	<0.02	0.010	0.015	0.011	0.011	–	–
Potassium	mg/L	0.33	0.30	0.30	67	3.1	1.1	0.74	–	–
Selenium	mg/L	<0.001	<0.001	<0.001	<0.001	0.00050	0.00050	0.00050	–	0.001
Silver	mg/L	<0.0001	<0.0001	<0.0001	0.00032	0.000061	0.000053	0.000052	–	0.0001
Sodium	mg/L	3.0	2.9	2.9	610	29	10	6.9	–	–
Sulphate	mg/L	<2	<2	<2	1400	60	17	10	–	–
Uranium	mg/L	<0.0001	<0.0001	<0.0001	0.0021	0.00014	0.00007	0.00006	–	–
Zinc	mg/L	0.012	0.020	0.018	0.027	0.013	0.018	0.018	0.5	0.03

Notes:

0.3 Concentration greater than the CCME guideline.

<0.001 – Values in red indicate that the value is below the detection limit. Concentrations were assumed to be half of the detection limit, if the analysis results were below the detection limit.

(1) Polishing Pond water quality was taken from the water chemistry of the mine effluent after treatment and aging (SGS, 2007).

(2) MMER [Metal Mining Effluent Regulations], 2002. Metals Mining Effluent Regulations. Canada Gazette Part II, Vol. 136, No. 13. SOR/DORS/2002-222.

(3) CCME [Canadian Council of Ministers of the Environment], 2002. Canadian Water Quality Guidelines for the Protection of Aquatic Life: Summary Tables. Updated 2002.

(4) Aluminum guideline = 0.005 mg/L, if pH <6.5, [Ca^{2+}] <4 mg/L and DOC <2 mg/L; aluminum guideline = 0.1 mg/L, if pH ≥6.5, [Ca^{2+}] ≥4 mg/L and DOC ≥2 mg/L.

(5) Total Ammonia guideline = 1.37 mg/L at pH 8.0, T = 10°C; ammonia guideline = 2.20 mg/L at pH 6.5, T = 10°C.

(6) Copper guidline = 0.002 mg/L, if [$CaCO_3$] = 0–120 mg/L; copper guideline = 0.003 mg/L, if [$CaCO_3$] = 120–180mg/L; and copper guideline = 0.004 mg/L, if [$CaCO_3$] >180 mg/L.

(7) There is no CCME guideline for total cyanide. However, the CCME guideline for free cyanide is 0.005 mg/L.

(8) Lead guideline = 0.001 mg/L, if [$CaCO_3$] = 0–60 mg/L; lead guideline = 0.002 mg/L, if [$CaCO_3$] = 60–120 mg/L; lead guideline = 0.004 mg/L, if [$CaCO_3$] = 120–180 mg/L; lead guideline = 0.007 mg/L, if [$CaCO_3$] >180 mg/L.

(9) Nickel guideline = 0.025 mg/L, if [$CaCO_3$] = 0–60 mg/L; nickel guideline = 0.065 mg/L, if [$CaCO_3$] = 60–120 mg/L; nickel guideline = 0.11 mg/L, if [$CaCO_3$] = 120–180 mg/L; nickel guideline = 0.15 mg/L, if [$CaCO_3$] >180 mg/L.

(10) Nitrate guideline – there is no specific guideline value, but concentrations that stimulate weed growth should be avoided.

Table 4.5-1. Initial Downstream Water Quality Simulation Results

Final Water Quality Projections

The treated effluent contaminant loading was adjusted downwards by 50% for 21 of the 25 modeled parameters to simulate the effects of the wetland on discharge water quality prior to entering receiving waters. It is possible that tertiary treatment efficiency may be even higher than projected as the majority of the contaminants after effluent treatment present as suspended solids which are more amenable to wetland attenuation than dissolved forms.

Sodium, potassium, calcium, and chloride levels were not reduced as experience indicates that these parameters show little reduction from the effects of wetland treatment. The results of the simulation can be found in Table 4.5-2. It shows that iron is marginally above guidelines in Scraggy Lake, 0.32 mg/L projected versus 0.30 mg/L CCME, and copper is marginally above guidelines in Fish River, 0.0021 mg/L projected versus 0.0020 mg/L CCME.

Copper loading in Scraggy Lake is predicted higher than guidelines at 0.0052 mg/L versus 0.0020 mg/L CCME. The source of the copper is the copper sulphate used to catalyze the cyanide destruction reaction and therefore can be addressed through process management. An examination of the chemical processes occurring in the downstream environment may also indicate that projected copper concentrations are overstated. Given the conservative nature of the model, it is expected that refinement of the treatment process to address this single outlying parameter will result in no downstream impact.

Downstream Water Quality Simulation
Wetland Contaminant Attenuation - Normal Flow Scenario
Touquoy Golf Project

Parameter	Units	Baseline Water Quality				Simulation Results			Water Quality Guidelines	
		Scraggy Lake	Fish River	Lake Charlotte	Wetland(1)	Scraggy Lake	Fish River	Lake Charlotte	MMER	CCME
Aluminum	mg/L	0.19	0.17	0.17	0.020	**0.18**	**0.17**	**0.17**	–	0.005 (4)
Ammonia (Total)	mg/L as N	<0.05	<0.05	<0.05	9	0.13	0.052	0.041	–	2.2 (5)
Antimony	mg/L	<0.002	<0.002	<0.002	0.005	0.0012	0.0010	0.0010	–	–
Arsenic	mg/L	<0.002	0.005	0.004	0.09	0.0046	0.0049	0.0046	0.5	0.005
Cadmium	mg/L	0.00002	<0.000017	<0.000017	0.000001	**0.000019**	0.0000072	0.0000077	–	0.000017
Calcium	mg/L	1.0	1.3	1.2	108	10	3.6	2.6	–	–
Chloride	mg/L	4.0	4.0	4.0	24	4.8	4.2	4.1	–	–
Chromium	mg/L	0.005	<0.002	<0.002	0.0001	0.0046	0.0020	0.0016	–	0.0099
Cobalt	mg/L	<0.0004	<0.0004	<0.0004	0.11	0.0048	0.0014	0.0009	–	–
Copper	mg/L	<0.002	<0.002	<0.002	0.10	**0.0052**	**0.0021**	0.0017	0.3	0.002 (6)
Cyanide (Total)	mg/L	<0.002	<0.002	<0.002	0.22	0.220	0.0035	0.0024	1	– (7)
Iron	mg/L	0.24	0.22	0.21	2.2	**0.32**	0.25	0.23	–	0.3
Lead	mg/L	<0.0005	<0.0005	<0.0005	0.0009	0.00034	0.00027	0.00026	0.2	0.001 (8)
Magnesium	mg/L	0.43	0.50	0.50	5	0.63	0.53	0.52	–	–
Manganese	mg/L	0.046	0.052	0.048	0.07	0.047	0.051	0.050	–	–
Nickel	mg/L	<0.002	<0.002	<0.002	0.0036	0.0011	0.0010	0.0010	0.5	0.025 (9)
Nitrate	mg/L as N	0.05	0.16	0.13	0.06	0.15	0.16	0.14	–	– (10)
Phosphorous	mg/L	0.015	<0.02	<0.02	0.005	0.002	0.011	0.011	–	–
Potassium	mg/L	0.33	0.30	0.30	33	3.2	1.1	0.74	–	–
Selenium	mg/L	<0.001	<0.001	<0.001	0.000	0.00049	0.00050	0.00050	–	0.001
Silver	mg/L	<0.0001	<0.0001	<0.0001	0.00020	0.000055	0.000051	0.000051	–	0.0001
Sodium	mg/L	3.0	2.9	2.9	305	16.0	9.7	6.9	–	–
Sulphate	mg/L	<2	<2	<2	700	31.0	8.8	5.6	–	–
Uranium	mg/L	<0.0001	<0.0001	<0.0001	0.0011	0.00093	0.00006	0.00006	–	–
Zinc	mg/L	0.012	0.020	0.018	0.014	0.012	0.018	0.018	0.5	0.03

Notes:

0.3	Concentration greater than the CCME guideline.
0.17	Concentration greater than CCME guideline due to high background

<0.001 – Values in red indicate that the value is below the detection limit. Concentrations were assumed to be half of the detection limit, if the analysis results were below the detection limit.

(1) Wetland outflow water quality derived by applying 50% attenuation efficiency to projected polishing pond water quality

(2) MMER [Metal Mining Effluent Regulations], 2002. Metals Mining Effluent Regulations. Canada Gazette Part II, Vol. 136, No. 13. SOR/DORS/2002-222.

(3) CCME [Canadian Council of Ministers of the Environment], 2002. Canadian Water Quality Guidelines for the Protection of Aquatic Life: Summary Tables. Updated 2002.

(4) Aluminum guideline = 0.005 mg/L, if pH <6.5, [Ca^{2+}] <4 mg/L and DOC <2 mg/L; aluminum guideline = 0.1 mg/L, if pH ≥6.5, [Ca^{2+}] ≥4 mg/L and DOC ≥2 mg/L.

(5) Total Ammonia guideline = 1.37 mg/L at pH 8.0, T = 10°C; ammonia guideline = 2.20 mg/L at pH 6.5, T = 10°C.

(6) Copper guidline = 0.002 mg/L, if [$CaCO_3$] = 0–120 mg/L; copper guideline = 0.003 mg/L, if [$CaCO_3$] = 120–180mg/L; and copper guideline = 0.004 mg/L, if [$CaCO_3$] >180 mg/L.

(7) There is no CCME guideline for total cyanide. However, the CCME guideline for free cyanide is 0.005 mg/L.

(8) Lead guideline = 0.001 mg/L, if [$CaCO_3$] = 0–60 mg/L; lead guideline = 0.002 mg/L, if [$CaCO_3$] = 60–120 mg/L; lead guideline = 0.004 mg/L, if [$CaCO_3$] = 120–180 mg/L; lead guideline = 0.007 mg/L, if [$CaCO_3$] >180 mg/L.

(9) Nickel guideline = 0.025 mg/L, if [$CaCO_3$] = 0–60 mg/L; nickel guideline = 0.065 mg/L, if [$CaCO_3$] = 60–120 mg/L; nickel guideline = 0.11 mg/L, if [$CaCO_3$] = 120–180 mg/L; nickel guideline = 0.15 mg/L, if [$CaCO_3$] >180 mg/L.

(10) Nitrate guideline – there is no specific guideline value, but concentrations that stimulate weed growth should be avoided.

Table 4.5-2. Downstream Water Quality Simulation Results with Wetland Attenuation

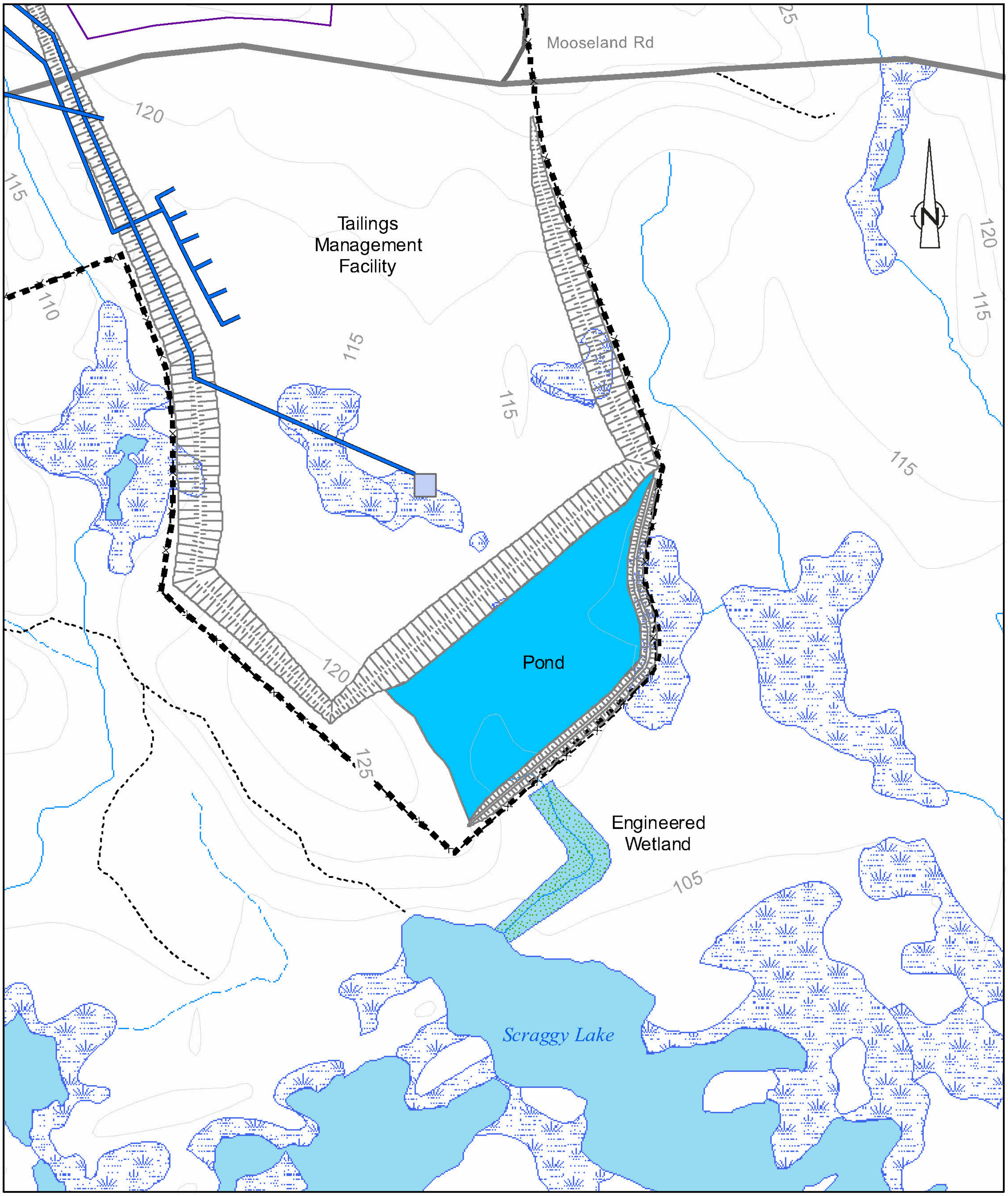


Figure 4.5-1
PROPOSED ENGINEERED WETLAND
TOUQUOY GOLD PROJECT
DDV GOLD LTD.
Moose River Gold Mines
Halifax County, Nova Scotia

Legend

- 🟩 Engineered Wetland
- ▨ Wetlands; Bogs
- 🟦 Lakes

0 0.1 0.2 0.3 0.4
Kilometres

CONESTOGA-ROVERS & ASSOCIATES

820933-D (8) GIS-DA451 October 26, 2007

4.6 HISTORIC TAILINGS MANAGEMENT PLAN

The proposed Touquoy Gold Project is located in the area of six historic mining stamp mills that operated between 1882 and 1925. Historic tailings were identified in areas within and outside the proposed open pit boundaries.

A Historical Tailing Management Plan (included in Appendix P) has been developed with the objective of identifying the most appropriate disposal option for Historic Tailings that will be disturbed during mining operations and the procedure to decide the fate of the historic tailings that will not necessarily be disturbed during mining operations (Risk Assessment). Figure 4.6-1 illustrates the approach to Historic Tailings Management.

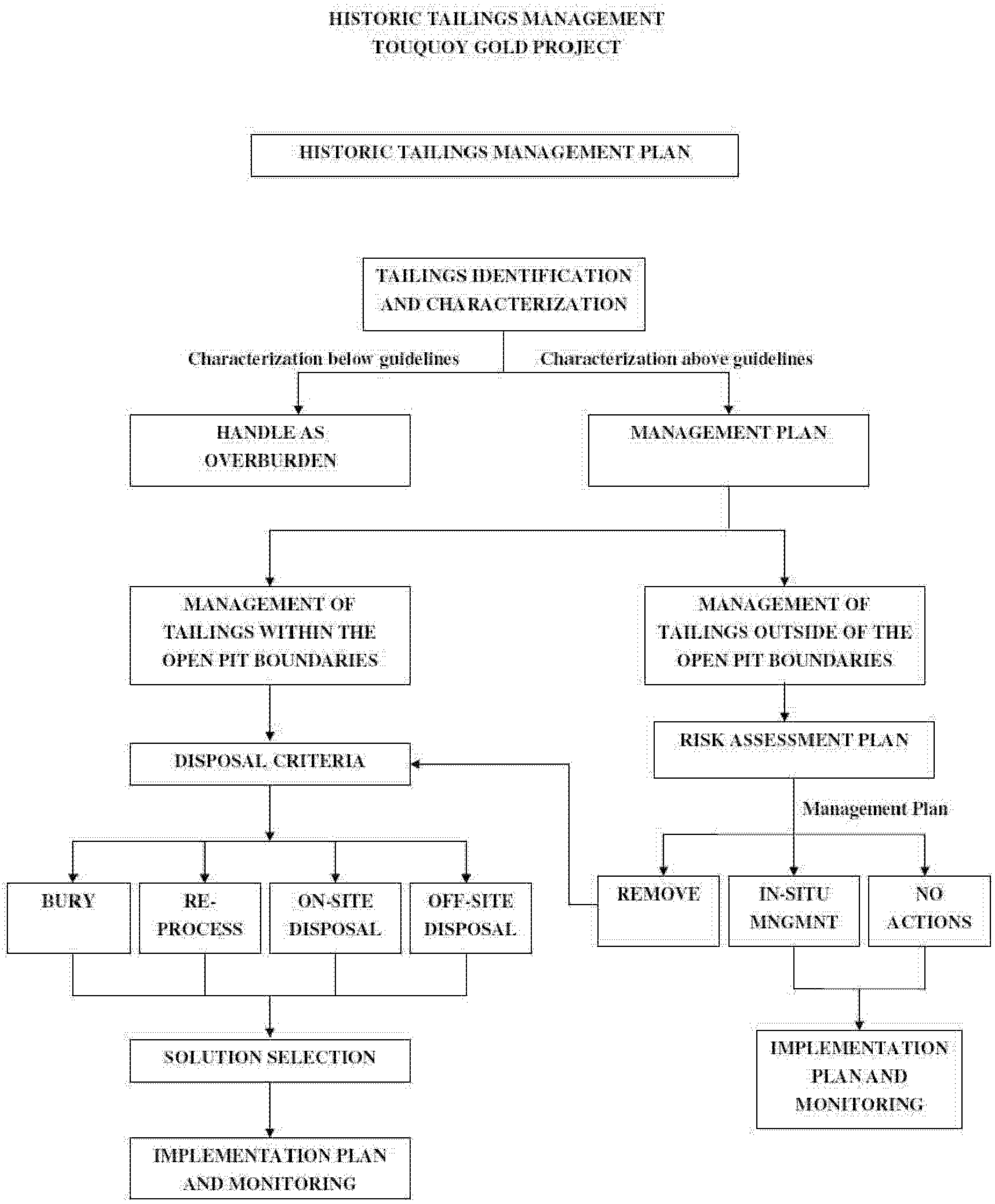
4.6.1 Management Of Tailings Within The Open Pit Boundaries

Tailings that are located within the open pit boundaries will be removed and disposed. Disposal criteria have been developed to address the various constraints that may affect the choice of a disposal option and define the most appropriate solution: risks (contaminants remobilization; short or long term environmental impact; short or long term impact on human health), technical feasibility, cost, future liability and permanent solution. The option of On-site containment shows the least constraints with respect to the defined criteria and is thus recommended for the management of the excavated/disturbed tailings. An implementation and monitoring program is presented in the Historic Tailings Management Plan.

4.6.2 Management Of Tailings Outside Of The Open Pit Boundaries

A risk assessment will be performed to define the management of impacts at the site and will be based on determination of risks associated with impacts that relate to the site use, characteristics and site users. The analysis will identifying the contaminants, pathways and a receptors. Additional characterization beyond what is required to determine if the soil is above or below guidelines is often needed for input data for the risk assessment. The extent of horizontal and vertical impact on the soil due to the tailings is not known at this point. An investigation program will be necessary to sample a series of boreholes and install groundwater-monitoring wells.

Figure 4.6-1 Historic Tailings Management



From the input data models are used to determine the risk associated with the contaminants of concern at a site and Site Specific Target Levels (SSTL's) are calculated. Where the SSTL's are above the values found on the site, the material would typically be left in place with restrictions on site use and uses for the adjacent lands such as restricting surface water flow, erosion, mass removal of materials that could alter surface water and groundwater movements. Where the SSTL's are below the values found on the site, the materials would be managed as if they were above the applicable CCME guidelines. We foresee three main options: Removal and disposal; On-site Treatment; No actions following the solution management option, an implementation and monitoring plan will be developed to address the solutions specific requirements.

5.0 CONSULTATION AND COMMUNICATION

Section 5.0 outlines the specific activities completed and provides details on issues raised.

5.1 BACKGROUND

Prior to the filing of the Environmental Assessment Registration Document (EARD) in March 2007, the Company undertook a public consultation and communication program. This program consisted of a number of small group meetings, briefings with civic officials, and elected representative from all three levels of government, media interviews and three Open Houses. A number of public and stakeholder comments were received during the filing of the EARD (25 day review period) and these mostly originated from the Eastern Shore area.

Following the receipt of the Minister's decision which indicated a need for a Focus Report, the Company felt it appropriate to broaden its consultation and communication program to the Eastern Shore area. Whilst there had been some media coverage and advertised announcements of Company Open Houses prior to the filing of the EARD, a considerable effort has been made in recent months to better inform and obtain feedback from individuals and groups in the Eastern Shore area. At the same time, consultations and communications have continued with other geographic areas that are associated with the Project.

5.2 EXPANDED PUBLIC ENGAGEMENT PROGRAM

The objectives of the Company's expanded public engagement program since April 2007 have been to:

- Provide information about the Project to individuals and groups
- Encourage feedback and answer questions
- Elicit suggestions and recommendations to improve the Project design

In pursuit of these objectives, the company developed a stakeholders list composed of individuals and groups including:

- Elected Officials
- Provincial and Federal Regulators
- Non-governmental Organizations

- Special Interest Groups
- Community Organizations
- Business Community
- General Public

Stakeholders were sought out in order to both provide information and seek feedback in aspects of the Project. Among these stakeholders were parties who had filed commentary during the EARD review process. These groups and individuals were a focus of consultative efforts in order to better understand and address the specific concerns expressed during the EA review. The company also developed an email data base for the purposes of issuing statements and Project status updates. These statements and Project updates prompted a number of requests for briefings and also prompted a number of media interviews.

With the specific intent again of enhancing consultation and communications in the Project area, the Company held two added Open House information sessions in addition to the three from prior years. These were staged in Tangier on August 8, 2007 and Upper Musquodoboit August 9, 2007.

Both events were advertised in the Weekly Press and Eastern Shore Gazette as well as on the three area Job Search Centre websites one week in advance. For these sessions the Company assembled a team of twelve (12) experts to meet with members of the public. Total attendance at the two sessions exceeded 100 persons.

5.3 RECENT STAKEHOLDER CONSULTATION

The following is a listing of parties with whom the company initiated briefings and meetings since April 2007:

Federal Elected Officials and Their Representatives

Hon. Peter Stoffer, NDP MP Sackville-Eastern Shore
Ms. Anne Bigelow, Director of Regional Affairs for Hon. Peter MacKay, MP Central Nova

Provincial Elected Officials and Their Representatives

Hon. Brooke Taylor, MLA East Hants-Colchester, Minister of Agriculture
Hon. Ron Chisholm, MLA Guysorough County, Minister of Fisheries
Hon. Bill Dooks, MLA Eastern Shore, Minister of Energy

Hon. David Morse, Minister of Natural Resources
Executive Assistant to Hon. Mark Parent, Minister of Environment and Labour
Executive Assistant to Hon. Richard Hurlburt, Minister of Economic Development

Opposition Representatives

NDP Opposition Environment and Natural Resources Critics
Liberal Natural Resources and Environment Critics
Mr. Sid Prest, NDP Eastern Shore Regional Outreach Worker

Municipal Elected Officials and Organizations

HRM Regional Council
Mr. Steven Streatch, HRM Councillor for Project area
HRM Watershed Advisory Board
HRM Emergency Measures Organization

Special Interest Groups

Canadian Parks and Wilderness Society (CPAWS)
Ecology Action Centre
Nova Scotia Nature Trust
Nature Conservancy of Canada
Eastern Shore Forest Watch
Eastern Shore Fishermen's Protective Association
Atlantic Salmon Association
Nova Scotia Salmon Association
Eastern Shore Wildlife Association

Local Business Community

Greater Halifax Partnership
Sheet Harbour Chamber of Commerce
Antigonish and Eastern Shore Tourism Association
Seaside Tourism and Business Association
Eastern Shore Job Search Centre (Porter’s Lake)
Sheet Harbour Job Search Centre
Musquodoboit Valley Job Search Centre

Industry

Nova Scotia Mining Association
Mining Society of Nova Scotia
Neenah Paper

Government Agencies

NSEL – Protected Areas
NSEL – Pollution Control
NSDNR – Species at Risk
NSDNR – Industry Liaison
NSDNR – Mineral Development and Policy
Environment Canada - Atlantic Region
Natural Resources Canada
Department of Fisheries and Oceans

In addition to meetings with the 40 parties listed above, the two open house information sessions held in August put the company in contact with more than 100 interested citizens. Also, during the months of August and September, company representatives attended public meetings held by Eastern Shore Forest Watch at three sites on the Eastern Shore; Tangier, Musquodoboit Harbour, and Oyster Pond; and one site in the Musquodoboit Valley at Middle Musquodoboit. This provided the opportunity to answer questions from another 120 members of the general public.

5.4 ISSUES OF PUBLIC CONCERN

Numerous questions and issues of concern have been raised with regard to the Project both during the original public review of the EARD and the expanded program of public engagement. These have been organized by category and are addressed in detail in the "Answers to Stakeholder Concerns" section of this document. In all, 255 questions are addressed. The breakdown by category is given below.

Table 5.4-1 Summary of Stakeholder Concerns by Topic

Topic	Number of Questions
Natural Environment	
Wildlife and Habitat	19
Baseline Geochemistry	8
Air/Light/Noise/View	15
Socio-Economic	
Employment	9
Project Benefits	12
Community	11
Traffic and Transportation	5
Tailings Management	
Design	6
Extreme Weather	5
Monitoring	2
Seepage	9
Dam Failure	15
Emergency Response	16
Water Management	
Usage	8
Acid Rock Drainage	17
Cyanide Destruction	11
Effluent Treatment	11
Effluent Water Quality	12
Water Quality Modeling	9
Wetland Purification	9
Other	
Monitoring	6
Compliance	7
Historic Mining	10
Reclamation	23
Total	**255**

5.5 PUBLIC OPINION RESEARCH

In September/October 2007, the Company contracted an independent opinion research professional to undertake public attitude research in the Eastern Shore Area. This research undertaken as a probability, telephone intercept has a known probability of error and can be confidently relied upon. The results of this research are in Appendix U – Public Opinion Survey. In summary, the results indicate a 66% level of awareness of the Project and a 67% level of overall support for the Project.

5.6 USE OF STAKEHOLDER INPUT IN THE PROJECT DESIGN

The purpose of the broadened public consultation was (1) to ensure that the public had sufficient, accurate information about the Project to allow people to make an informed decision and (2) to understand the concerns of the community and address those concerns in the Project design.

The following is a list of the Project design changes which have been implemented as a result of feedback from public consultation. It should be noted that many community concerns were already addressed in the Project design that was presented in the EARD. The enhancements do not reflect a modified project but rather one with a greater level of public input for certain details. All of these are covered in detail in the "Response to Stakeholder Concerns", section of the Focus Report.

This list represents items which were either (1) not explicitly part of the development plan prior to the broadened program of public consultation or (2) identified as being of such significance to the stakeholders that their treatment in the Project design warranted review. In all, DDV Gold has employed stakeholder input on 25 issues to enhance the Project design. These issues are listed below.

5.6.1 Public Engagement

Below are specific ways in which DDV Gold has used public input to improve Public Involvement aspects of the Project.

Improve Report Presentation

The Focus Report format and presentation have been revised to make it easier to use; the document will be available at more locations than was the EARD; and additional supporting information is available for viewing at the DDV Gold offices in Moose River Gold Mines.

Expand Public Consultation

DDV Gold has undertaken since May 2007 to broaden its public consultation efforts far in excess of that required by legislation. The company has met with over 30 different community, government, and non-governmental organization, in some instances on multiple occasions, held two more Open House information sessions, and attended public meetings held by local special interest groups.

5.6.2 Tailings Management

Tailings Dam Design Document provided in Appendix D and discussed below.

Ensure the Tailings Facility has Capacity to Manage Inflows from Extreme Weather

The tailings facility is designed to handle the in-flow from the 1/200 year storm which is about 200 mm in 24 hours. To put this in perspective, Hurricane Juan dropped about 75 mm in 48 hours and the largest recorded precipitation event since 1950 was about 300 mm in the same period.

Employ a "Double Fail-Safe" Dam Design

The tailings dam design incorporates a "Quadruple Fail Safe" arrangement that employs four barriers to contain the downstream flow of tailings in the event of a dam failure.

Ensure Tailings Dam Stability

Dam failure could only occur in the event of the 1/10,000 year earthquake which has a 0.05% probability (5 in 10,000) of occurring during the life of the Project. To put this in perspective, the 1/1,000 year earthquake, which has a probability of 0.5% of occurring in the same period, would destroy every multi-story structure in downtown Halifax but would leave the tailings dam undamaged.

Assess Impact of Dam Failure

Studies show that the worst case dam failure scenario would result in 500,000 m^3 of tailings or 10% of the total volume at full capacity being released in the event of failure. For the purpose of this analysis it was necessary to assume that all of the safety procedures, monitoring, and emergency spillways simultaneously failed in order to simulate conditions that would result in failure.

Develop Tailings Facility Emergency Procedures

DDV Gold has developed the entire operating manual for the tailings facility including emergency procedures. This effort is unprecedented as such a document is typically never produced until after construction of the facility.

Pay Compensation in the Event of Dam Failure

DDV Gold will carry a multi-million dollar insurance policy to cover the costs associated with compensation for harm caused and clean-up for a tailings dam failure. This amount would provide for replacement of impacted land, replacement of contaminated wells, and other clean-up or other expenses.

5.6.3 Environmental Protection

Below are specific items from the enhanced public consultation relating to Environmental Protection that DDV Gold has committed to.

Funding for Land Conservation in Nova Scotia

DDV Gold is committed to providing meaningful funding, once the Project is operational, to a relevant organization, or organizations, to assist in the acquisition of selected lands in Nova Scotia for conservation purposes and has undertaken preliminary exploratory discussions directly with representatives of several organizations in this respect. The Company appreciates that such land acquisition would assist the Province in achieving its goal of legally protecting 12% of its total land mass by 2015 in accordance with the Environmental Goals and Sustainable Prosperity Act (Bill 146) Section 4(2)(a).

Develop a Historic Mine Tailings Remediation Plan

DDV Gold has engaged a consulting engineer experienced in site remediation to develop a methodology for the identification, evaluation, and management of historic mine tailings encountered during the development of the Touquoy Gold Project site. This methodology includes the use of a risk assessment approach to determine whether tailings should remain in place or be disposed of and rationale for the disposal method.

Ensure that Long-term Environmental Obligations Fulfilled

DDV will post a reclamation bond as required by law and is obliged to continue to treat site runoff until it returns to original quality. It will employ progressive reclamation so it is not reliant on the bond to reclaim the site. The company will sell forward sufficient production to ensure Project economics. Testing indicates that no long-term treatment legacy will persist, never-the-less, the sale of the plant for scrap or salvage at closure will ensure that funds are available to continue treatment of site water as long as necessary.

Manage Waste from Effluent Treatment

The waste solids from effluent treatment will be removed from treatment ponds annually and stored in specially designed containment cells located at the north end of the tailings pond. These cells will be constructed out of waste rock for strength, lined with clay to ensure containment, and covered with filter material and waste rock to protect the clay liner. Storage in this manner will provide stable chemical conditions that will prevent the remobilization of arsenic and metals in perpetuity.

5.6.4 Water Quality/Use

Manage Acid Mine Drainage Issues Effectively

Testing indicates that acid mine drainage is not an issue at the Touquoy site. Environment Canada has indicated that it shares this opinion based on discussions with DDV Gold, documentation, and information gathered through a site visit. Testing shows that the neutralizing potential of the host rocks is sufficient to offset any acid generation and tailings are not acid generating. The existing mini-pit, excavated 18 years ago in the heart of the orebody has an alkaline pH and hosts a fish population.

Ensure that Discharged Water does not Affect the Downstream Watershed

Water discharged from the site will go through four treatment processes: cyanide destruction, natural degradation and settling, effluent treatment, and wetland purification. Discharge water quality must comply with the most stringent regulations ever applied in Nova Scotia. Receiving water quality must adhere to federal guidelines for the protection of aquatic life and monitoring of environmental impacts is mandatory.

Address the Potential for Water Well Contamination

Local experts confirm that the possibility of water well contamination as a result of the development and operation of the Touquoy Gold Project is extremely remote. Never-the-less, DDV Gold will conduct baseline surveys of well water quality in potentially affected communities and the Company will carry insurance to address validated claims.

Limit Water Withdrawal from Square Lake

Start-up has been scheduled to occur in the fall/winter period when precipitation is highest limiting the impact on the volume of Square Lake during the driest month to a maximum reduction of 6%. The effect on lake level would be negligible. In all likelihood, collection of runoff during tailings dam construction will eliminate the need to withdraw water from Square Lake during start-up entirely. After start-up, only a nominal amount of "make-up" water is drawn from Square Lake with 90% of requirements being met by re-cycling water from the tailings facility.

Ensure Development Protects On-site Watercourses

The Project design will leave 30 m buffer zones on either side of watercourses and make use of bottomless culverts, in consultation with the Department of Fisheries and Oceans wherever stream crossings are required.

5.6.5 Wildlife

The following items and responses from DDV Gold relative to wildlife have been identified through the enhanced public consultation program.

Develop a Comprehensive Moose Management Plan

DDV Gold has taken into account recommendations made in the NSDNR Recovery Plan for Moose in Mainland Nova Scotia (March 2007) and the draft guidelines for developers engaged in environmental assessment registration in the development of it moose management plan. In particular, the company will partner with institutions, agencies, and other groups to support field research, exercise stewardship of the surrounding areas, and engage public support for preservation of moose through its employees and community organizations.

Ensure Rare Lichens Not Impacted by Development

DDV Gold has determined through its work for the Focus Report that no Project activities will generate emissions which will cause harm to sensitive species of rare lichens in the area. Furthermore, the company will sponsor research to determine the actual extent of these organisms in the area which at this point is only postulated.

Participate in Programs to Help Rehabilitate Local Rivers

DDV Gold has entered into discussions with Eastern Shore community organizations regarding the possibility to assisting in enhancing local salmon populations through liming or provision of fish ladders.

5.6.6 Local Communities

Local community issues were identified and are addressed below.

Ensure Employment for Local Residents

DDV Gold will target 90% of its employees to be drawn from the Musquodoboit Valley and Eastern Shore with preferential hiring for candidates of equal merit from those regions. DDV Gold will advertise job openings through the local job search centres and collaborate with local educational institutions and government organizations to provide training and employment opportunities for less qualified local residents.

Support the Local Economy

DDV Gold is actively meeting with local communities to determine what services and resources can be utilized in support of construction and operations. Given equal merit, the company will make preferential use of suppliers and services from the Musquodoboit Valley and Eastern Shore within 100 km of the site. A recent study (Gardner Pinfold and CRA, 2006) documented the fact that for every job at a minesite in Nova Scotia, 2-3 jobs were created in the service sector.

Preserve Moose River Gold Mines History

Subject to stakeholder input and public safety and environmental considerations the Moose River Provincial Park will be relocated to a site overlooking the open pit where an interpretative centre will be established. The centre will be constructed in the same style as the existing museum and use parts of the original building as much as is practicable. The centre will be funded by the company freeing it from dependence on dwindling government support.

5.6.7 Traffic And Transportation

Limit Traffic and Use of Inadequate Routes

It is estimated that 6-10 truck loads of materials and 2-4 truck loads of supplies will be shipped to site by truck daily during construction and operations respectively. The majority of this traffic will travel along Highways 102 and 224 to site. This amounts to a nominal increase in traffic on a route which already accommodates large trucks and school buses without difficulty. Personal cars are expected to number 20-30 each shift during operations.

Ensure that Sodium Cyanide Transport is Safe

The supplier is fully permitted to transport cyanide in Nova Scotia and its emergency response plan is on file with Transport Canada. Sodium cyanide will transported to site in reusable, steel bins in steel shipping containers. The route will be by truck from the railhead at the Town of Truro, along Highways 102 and 224, and the Moose River Road to site. The supplier will meet with communities upon request to address concerns related to the shipment or use of cyanide.

5.7 WHAT WE LEARNED

The following describes the things the company learned as a result of the broadened program of stakeholder consultation prior to completion of the Focus Report. Over the last four years DDV Gold has received useful feedback from both supporters and opponents of the Project that have served to improve the Project plan and make it more responsive to the concerns of the community.

The community feedback described in the following paragraphs largely highlights expressed concerns, as these enable the proponent to consider improvements to the Project plan and in a broader context, the way in which mining is perceived in Nova Scotia. It must therefore also be acknowledged and emphasized that the proponent has received many expressions of goodwill and encouragement, but that such expressions, perversely perhaps, are less relevant in this perspective.

5.7.1 Value Of Public Engagement

Since its involvement in the Project in mid-2003 DDV Gold has found the public engagement process to be extremely valuable. DDV Gold has embraced the consultation process far in excess of legislated requirements, particularly since submission of the EARD in early 2007, and this has provided the Company with (1) valuable insight it would not otherwise have gained and (2) an opportunity to share information with the community in a way that enhanced understanding for all parties.

5.7.2 Usefulness Of Information

DDV Gold was very surprised to learn that many parties with concerns expressed since the EARD was submitted had not read the EARD. This was evident as many of the concerns raised were answered explicitly in the document. The technical nature of the subject, lack of high-speed internet in some communities, and the limited length of the public review period were all provided as reasons why this might be so. DDV Gold recognizes the need to create a Focus Report document which provides the information people want, in a form that is readily accessible, and which addresses the needs of all parties.

5.7.3 Perception Of Mining Activity

DDV Gold has spoken with groups and individuals who have both supported and opposed development. Generally, objections to the Project have been based on the belief that mining would cause unacceptable levels of environmental impact specifically related to air and water quality and wilderness value. Supporters of the Project acknowledge that development would result in environmental impact but felt that was the price for creating jobs and a strong economy. Surprisingly, many supporters had little knowledge of how development could be managed to lessen impacts.

DDV Gold must ensure that one focus of its Community Liaison Committee is demonstrate to all members of the community how a mining Project can be operated in an environmentally conscious manner.

5.7.4 Lack Of Local Examples

The lack of a vibrant metal mining industry in Nova Scotia during the last 30 years has meant that advances in technology and best practice that have successfully allowed operators to respond to social concerns in other jurisdictions is lacking here. As a result, a proponent is challenged to convince a skeptical public that a mining Project can be developed in an environmentally sensitive manner.

DDV Gold recognizes, as a result of its public consultation process, that it will have to take a leadership role in demonstrating environmentally responsible mine development. In particular, it will be important to show how the many examples of best practice in Nova Scotia industry today can be applied in a mining context.

5.7.5 Industry Credibility

In recent discussions with parties concerned about the project a common sentiment has been implied that mining companies, and in particular gold mining companies, are run by management with low ethical standards. The belief holds that gold mining companies don't pay their bills or fulfill their environmental obligations and change their company names to avoid responsibility. This view results in the proponent's proposed solutions to public concerns often being greeted with suspicion rather than being welcomed. This hinders the introduction of new ideas which will enable Nova Scotia to have a vibrant gold mining industry which employs modern methods and best practice.

DDV Gold understands that it must continue to strive to achieve the highest levels of corporate conduct in order to confirm its credibility in the community.

5.7.6 Perceived Weak Standards

DDV Gold was frequently told that it must exceed all regulatory requirements because the environmental standards governing the Project are weak. Although historically true, it is a fact that the standards applicable today to regulate the Touquoy Project for environmental protection are the most stringent ever applied in Nova Scotia. Never-the-less, it is important for the proponent to recognize that anything less that exceptional performance will be considered deficient. Therefore, DDV Gold will work to aid the public in understanding the significance of the standards applied to the Project and as a result will gain greater confidence in the operator's ability, and the industry at large, to protect the environment.

5.7.7 Perceived Weak Enforcement

An often repeated view expressed to DDV Gold particularly by special interest groups is that there is little confidence in the authorities' ability to administer their regulations. DDV Gold believes that the regulatory framework for mining in Nova Scotia is quite strict in comparison to other jurisdictions but understands that with so little metal mining activity in the province it is difficult for people to see those regulations working effectively. DDV Gold will work closely with the various government agencies in order to demonstrate that it is meeting all its prescribed obligations.

5.7.8 Expectations Of The Approval Process

Greater involvement of the public in the approval process offers tremendous benefits but also entails certain risks and responsibilities. The environmental approval process is comprised of two stages: Environmental Assessment (EA) and Industrial Approval (IA). The EA determines if the Project is a net benefit to the province based on the conceptual plan. Acceptance of the EA tells the proponent that it is worth the time, effort, and cost to do the detailed design work necessary to satisfy IA requirements.

Through consultation, DDV Gold has learned that many of the parties consulted were not satisfied with a conceptual plan at the EA stage and some felt that anything short of a detailed technical design was inadequate. Undoubtedly, the lack of trust, little experience with modern mining practice, and elements of the past record of historic mining in the province contributed to this view.

As this approach increases the risk (added investment with no guarantee of approval) of permitting for the proponent, DDV Gold suggests that some mechanism be considered that helps set public expectations during the EA process so that stakeholders get greater satisfaction and proponents are encouraged to see the process through.

5.7.9 Illusion Of Independent Perspectives

During the period of public engagement, both in prior years and the six months since submission of its EARD, DDV Gold has learned that community organizations are composed of only a small portion of the population. The same individuals are found to belong to numerous different groups thus, in our efforts to reach more of the community by talking to as many different organizations as possible, we frequently found ourselves talking to the same people supporting the same views under different banners.

We also learned that there were close ties between community groups and government agencies. This makes perfect sense if the government is to effectively serve the community, however, given this situation it would be incorrect to believe that each party represents a unique and independent point of view. For example, one community organization provided DDV Gold with an envelope containing information that represented "their concerns". It was simply photocopies of the comments submitted by the various government agencies on the Environmental Assessment Registration Document.

5.7.10 Environment Versus Development

A prevalent theme encountered in many meetings held during the Focus Report period was (1) that environmental protection and development are incompatible concepts and (2) if you are "for" one, you are "against" the other. This view existed in almost every sector of the community we encountered from special interest groups to regulators and elected officials to the general public.

This pre-existing view made it very difficult for many we met with to accept that a mining project, which by definition entailed disturbance of the environment, could be designed and operated in a manner that minimized impact, ensured protection, and hastened rehabilitation. Never-the-less, the concept that environmental protection and mining are compatible will continue to be a guiding principle for the development of the Touquoy Project and is seen by the proponent as the essential element in creating a sustainable, socially accountable mining industry in Nova Scotia.

5.8 CONCLUSIONS

Since Project inception the proponent has undertaken to proactively inform members of the public and local communities as to the nature of the Project and at the same time attempt to address reasonable concerns. The Company has recognized, of late, that there has been a need to better inform individuals in the Eastern Shore area of the specifics of the Project. To this end it has engaged, over the past several months, in a proactive and robust effort to consult and communicate. In addition to simply answering questions about the Project, the Company has made a considerable effort to tailor plans to meet the expressed concerns of groups and individuals as evidenced by the significant number of design changes resulting from stakeholder feedback.

6.0 ANSWERS TO STAKEHOLDER CONCERNS

The following section answers commonly posed questions about the Project. The question and answer format gives the information more relevance than if it was simply presented as part of a technical discussion. The logical sequence of query and response has been established through lengthy dialogue with stakeholders over the last six months.

Presenting the information in this fashion is a direct response to stakeholders who want the "bottom line" and don't have time to sift through reams of technical description. Although an effort has been made to be brief, this section still provides a great deal of information answering, as it does, over 150 questions about the Project.

The section does not seek to answer every question ever posed regarding the Touquoy development. It addresses the issues that have surfaced repeatedly throughout the public engagement process; issues which are common to almost every group encountered. Much of the Q&A presented relates to management and mitigation of Project impacts. These issues are dealt with here, rather than in Section 7 of the report, to ensure that they are most readily accessible.

Although every effort has been made keep answers short, the nature of the Project requires that a wide variety of complex issues be addressed. To aid the reader in getting the greatest value from this section, Table 6-1 provides a guide that will help readers quickly find the topic in which they are interested.

Table 6-1 Guide to Section 6 Topics

6.1	**Biophysical**	**6.2**	**Flora and Fauna**	**6.3**	**Socio-Economic**
6.1.1	Noise	6.2.1	Moose	6.3.1	Community
6.1.2	Light	6.2.2	Birds	6.3.2	Employment
6.1.3	Viewshed	6.2.3	Bats	6.3.3	Project Benefits
6.1.4	Atmospheric	6.2.4	Fish	6.3.4	Traffic
6.1.5	Geochemical	6.2.5	Odonates		
6.1.6	Wetlands	6.2.6	Lichens		
		6.2.7	Plants		
6.4	**TMF**	**6.5**	**Water**	**6.6**	**Other**
6.4.1	Design	6.5.1	Use	6.6.1	Historic Mining
6.4.2	Extreme Weather	6.5.2	ARD	6.6.2	Compliance
6.4.3	Seepage	6.5.3	Cyanide Destruct	6.6.3	Monitoring
6.4.4	Monitoring	6.5.4	Effluent Treatment	6.6.4	Reclamation
6.4.5	Dam Failure	6.5.5	Wetland Treatment		
6.4.6	Emergency Response	6.5.6	Effluent Quality		
		6.5.7	Downstream Quality		

6.1 BIOPHYSICAL

6.1.1 Noise

1. What is the ambient sound level on site?

The noise surveys conducted measured the ambient sound level on site at about 40 dBA, the sound one would experience walking through isolated woods.

2. Will the sound of operations be heard in the nearby wilderness?

A canoeist, 200 m off the north shoreline of Scraggy Lake will not experience sound above background except on an occasional basis.

3. Why will the noise from mining and processing operations not be audible?

All of the processing activities are carried out inside buildings. Equipment working in the open pit will be screened by the pit walls. Trees left throughout the sight around watercourses and various facilities will block sound. Given the small number of machines and the size of the property (1,000 acres) the generated noise is not sufficient to travel beyond the site boundaries.

4. What about noise from blasting?

Blasting noise is estimated to be 122 DB. At the safe blasting distance of 500 m, the noise from blasting will sound like distant thunder; at 1,000 m it will sound like a car door slamming. Blasting will be conducted daily, 5 days per week. The noise from a blast will last about 1 second.

5. How will you know if the noise isn't increasing?

The company will do annual surveys to assess the noise from operations. Exceedances will be addressed through remedial action.

6.1.2 Light

1. Will the lights from the mine be visible at nearby locations?

Depending on conditions, light from the site may be visible to locations outside the property.

2. How much light will be visible?

The light that may be visible would not illuminate any area beyond the property boundary. The nearest "receptors" (people who could potentially see light from the mine) are at Camp Kidston, 3 km distant, and a camper on the shoreline of Scraggy Lake. The camper would see < 60% of the permissible limit for obtrusive light and the children's camp < 12%.

3. Is this estimate conservative?

Yes. Typically, trees and other barriers can block up 90% of all incident light. In the study that was done it was assumed only 50% of incident light was blocked.

6.1.3 Viewshed

1. Will the site be visible from beyond the property boundaries?

Yes, theoretically the top of the waste rock stockpile at completion will be visible from outside the property limits. However, once re-vegetation is complete the stockpile will not be distinguishable from the surrounding hills which are of the same height.

2. Why will the mine facilities not be visible from outside the property?

The main reasons are (1) extensive forest cover and (2) low relief. There are few locations where an observer could have an unobstructed view over any great distance that would permit the mine to be seen. In many cases, trees are almost as tall as topographic features.

3. What about views across the open waters of lakes?

Yes, an observer would have a less obstructed view across a lake, however, the vantage point is so low relative to the surrounding trees that little opportunity exists to see past the shoreline. It is this reason that the 200 m wide band of trees at the north end of Scraggy Lake effectively screens the site and will only glimpses of the facilities at final height.

4. What will be seen from the public road passing through the site?

The public road will be screened by trees on both sides for that purpose. Very little of the facilities will be visible even from the road running through the site.

6.1.4 Air Emissions

1. State what are expected vehicle emissions

The complete emissions modeling report for the Project is provided in Appendix L. Isopleths of average annual sulphur dioxide emissions from smelting and vehicle emissions are shown on Figure 4.3-1. No impacts to sensitive receptors or listed cyanolichen species are predicted.

2. State what are expected smelting emissions

The complete emissions modeling report for the Project is provided in Appendix L.

Isopleths of average annual total suspended particulates from smelting activities are shown on Figure 4.3-2. Isopleths of average annual sulphur dioxide emissions from smelting and vehicle emissions are shown on Figure 4.3-1. No impacts on sensitive receptors or listed cyanolichen species are predicted.

3. Identify the distance to the nearest residential area

The nearest permanent residence will be 5 km away to the northwest.

Include an anti-idling program as part of mitigation to minimize vehicle emissions. An anti-idling program will be considered by DDV Gold, along with other emissions control measures.

Submit an emission summary including a quantitative analysis of all air contaminants using dispersion modeling.

The complete emissions modeling report for the Project is provided in Appendix L.

4. How will the operation control dust?

Details of the company's plans for dust control can be found in the Fugitive Dust Management Plan in Appendix E.

5. How will the company prevent sulphur dioxide emissions from affecting rare lichens on and around the project site?

The largest source of sulphur dioxide emissions on the site is vehicle exhaust. The concentration of sulphur dioxide in vehicle exhaust, given the number of vehicles involved and the dispersion that occurs in the atmosphere is insufficient to impact the rare lichens on and around the site.

6. How much greenhouse gases will the project emit?

Greenhouse gases are estimated to be about 8,100 tpa not including off-site electric power generation. This means the site would account for about 0.04% of all mining-related greenhouse gas emissions in Canada based on the 2005 national GHG inventory.

7. Is there any off-site hazard from airborne emissions generated by the project?

No. The predicted maximum ground level ambient air concentrations of all potential contaminants calculated by air dispersion modeling are well below applicable standards at the property boundaries.

6.1.5 Geochemical

Geochemical Baseline

1. Expand the baseline chemical data over the entire site.

The baseline soil sampling grid has been expanded for the site as described in Section 3.8 for the Focus Report. Multi-element analysis was performed for all samples.

2. Soil sampling should be expanded to identify arsenic and mercury resulting from historic mining activity.

DDV Gold has conducted investigations into the presence of historic mine tailings on the site as detailed in the "Historic Mining" section of the Q&A

3. Determine why sample SED 9 showed anomalous lead values.

The anomalous lead value from SED 9 is attributed to a lead sinker from recreational fishing. Additional sampling was conducted with no anomalous results.

4. Sediment samples at the north end of Scraggy Lake show high levels of As, Cd and Pb. Include plans for avoiding such areas or outline how such areas will be managed to prevent mobilization of these contaminants into surface waters.

Treated effluent will be discharged from the polishing pond into an engineered wetland that will reduce flow velocity and minimize the likelihood of disturbing existing sediments. DDV Gold will make all appropriate applications to permit outflow structures which will include a detailed investigation of site specific conditions and mitigation measures as required.

5. Determine the source of cyanide in samples SED 5, 9, and 10 and consider mitigation measures to prevent contamination of Scraggy Lake.

Samples SED 5, 9, and 10 contained organic matter which was not suitable for analysis as stated in the EARD, p 107. Cyanide is a naturally occurring compound. Toxic forms of cyanide do not have sufficient stability to persist naturally for any length of time. Stable forms of cyanide which occur naturally, typically ferro-cyanide complexes, are not hazardous.

6.1.6 Wetlands

1. Provide more complete description of wetlands including ecological character, types and quality of peat, and quality and source of water.

Wetland reports (excluding spring flora survey and peat information) were provided in Appendix K of the EARD. Complete wetland reports are provided in the Supplemental Biophysical Surveys section.

2. Develop compensation plan with NSDNR and NSEL

DDV Gold will develop a suitable wetland compensation plan in consultation with NSDRN and NSDEL after the Touquoy Gold Project has been approved by the Province.

3. Can wetland #5 be avoided? If not, establish a monitoring point to assess downstream impacts.

Wetland 5 cannot be avoided at this point. A series of water quality monitoring stations will be established around the Project site, and a point downstream of Wetland 5 may be considered as a monitoring station. A wetlands compensation plan will be developed and submitted to NSDEL and NSDNR for approval.

4. Survey wetlands in spring 2007 to obtain additional info on flora and fauna.

Complete wetland reports, containing results of surveys in 2006 and 2007, are provided in the Supplemental Biophysical Surveys Section.

5. Ensure wetland approvals are secured prior to alteration or destruction of wetlands.

DDV Gold will ensure that all wetland approvals are secured prior to any alteration or destruction of wetlands on the Project site.

6.2 FLORA AND FAUNA

1. Describe the baseline studies done to assess flora and fauna in the Project area.

Descriptions of the baseline biophysical studies done for the Project up to March of 2007 were provided in the EARD. Baseline studies conducted since then are described in the Supplemental Biophysical Studies section of the Focus Report.

6.2.1 Moose

1. Examine the impacts of the development on the Eastern Shore Moose population.

Potential impacts were discussed at length in the EARD and are discussed further in Section 7.6.1 and the Moose Management Plan (Appendix W). DDV Gold is committed to assisting NSDNR and other parties in moose recovery efforts in Nova Scotia.

2. Provide a moose management plan with targets and measurable outcomes.

A moose management plan has been developed for the site and is provided in (Appendix W). However, the extremely low frequency of moose occurrence on the site makes developing a plan with measurable outcomes unrealistic. DDV Gold is committed to assisting NSDNR and other parties in moose recovery efforts in Nova Scotia.

6.2.2 Birds

1. Determine the risk of transmission of toxins from the TMF to waterfowl and other wildlife in the food chain.

This risk was discussed in the EARD. While the TMF will contain trace residual cyanide and arsenic, both of these substances will be present at levels below those considered harmful to wildlife. In addition, cyanide is short-lived and does not bioaccumulate in fish, thus it will also not bioaccumulate in fish-eating species. Arsenic also does not biomagnify in food webs. Arsenic in the TMF will be contained with the bottom sediments and elevated levels will not occur in the water column. The risk of transmission of toxins from the TMF to local food webs is very low.

2. Document migratory bird survey methods in detail.

Descriptions of the migratory bird surveys done in 2005 were provided in the EARD. Results and survey methods for migratory bird surveys conducted in 2007 are described in detail in the Supplemental Biophysical Surveys section of the Focus Report.

3. Investigate steps to sustain migratory land bird populations given the development will disrupt some mature forest habitat.

The Project will not have an effect on the sustainability of local migratory bird populations. While approximately 123 ha of forest will be cleared for the Project (see Figure 9.3 in EARD) that is not presently cleared or used for residential properties or roads, similar mature forest habitat is extensive within the local area.

4. Provide additional surveys for birds.

Migratory bird survey methods and 2007 bird survey results are described in detail in the Supplemental Biophysical Surveys Section.

6.2.3 Bats

1. Comment on the two yellow-listed bat species that were not mentioned in the EARD.

The two yellow-listed bat species which were not discussed in the EARD were not mentioned because there has never been a record of these two species in the area. The 100 km ACCDC database search and the 10 km Nova Scotia Museum environmental screening did not contain any records of these two species.

6.2.4 Aquatic Fauna

1. Provide final designs of watercourse crossings using bottomless culverts

DDV Gold will provide final designs of watercourse crossings using bottomless culverts once the Touquoy Gold Project has been approved by the province.

2. Undertake calculations to demonstrate that fish, particularly in the Moose River, will not be impacted by blasting

DDV Gold has completed calculations to show that fish will not be impacted by blasting. These calculations are provided in Section 3.

6.2.5 Odonates

1. Provide description of odonates potentially present on site and do a field survey if suitable habitat exists on site.

A desktop survey of odonates possible present on the Project site was conducted and is provided in the EARD. Odonates observed during wetlands and botany surveys on the Project site in 2007 were identified. No red- or yellow-listed odonate species were identified.

6.2.6 Lichens

1. Establish rigorous monitoring for rare lichens on site and boreal felt lichens in the area.

DDV Gold proposes to conduct additional lichen surveys in the area of Moose River Gold Mines to provide additional knowledge of these species in the area. Surveys supported by DDV Gold would cover an area equivalent to the area of the proposed Project footprint. These surveys are discussed in detail in Section 3.

There are no boreal felt lichens occurring within 8 km of the Project. No impacts to this species are predicted. DDV Gold will continue to liaise with NSDNR on boreal felt lichen programs.

2. Discuss the impacts of SO_2 on rare lichens on site and in the immediate area.

The potential impact of SO_2 on rare lichens on the site and in the immediate area is discussed in detail in Section 4. No impacts are predicted.

6.2.7 Plants

1. Provide additional surveys for endangered vascular plants for the adjusted site boundaries.

These surveys are provided in the Supplemental Biophysical Surveys Section. No red- or yellow-listed vascular plant species were encountered.

6.3 SOCIO-ECONOMIC

6.3.1 Community

1. How big is Moose River Gold Mines?

The town site is composed of 27 buildings.

2. How many people live in the community?

As of October 2007, there were 8 permanent residents occupying 4 residences.

3. Why does the town have to be disturbed?

The community was established in the midst of the historic mining works as was the custom of the day in the latter half of the 1800s. This was directly above the orebody. The existing town site now lies within or directly adjacent to the proposed open pit.

4. What will happen to the town site?

The buildings will be dismantled and the materials disposed of at an approved site. Some structures may be moved or re-used but most are in poor repair as the majority of houses are used as summer cottages or hunting camps rather than permanent homes.

5. How will the company acquire title to the land?

DDV Gold has made option agreements with the majority of landowners to purchase their properties at an agreed price once Project approval is received and project financing is in place.

6. Are there any benefits to the removal of the town?

Most of the remaining residents live in Moose River Gold Mines where there are limited services and amenities are limited because they don't have the means to leave. Well water in town is not potable and the site is generally contaminated by tailings and physical disturbance from historic mining activities. The mine development provides an opportunity for residents to relocate to a better serviced location and for the contamination caused by historic mining to be cleaned up.

7. What will happen to the provincial park at Moose River Gold Mines?

The park is located in the southwest corner of the proposed open pit. Developing the mine without disturbing the park would have significant impact on the Project economics because the park too, overlies the orebody. The park and its monuments will be relocated to a landscaped site overlooking the pit.

8. Why is it permitted to disturb the park?

The park was established to commemorate the famous rescue that occurred in 1936 as well as the long mining history at Moose River Gold Mines. As a result, the charter for the park is the only one in Nova Scotia that allows for mining inside the park boundaries. Also, similar to areas of the town, the park sits on top of ground contaminated by old mine tailings containing arsenic and mercury that will be cleaned up as a result of development.

9. What will happen to the park?

The park and its monuments (cairn and stamp mill) would be relocated by the Company, subject to stakeholder input and public safety and environmental considerations, to a site overlooking the open pit. The site would be landscaped.

10. What will happen to the museum?

Again, subject to stakeholder input, an interpretative centre would be established by the Company at the relocated park. The centre would ensure that the history at Moose River Gold Mines is preserved and allow visitors to make a connection between gold mining in the past and present, a common theme at many modern gold mining operations.

6.3.2 Employment

1. How many jobs will the Project generate during construction?

The Project is expected to employ 200 people for a period of 12 months.

2. How many jobs will the Project create during production?

The Project will employ approximately 150 people, fulltime including long-term contractors, for 5-7 years.

3. What will the wage standard be?

Rates of pay will commensurate with industry standards. The mining industry is the highest paying sector of the economy in Nova Scotia.

4. From where will the employees be hired?

The company expects to hire 90% of its employees from the Musquodoboit Valley and Eastern Shore. These regions, within 100 km of the mine site, are considered the "local area". This level of local employment has been targeted in the company's employment policy included in Appendix X.

5. Will local residents get first chance at job opportunities?

Yes. The company will partner with the job search centres in Middle Musquodoboit, Sheet Harbour, and Porter's Lake to advertise opportunities first. Given candidates of equal merit, the company will preferentially hire from the local area.

6. Will the company hire from outside the area?

Yes, if people with the requisite skills and aptitude are not available locally. It is expected that the Project will attract some Nova Scotians working elsewhere back to the province.

7. Will the company train employees?

Yes. The Project plan is based on hiring people with basic skills and aptitude and providing them with the specialist knowledge to operate the Project themselves. The Project will rely more on contract services until the workforce is fully trained but after 18-24 months it is expected that most tasks will be performed in-house.

8. How else will the Project benefit the local area in terms of employment?

The company will partner with federal and provincial agencies to assist candidates in the local area in upgrading their skills or qualifications, achieving certification in their chosen field, or returning to the workforce after a prolonged absence. These programs are available to any employer and do not constitute an additional burden on the taxpayer.

9. Will the company offer summer employment opportunities?

Yes. The company will offer summer employment opportunities to fulltime students enrolled in minerals engineering, geology, and or environmental studies.

6.3.3 Project Benefits

1. How much will the project contribute to the economy?

The project will cost about $70 M to construct and another $25-$35 M annually to operate. In terms of capital and operating cost, expenditure over the life of the project in Nova Scotia will be at least $220 M.

2. How much valued is added in Nova Scotia?

Gold is poured on site and only sold to a refinery outside Nova Scotia for final refining. This means 99% of the value is added in Nova Scotia with almost all benefit accruing locally.

3. How much will the project pay in taxes and royalties?

The province levies a royalty based on either the value of the gold produced or the net income from the operation. Royalties of at least $6M are expected to accrue to the Province over the life of the mine. In addition, the company will pay tax on profits once 110% of the initial investment is recovered. This treatment is legislated in Nova Scotia and many other jurisdictions to encourage investment in capital intensive industries.

4. Will the development improve local infrastructure?

Yes. The company will add 5 km of power line from Caribou Mines to the Moose River Road and upgrade 5 km of the Moose River Road line from single to 3-phase power. The company will work with HRM and the province to ensure that roads are safe to handle the added mine-related traffic. These infrastructure improvements will remain for the benefit of the local communities after the mine closes.

5. How efficient is the project's use of land?

The project would generate more than 2,000 man-hours of employment for every acre disturbed. This compares favourably with other resource industries.

6. What kind of spin-off benefit is expected from the project?

Typically in Nova Scotia, for every job created at a mine site, 2-3 jobs are created in the service sector to support operations.

7. Will there be other benefits to the local community?

At its reasonable discretion the Company will contribute to local worthy causes to improve the well-being of residents of nearby communities. The company will also partner with local community organizations to assist with special projects linked to environmental protection.

8. In what way is the project sustainable?

Sustainability is defined by the United Nations as "development which meets the needs of the present without compromising the ability of future generations to meet their own needs". The project will provide employment and economic growth with relatively minimal impact to the environment and without adversely affecting other community, business or recreational activities. When the project is closed the surrounding lands will not be diminished in value and the site will be reclaimed in a manner that provides equal or better value to the community than the land had before development.

9. Are the skills people develop a sustainable aspect of the project?

The skills, experience, and qualifications people gain by working at the mine will be transferable to other applications. For example, a welder who becomes a journeyman at Touquoy will be qualified to as a journeyman anywhere; an environmental technologist who learns how to manage water treatment at Touquoy will be qualified to do so elsewhere.

10. What's the project legacy for Nova Scotia in terms of promoting future economic growth?

The project will train Nova Scotians to apply best practice and modern technology to sustain mineral development in the province that is both economically beneficial and environmentally responsible. That means that the skills to develop mines which are financially, environmentally, and socially acceptable will reside within the province to drive future prosperity which does not come at the expense of the environment.

11. Is there a sustainable aspect to the company's planned community involvement?

If the mine contributes to improving community facilities that benefit remains long after the mine is closed. For example the Company has discussed the possibility of providing expertise or resources to aid in the liming of selected eastern shore rivers to promote the return of Atlantic salmon. Planned properly, such activities could become self-sustaining.

12. Does the company have any plans that will benefit the community at large in achieving a balance between development and environmental protection?

DDV Gold is committed to providing meaningful funding, once the Project is operational, to a relevant organization, or organizations, to assist in the acquisition of selected lands in Nova Scotia for conservation purposes and has undertaken preliminary exploratory discussions directly with representative of several organizations in this respect. The Company appreciates that such land acquisition would assist the Province in achieving its goal of legally protecting 12% of its total land mass by 2015 in accordance with the Environmental Goals and Sustainable Prosperity Act (Bill 146) Section 4(2)(a).

6.3.4 Traffic And Transportation

1. Implement appropriate safety and security measures with regard to public traffic passing through the site.

The public road will be fenced on both sides where it travels through the site. The road will be screened from active working areas by barriers of trees. During construction flag persons will control traffic flow. During operations, the two points where haul trucks must cross the road will be controlled by traffic lights. Traffic will be stopped during blasting which will be conducted about five times per week at a regularly scheduled, posted times.

2. The proponent should abide by the regulations for Interprovincial Movement of Hazardous Waste.

The Project has no requirement to move hazardous waste outside the province. Transport of sewage, garbage, or petroleum contaminated soils to appropriate disposal facilities will be performed by approved contractors in compliance with all applicable regulations.

3. Provide details about cyanide transportation.

Sodium cyanide (CN) will be transported in rugged, reusable, steel "flo-bins" (see details in Appendix Y – Cyanide Transport Route Report). The manufacturer (Dupont) is already permitted to ship CN in Nova Scotia by Transport Canada and will do so through an authorized local carrier. Dupont's emergency response plan is on file with the appropriate authorities.

Dupont has conducted a route hazard assessment to determine the final route to site. CN will be shipped by rail to Truro and road to site via Highways 102, 224, and the Moose River Road. Dupont will meet with interested parties in the relevant communities to explain how CN will be shipped and handled safely.

4. What is the anticipated traffic volume and route to site?

Heavy truck traffic to site is expected to average 6-10 trips per day for construction (1 year) and 2-4 trips per days for operations (6 years). Personal vehicles are expected to be about 30 on dayshift, Monday to Friday and 20 on nightshift and weekends. 2/3 of the traffic is expected to make use of the Moose River Road and 1/3 the Mooseland Road.

5. Are the roads safe for use by heavy trucks?

The Moose River and Mooseland roads are currently used by both private vehicles, school buses and 30t logging trucks. The roads are subject to annual repair to address surface cracking and potholes. At present, the condition of the roads is adequate for safe use. The increase in traffic resulting from the development is not large. DDV Gold will monitor road conditions during development. If a safety concern arises, the company will seek a solution cooperatively with HRM and provincial authorities.

6.4 TAILINGS MANAGEMENT FACILITY (TMF)

6.4.1 TMF Design

1. Describe the TMF site

The TMF is located about 1 km east of the open pit, south of the Mooseland Road which runs through the site. It comprises an area of about 130 ha of which 100 ha is used for tailings storage and 30 ha for water treatment. The ground slopes gradually from north to south at less than 2% and forms a shallow basin with slightly higher ground on the west and east flanks.

2. Describe the TMF

The TMF is composed of two areas, (1) the tailings impoundment and (2) the polishing ponds. The tailings impoundment stores the waste (sand and water) from ore processing which contains low levels of naturally occurring contaminants and process reagents, principally cyanide. The polishing ponds are used to treat and hold water for testing prior to discharge.

3. What other facilities exist at the TMF?

The tailings pipeline runs along the top of the dams and carries the tailings to each discharge point. The decant tower and reclaim water pipeline recover water from the tailings impoundment for re-use in the mill. The effluent treatment plant removes contaminants from excess water prior to discharge. An electrical substation and power line provide power to run the TMF facilities. At the north end of the TMF is located the containment cells used to store the waste from effluent treatment.

4. Describe the tailings dams

The dams for the tailings impoundment are "horseshoe-shaped" and approximately 3,000 m in length. At completion the dams will be 6-16 m high, 25-55 m wide at the base, and 8 m wide at the crest. They are constructed of waste rock from the open pit with a 6 m wide compacted clay core protected by 1 m of filter material. The core is keyed 1.5 m into bedrock or impermeable soils which are sealed with cement to inhibit seepage.

5. Describe the polishing pond dams

The polishing pond dams are of similar construction to the tailings dams but lower in height at 6 m. One side of the polishing pond makes use of a natural hill instead of a man-made dam. This is where the effluent treatment plant is located.

6. What are the divider dykes?

There are two divider dykes in the TMF, one in the tailings impoundment and the other in the polishing pond. Both divider dykes are rockfill structures without clay cores whose purpose is to contain tailings or precipitated solids allowing the decantation of clear water for recovery or discharge.

7. How many dams contain the tailings?

Four dams contain the tailings in the event of a failure. These are the two divider dykes, the main tailings dam, and the polishing pond dam. It is important to recognize that the tailings and polishing pond divider dykes are 4.5 m and 14.5 m high respectively and as such provide significant redundancy in the event of a primary dam failure.

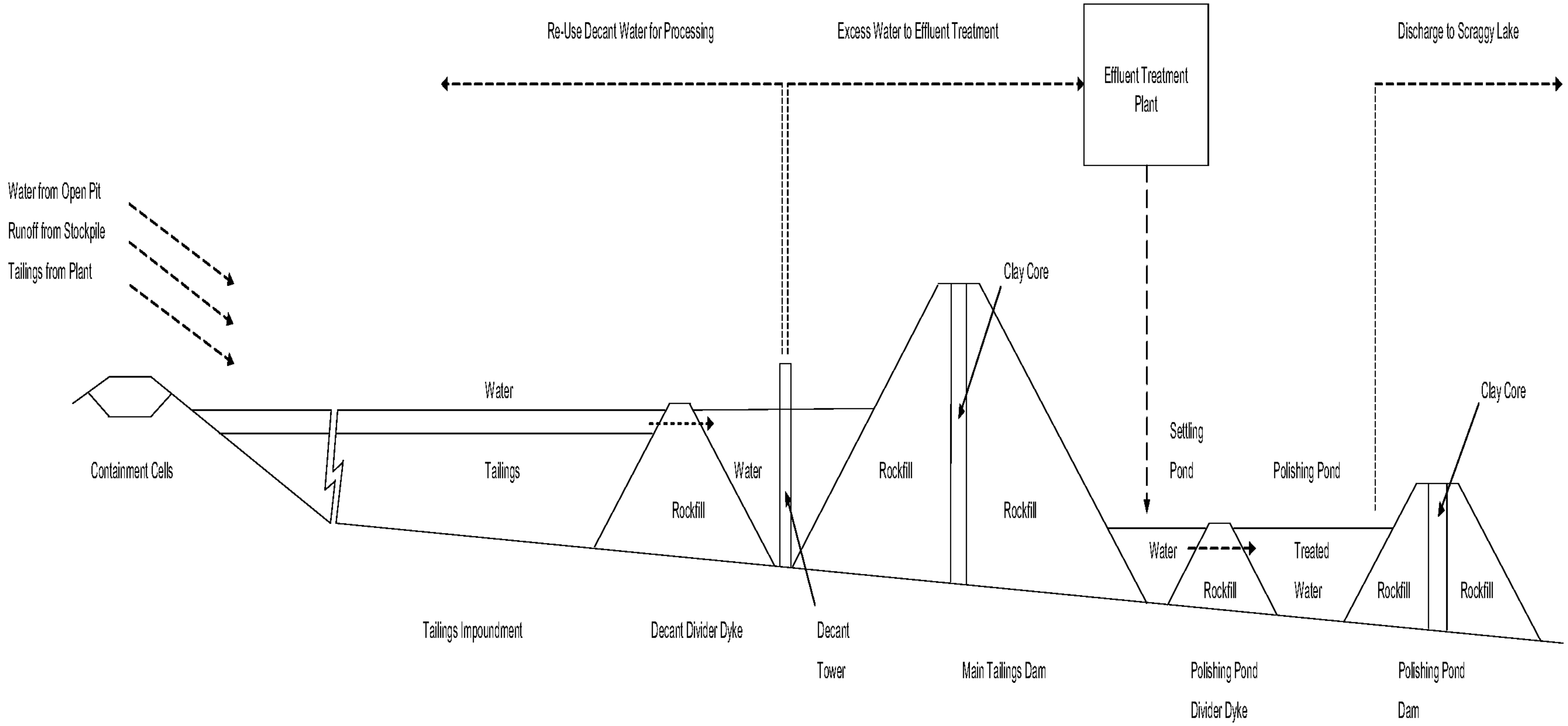


Figure 6.4-1 Touquoy Gold Project – Tailings Facility Operation Diagram
(Drawing not to scale)

8. How does the TMF function?

Tailings are stored in the tailings impoundment against the divider dyke. Water is retained 30-60 days before flowing through the divider dyke to the decant tower. Tailings water is reclaimed for use in processing. Excess water is treated at the effluent treatment plant. Contaminants settle out in the treatment pond. Clean water is retained and tested 7-30 days before discharge.

6.4.2 TMF Provisions For Management Of Extreme Weather

1. Are the dams equipped with spillways?

Yes. Spillways are designed to permit excess water to overflow from the tailings pond to the polishing pond where additional storage capacity exists and in the polishing pond dam for the discharge of treated water. The spillways are designed to handle the Probable Maximum Flood (PMF) which is equal to about 500,000 m^3 of inflow in 24 hours. This protects the dams from failure due to overtopping (see Q&A for Tailings Dam Failure).

2. What features have been designed into the TMF to enable the facility to manage extreme precipitation events?

The tailings impoundment has sufficient capacity to contain the inflow from the 1 in 200 year storm, equal to about 200,000 m^3 of water in 24 hours. In addition, the polishing pond has an additional 150,000 m^3 of surge capacity that can be used to contain excess water from the tailings impoundment if necessary.

3. Does this mean that if there is an inflow of more than 350,000 m^3 in 24 hours the TMF would overflow via the spillways?

No. The dam is raised annually to provide storage capacity for the tailings that will be generated in the coming year. The dam is always built up one year ahead of time to ensure that sufficient storage exists for the next year. This approach ensures that the surge capacity in the TMF never drops below 1.4 M m^3 as shown by the schedule in Figure 6.4-2.

4. What other operating practices have been adopted to enhance the facility's capacity to manage extreme weather?

The entire 600,000 m^3 of polishing pond capacity is available to address excess inflow during the spring thaw as these ponds will be drained each winter.

5. How do the TMF design standards for managing extreme inflows compare to local historical weather events?

Based on the data provided in Table 6.4-1, the TMF has enough surge capacity to contain without overflow 20x the rainfall that occurred during Hurricane Juan, almost 5x the precipitation from the largest event in the last 55 years, and almost 3x the Probable Maximum Flood.

Table 6.4-1 TMF Design Criteria compared to Largest Local Precipitation Events in Last 50 Years

Date	Location	Maximum Precipitation	Total Precipitation	Storm Duration	Equivalent TMF Inflow[1]
		(mm in 24 hrs)	(mm)	(hrs)	(m^3)
Probable Maximum Flood	Moose River	493	493	24	500,000
1/100 yr wet year[2]	Moose River	220	220	24	220,000
1/200 yr storm	Moose River	190	190	24	190,000
15/08/71	Halifax Airport	218	296	48	300,000
15/08/71	Middle Musq	173	243	72	240,000
10/12/75	Halifax Airport	99	99	24	99,000
22/07/83	Halifax Airport	90	90	24	90,000
29/09/03	Hurricane Juan	38	74	48	74,000

(1) TMF inflow volume if the event had occurred at Moose River
(2) Refers to wettest month (April) during spring thaw
(3) Probable Maximum Flood, 1/100 Year Wet Year, and 1/200 Year Storm criteria used to design tailings facility

Annual Dam Storage Capacity (m3 x 1000)

Month	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
PP Surge Capacity	150	150	150	150	150	150	150	150	150	150	150	150	150
TMF Surge Capacity	220	220	220	220	220	220	220	220	220	220	220	220	220
Current Year Dam	3000	2750	2500	2250	2000	1750	1500	1250	1000	750	500	250	0
Next Year Dam										750	1500	2250	3000
Total Capacity	3370	3120	2870	2620	2370	2120	1870	1620	1370	1870	2370	2870	3370

Based on 1,500,000 t x 1.4 t/m3 = 2,100,000 m3 tailings solids; 1,500,000 t x .55 = 850,000 m3 free water; remaining water intersticial in tailings

Figure 6.4-2 TMF Capacity by Month

6.4.3 TMF Seepage Management

1. Why doesn't the tailings dam leak?

The clay core of the dam is 6 m wide and designed to inhibit seepage. The core is keyed into bedrock or low permeability soil to a depth of 1.5 m. The bottom of the key trench is slush grouted (cemented) to seal cracks and provide a continuous barrier to seepage. Tailings are deposited against the dams to reduce seepage.

2. Are the dams impermeable?

No, however, the transmissivity of the clay core is designed to be 1 x 10^{-8} m/s which is extremely low. At this rate, it would take seepage 3 years to travel 1 m through this material.

3. How much seepage is expected?

Seepage is estimated at 18 m^3/d of seepage. This is 0.4% of the water volume being deposited in the TMF each day. This is about the volume of a typical 2-axle tanker truck seeping from an area the size of over 300 football fields.

4. Why doesn't groundwater go under the dams?

Groundwater flow in the area is predominately within 2-3 m of surface. This condition is caused by thin soils and bedrock which is neither highly weathered nor fractured. This is why the ground in the TMF area is so soggy.

5. How can we be certain of the subsurface conditions?

These conditions were confirmed by test pitting and drilling in the TMF area which characterized the top 3 m and next 7 m of bedrock as having transmissivities of 1 x 10^{-4} m/s 1 x 10^{-6} m/s respectively. This is less than the core of the dam but still <u>very</u> low.

6. Why can't water seep into the ground in the middle of the basin and escape through cracks in the rocks?

Transmissivity below the weathered layer of bedrock is estimated at 1 x 10^{-8} m/s, the same as the clay core of the dam. Thus the natural ground at depth is highly impermeable. The water level in the tailings impoundment will be managed through recycle and discharge so that sufficient hydraulic head is not developed to overcome the resistance to flow in the bedrock.

7. How can we know if water is escaping into the ground beneath the tailings basin?

Groundwater monitoring wells will be established on both sides and downstream of the TMF. Water levels and quality will be measured on a regular basis (see OMS monitoring schedule for details).

8. What can be done if contamination is discovered in groundwater?

Holes can be drilled along the downstream perimeter of the dam to identify the structure which is permitting the flow to occur. Grout can be pumped into the structure to seal it or a series of pumping wells can be established to collect the contaminated groundwater and return it to the TMF.

9. How is "design" seepage managed?

Design seepage, 18 m^3/d, will be intercepted by the seepage collection ditches on the east and west sides of the TMF. The polishing pond serves to collect seepage downstream of the tailings impoundment. Regular analyses of water from the collection ditches will indicate if seepage is present. Any seepage will be pumped back into the TMF as outlined in Figure 6.4-3.

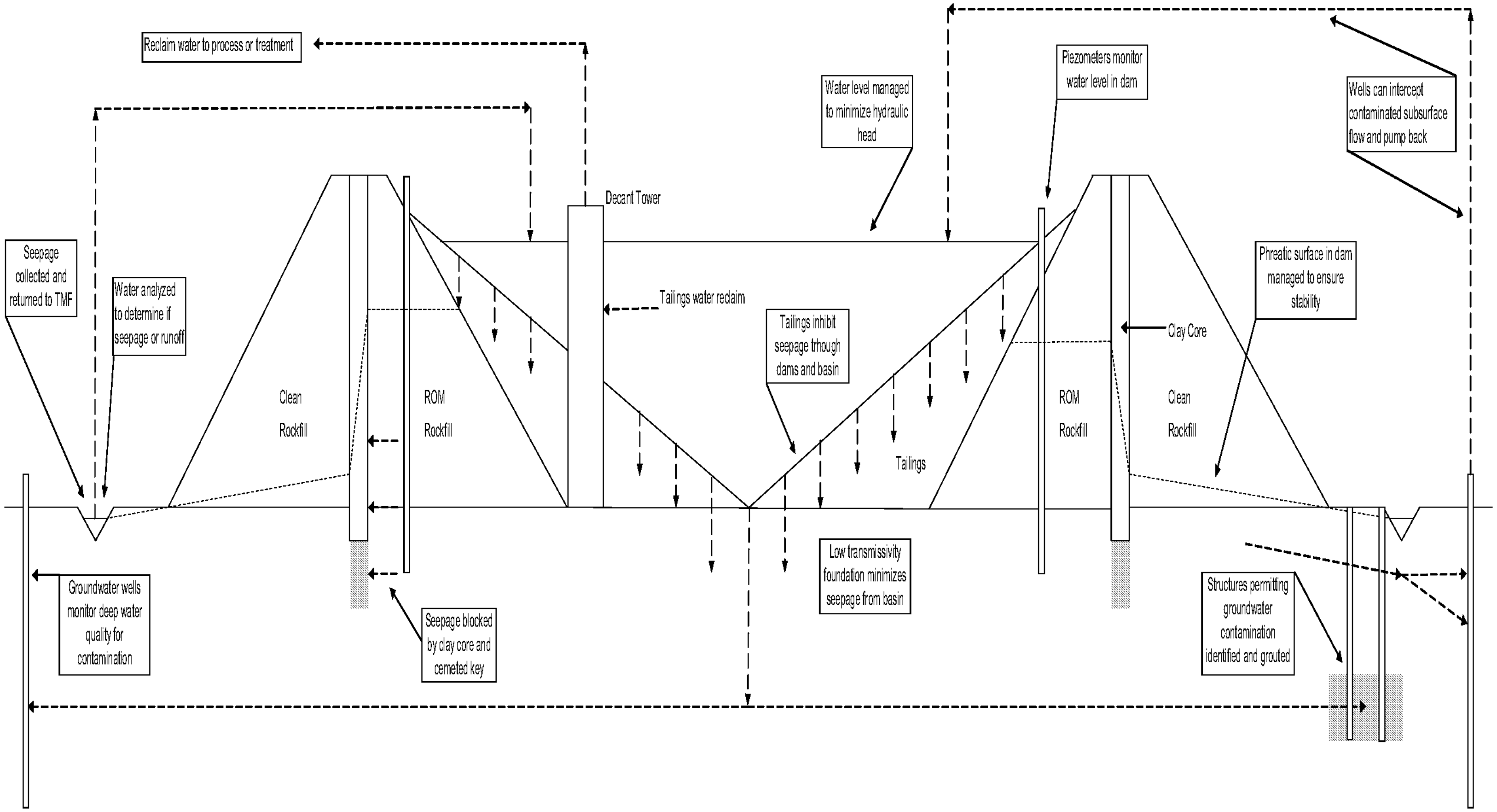


Figure 6.4-3 Touquoy Gold Project – TMF Seepage Management Systems
(Drawing not to scale)

6.4.4 TMF Monitoring

1. What items at the TMF are subject to inspection, by whom are inspections performed, and how often are they conducted?

The following table is excerpted from the TMF OMS Manual and details the schedule for inspections at the TMF.

Table 6.4-2 TMF Visual Inspection Schedule

TMF VISUAL INSPECTION FREQUENCY	General Manager	Mill Supt	Mine Supt	HS&E Supt	Mine Engineer	Environmental Tech	Safety Officer	Operations
TAILINGS LINE								
Main	A	Q	Q	M		D	D	S
Distribution	A	Q	Q	M		D	D	S
Spigots	A	Q	Q	M		D	D	S
DAMS								
Containment	A	Q	Q	M	M	D	D	S
Divider	A	Q	Q	M	M	D	D	S
Polishing Pond	A	Q	Q	M	M	D	D	S
DRAINAGE								
Ditches	A	Q	Q	M	M	D	D	S
Spillways	A	Q	Q	M		D	D	S
Discharge Channel	A	Q	Q	M		D	D	S
Seepage Collection	A	Q	Q	M		D	D	S
RECLAIM								
Decant Tower	A	Q	Q	M		D	D	S
ET Water Line	A	Q	Q	M		D	D	S
Reclaim Water Line	A	Q	Q	M		D	D	S
INFRASTRUCTURE								
Effluent Treatment Plant	A	Q	Q	M		D	D	S
Substation	A	Q	Q	M		D	D	S
Power Line	A	Q	Q	M		D	D	S
On-dam Power Dist	A	Q	Q	M		D	D	S
Roads	A	Q	Q	M	M	D	D	S

FREQUENCY	A	Annual	M	Monthly	S	Each Shift
	Q	Quarterly	D	Daily		

2. What other forms of monitoring are conducted at the TMF and what is their frequency?

The following table is excerpted from the TMF OMS Manual and details the frequency and nature of other monitoring at the TMF.

Table 6.4-3 TMF Monitoring Schedule

TMF MONITORING FREQUENCY	Hourly		Shift		Daily		Monthly		Quarterly
FLOWS									
Tailings to TMF	X								
Reclaim to Mill	X								
Effluent to ETP	X								
ETP to PP	X								
Discharge from PP	X								
WATER QUALITY									
Groundwater							X		
Seepage							X		
Tailings (ETP feed)			X						
ETP Discharge to PP			X						
PP Discharge					X				
WATER LEVEL									
Tailings Pond					X				
Polishing Pond					X				
Groundwater Wells							X		
Piezometers							X		
PHYSICAL									
Settlement							X		
Topographic Survey							X		
Tailings Beach Survey									X
Bathymetric Survey									X

6.4.5 Tailings Dam Failure

1. What is the probability of a tailings dam failure?

During the period, 1950-1986 approximately 8800 large embankment dams were constructed. The average annual frequency of failure is 2.7 x 10^{-4} or about 3 in 10,000. Assuming that there are 10,000 large dams in the world, on average, there are three failures somewhere every year.

2. What are the modes of dam failure?

Overtopping and piping each account for about 45% of all dam failures. The remaining 10% are the result of slides caused by geotechnical conditions (8%) or earthquake (2%). Overtopping occurs when the water behind the dam overflows the dam crest. Piping occurs when water pressure disrupts the internal dam stability initiating a collapse from within and is typically a function of poor design (no zoned material to handle internal water pressure) or inadequate quality control during construction.

3. How do these statistics relate to the Touquoy tailings dam?

Based on the provision for spillways in the design and capacity to contain a minimum of 3x the PMF, the likelihood of overtopping is almost zero. The probability of a piping failure is similarly low given that the clay core is protected by a filter zone and that the designer will oversee construction. Failure due to geotechnical conditions is unlikely as the ground is only gradually sloping and bedrock is near surface. Thus, the only reasonable possibility of failure is due to earthquake which accounted for only 2% of all dam failures worldwide from 1950-1986.

4. To what design standards are the tailings dams designed?

The design standards for the tailings dam are specified by the Canadian Dam Association safety guidelines (Appendix Z). The consequence of failure for the dam is considered "significant" to "high" therefore the dam is designed to withstand horizontal acceleration due to a seismic event of 0.15 g, the equivalent of a magnitude eight earthquake. An earthquake of this magnitude has never occurred in Nova Scotia in recorded history.

5. How do the safety standards for the dam design compare to those for other infrastructure in the local area?

The building code for the area specifies that structures should be designed to withstand a horizontal acceleration of 0.5 g, the equivalent of a magnitude five earthquake. As the

Richter scale is logarithmic, the tailings dam is designed to withstand seismic forces >1000x higher than those that existing roads, bridges, and buildings constructed locally can manage.

6. What is the probability that an earthquake will cause a tailings dam failure at Touquoy?

The tailings dam is designed to withstand 80% of the MCE (maximum credible earthquake) which is estimated to occur once in 10,000 years. Therefore, in any given year there is a 1/10,000 chance or a 0.0001 probability that an earthquake could occur that could cause the dam to fail.

7. What would be the relative effect of the MCE on Halifax and the tailings dam?

The same seismic event that would devastate Halifax, destroying bridges, roads, and multi-story buildings, would leave the tailings dam intact.

8. What are the projected consequences of a tailings dam failure?

A finite element model was used to simulate the effects of a tailings dam failure. The worst case scenario was a mudflow resulting from the following conditions:

- Earthquake in excess of the MCE (probability 1/10,000)
- Maximum design storage (occurs at the end of the mine life)
- Accommodating inflow from PMF (probability 1/200)

Based on only two barrier dams and no functioning spillways, it was estimated that 500,000 m^3 of tailings solids would flow a maximum of 600 m into the north end of Scraggy Lake. This volume amounts to about 2.0% of the total lake volume.

In addition to the solids, approximately 2.5 M m^3 of tailings water would be released from containment. The water would raise the level of Scraggy Lake a maximum of 0.35 m (1 ft) and would flow downstream at a rate not in excess of that experienced during normal spring runoff. Associated with the tailings water would be 24,000 m^3 of sediment.

9. Should the results of the dam failure analysis be qualified in any way?

Yes. In order to produce meaningful results of failure, it was necessary for the analysis to ignore two of the four dam barriers and assume that the spillways were inoperable. In other words, if all the safety features designed into the dam are considered, the possibility of failure is negligible and the impacts are minimal.

The probability of the worst case scenario occurring is 1 in 2,000,000; the probability of the PMF occurring in the same year as the MCE. Even this is grossly conservative since the earthquake would have to happen during the same day the flood occurred.

The simulation estimated that 90% of the tailings were retained behind the two dams considered. It follows that each additional barrier would also retain 90% of the tailings that collect behind it. Based on this reasoning, the expected tailings release considering all four barriers would be only 5,000 m^3 or 0.02% of the volume of Scraggy Lake.

10. What would be the impact of the tailings water release caused by a failure on the downstream watershed?

Untreated effluent would already be below MMER limits at the time of release into Scraggy Lake. Harm to aquatic life is expected to be confined to Scraggy Lake with acute toxicity limited in nature and persisting no longer than the initial period of mixing (< 24 hours). The impact on various water quality parameters is shown in Table 6.4-4 and described in detail in the memo, "Impact of Tailings Effluent Release as a Result of Dam Failure" which can be found in the appendices.

Table 6.4-4 Projected Downstream Water Quality 30 Days after Possible Dam Failure

Parameter		Units	MMER	CCME	TMF	Scraggy Lake	Fish River	Lake Charlotte
Acidity		pH			8.2	5.2	5.1	5.0
Aluminium		mg/L	---	0.005	0.009	0.188	0.197	0.199
Ammonia		mg/L	---	2.2	17.6	1.1	0.3	0.1
Arsenic		mg/L	0.5	0.0050	0.4720	0.0300	0.0120	0.0058
Cadmium		mg/L	---	0.000017	0.000003	0.000190	0.000050	0.000020
Chromium		mg/L	---	0.0099	0.0008	0.005	0.002	0.0012
Copper		mg/L	0.3	0.002	0.240	0.016	0.005	0.002
Cyanide		mg/L	1.0	0.005	0.200	0.013	0.004	0.002
Iron		mg/L	---	0.300	0.150	0.197	0.199	0.200
Lead		mg/L	0.2	0.0010	0.0014	0.0004	0.0003	0.0003
Nickel		mg/L	0.5	0.025	0.005	0.001	0.001	0.001
Selenium		mg/L	---	0.001	0.003	0.001	0.001	0.001
Silver		mg/L	---	0.0001	0.0002	0.0001	0.0001	0.0001
Zinc		mg/L	0.5	0.0300	0.0200	0.0100	0.0175	0.0194

🟩 ≤ CCME 🟨 Marginally > CCME 🟥 > CCME

11. How would a release of untreated water affect Lake Charlotte?

The only effect on water quality in Lake Charlotte after 30 days is expected to be a nominal increase in arsenic concentration, 0.0040 mg/L to 0.0058 mg/L, causing no hazard to human health and only moderately exceeding the CCME guidelines for protection of aquatic life.

12. Would there be any impact on marine water quality as a result of a release of tailings water due to a dam failure?

No, further dilution would completely mitigate the effects of any contamination on coastal waters.

13. How long will it take for watershed water quality to fall within CCME guidelines after a dam failure?

Water quality in the watershed would be expected to return to CCME guideline levels within 1-1.5 years.

14. How will the community know if water quality has been affected by a release of untreated tailings water due to a dam failure?

The company will undertake baseline water quality sampling in marine areas, rivers, lakes, and wells which could potentially be affected. Comparison of baseline to actual will determine if company activities have affected water quality.

15. How can the community be assured that the company will have the means to address harm caused by a dam failure?

The company will carry multi-million dollar insurance coverage that will be available to pay for clean-up, compensation, or land replacement in the event of a dam failure or uncontrolled release of untreated tailings water. This is not a legal requirement and is over and above the legislated need to post a reclamation bond.

6.4.6 TMF Disaster Management

1. What principles have been used to develop the disaster prevention plan for the Project?

No single measure is guaranteed to work 100% of the time. The only way to guarantee that the probability of a disaster is minimized is through redundancy and the use of complementary systems. This is the basis for the "fail-safe" disaster management philosophy used to design the Project.

2. What are examples of redundancy in the Project design related to disaster prevention?

The multi-barrier dam design places tailings behind four rockfill barriers so if one fails there is no loss of containment. At any given time, the tailings impoundment has enough capacity to contain almost 3x the probable maximum flood which is 7x the inflow from the 1/200 year storm.

3. Why not increase redundancy to eliminate the possibility of an emergency?

The tailings dam is designed to withstand 80% of the maximum credible earthquake (MCE). The MCE is projected to occur once every 10,000 years and has never occurred in Nova Scotia in recorded history. The risk of failure could be reduced further by building to a design standard of 100% of the MCE. This would result in significant increase in cost without any real increase in safety. This is precisely why the seismic safety standard for buildings and bridges in Nova Scotia is 3000x lower than that for the tailings dam.

4. If it is not practical to build in excessive levels of redundancy how is the risk of accident minimized?

Once the harm associated with an accident is minimized through design, complementary systems are used to reduce the probability of occurrence reducing the risk.

5. What are examples of complementary systems?

The four systems used to prevent and manage disasters in the Project design are:

- Engineering Design
- Operating Procedures
- Surveillance and Monitoring
- Contingency Plans

6. How do complementary systems work together to keep the Project safe?

The Project is designed to handle worst case conditions. The operating procedures are established to maximize design performance. Performance is monitored continuously to ensure performance achieves plan. Deviations from plan are assessed and corrective action taken as required. Contingency plans exist to respond when corrective action is ineffective and an emergency occurs.

7. What sort of incidents qualify as emergencies?

Table 6.4-5 is excerpted from the TMF OMS Manual and shows the events that qualify as emergencies and the responsibilities associated with each depending on severity.

Table 6.4-5 Emergency Classifications

	Level 1	Level 2	Level 3
Resources	Department	Site/Local	Site/Local/Off-Site
On-Scene Leader	Safety Officer	Health Safety & Emergency Support	Health Safety & Emergency Support
ER Responsibility	Mill GF	Mill Support	General Manager
Notification			
Internal	Department Management	Site Management	Corporate Management
External	None	Local Emergency Room Services	Public/local government
Area Control	Scene	Tailings Management Facility	Mine Site
Example	Minor motor vehicle accident	Motor vehicle accident with injuries	Dam overflow
	Minor fire	Major fire	Dam failure
	Minor t-line leak	T-line rupture	
	Downed powerline	Serious Injury	
	Chemical spill		

8. What is the general emergency response procedure (ERP) for the TMF?

The general ERP for the TMF is based on nine elements:

- Activation (alarm)
- First Response
- Communications

- Notification
- Shutdown of Operations
- Evacuation
- Specific Emergency Response
- Deactivation
- Resumption of Operations

The entire procedure excerpted from the TMF OMS Manual can be found in Appendix AA.

9. In the event of extreme weather, how is it decided if an emergency is to be declared?

The situation is managed through the elevated and extreme inflow protocols. If the pond level encroaches on design freeboard hourly monitoring is implemented. If the rate of rise exceeds 10 mm/hr then an emergency is declared. A description of the decision process can be found in Appendix AA.

10. Who is notified in the event of an emergency?

In the event of an emergency, site personnel, offsite emergency services, and local government will be notified depending on the severity of the emergency as shown in Table 6.4-5.

11. What happens after notification of an emergency?

Operating activities in the affected area will be stopped and all non-essential personnel will be evacuated. Depending on the severity of the emergency this could entail shut down of the entire site. The mine will also undertake to evacuate downstream areas if the situation presents a risk to persons at Scraggy Lake.

12. What specific actions will be taken to address a tailings dam failure or overflow?

Operations will seek to (1) reduce the water level in the TMF, (2) prevent sediment from flowing downstream, and (3) provide containment. All of these actions are described in excerpted sections of the OMS Manual found in Appendix AA.

13. How would the water level in the TMF be reduced?

If an emergency were declared, the mine and mill would be shutdown. The reclaim water and tailings pipelines would be relocated so that water could be pumped from the TMF into the open pit. Reconfiguring the pipelines would take 12-24 hours.

14. How would sediment be prevented from flowing downstream?

Two kilometres south on Scraggy Lake the lake narrows to a span of 50 m. A net composed of braided steel cable containing hay bales called a "siltation barrier" will be winched across the lake at this point. The barrier will decrease the rate of flow through the narrows causing suspended sediment to drop to the bottom. The barrier will be put in place and maintained as part of normal operations. Its deployment will take a matter of minutes.

15. How would flow from a failure be contained?

Mining equipment from the open pit would be used to load material from the waster rock stockpile to be used to build containment berms or repair the dam. The multi-barrier dam design ensures that even in the event of a failure, considerable material would be available at the site of the breach to block the flow.

16. Who is responsible for responding to a dam failure or overflow?

The duties of each responsible person are specified in the excerpt from the OMS Manual found in Appendix AA.

6.5 WATER

6.5.1 Water Usage And Management

1. Where does the water come from to run the Project?

1.3 M m^3/yr of water or 90% of the water used in processing is recycled from the tailings pond as stated in the EARD, p40.

2. Why isn't all the water recycled?

Fresh water is required for drinking, safety showers, gland seal pumps, and some reagent mixing. This is called "make-up" water.

3. How much "make-up" water is required?

During normal operations, the plant needs about 20 m^3/hr of water which is drawn from Square Lake. This is less than the recharge in any given month and therefore has no impact on the lake.

4. Where does water come from during start-up?

The tailings facility construction will start in April and be completed by October regardless of when the plant actually starts up. Once the dam core is keyed into bedrock water from runoff will accumulate in the tailings basin. Approximately 300,000 m^3 of water will be required to begin recycling. Table 6.5-1 shows that during the dam construction period site runoff will provide sufficient water to start up the plant eliminating the need to withdraw significant quantities from Square Lake.

Table 6.5-1 Runoff Available for Plant Start-Up

Month	Site Runoff	
	Average Year (m^3)	Wet Year (m^3)
June	126,000	210,000
July	131,000	219,000
August	130,000	218,000
September	130,000	218,000
October	155,000	259,000
Total	672,000	1,124,000

5. How much water has to be discharged from the site?

In an average year, 1.5 M m^3 of water, over and above the needs of processing will report to the site in the form of seepage from groundwater, precipitation, snow melt, and runoff. In a "wet" year, this volume can increase to 2.5 M m^3.

Why does excess water have to be discharged?

Excess water must be discharged to minimize the size of the TMF, minimize seepage, and ensure the stability of the dams. The larger the TMF the greater the footprint and resulting disturbance; the larger the volume of water stored the greater the potential for seepage and instability.

6. How does water from all over the site get to the TMF for discharge?

Water from the open pit is collected in sumps and pumped via pipeline to the TMF. Runoff from the waste rock stockpile drains by gravity via ditches to the TMF. Runoff from the plant site reports to the process water pond. Excess plant site water reports to the TMF with the majority of waste water via the tailings pipeline.

7. Why does all the runoff from site go to the TMF prior to discharge?

All site runoff is potentially contaminated. Runoff from the open pit and waste rock stockpile may contain arsenic and other elements which have leached out of the natural rock. Runoff from the plant site could potentially be contaminated by residue from a reagent spill. The same contaminants present in tailings may be present in runoff water at lower concentrations.

8. What systems are available to treat contaminated water on the Project site?

The Project employs five treatment systems to clean contaminated water prior to discharge. These are:

- Cyanide destruction
- Natural degradation
- Settling
- Effluent treatment
- Wetland purification

6.5.2 Acid Rock Drainage (ARD)

1. What causes ARD?

ARD is caused by the oxidation of sulphide minerals, primarily pyrite and pyrrhotite, which are commonly associated with metal deposits. The waste rock associated with the ore typically contains less than 0.3% sulphide minerals which limits its capacity to generate significant quantities of acidity.[2]

2. Why are the rocks at Moose River not prone to acid generation?

The rock hosting the Touquoy deposit (Moose River formation) contain a preponderance of carbonate minerals[3] which neutralize acidity generated by sulphide mineralization present. In contrast, many regions in Nova Scotia including the nearby Halifax Airport (Halifax formation) are devoid of carbonate minerals and highly prone to acid generation.

3. How do we know that mineralogy at Moose River inhibits acid generation?

---

[2] Table 5, Acid-Base Accounting Results, Geochemical Study (Ver 2), Golder Assoc, Aug 2007

[3] Golder Assoc, Aug 2007

Mineralogical studies were conducted which concluded that while 50-100% of pyrite and pyrrhotite were locked in within the silicate matrix and not available to produce acidity, 50-80% of carbonate minerals present were readily available for neutralization.[4] In addition, studies showed that 70-100% of carbonate mineralization was in the form of calcite which has the highest neutralizing potential of all carbonate minerals.[5] In other words, the minerals that neutralize acidity are chemically active while those that produce acidity are not.

4. What is ABA testing and what does it tell us about ARD potential at Touquoy?

ABA stands for Acid-Base Accounting. It measures the ratio of neutralizing potential (NP) to acid potential (AP) and provides a qualitative measure of the potential for material to produce acidity. The proportion of AP to NP is called neutralization potential ratio (NPR) as described in Table 6.5-2.[6]

The ABA testing of waste rock showed that over 70% of the 80 waste rock samples tested had no capacity to generate acid, NPR > 4. Of the remainder, 20% had low AP and only 10% were considered "possibly" or "likely" acid generating.[7]

5. What is NAG testing and what does it tell us about ARD potential at Touquoy?

NAG stands for Net Acid Generation. It is a qualitative indicator for acid generation under long-term or terminal conditions. NAG-pH is measured after the complete oxidation of all sulphide minerals and dissolution of all NP. Testing showed that only 5% of all waste samples had acidic NAG-pH. Most significantly, all the samples which had shown low AP returned NAG-pHs of 7-10, neutral to highly alkaline.[8] This indicates that the long-term potential for acid generation is very low.

Table 6.5-2 Neutralizing Potential Ratio Scale by Price (1977)

Potential for ARD	Criteria	Comments
Likely	NPR < 1	Likely acid generating unless sulphides non-reactive
Possibly	1 < NPR < 2	Possibly acid generating if NP is insufficiently reactive or depleted at a faster rate than sulphides
Low	2 < NPR < 4	Not potentially acid generating unless extremely reactive, highly exposed sulphides combined with insufficiently reactive NP
None	NPR > 4	Not expected to generate acidity

---

[4] Geochemical Study (Ver 2), Results, p15-16 Golder Assoc, Aug 2007
[5] Geochemical Study (Ver 2), Results, p15, Golder Assoc, Aug 2007
[6] Geochemical Study (Ver 2), Methods, p10, Golder Assoc, Aug 2007
[7] Geochemical Study (Ver 2), Results, p17-26, Golder Assoc, Aug 2007
[8] Geochemical Study (Ver 2), Results, p19, Golder Assoc, Aug 2007

6. What is kinetic testing and what does it tell us about ARD potential at Touquoy?

Kinetic or humidity cell tests are repetitive leach tests designed to evaluate material reactivity, mass loading and/or resultant water quality over time (see Appendix BB - Kinetic Test Summary). Humidity cell testing is typically conducted over a 20 week period which experience has shown to be a good indication of terminal water quality. All 10 waste rock humidity cells returned pHs of 6.8-7.8 over 16 weeks indicating no long-term potential for acid generation.[9]

7. Is there any other evidence that ARD will not be a significant issue at Touquoy?

Yes, groundwater analyses of samples taken from boreholes drilled in the pit area return pHs of 7-8.[10] In addition, a test pit, 30 metres deep and 60 metres in diameter, was developed by Seabright Resources in 1989. The excavation is located where the orebody outcrops (comes to surface) and therefore has exposed sulphide-rich mineralization to the effects of air and water for 18 years. The water in the flooded pit is pH 6.5-7.9[11] (depending on season) and hosts a fish population. The mini-pit serves as a "living-laboratory" further demonstrating that acid generation at Touquoy will not be prevalent.[12]

8. Does the ore have potential to generate acid?

Partly. 90% of the ore samples tested showed potential to produce acidity on the basis of ABA. These nine samples of selected 1m lengths of drill core are not representative of the orebody as a whole. Sulphide concentrations ranged from 0.1-1.0% and averaged 0.5%. Extensive ore testing was not conducted because all ore will be milled during the mine life.

45% of the marginal (low grade) ore samples tested had some potential to generate acidity, however, not unlike the waste rock, none had an NPR less than 2 and all samples subject to NAG testing returned NAG-pHs between 7 and 11.[13] The kinetic testing on marginal ore returned a 16 week pH of 6.9.[14]

9. Will ore stockpiles remaining at the end of the mine life present a potential for ARD?

---

[9] Geochemical Study (Ver 2), Appendix B, Kinetic Test Results, Golder Assoc, Aug 2007

[10] "Potential for Acid Rock Generation – Review of Water Chemistry Data", K. Phinney, Aug 2007

[11] "Potential for Acid Rock Generation – Review of Water Chemistry Data", K. Phinney, Aug 2007

[12] Geochemical Study (Ver 2), Conclusions, p33, Golder Assoc, Aug 2007

[13] Geochemical Study (Ver 2), Results, p27, Golder Assoc, Aug 2007

[14] Geochemical Study (Ver 2), Appendix B-6, Golder Assoc, Aug 2007

All ore down to a cutoff grade of 0.5 g/t is planned to be processed during the mine life. No ore stockpiles are expected to remain after closure. The ability to "sell-forward" production will enable the Company to ensure that this is the case. As a contingency, any remaining ore stockpiles can be re-handled into the pit where flooding will prevent any further oxidation of sulphides present.

10. Do tailings have potential to generate ARD during operation and after closure?

Although ABA testing showed AP for all samples, NAG-pH was 7.5-10 in every case. The humidity cell pH for one sample was mildly acidic to neutral, 6.3-7.8, and neutral for the other. Depletion rate calculations indicate that sulphides will deplete before neutralization potential.[15] The tailings are not expected to be acid generating due to low sulphide concentrations and the availability of carbonate minerals.[16]

11. Why do the tailings samples exhibit lower AP than the 9 individual ore samples?

The tailings were generated from representative ore composites created by sampling numerous intervals from many drillholes over both the entire pit and each specific area. These ore composites used to generate the tailings are representative of the entire orebody.[17] On the other hand, the small population of ore samples subject to direct testing represent only localized (1 m)[18] intercepts of high grade mineralization and was intended to characterize material that was distinctly ore, not to be representative of all ore.

12. Is high sulphide waste an issue for ARD and what provisions have been made to manage it?

High sulphide waste is not expected to be an issue as the high grade ore zones, which contain more sulphide than waste rock, typically average no more than about 0.5% sulphides.[19] During operations, sulphide and carbonate content will be determined by blasthole assay to identify any zones of high sulphide waste within the material being mined. Any high sulphide waste encountered will be mixed with material possessing excess NP during placement in the waste rock stockpile to minimize short and long-term ARD issues. No high sulphide waste will be used for earthwork construction and in particular none will be used on the outer faces of the tailings dam walls.

13. Is sampling for ARD testing adequate?

---

[15] Geochemical Study (Ver 2), Appendix B-8, Golder Assoc, Aug 2007

[16] Geochemical Study (Ver 2), Results, p29, Golder Assoc, Aug 2007

[17] "Gravity Concentration, Leaching, Flotation, and Other Testwork on Samples from the Touquoy Gold Deposit', Appendix I, Composite Samples, PJ Lewis, Sep 2006

[18] Geochemical Study (Ver 2), Methods, p6, Golder Assoc, Aug 2007

[19] Geochemical Study (Ver 2), Acid-Base Accounting Results, Table 5, Golder Assoc, Aug 2007

Based on a review of the drill logs and cross sections it is expected that the existing samples provide a good overview of potential conditions in the overall pit, including the western portion.[20] During future in-fill drilling, confirmatory sampling will be conducted in the centre portion of the west end of the pit to further evaluate sulphide concentrations.

14. What measures are in place to manage ARD which may occur during operations?

All water on site be it runoff from the waste rock stockpile, plant site, or open pit is collected and directed to the tailings management facility (TMF). This water is either recycled for use in processing or treated to remove contaminants and discharged. During treatment, pH is adjusted with lime to be neutral (7-8) thus any acidity from ARD will be neutralized.

15. What measures are in place to manage ARD which may occur after closure?

Treatment of water discharged from site will continue until water quality returns to pre-existing levels. Any acidic runoff from the waste rock stockpile or the tailings themselves will be directed to the reclaimed TMF and neutralized prior to discharge.

16. Is it reasonable to expect that the Project will have a long legacy of ARD?

No. Depletion calculations based on humidity cell results for waste, marginal ore, and tailings, indicate that the depletion rate of sulphides is either equal to or faster than that of NP or, in the instances where the depletion of NP is faster, the % sulphides is so low that long-term acid generation is not expected.[21] These conclusions are supported by the results of NAG-pH and kinetic testing and lead to the expectation that there will not be a long legacy of ARD at the Project site.

17. What general conclusions can be drawn from the results of testwork with regard to the potential for ARD at Touquoy?

Calcite is the dominant control on buffering capacity. As calcite is very effective in providing neutralizing capacity, even at NPRs of 2-4, net neutral conditions are likely to be realized.[22]

---

[20] Geochemical Study (Ver 2), Methods, p6, Golder Assoc, Aug 2007
[21] Geochemical Study (Ver 2), Results (humidity cells), p17-27, Golder Assoc, Aug 2007
[22] Geochemical Study (Ver 2), Results, p31, Golder Assoc, Aug 2007

6.5.3 Cyanide Destruction

1. What is cyanide destruction?

The Project employs a dedicated process circuit to destroy the residual sodium cyanide after it is used to extract the gold from the ore. The system is called the INCO SO_2/Air process. It is acknowledged as the most effective way to detoxify tailings after cyanidation. It was developed by INCO (now CVRD) in the 1980s in response to the need in Canada to meet higher standards for cyanide management. It is used in six of the ten Canadian gold mining operations which employ a cyanide destruction circuit (see Appendix CC - Fate of Cyanide Reagent).

2. Are all forms of cyanide harmful?

No. There are three primary forms of cyanide: free cyanide (CN_F), weak acid dissociable cyanide (CN_{WAD}), and ferro-cyanide complexes. Free cyanide is directly toxic. CN_{WAD} is potentially toxic because it readily decomposes at low pH creating free cyanide. Ferro-cyanide complexes are non-toxic. They occur naturally, are highly stable, and are used as preservatives in the food industry and additives in animal feed.

3. How does the INCO SO_2/Air process work?

The toxic forms of cyanide, free cyanide (CN_F) and weak acid dissociable cyanide (CN_{WAD}), are oxidized to a compound called cyanate (CNO^-) which is 100x less toxic.

4. How effective is INCO SO_2/Air on the Touquoy ore?

Test work conducted indicates that the Touquoy ore is highly amenable to cyanide destruction because it contains few impurities which could interfere with the reaction. The results of test work showed that INCO SO_2/Air reduced the concentration of total cyanide (CN_T) from 170 ppm to 2.7 ppm in 4 ½ hours. These results are provided in Appendix A of the EARD.

5. What happens to the cyanate?

Cyanate readily decomposes into carbon dioxide and ammonium in the tailings impoundment.

6. Why doesn't the breakdown of cyanate form ammonia?

The reaction is pH dependent. At high pHs ammonia would be formed which is poisonous in high concentrations to aquatic life. The pH in the tailings pond will be 7-8 which means the reaction will preferentially form ammonium rather than ammonia.

7. Is there any harm caused by the production of ammonium?

Ammonium is a source of nitrogen which at high concentrations can promote algal growth and oxygen depletion in receiving waters. Treated water will be discharged into an engineered wetland to fix dissolved nitrogen and eliminate the potential for eutrophication.

8. How much cyanide is left over after the cyanide destruction process?

The concentration of cyanide after cyanide destruction is 2.5-3.5 ppm based on the results of the AAMTEC detoxification study in the EARD and effluent treatment test work performed recently (see Appendix DD – Effluent Treatment Testwork). Of this, 20-25% is ferro-cyanide and the remainder is CN_{WAD} which is potentially toxic. For comparison cyanide concentrations above 50 ppm are considered harmful to terrestrial fauna.

9. What happens to the residual cyanide which isn't immediately destroyed?

That cyanide remains in the tailings water which is transferred with the tailings solids to the TMF. In the TMF, the residual cyanide undergoes a process called natural degradation where the remaining CN_{WAD} breaks down (hydrolysis) in the presence of water and sunlight. The cyanide forms hydrogen cyanide (HCN) gas in low concentrations which is dispersed harmlessly in the atmosphere and the metals, under the mildly basic conditions in the TMF, form insoluble hydroxides which settle out with the tailings solids.

10. How long does it take for the residual cyanide to break down?

The TMF is designed with sufficient capacity to retain tailings water for 30-60 days before recycle or treatment. Effluent treatment testing recently completed showed that the total cyanide concentration in tailings effluent dropped from 3.5 ppm to 0.21 ppm over a period of 55 days.

11. Why isn't the HCN gas emitted from the TMF hazardous?

The HCN resulting from natural degradation is emitted at such low concentrations that it is not hazardous. Studies have shown for tailings facilities where the only method of cyanide destruction was natural degradation; concentrations of HCN one metre above the surface of the pond were so low as to be not measurable.

6.5.4 Effluent Treatment

1. Why is settling considered treatment?

Contaminants are carried in the solids suspended in runoff or tailings water. Settling out these sediments with the tailings removes these deleterious materials and permits the subsequent effluent treatment processes to function more effectively.

2. What is the purpose of effluent treatment?

Effluent treatment is designed to remove arsenic and dissolved metals prior to discharge. The ferric iron added to the effluent to remove metals also has an additional benefit of combining with any free cyanide to form stable, non-toxic ferro-cyanide complexes.

3. Where does effluent treatment take place?

Effluent treatment is performed in a dedicated facility located on the low hill which forms the west wall of the polishing pond.

4. How does the effluent treatment process work?

Water from the TMF is recovered by a pump in the decant tower and pumped to the effluent treatment plant (ETP). Ferric sulfate is added which combines with dissolved arsenic at low pH to form ferric arsenate. If the arsenic needs to be oxidized, hydrogen peroxide can be added during mixing. pH is adjusted back to neutral (7-8) with lime and the water is discharged to a settling pond where the insoluble ferric arsenate settles out. Neutralization also promotes the formation of metal hydroxides which removes copper, nickel, and zinc from solution.

5. How much water has to be treated each year and at what concentration of arsenic?

In a typical year, the plant will need to treat 1.5 M m^3 at a dissolved arsenic concentration of 0.45 ppm as shown in the table below.

6. What's the design capacity of the effluent treatment plant?

The plant is designed to treat 2.5 M m^3 of water each year at a concentration of 2 ppm dissolved arsenic. As such the plant has the capacity to manage 150% of the expected volume and 4x the concentration in a typical year.

7. What happens to the ferric arsenate from the effluent treatment reaction?

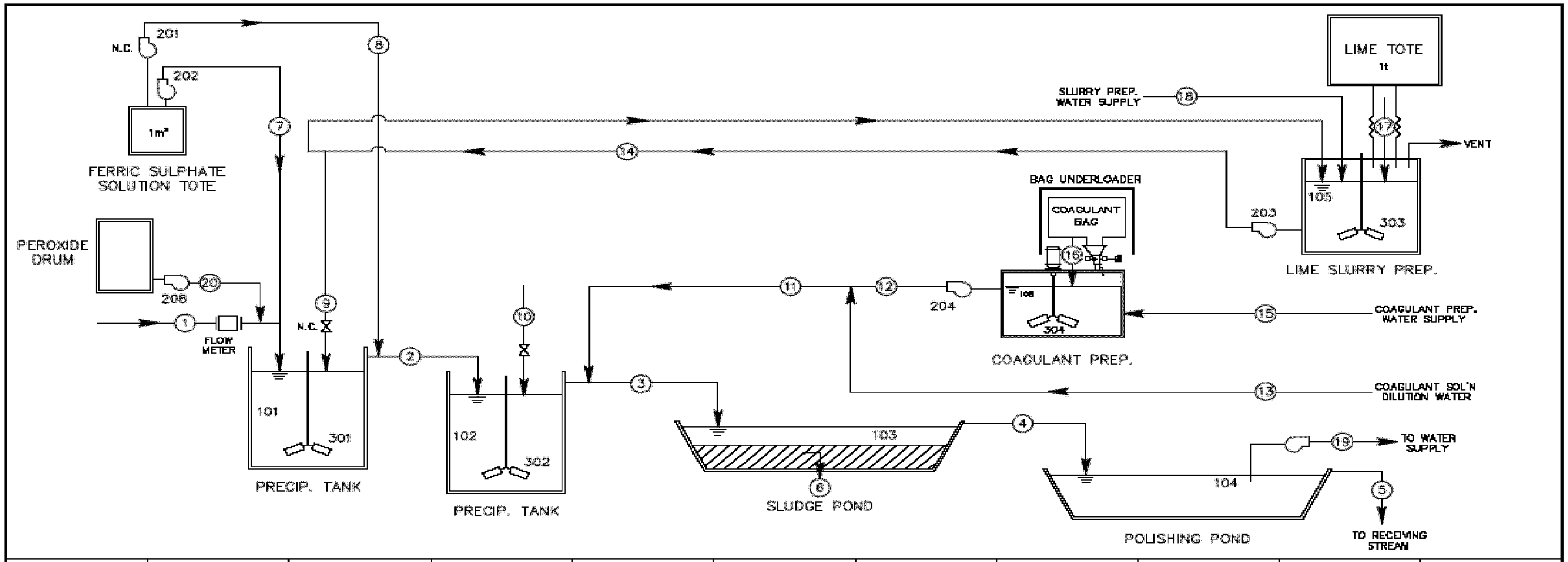
The ferric arsenate settles to the bottom of the treatment pond. In the winter, the pond is drained and the sludge is removed with an excavator and deposited in a purpose-built containment cell at the north end of the TMF.

8. How much sludge is to be disposed of each year?

Based on typical throughput and arsenic concentration of 0.45 ppm, about 1,900 m^3 of sludge will be deposited each year.

Table 6.5-3 Arsenic Concentration and Annual Treatment Volumes

Source	As ppm	Normal m3 x 1000	Wet m3 x 1000
Tailings	0.50	1450	1450
Pit	0.80	270	450
Dump	0.80	300	500
Plant	0.60	120	200
TMF	0.00	910	1450
Subtotal		1600	2600
Evap		-150	-150
Seepage		-100	-100
		-250	-250
Subtotal	0.45	2800	3800
Recycle	0.45	-1300	-1300
Net Treated	0.45	1500	2500



	1	2	3	4	5	6	7	8	9	10
LINE	TAILINGS EFFLUENT	STAGE I PRECIPITATION	STAGE II PRECIPITATION	CLARIFIED WATER	FINAL EFFLUENT	SETTLED SLUDGE	FERRIC SULPHATE 12% SOLUTION	FERRIC SULPHATE 12% SOLUTION	LIME SLURRY 10% SOLIDS	LIME SLURRY 10% SOLIDS
TOTAL MASS DRY SOLIDS	59 kg/h	59 kg/h	59 kg/h	0	0	59 kg/h	0	0	11 kg/h	11 kg/h
FLOW RATE	450 m^3/h	450 m^3/h	453 m^3/h	452 m^3/h	449 m^3/h	0.8 m^3/h	0.028 m^3/h	0.028 m^3/h	0.11 m^3/h	0.11 m^3/h

	11	12	13	14	15	16	17	18	19	20
LINE	COAGULANT 0.05 wt%	COAGULANT 0.3 wt%	COAGULANT DILUTION WATER	LIME SLURRY RECIRCULATION	COAGULANT PREPERATION WATER	DRY COAGULANT	HYDRATED LIME (10 min. BATCH)	SLURRY WATER (10 min. BATCH)	WATER SUPPLY CONTINUOUS	HYDROGEN PEROXIDE
TOTAL MASS DRY SOLIDS	0	0	0	1100 kg/h	0	1.4 kg/h	6000 kg/h	0	0	0
FLOW RATE	2.7 m^3/h	0.44 m^3/h	2.3 m^3/h	11 m^3/h	0.45 m^3/h	0.0018 m^3/h	12.5 m^3/h	54–57 m^3/h	3 m^3/h	0.0006 m^3/h

CBCL
CBCL LIMITED
Consulting Engineers
ISO 9001 CERTIFIED

Designed K.P.
Drawn M.R.H
Checked N.A.
Approved N.A.
Scale N.T.S.
Contract No 070836
Drawing File: 070836_FIG 2-1.DWG Date: 10/12/2007 2 04 P.M.

ATLANTIC GOLD
TOUQUOY EFFLUENT
TREATMENT STUDY

FLOW DIAGRAM
EFFLUENT TREATMENT

FIGURE No. **2.1**

Figure 6.5-1 Effluent Treatment Plant Flowsheet

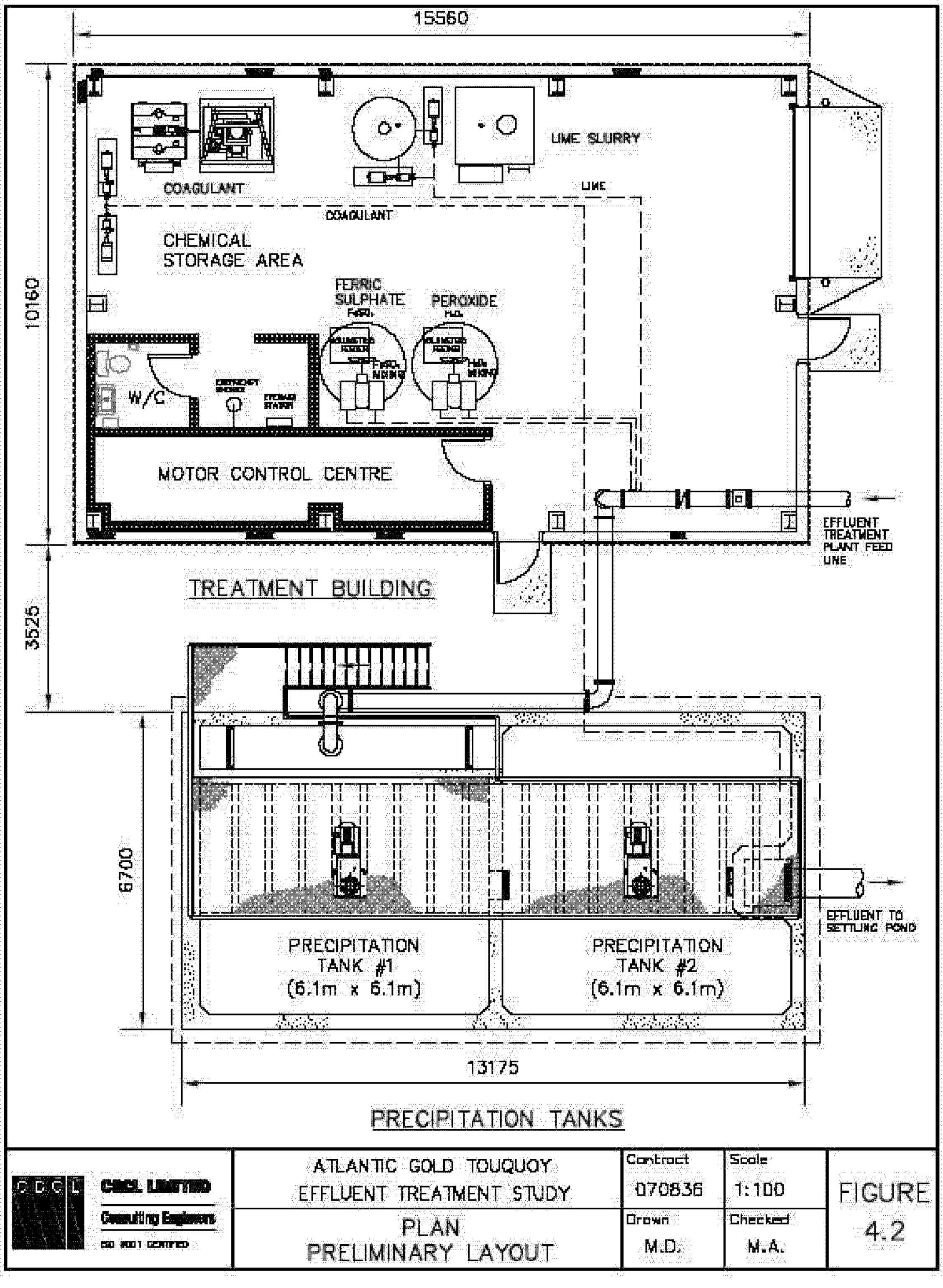


Figure 6.5-2 Effluent Treatment Plant Layout

9. Describe the containment cell

The containment cell consist of an area 135m x 275m (3.5 ha) surrounded by a clay embankment 4.5 metres high. The embankment is buttressed with waste rock to provide physical strength and erosion protection. The waste rock also flattens the slopes of the structure making it impervious to earthquake.
What keeps the sludge from leaking out?

The cell is lined with 1 m of clay overlain by 0.5 m of filter material. The sludge will be stored in a 2 m thick layer capped with 0.5 m of clay and 0.5 m of soil and vegetation. The filter layer drains water from the sludge to a sump where it is pumped back into the TMF for re-treatment. The clay berm and liner have transmissivity equal to or lower than the clay core of the tailings dam (1 x 10^{-6} – 10^{-8} m/s).

10. How much capacity does the cell have?

The cell as designed can contain 20,000 m^3 of sludge. This allows for 1,900 m^3/yr for five years of operations; 3,000 m^3 for post-closure treatment, 5,000 m^3 for historic tailings, and a 15% contingency. The cell can be expanded or reduced in size as required.

11. What determined the location of the cell?

It is located (1) within the boundaries of the TMF, (2) where the ground has a high clay content, and (3) any leakage would be contained by the mass of 5 M m^3 of deposited tailings without the need for physical intervention.

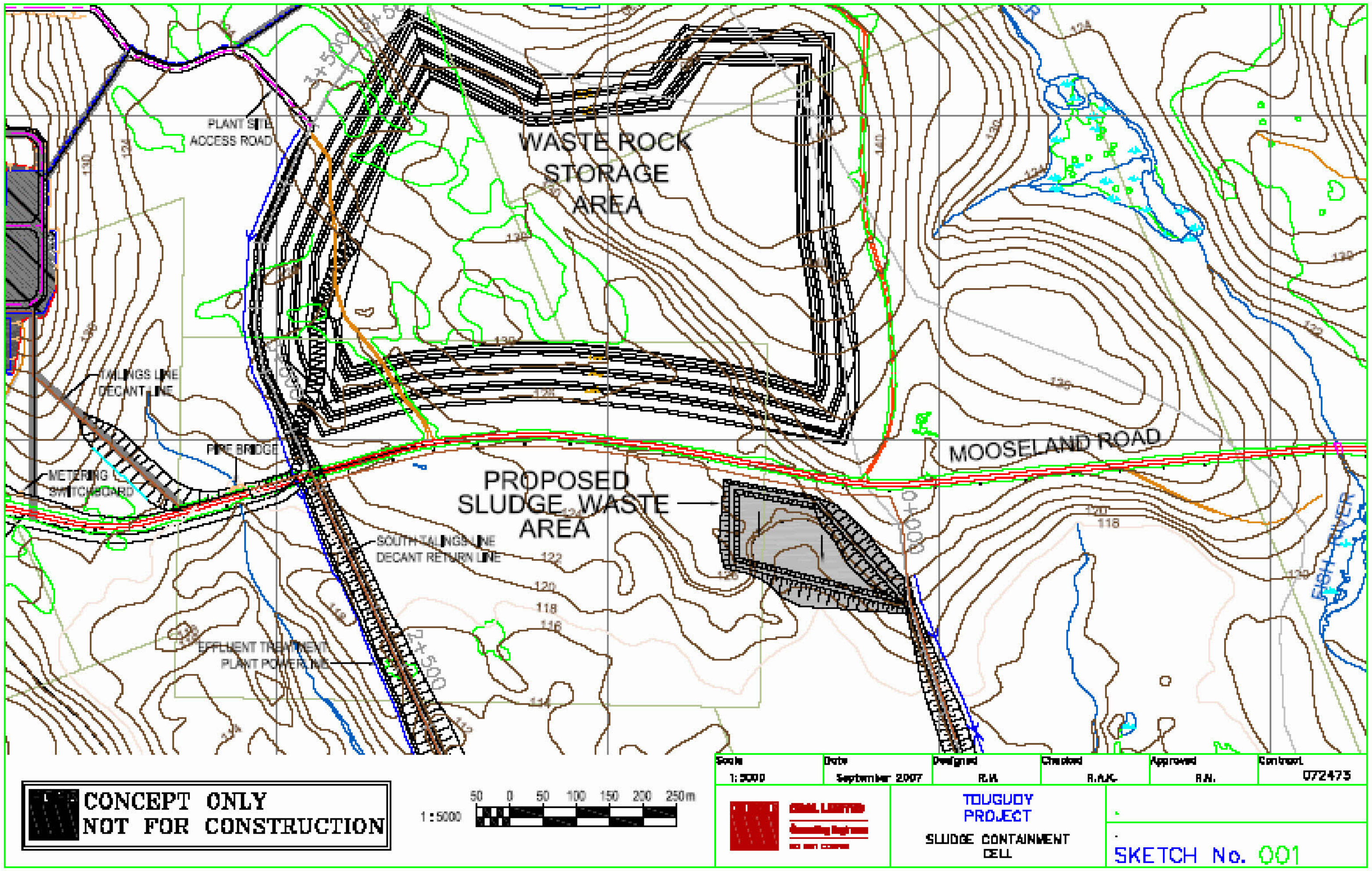


Figure 6.5-3 Location of Effluent Treatment Sludge Containment Cell

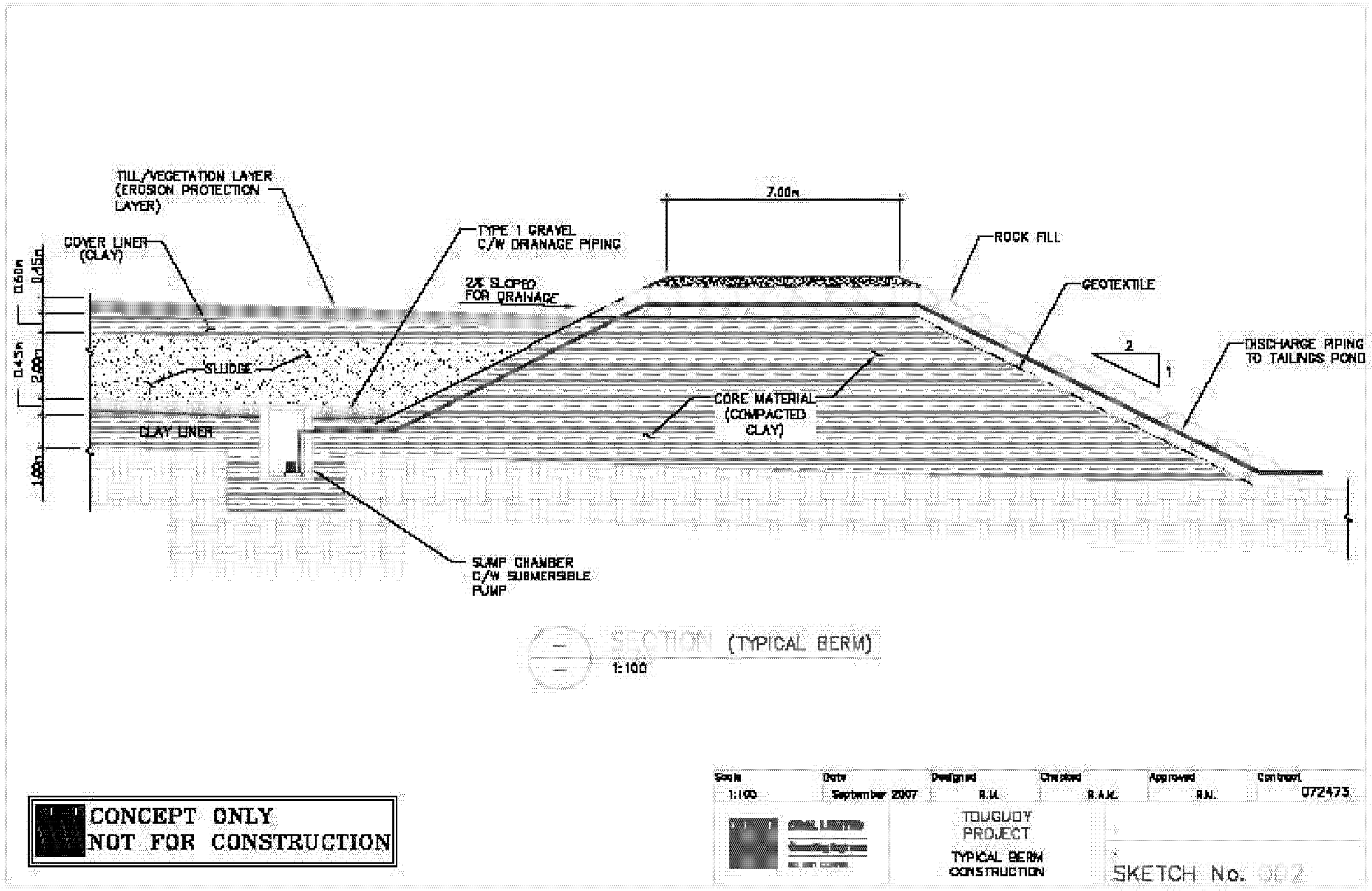


Figure 6.5-4 Sludge Containment Cell Cross-Section

6.5.5 Effluent Water Quality

1. What is the concentration of contaminants in the water as it moves from the plant to be discharged?

Table 6.5-4 shows the change in water quality as it moves from the process plant through the TMF to discharge. Values were derived from the results of laboratory testing for design of the effluent treatment system. In all cases, effluent contaminant concentrations are below MMER discharge requirements.

Table 6.5-4 Effluent Water Quality

Parameter		Before Detox	After Detox	After Aging	After Treatment	MMER
Location		In plant	1 day in TMF	45 days in TMF	Discharge to wetland	Discharge
TSS	ppm	---	7.71	4.54	3.97	15.00
pH		10.00	7.92	8.21	7.96	---
CN_T	ppm	200.00	3.50	0.21	0.44	1.00
CN_{WAD}	ppm	170.00	3.10	0.19	0.12	---
NH_4/NH_3	ppm	---	99.00	17.60	17.10	---
As	ppm	---	0.478	0.472	0.018	0.500
Cu	ppm	---	7.940	0.240	0.290	0.300
Ni	ppm	---	0.039	0.005	0.007	0.500
Pb	ppm	---	0.027	0.012	0.002	0.200
Zn	ppm	---	0.057	0.020	0.027	0.500

2. Why is effluent discharged to an engineered wetland?

Effluent is discharged to an engineered wetland to:

- allow pH to adjust downwards as receiving waters are considerably more acidic
- fix dissolved nitrogen in the water that could potentially cause eutrophication

- remove remaining heavy metals that could contribute to long-term impact on aquatic life

3. What is aging?

Aging is the process during which water is retained in the TMF before recycle or treatment. It is designed to be 30-60 days.

4. Why does ammonia/ammonium concentration reduce during aging?

Some ammonia volatilizes during aging while the remainder forms ammonium as the pH trends downwards.

1. Why does copper concentration reduce during aging?

Soluble copper precipitates as copper hydroxide under the mildly alkaline conditions in the TMF.

2. Why does cyanide concentration reduce during aging?

Cyanide undergoes natural degradation due to the effects of sunlight and volatilizes as HCN gas.

3. Why do lead, nickel, and zinc concentrations reduce during aging?

Similar to copper, soluble metal complexes decompose and precipitate as hydroxides under the mildly alkaline conditions.

4. What is the dissolved arsenic concentration after effluent treatment?

The dissolved arsenic concentration after treatment is 0.06 ppm or about 1/3 of the total arsenic. At discharge, total arsenic concentration is more than 8x lower than the MMER limit.

5. How does the lead concentration at discharge compare to the MMER limit?

At discharge, the lead concentration is 100X below the allowable MMER limit.

6. How does the zinc concentration at discharge compare to the MMER limit?

At discharge, the zinc concentration is half of the allowable MMER limit.

7. How does the nickel concentration at discharge compare to the MMER limit?

At discharge, the nickel concentration is 70x below the allowable MMER limit.

8. How does the cyanide concentration at discharge compare to the MMER limit?

At discharge, the total cyanide concentration is less than half the allowable MMER limit. The potentially toxic form of cyanide, CN_{WAD}, is 1/10th of the allowed total cyanide.

6.5.6 Downstream Water Quality Modeling

1. What do the results of water quality modeling indicate?

The results of downstream water quality modeling are shown in Table 6.5-5. All 25 items are less than federal MMER regulations for discharge of mining effluent. Also, 20 of the 25 items are less than the CCME water quality guidelines for the protection of aquatic life.

2. What's the relationship between CCME and MMER?

The CCME guidelines specify concentration thresholds above which a contaminant is potentially harmful if unmanaged. MMER is a regulatory regime which permits an operator to discharge at levels above CCME only if he can demonstrate through the prescribed monitoring program that no harm is caused.

3. Which items exceed the CCME guidelines?

The items which exceed CCME guidelines are aluminum, arsenic, cadmium, copper, and iron.

4. Should these results be qualified in any way?

Yes. Natural levels of aluminum and cadmium are above CCME guidelines in the downstream watershed.

5. As the modeled concentrations for arsenic, copper, and iron are above CCME guidelines, is it certain that they will result in harm to aquatic life?

No. It is clear from the concentrations of aluminum and cadmium that exceeding guidelines does not guarantee harm will occur. Both exceed guidelines naturally yet the health of aquatic life in the downstream watershed is considered good and water quality is not considered a human health issue.

6. What can be definitively said about the risk to aquatic life?

The concentration of contaminants in receiving waters is very low and therefore the risk to aquatic life is minimal. Dissolved contaminants present the greatest risk to aquatic life as it is these which are most readily metabolized. In this regard, none of the contaminants exceed guidelines in any downstream body. Any risk associated with solids concentrations present a potential long-term exposure risk that can be managed through monitoring.

Table 6.5-5 Relative Dissolved and Solid Contaminant Concentrations for Selected Metals in Receiving Waters

Parameter	CCME Guideline (mg/L)	Scraggy Lake			Fish River			Lake Charlotte		
		Dissolved (mg/L)	Solid (mg/L)	Total (mg/L)	Dissolved (mg/L)	Solid (mg/L)	Total (mg/L)	Dissolved (mg/L)	Solid (mg/L)	Total (mg/L)
Arsenic	0.005	0.000	0.008	0.008	0.000	0.007	0.007	0.000	0.006	0.006
Copper	0.002	0.003	0.006	0.009	0.001	0.002	0.003	0.001	0.001	0.002
Iron	0.300	0.002	0.408	0.410	0.001	0.269	0.270	0.001	0.239	0.240

7. Is there a risk to human health?

No. Table 6.5-6 shows the limits for drinking water quality compared to the modeled values. These guidelines for drinking water quality are based on a lifetime of exposure (70 years) which could increase the possibility of cancer from 1/1,000,000 to 1/100,000. As the modeled values are extremely close to the guidelines and the watershed is not used as a permanent source of drinking water there is no risk to human health.

Table 6.5-6 Projected Downstream Water Quality vs to CCME Drinking Water Quality Guidelines

Parameter	CCME Drinking Water Guideline	Scraggy Lake	Fish River	Lake Charlotte
	mg/L	mg/L	mg/L	mg/L
Aluminum	0.1/0.2(1)	0.18	0.17	0.17
Arsenic	0.01	0.0082	0.0068	0.0061
Cadmium	0.005	0.000019	0.0000072	0.0000077
Copper	≤ 1.00	0.0086	0.0032	0.0023
Iron	≤ 0.30	0.41	0.27	0.24

Guidelines apply only to water treatment facilities using aluminum-based coagulants for treatment

8. Do the modeling results indicate that treatment is ineffective?

No. The results from effluent treatment as described in the "Effluent Water Quality" section of Q&A are better than would be typically expected for industrial water treatment. Given the extremely low concentrations of contaminants, however, only environmental effects monitoring as prescribed by MMER will determine for certain if there are long-term downstream impacts.

9. Is there anything the company has done which is over and above typical design requirements to further reduce the possibility that there are no long-term downstream impacts on aquatic life?

Yes. The treatment flow sheet was amended to include tertiary treatment in the form of an engineered wetland. Discharging effluent into a man-made wetland environment is a proven method of removing residual levels of contamination (metals, nitrates) from waste water. Details regarding the expected benefit of tertiary treatment can found in the Q&A section "Wetland Purification".

Table 6.5-7 Comparison of Water Quality Model Inputs and Simulation Results to Guideline Values for Normal Flow Conditions

Parameters	Units	Water Quality Model Inputs				Simulation Results			Water Quality Guidelines	
		Scraggy Lake Baseline Water Quality	Fish River Baseline Water Quality	Lake Charlotte Baseline Water Quality	Polishing Pond Water Quality (1)	Scraggy Lake Outlet	Fish River Outlet	Lake Charlotte Outlet	Federal Canadian Metal Mining Effluent Regulations (2)	Canadian Water Quality Guidelines for the Protection of Aquatic Life (3)
Aluminum	mg/L	0.19	0.17	0.17	0.040	**0.18**	**0.17**	**0.17**	–	0.005 (4)
Ammonia (Total)	mg/L as N	<0.05	<0.05	<0.05	17	0.23	0.079	0.057	–	2.2 (5)
Antimony	mg/L	<0.002	<0.002	<0.002	0.011	0.0014	0.0011	0.0011	–	–
Arsenic	mg/L	<0.002	0.005	0.004	0.17	**0.0082**	**0.0058**	**0.0051**	0.5	0.005
Cadmium	mg/L	0.00002	<0.000017	<0.000017	<0.000003	**0.000019**	0.0000072	0.0000077	–	0.000017
Calcium	mg/L	1.0	1.3	1.2	215	10	3.6	2.6	–	–
Chloride	mg/L	4.0	4.0	4.0	24	4.8	4.2	4.1	–	–
Chromium	mg/L	0.005	<0.002	<0.002	<0.0005	0.0046	0.0020	0.0016	–	0.0099
Cobalt	mg/L	<0.0004	<0.0004	<0.0004	0.22	0.0094	0.0026	0.0016	–	–
Copper	mg/L	<0.002	<0.002	<0.002	0.20	**0.0095**	**0.0032**	**0.0023**	0.3	0.002 (6)
Cyanide (Total)	mg/L	<0.002	<0.002	<0.002	0.44	0.020	0.0059	0.0039	1	– (7)
Iron	mg/L	0.24	0.22	0.21	4.5	**0.41**	0.27	0.24	–	0.3
Lead	mg/L	<0.0005	<0.0005	<0.0005	0.0018	0.00037	0.00028	0.00027	0.2	0.001 (8)
Magnesium	mg/L	0.43	0.50	0.50	10	0.84	0.59	0.55	–	–
Manganese	mg/L	0.046	0.052	0.048	0.13	0.049	0.052	0.050	–	–
Nickel	mg/L	<0.002	<0.002	<0.002	0.0071	0.0013	0.0011	0.0010	0.5	0.025 (9)
Nitrate	mg/L as N	0.05	0.16	0.13	0.12	0.25	0.18	0.16	–	– (10)
Phosphorous	mg/L	0.015	<0.02	<0.02	0.010	0.015	0.011	0.011	–	–
Potassium	mg/L	0.33	0.30	0.30	67	3.1	1.1	0.74	–	–
Selenium	mg/L	<0.001	<0.001	<0.001	<0.001	0.00050	0.00050	0.00050	–	0.001
Silver	mg/L	<0.0001	<0.0001	<0.0001	0.00032	0.000061	0.000053	0.000052	–	0.0001
Sodium	mg/L	3.0	2.9	2.9	610	29	10	6.9	–	–
Sulphate	mg/L	<2	<2	<2	1400	60	17	10	–	–
Uranium	mg/L	<0.0001	<0.0001	<0.0001	0.0021	0.00014	0.00007	0.00006	–	–
Zinc	mg/L	0.012	0.020	0.018	0.027	0.013	0.018	0.018	0.5	0.03

Notes:

0.3 Concentration greater than the CCME guideline.

<0.001 – Values in red indicate that the value is below the detection limit. Concentrations were assumed to be half of the detection limit, if the analysis results were below the detection limit.

(1) Polishing Pond water quality was taken from the water chemistry of the mine effluent after treatment and aging (SGS, 2007).

(2) MMER [Metal Mining Effluent Regulations], 2002. Metals Mining Effluent Regulations. Canada Gazette Part II, Vol. 136, No. 13. SOR/DORS/2002-222.

(3) CCME [Canadian Council of Ministers of the Environment], 2002. Canadian Water Quality Guidelines for the Protection of Aquatic Life: Summary Tables. Updated 2002.

(4) Aluminum guideline = 0.005 mg/L, if pH <6.5, [Ca^{2+}] <4 mg/L and DOC <2 mg/L; aluminum guideline = 0.1 mg/L, if pH ≥6.5, [Ca^{2+}] ≥4 mg/L and DOC ≥2 mg/L.

(5) Total Ammonia guideline = 1.37 mg/L at pH 8.0, T = 10°C; ammonia guideline = 2.20 mg/L at pH 6.5, T = 10°C.

(6) Copper guidline = 0.002 mg/L, if [$CaCO_3$] = 0–120 mg/L; copper guideline = 0.003 mg/L, if [$CaCO_3$] = 120–180mg/L; and copper guideline = 0.004 mg/L, if [$CaCO_3$] >180 mg/L.

(7) There is no CCME guideline for total cyanide. However, the CCME guideline for free cyanide is 0.005 mg/L.

(8) Lead guideline = 0.001 mg/L, if [$CaCO_3$] = 0–60 mg/L; lead guideline = 0.002 mg/L, if [$CaCO_3$] = 60–120 mg/L; lead guideline = 0.004 mg/L, if [$CaCO_3$] = 120–180 mg/L; lead guideline = 0.007 mg/L, if [$CaCO_3$] >180 mg/L.

(9) Nickel guideline = 0.025 mg/L, if [$CaCO_3$] = 0–60 mg/L; nickel guideline = 0.065 mg/L, if [$CaCO_3$] = 60–120 mg/L; nickel guideline = 0.11 mg/L, if [$CaCO_3$] = 120–180 mg/L; nickel guideline = 0.15 mg/L, if [$CaCO_3$] >180 mg/L.

(10) Nitrate guideline – there is no specific guideline value, but concentrations that stimulate weed growth should be avoided.

6.5.7 Wetland Effluent Purification

1. Why will effluent be discharged to an engineered wetland?

Water quality modeling indicates that even after secondary treatment potential exists to further minimize the possibility of downstream impact. Discharge into an engineered wetland will permit natural processes to remove residual contamination after primary and secondary treatment.

2. What will be the effects of the wetland?

Discharging into an engineered wetland will:

- Permit a gradual reduction in pH
- Reduce dissolved nitrogen levels to prevent eutrophication in Scraggy Lake
- Further reduce metal (As, Cu, Fe) concentration to meet CCME standards in receiving waters

3. How effective is a wetland at purifying effluent?

Table 6.5-4 shows the treatment effectiveness expected from passing effluent through a wetland after initial treatment. These estimates are conservative as the majority of the remaining contamination after effluent treatment is suspended solids which are particularly amenable to wetland purification. Projections are based on established performance.

Table 6.5-8 Wetland Purification Efficiency

Parameter	Estimated Reduction
pH	20%
Arsenic	50%
Copper	50%
Iron	50%
Nitrogen (as NO_3^- and NH_4^+)	50%

4. Is this a proven method for effluent treatment?

Yes. This approach is recommended by Environment Canada as a natural means of attenuating the concentration of contaminants in industrial effluents. It is successfully used in Nova Scotia for final treatment of landfill effluent in Sackville.

5. Where will the wetland be located?

The wetland will be located directly downstream and to the east of the polishing pond as shown in Figure 4.5-1.

6. How big will the wetland be?

Retention time determines the size of the wetland. To achieve the reduction in contaminants detailed in Table 6.5-8 water must be retained in the wetland for a minimum of 24 hours. At a maximum discharge rate of 500 m^3/hr of effluent, the wetland must be able to contain 12,000 m^3. Assuming an average depth of 0.5 m, this would require a minimum area of 2.4 ha.

7. Could the wetland be increased in size if desired?

Yes. If practical and economic, the wetland could be enlarged, increasing retention time and treatment effectiveness. The enlargement of the wetland could be connected to the company's compensation for the disturbance of wetlands which occurs during the construction of the tailings facility.

8. Does a detailed design for the wetland exist?

The design for the wetland will be developed and submitted as part of Industrial Approval.

9. What is the projected downstream water quality after supplementary treatment in the wetland?

Table 6.5-6 shows the effect on downstream water quality of employing a wetland in the effluent treatment plan. As a result, all parameters identified as potentially problematic by water quality modeling are projected to be below CCME guidelines for the protection of aquatic life.

Table 6.5-9 Projected Downstream Water Quality as a Result of Wetland Purification

Downstream Water Quality Simulation
Wetland Contaminant Attenuation - Normal Flow Scenario
Touquoy Golf Project

		Baseline Water Quality				Simulation Results			Water Quality Guidelines	
Parameter	Units	Scraggy Lake	Fish River	Lake Charlotte	Wetland(1)	Scraggy Lake	Fish River	Lake Charlotte	MMER	CCME
Aluminum	mg/L	0.19	0.17	0.17	0.020	**0.18**	**0.17**	**0.17**	–	0.005 (4)
Ammonia (Total)	mg/L as N	<0.05	<0.05	<0.05	9	0.13	0.052	0.041	–	2.2 (5)
Antimony	mg/L	<0.002	<0.002	<0.002	0.005	0.0012	0.0010	0.0010	–	–
Arsenic	mg/L	<0.002	0.005	0.004	0.09	0.0046	0.0049	0.0046	0.5	0.005
Cadmium	mg/L	0.00002	<0.000017	<0.000017	0.000001	**0.000019**	0.0000072	0.0000077	–	0.000017
Calcium	mg/L	1.0	1.3	1.2	108	10	3.6	2.6	–	–
Chloride	mg/L	4.0	4.0	4.0	24	4.8	4.2	4.1	–	–
Chromium	mg/L	0.005	<0.002	<0.002	0.0001	0.0046	0.0020	0.0016	–	0.0099
Cobalt	mg/L	<0.0004	<0.0004	<0.0004	0.11	0.0048	0.0014	0.0009	–	–
Copper	mg/L	<0.002	<0.002	<0.002	0.10	**0.0052**	**0.0021**	0.0017	0.3	0.002 (6)
Cyanide (Total)	mg/L	<0.002	<0.002	<0.002	0.22	0.220	0.0035	0.0024	1	– (7)
Iron	mg/L	0.24	0.22	0.21	2.2	**0.32**	0.25	0.23	–	0.3
Lead	mg/L	<0.0005	<0.0005	<0.0005	0.0009	0.00034	0.00027	0.00026	0.2	0.001 (8)
Magnesium	mg/L	0.43	0.50	0.50	5	0.63	0.53	0.52	–	–
Manganese	mg/L	0.046	0.052	0.048	0.07	0.047	0.051	0.050	–	–
Nickel	mg/L	<0.002	<0.002	<0.002	0.0036	0.0011	0.0010	0.0010	0.5	0.025 (9)
Nitrate	mg/L as N	0.05	0.16	0.13	0.06	0.15	0.16	0.14	–	– (10)
Phosphorous	mg/L	0.015	<0.02	<0.02	0.005	0.002	0.011	0.011	–	–
Potassium	mg/L	0.33	0.30	0.30	33	3.2	1.1	0.74	–	–
Selenium	mg/L	<0.001	<0.001	<0.001	0.000	0.00049	0.00050	0.00050	–	0.001
Silver	mg/L	<0.0001	<0.0001	<0.0001	0.00020	0.000055	0.000051	0.000051	–	0.0001
Sodium	mg/L	3.0	2.9	2.9	305	16.0	9.7	6.9	–	–
Sulphate	mg/L	<2	<2	<2	700	31.0	8.8	5.6	–	–
Uranium	mg/L	<0.0001	<0.0001	<0.0001	0.0011	0.00093	0.00006	0.00006	–	–
Zinc	mg/L	0.012	0.020	0.018	0.014	0.012	0.018	0.018	0.5	0.03

Notes:

0.3	Concentration greater than the CCME guideline.
0.17	Concentration greater than CCME guideline due to high background

<0.001 – Values in red indicate that the value is below the detection limit. Concentrations were assumed to be half of the detection limit, if the analysis results were below the detection limit.

(1) Wetland outflow water quality derived by applying 50% attenuation efficiency to projected polishing pond water quality

(2) MMER [Metal Mining Effluent Regulations], 2002. Metals Mining Effluent Regulations. Canada Gazette Part II, Vol. 136, No. 13. SOR/DORS/2002-222.

(3) CCME [Canadian Council of Ministers of the Environment], 2002. Canadian Water Quality Guidelines for the Protection of Aquatic Life: Summary Tables. Updated 2002.

(4) Aluminum guideline = 0.005 mg/L, if pH <6.5, [Ca^{2+}] <4 mg/L and DOC <2 mg/L; aluminum guideline = 0.1 mg/L, if pH ≥6.5, [Ca^{2+}] ≥4 mg/L and DOC ≥2 mg/L.

(5) Total Ammonia guideline = 1.37 mg/L at pH 8.0, T = 10°C; ammonia guideline = 2.20 mg/L at pH 6.5, T = 10°C.

(6) Copper guidline = 0.002 mg/L, if [$CaCO_3$] = 0−120 mg/L; copper guideline = 0.003 mg/L, if [$CaCO_3$] = 120−180mg/L; and copper guideline = 0.004 mg/L, if [$CaCO_3$] >180 mg/L.

(7) There is no CCME guideline for total cyanide. However, the CCME guideline for free cyanide is 0.005 mg/L.

(8) Lead guideline = 0.001 mg/L, if [$CaCO_3$] = 0−60 mg/L; lead guideline = 0.002 mg/L, if [$CaCO_3$] = 60−120 mg/L; lead guideline = 0.004 mg/L, if [$CaCO_3$] = 120−180 mg/L; lead guideline = 0.007 mg/L, if [$CaCO_3$] >180 mg/L.

(9) Nickel guideline = 0.025 mg/L, if [$CaCO_3$] = 0−60 mg/L; nickel guideline = 0.065 mg/L, if [$CaCO_3$] = 60−120 mg/L; nickel guideline = 0.11 mg/L, if [$CaCO_3$] = 120−180 mg/L; nickel guideline = 0.15 mg/L, if [$CaCO_3$] >180 mg/L.

(10) Nitrate guideline − there is no specific guideline value, but concentrations that stimulate weed growth should be avoided.

6.6 OTHER

6.6.1 Historic Mining

1. Identify historic mine tailings and determine their extent

DDV Gold conducted a survey of the site in June 2007 and has identified historic mine tailings in two locations amounting to approximately 5,000 t. The tailings contain elevated levels of arsenic and mercury resulting from historic process operations at Moose River. Some of the material lies within the proposed open pit while other extends under the present park site and along the banks of the Moose River. Details can be found in the appendices to the Focus Report.

Quite recently a third tailings location was identified - the McGregor Mill tailings - along Moose River well north of the proposed pit area. Approximately 2,500 tonnes of tailings remain in-situ.

2. Develop a management plan to deal with historic mine tailings that ensures contaminants are not remobilized by activities

DDV Gold retained Inspec-Sol Limited to develop a historic mine tailings management plan for the Touquoy site. The plan concludes that on-site containment of tailings within the pit boundaries is the best disposal option. For tailings within the development area but whose disturbance is not essential, a risk assessment process is recommended to determine whether to avoid, manage in situ, or remove and dispose.

3. Is there broader benefit to Nova Scotia from cleaning up the Moose River townsite?

Yes. DDV Gold hopes to partner with provincial agencies to use the remediation process at the Touquoy Project as a test case for the management of historic mine tailings at other similarly contaminated sites in the province.

4. Is there potential for trace mercury in the ore to form Hg-CN complexes?

Theoretically yes, but although mercury can form stable complexes with cyanide during cyanidation it is present in the ore at such exceedingly low concentrations (<5 to 12 ppb) that should such complexes be formed they also would exist at such low concentrations as to have no environmental consequence. It should be clarified here that those higher levels of mercury (up to 0.723 ppm) recorded in feed solution prepared for cyanide destruction testwork performed by AMMTEC (refer AMMTEC Report A10174, Appendix V, June 2006 as appended to the EARD) are an artifact of the standard laboratory methodology of using mercury amalgamation to extract to coarser gold in preparation of the feed sample.

To confirm this mercury analyses of the master ore composite (TAM) and 12 sub-composites were run using a highly accurate, state-of-the-art analytical technique (ICP-MS) with a detection limit of 5 ppb. Mercury concentrations from <5 to 12 ppb with an average of 7 ppb were obtained for these 13 samples. Analytical certificates are given in Appendix J.

5. What happens to Hg-CN complexes during the cyanide destruction process?

Hg-CN complexes would be oxidized to cyanate and mercuric sulphide while others would be reduced to elemental mercury which physically attaches itself to gangue material in the tailings. However given the very low levels of mercury in the Touquoy ore the fate of mercury in the cyanidation and cyanide-destruction processes is of diminished relevance with respect to environmental impact.

6. Is there potential for residual CN to leach mercury from soils in the tailings impoundment and create Hg-CN complexes?

No. Natural mercury concentrations in soil are exceedingly low and the concentration of cyanide after detoxification is too low to support leaching. Baseline surveys of site soils show no indication of mercury contamination in the proposed tailings facility area which might provide leachable quantities of metal. Mercury in soil levels in the area of the proposed tailings impoundment are low, ranging from <1 to 2ppm using ICP analytical methodology with 1ppm detection limit.

It could reasonably be expected that more accurate analytical methodology (ICP-MS) would indicted levels commensurate with those above noted for Touquoy ore. The rapid breakdown of cyanide further precludes sufficient cyanide being present to cause cyanidation to occur.

7. Is there potential for Hg-CN complexes to remain mobile in the tailings impoundment?

No. The anoxic conditions in the tailings would result in mercury being deposited as either mercuric sulphide or in elemental form. It is emphasized that mercury levels in the tailings are exceedingly low and average about 10ppb.

8. What is the potential for Hg-CN complexes which don't breakdown in the tailings impoundment to be discharged into the surrounding environment?

There is no potential. The ferric iron treatment system to be used to treat water prior to discharge will effectively remove any residual mercury to very low levels. Ferric hydroxide flocculation is a very effective method for the removal of mercury. It is emphasized that mercury levels in the tailings are exceedingly low and average about 10ppb.

9. How will mercury and mercury-containing compounds be managed in the tailings facility?

Insoluble mercury compounds and elemental mercury will be distributed throughout the tailings in harmless concentrations. Precipitate from effluent treatment or historic tailings containing mercury - also at very low levels - will be stored in purpose-built containment cells that will prevent the remobilization of any contaminants. It is emphasized that mercury levels in the tailings are exceedingly low and average about 10ppb.

10. Any underground workings beneath surface water bodies should be reported and accounted for in the operating plan

Underground workings will be identified, plotted, and made safe prior to the advance of mining on each level as described in the EARD, p28.

6.6.2 Regulatory Compliance

1. Develop contingency plans to address spills or accident prior to start of construction

A comprehensive Emergency Response Plan will be developed prior to the start of construction as required by Industrial Approval.

2. Provide details of reagent storage, handling, mixing, and containment prior for Industrial Approval

Design details for reagent storage, handling, mixing, and containment will be provided for Industrial Approval. General descriptions of provisions for reagent handling and management can be found in the EARD, p41-46.

3. Provide more information on petroleum storage and handling arrangements

Diesel and gasoline will be stored in above ground, double-walled steel storage tanks equipped with leak detection. Lubricants will be stored in 1000 L "lube-cubes" and placed on a concrete pad when not installed in the lube truck for dispensing. Propane

(LPG) will be stored in standard steel "bullet" tanks and dispensed on demand via pipeline. Detailed designs for all petroleum storage and dispensing facilities will be provided for Industrial Approval.

4. Proponent should adopt the principles of the ICMC

DDV Gold has committed to abiding by the principles of the ICMC as stated on p 46 of the EARD. A pre-production audit is not possible until construction drawings are finalized.

5. Obtain permits and approvals for management and treatment of sewage

Sewage will be collected in plastic holding tanks and shipped off-site for disposal in an appropriate facility as described on p50 of the EARD.

6. Develop the following:

- Erosion Control and Sedimentation Plan
- Environmental Protection Plan
- Hazardous Materials Management Plan
- Emergency Response Plan
- Environmental Effects Monitoring Plan

All of these plans will be developed prior to construction as required to fulfill Industrial Approval.

7. Provide detailed designs for all aspects of the Project

The proponent will provide design information for the EARD/Focus Report as is consistent with and necessary for the description of the conceptual Project plan. The company will provide all detailed technical information including designs to fulfill Industrial Approval at the appropriate stage of permitting.

8. DDV Gold should embrace the National Chemical Categorization Initiative (NCCI) and take into account CEPA provisions for storage, handling, transport, and use of hazardous materials

DDV Gold has reviewed the NCCI, will endorse the initiative, and meet CEPA requirements for the storage, handling, transport, and use of hazardous materials.

6.6.3 Monitoring

1. How will the company determine site water quality?

The company will have an assay laboratory on site that will conduct analyses in support of all aspects of operations.

2. How can the company be sure the results from the laboratory will be correct?

The laboratory will employ industry-standard QA/QC procedures including the use of blind standards and blanks. Analytical equipment will be periodically recalibrated to CSA standards by independent contractors.

3. How will compliance with regulatory standards be assured?

The company will submit results to the various government regulatory agencies whose responsibility it is to ensure compliance.

4. How will the public be assured that the company is complying with the required standards?

The company will share the same information provided to regulators with the Community Liaison Committee and assist its members in understanding both the standards and the results.

5. How can the public or the regulators be assured that the laboratory analyses are accurate?

Test results will be routinely verified by an independent third party (laboratory) at the company's expense.

6. What other sort of independent reviews will be conducted?

The tailings dam will be inspected annually by a professional engineer who will attest to its condition. Being a signatory to the International Cyanide Management Code (ICMC) requires that the operation be subject to an independent audit once a year.

6.6.4 Reclamation

1. What happens to the open pit at closure?

The open pit will be allowed to flood forming a lake. The condition of the mini-pit indicates that there will be no acidification. It is expected that the flooded pit will develop into a viable aquatic habitat as the mini-pit has.

2. How long will it take for the pit to flood?

Current projections are that it will take 20 years for the pit to flood. The company will consider options in cooperation with regulatory authorities to speed this process up.

3. How long will it take for the pit area to be reclaimed?

The mini-pit also shows how the surrounding area naturally reclaimed itself over a period of 18 years. Active reclamation will speed this process up considerably.

4. Can wetland habitat be created in the mined out pit?

Yes. The crest of the top bench can be dozed down to create a 10 m wide shallow zone around the perimeter of pit. This shallow zone will promote the establishment of plants that will provide a basis for colonization of the pit by other flora and fauna.

5. Why not fill the pit back in?

Backfilling the pit is not economically feasible. The pit contains 30 Mt of material occupying a volume of approximately 10 M m^3. The waste rock amounts to 2/3 of the total or 20 Mt and swells to an equal volume of 10 M m^3. The waste rock is stored 1 km from the open pit and will cost approximately \$1.50/m^3 to load and haul back into the pit, a total of \$15 M. The return on investment for the project is 20% or approximately \$14 M. Thus, if the pit were to be backfilled there would be no incentive to develop the project as all the return would be spent refilling the pit.

6. What will happen to all the buildings and other facilities?

The buildings and other facilities will be removed down to concrete foundations within the first two years after closure.

7. What will happen to the waste rock stockpile at closure?

The waste rock stockpile will be re-sloped (landformed) from angle of repose to 2.5:1 (h:v). The flattened slopes will be covered with soil and seeded. Vegetation will inhibit erosion, generation of dust, and prevent leaching of contaminants into runoff. The stockpile at closure will be no higher than the surrounding hills.

8. What sort of plants will be used for re-vegetation?

Native species (grasses and shrubs) best suited to colonizing disturbed areas will be established first to fix the soil. Trees and other plants will be introduced when conditions are amenable to promoting robust growth.

9. What will happen to the tailings facility at closure?

The slopes of the dams will be flattened from angle of repose to 2.5:1 (h:v) to enhance stability. The tailings impoundment will be drained. Drainage from other areas will be diverted away from the TMF and runoff from the facility itself will be directed by ditches to treatment. The tailings will be capped with clay, covered with topsoil, and vegetated.

10. How long will treatment of runoff water continue?

Treatment will continue until the water draining through the facility returns to the quality which existed prior to development.

11. How long is treatment expected to be needed?

The static testing and humidity cells indicate that the potential for both long-term acid generation and dissolution of contaminants is very low. On this basis, water treatment is expected to be continued less than five years.

12. Why is it better to drain the TMF than turn it into a wetland?

Removing the water from the tailings impoundment makes the facility even less susceptible to earthquake. Also, as there is little potential for long-term acid generation there is no need to store the tailings under water, however, submerging tailings could promote the dissolution of contaminants in the water. This would be mitigated in part by the purifying effect of the wetland but would not be an issue if the facility is drained.

13. Will the company post a reclamation bond?

Yes, the company will post a reclamation bond as per legislation. The value of the bond will be based on the amount of disturbed area and is expected to be on the order of $2 M.

14. How can the company be sure that it will have enough money to meet all its environmental obligations at closure?

The company can "sell forward" its production to lock in current high gold prices and ensure the project economics. This will be a requirement of the lenders to ensure that the return on their investment is secure but it also serves to make certain that the company will have sufficient funds to meet its future environmental obligations.

15. Why would the company engage in reclamation before the end of production?

By reclaiming the site during production, the company can be more profitable than waiting to the end of the project life to clean up. Such an approach is now considered "best practice" in the industry worldwide.

16. How does progressive reclamation enable a company to be more profitable?

The primary tenet of progressive reclamation is to plan activities with reclamation in mind. For example, if all the trees are cut down to develop the site the developer has to bear the cost of cutting, manage erosion, possibly provide alternate habitat, and eventually re-vegetate. If development is planned for minimal disturbance then those costs may never have to be borne.

17. What are examples of progressive reclamation that will be employed at the project?

The waste rock stockpile will be constructed in 10 m lifts (layers). When each lift is completed it will be re-sloped and seeded while the next lift is under construction. Similarly, all permanent embankments, berms, roads, and ditches will be reclaimed as soon after construction as practical.

18. What else will be done?

Topsoil will be stockpiled near areas where it is to be replaced. Organic matter from grubbing (roots and stumps) will be mulched to provide source biomass for re-vegetation rather than burned.

19. How does progressive reclamation help ensure that provisions for closure will be sufficient?

With a large part of reclamation costs being borne during operations, less money is required at the end of the project life to reclaim the site and therefore less possibility exists of the reclamation bond being inadequate.

20. How long is the company responsible for the site?

The company is responsible until a mine closure certificate is granted by the regulatory authorities. A mine closure certificate is issued when regulators are satisfied that all obligations related to the closure plan have been fulfilled and no long-term liabilities remain. Once a mine closure certificate is issued responsibility for the site reverts to the province.

21. Why is a detailed reclamation plan not required until 6 months before closure?

A detailed reclamation plan is not required until shortly before shutdown because the exact conditions at closure will be better predicted in the future after more experience is gained. Also, generating a detailed reclamation plan now presumes that the needs and desires of the community, in terms of how it wants to see the site reclaimed, will not change.

22. What uses are currently envisioned for the site after closure?

Uses for the site after closure are presently envisioned to be the same as those uses for the site in the recent past, namely recreation (hunting and fishing) and forestry.

23. How long after closure will it be before these activities can resume?

Recreation will likely be permitted within 3-5 years of closure. Commercial forestry will probably resume in 15-20 years given typical rates of growth.

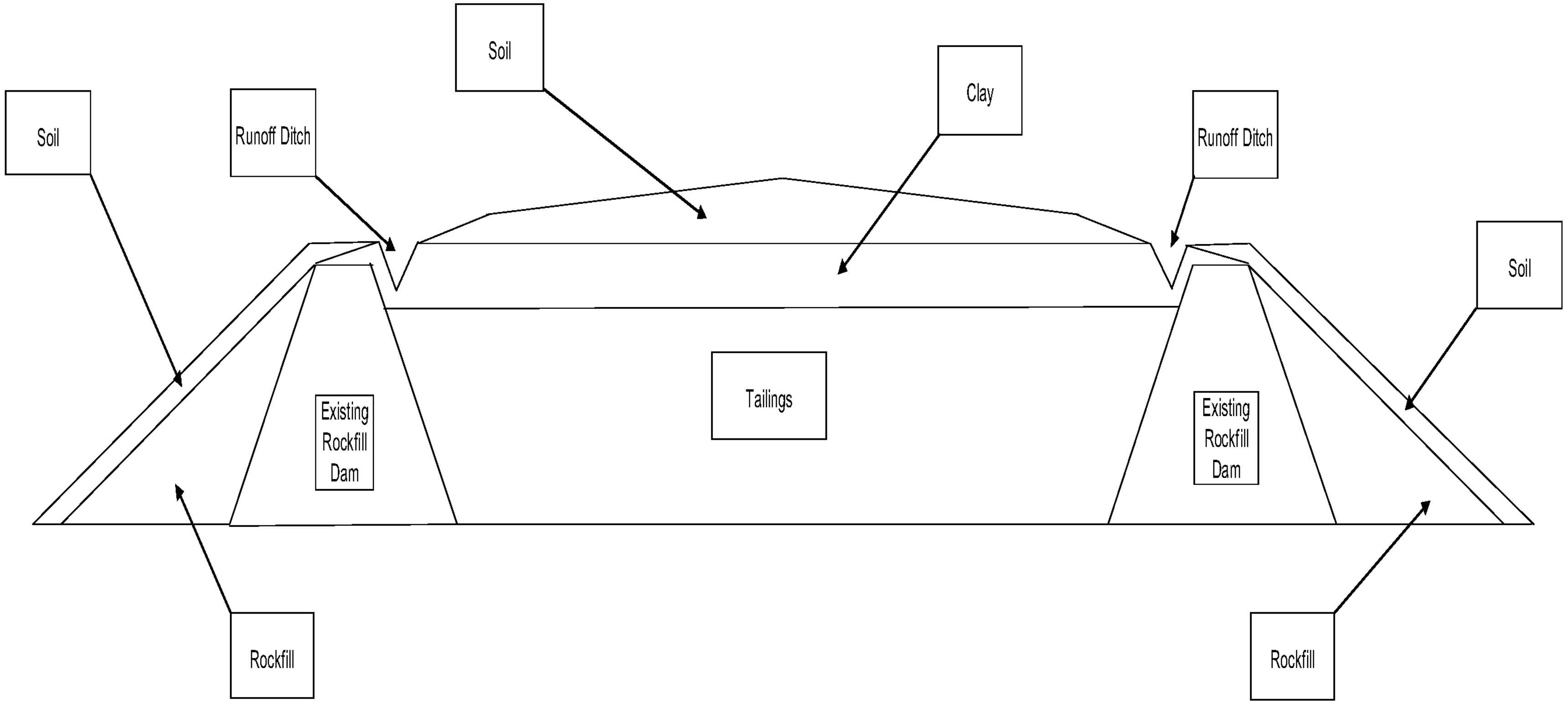


Figure 6.6-1 Cross-Section of Reclaimed Tailings Facility
(drawing not to scale)

7.0 MITIGATION AND MONITORING

This section provides information on the comprehensive mitigation measures and monitoring identified to date for the Project. Additionally, contingency plans and proposed compensation are discussed. A brief section on reclamation and mine closure is also provided.

7.1 OVERVIEW

Mitigation and monitoring are arguably the two most important aspects of this project. The mitigation measures embodied in the project design are unprecedented for a mining development in Nova Scotia. The project exceeds all standards ever applied to metal mines in the province.

Mitigation alone, however, is not enough. Without monitoring there is no guarantee of sustainability as conditions may change to render a particular mitigation strategy ineffective. The key to effective mitigation is well-designed, well-implemented monitoring that permits the operation to adjust to changing conditions in a timely manner.

The number of mitigation and monitoring measures employed in the project design is large and varied. It covers everything from recycling to water treatment and tailings dam design to wildlife surveys. Over 300 measures have been identified to address and manage environmental and socio-economic issues related to the project. In order to make this information more accessible this information has been organized in a unique manner.

In Section 7.2 of this chapter the reader will find a complete listing by category of all mitigation and monitoring measures in the project design. Each item is accompanied by a brief description which allows the reader to understand the nature and significance of the entry. These items are summarized by topic in Table 7.1-1.

Table 7.1-1 Mitigation and Monitoring Measures Designed into Project

Item	Number of Measures		Number of Measures
Design Principles	11	TMF – Extreme Weather	7
General Practices	9	TMF – Contingency	8
Employment	14	TMF – Failure	6
Access & Traffic	7	Tailings Line	7
Materials Handling	12	Tailings Discharge	6
Cyanide	8	Cyanide Destruction	13
Wildlife – General	12	Effluent Treatment	16
Wildlife – Moose	12	Wetland Purification	6
Wildlife – Lichen	5	Acid Rock Drainage	10
Air Quality	17	Water Quality Monitoring	12
Dust	10	Flow Monitoring	4
Noise & Light	11	Physical Monitoring	7
Soil	3	Tailings Dam Inspections	12
Water Management	15	Reclamation	14
TMF – Design	10	Closure	8
TMF – Seepage	12	Site Remediation	6

7.2 MITIGATION AND MONITORING

The following pages provide a listing of all mitigation and monitoring measures designed into the project. More detailed explanations of the items considered most significant in each category can be found in Section 6, Answers to Stakeholder Concerns. In this case, the question and answer format provides a step-by-step explanation which leads the reader through 24 complex topic areas.

In addition, detailed technical documentation is provided in the appendices where appropriate. Design details which are considered proprietary will be made available as required at a suitable point in the permitting process.

Project Design Principles		
1	All facilities sited to avoid fish habitat	No fish habitat is disturbed in the development of the site
2	Facilities sited to minimize disturbance of wetlands	Only 4.3 ha of wetlands are disturbed by development of the site
3	TMF sited to pose minimum threat in event of dam failure	Alternate locations pose greater threat to Moose River or Square Lake
4	TMF sited to minimize impact of effluent discharge	Discharge to Scraggy lake provides the greatest dilutive effect on released effluent

5	Minimal shadow effect	Project design and operating plan will limit significant impacts to property boundaries
6	Technology will mitigate impacts that otherwise would be caused	The use of technology to mitigate impacts within the property boundaries permits off-site impacts to be dramatically reduced
7	Project can co-exist with proposed wilderness area	Project design will be crafted to ensure that the natural value of the proposed adjacent wilderness area is undiminished
8	Local workforce can operate mine	Processes and systems selected such that local employees can be readily trained to use effectively
9	Project has no long-term environmental legacy	Development will not create conditions which require ongoing management and delay closure
10	Site will be returned to an equal or better state at closure	Reclamation plan will be updated so that at closure the site is left in a state which provides maximum value to the community
11	Development will promote sustainable community activities	The company will promote value-added activities in the community which will outlive the mine development
	General Practices	
12	Operation will engage in recycling	Garbage will be segregated into metal, fibre (paper and wood), and trash
13	Garbage will be disposed of off-site	Garbage will be hauled by disposed of in an approved off-site facility; recyclables will be hauled to an industrial recycling depot
14	Sewage will be disposed of off-site	Sewage will be collected in holding tanks and hauled off-site to an approved disposal facility
15	Waste Oil to be re-used and then burned as fuel	Waste oil from heavy equipment will be filtered and re-used once before disposal through use in blasting or as heating oil
16	Low phosphate cleaners to be used	Any soaps or cleaners used on-site will be low phosphate
17	Oil/water separator on wash pad sump	An oil/water separator will permit oil in wash water at the wash pad to be separated and disposed of in an appropriate manner
18	Purchase from local suppliers	Given product quality and price of equal merit, the company will purchase from local suppliers first
19	Low environmental impact choices	When the opportunity exists, the company will choose to use products which minimize environmental impacts
20	Reduce waste in community by utilizing local materials	Company will examine the possibility of using waste cement kiln
	Employment	
21	Hire locally	Given candidates of equal merit, the company will hire people resident within 100 km of the mine site first
22	Hire returning area residents	Given candidates of equal merit, the company will give hiring preference to original residents of the area returning to NS
23	Hire Nova Scotians first	Given candidates of equal merit, the company will give hiring preference to Nova Scotians

24	Hiring target	The company will target 90% of employees to come from the Musquodoboit Valley and Eastern Shore
25	Hold job fairs	The company will hold job fairs to advertise employment opportunities
26	Advertise locally first	The company will advertise using the local job search centres and newspapers before advertising further a field
27	Provide equal opportunity employment	The company will not discriminate in its hiring policies on the basis of race, sex, or age; hiring will be merit driven
28	Partner with local educational institutions	The company will partner with local institutions to develop training tailored to the skills required to work at the project
29	Trade Certification	The company will assist employees in achieving trade certification and will support apprenticeship programs
30	Provincial assistance programs	The company will partner with provincial and federal agencies to assist employment candidates in getting training required for hiring
31	Contractor hiring	Given contractors of equal merit, the company will give hiring preference to firms from the local area
32	Competitive wages	The company will pay competitive wages; the mining industry is recognized as the highest paying sector in the NS economy
33	Summer employment	The company will provide summer employment opportunities for students taking earth sciences, mineral engineering and or environmental studies
34	Dedicated human resources manager	The company will have an individual dedicated to managing human resources for the project
	Access and Traffic	
35	No bypass of main road around site	Use of existing road through site eliminates additional disturbance to the project site
36	Traffic lights	Traffic lights will permit haul trucks to safely cross the public road to travel to the crusher or waste rock stockpile
37	Speed limits	The speed limit on site will be 50 kph; low vehicle speeds will promote safety and reduce wildlife mortality
38	Traffic volumes	During operations traffic is expected to be only 20-30 cars/day and 2-4 heavy trucks
39	Traffic routes	2/3 of the additional traffic related to the development is expected to reach site via the Moose River Rd away from Tangier-Grand Lk
40	Bypass road	A bypass road will be constructed using an existing track to give continued access west of the Moose River with minimum disturbance
41	Access to Scraggy Lake	The development will neither increase nor diminish access to Scraggy Lake and the adjacent area
	Material Handling	
42	Fuel Storage	Fuel will be stored and dispensed from double-

		walled, above ground storage tanks eliminating risk of ground contamination
43	Lubricant Storage	Lubricants will be supplied in re-usable 1t "lube cubes" to avoid disposal of barrels
44	Reagent Containers	Reagents will be supplied either in bulk and stored in silos or reusable IBC (individual bulk containers) eliminating trash
45	Secure reagent storage	All reagents including sodium cyanide will be stored in a locked, ventilated, warehouse only accessible to authorized personnel
46	Inventory Control	All materials on site will be subject to the materials inventory control system to manage usage and minimize waste
47	Spill containment during storage	The reagent warehouse floor will be a concrete slab edged with curbs to contain spills and keep reactive materials separated
48	Spill containment during use	All areas where hazardous materials are used will have spill containment curbs and sumps to reclaim spilled material
49	Dust containment during mixing	All reagent mixing areas that can potentially generate hazardous dust will be fitted with dust hoods and extractor fans
50	Materials handling training to be provided	Employees handling hazardous materials will be permitted to do so only after receiving appropriate training
51	Hazardous material management plan will be developed	A hazardous materials management plan will be developed to address the use and handling of hazardous materials on site
52	Personal protective equipment to be worn	Hazardous materials will only be handled when the appropriate protective equipment supplied by the company is worn
53	Emergency response procedures in place	Employees will be trained to respond in the event of emergency including first aid; medical services will be advised of site hazards
		Cyanide
54	Packaging	Sodium cyanide will be provided in steel, reusable "flo-bins" which are returned to the supplier for refill after use
55	Permit to transport cyanide	The supplier is permitted by Transport Canada to transport and supply cyanide in Nova Scotia
56	Emergency Response Plan on file	The supplier's emergency response plan is on file with Transport Canada and will be activated in the event of a transport accident
57	Transport route selection	Cyanide will be shipped by rail to Truro and by truck to site via Hwy 102, 224, and the Moose River Road. All carriers have been subject to safety audit.
58	Public consultation regarding cyanide transport	The supplier will meet with residents of communities through which cyanide will be transported to address any concerns
59	Cyanide antidote kits	Cyanide antidote kits will be available in working

		areas and employees will be trained in their use
60	Cyanide Monitoring	Areas using cyanide monitoring will be equipped with cyanide monitors which alarm if concentrations rise above allowable limits
61	Local medical services to be informed	Local medical services will be informed about the materials, including cyanide, in use at the mine to ensure readiness
Wildlife General		
62	Baseline database and field studies performed for mammals	2004-2007, baseline studies have been conducted on mammals on the property and in the downstream area
63	Baseline database and field studies performed for birds	2004-2007, baseline studies have been conducted on birds on the property and in the downstream area
64	Baseline database and field studies performed for herpetiles	2004-2007, baseline studies have been conducted herpetiles on the property and in the downstream area
65	Baseline database and field studies performed for fish	2004-2007, baseline studies have been conducted on fish on the property and in the downstream area
66	Baseline database and field studies performed for invertebrates	2004-2007, baseline studies have been conducted on invertebrates on the property and in the downstream area
67	Baseline database and field studies performed for plants	2004-2007, baseline studies have been conducted on plants on the property and in the downstream area
68	Development will consider breeding season for birds	Development on site April-Sept will be done in a manner which minimizes disturbance to nesting habitat
69	Facilities will be fenced	The TMF, plant, open pit, and public road will be fenced to prevent entry by large mammals
70	Considerable wildlife habitat will remain on site	Shelter belts along watercourses and other forest on site will provide habitat for fauna tolerant of human activities
71	Cyanide concentrations in TMF will not be hazardous to animals	The expected CN concentration of < 10 ppm CN_{WAD} in the TMF is >5x lower than that hazardous to terrestrial and avian life
72	Site infrastructure does not pose an undue threat to wildlife	Buildings, lights, powerlines, and roads are all familiar features of the local landscape and do not pose a unique or undue hazard
73	Wildlife mortality to be considered performance criteria	A key performance indicator for the project will be wildlife mortality in order to raise awareness of importance among workforce
Wildlife Moose		
74	Development does not restrict free range of moose	Moose can easily bypass the mine site as they move from their base habitat in the Ship Harbour area to other regions
75	Poaching deterrent	The presence of the mine operating 24/7 will discourage poaching activities in the area and reduce access to other areas
76	Provide stewardship for surrounding wilderness	Technical staff from mine site will periodically patrol surrounding wilderness areas to assess conditions and document findings

77	Support research and field studies	The company will provide financial support and resources to aid government, academia, and community groups to conduct study
78	Post signs	The company will post signs describing its surveillance of moose to engender public support and further discourage poaching
79	Promote public engagement	Through its employees and community groups the company will raise public awareness and gather support to address issues
80	Development does not include unique habitat	Mine site is potential moose habitat although by no means optimal due to the long history of human activity in area
81	Traffic Mortality	2/3 of site traffic is expected to come via Moose River Rd which is north of the known moose habitat
82	Baseline monitoring information	Ongoing monitoring of downstream water quality may provide basis for studies on effects of acid rain and metals on moose
83	Managing direct impacts from operations	Technical staff will ensure that operations (blasting or dam const) do not affect wintering or calving moose near the mine site
84	DNR Moose Recovery Plan	The company will use the DNR Moose Recovery Plan as a guide to managing moose related issues for the project
85	DNR Guidelines for Developers	The company has considered the DNR Guidelines for Developers in formulation of its moose management plan for the Focus Report
Wildlife Lichen		
86	Baseline studies discovered rare species of cyano-lichens	Baseline studies conducted for the development discovered the presence of lichens species on site considered to be "at risk"
87	Project design altered to minimize impact on rare species	Facilities were re-configured to limit disturbance to less than half of the occurrences on site
88	Compensation for disturbance	To compensate for disturbance of rare species on site company will undertake studies to identify more occurrences in locale
89	No threat from air emissions to lichens on site	Although cyano-lichens are highly sensitive to SO$_2$, the mine will not emit harmful concentrations
90	No threat from air emissions to lichens in area	The extremely rare boreal felt lichen, known to exist within 10 km of site, is similarly not at risk from project air emissions
Air Quality		
91	Baseline air quality studies	Baseline air quality was established through field studies both on the project site and in the focus report area
92	Air quality modeling conducted	Modeling was conducted to establish total annual emissions and emission concentrations for the site and nearby receptors
93	Annual air quality monitoring to be conducted	Air quality sampling will be conducted twice a year for TSP for comparison to baseline and manage issues

94	Baseline weather data was collected	Baseline weather data was collected both through field measurements and from MSC sources in Middle Musquodoboit
95	Weather data will be collected daily	An on-site weather station will collect weather data daily to provide a record and aid in project management
96	Carbon Dioxide	CO_2 emissions predominantly from diesel engine exhaust total x,000 t/yr
97	Carbon Monoxide	CO concentrations less than 0.1% of permissible levels at nearest off-site receptors
98	Total greenhouse gas emissions minor	GHG emissions for the project excluding power generation amount to about 0.05% of all GHG emissions by mines in Canada
99	Oxides of Nitrogen concentrations harmless	NO_x concentrations less than 0.1% of permissible levels at nearest off-site receptors
100	Sulfur Dioxide concentrations harmless	SO_2 concentrations less than 0.1% of permissible levels at nearest off-site receptors
101	Suspended particulate concentrations not hazardous	Concentrations of suspended particulates are in all cases less than 7% of permissible levels at nearest off-site receptors
102	Particulate metal concentrations minimal	Concentrations of particulate metals are generally less than 1% of permissible levels at nearest off-site receptors
103	Hydrogen Cyanide concentrations harmless	Concentrations of HCN gas at the property boundary 200 m south of the TMF are below the permissible level
104	Scrubbers and filters used on stacks	All stacks and exhaust vents will be fitted with scrubbers and filters to reduce emissions
105	Stack emissions to be measured annually	Exhaust from stacks will be sampled annually and results used to measure performance and manage issues
106	Low sulphur diesel fuel used	All diesel equipment will run on low sulphur diesel fuel as legislated in NS
107	Engine idling program to be implemented	Company will implement program to minimize engine idling to address GHG emissions
Dust		
108	Fugitive dust management plan	Company has developed a fugitive dust management plan to control dust from operations
109	Haul roads, bench floors, and waste dump	Roads and bench floors will be watered to suppress dust
100	Blasting	Most dust from blasting will fall to earth within the pit area
111	High moisture material	High moisture content in ore and waste (4%) will discourage dust generation
112	Wet climate	Measurable precipitation 180 days per year will assist in reducing dust
113	Progressive reclamation	Capping completed dump lifts and permanent embankments with soil and re-vegetating will reduce dust from disturbed areas
114	Crushing and conveying	Water sprays and dust collection will be employed

		as required
115	Crushed ore stockpile and ore reclaim	Stockpile is in a covered building which will prevent the spread of wind blown dust
116	Gold extraction	All process activities from grinding to electrowinning handle slurry or gold in solution and generate no dust
117	Tailings beach	Tailings discharge will be relocated frequently to ensure beach remains moist
	Noise & Light	
118	Baseline noise studies were conducted for study area	Ambient noise levels on site and in the surrounding areas were determined to be 40 dBA
119	Noise impact assessment was conducted	Continuous noise emanating from site will not exceed ambient levels at the nearest off-site receptors
120	Periodic monitoring to be conducted	Noise levels from operations will be monitored periodically to address off-site impacts and ensure on-site OHS compliance
121	Blasting noise will be limited	Impulse noise from blasting will be [122 dB; at 1000 m a blast will sound like a car door slamming
122	Blasting frequency and duration	Blasting will be conducted 5 times per week; the actual duration of the noise of blasting will be < 2 s per event
123	Blast design to consider noise impacts	Delay between holes will be designed to minimize peak noise level and vibration and limit explosive use
124	Vibration from blasting to be monitored	Blasting vibration will be monitored periodically to monitor impact on foundations and tailings dam at site
125	Blasting effects on Moose River	A regular monitoring program will be developed to ensure that blasting does not result in harmful impacts on Moose River
126	Baseline light survey was conducted	Survey measured ambient light levels at night under various conditions to provide comparison to projected operating levels
127	Light pollution study was performed	Study indicated that light from the project at night would not significantly impact the surrounding wilderness areas
128	Viewplane analysis was conducted	Visibility of the site from surrounding areas was examined; impact was determined to be minimal
	Soil	
129	Baseline soil quality determined	Comprehensive site soil sampling campaign undertaken to establish baseline conditions for soil quality on site
130	Baseline sediment quality determined	Sediment sampling was conducted in streams on site and Scraggy Lake to establish baseline sediment quality
131	Erosion - Sedimentation Management Plan to be developed	Plan to be developed to minimize and manage erosion and sedimentation during construction and operations

Water Management		
132	Hydrologic model developed for site	Model describes quantities and rates of flow on site based on MSC data and field observations
133	Hydrologic model developed for downstream watershed	Model describes quantities and rates of flow in downstream watershed based on MSC data and field observations
134	Water balance developed for site and TMF	Water balance employs site hydrologic model to determine the net flow from the TMF for treatment and discharge
135	Water quality model developed for downstream watershed	Model predicts the impact of discharge on receiving water quality and compares it to MMER and CCME standards
136	Process water will be recycled	90% of water used in processing will be recycled from the TMF
137	Fresh water needs less than Square Lake recharge	After start-up, the plant will draw 20 m^3/hr from Square Lake, significantly less than recharge in any month
138	Limited impact on Square Lake from start-up	In the driest year, start-up will reduce the volume of Square Lake by 6%; impact on lake level is nominal
139	Start-up scheduled for fall/winter	Start-up is scheduled for the time of year with the highest runoff
140	Start-up water withdrawal for limited period only	Withdrawal of water from Square Lake for start-up limited to three months
141	Plant site runoff collected	Runoff from plant site will be collected in process water pond and recycled
142	Mine water collected	Water from the open pit will be collected and pumped to TMF for recycling or treatment
143	Waste Rock Stockpile water collected	Runoff from the Waste Rock Stockpile will drain by gravity to the TMF for recycling or treatment
144	Open Pit Ring Drain	The open pit will be encircled by a ring drain to limit inflow of runoff and water percolating through till from entering the pit
145	Open Pit Barrier Berm	The open pit will be surrounded by a barrier berm to prevent entry of water from Moose River in the event of flood
146	No transfer of water from river to pit	Hydrological studies indicate that Moose River and the subsurface area of the open pit comprise two separate hydrologic regimes
TMF Design		
147	Multi-barrier dam design	Two rockfill, clay-core dams and two rockfill divider dykes provided four barriers between contained tailings and downstream areas
148	Low dam height	Main dam only 16 m high; low profile promotes stability and reduces visual impact
149	Superior mechanical strength	Dam body constructed from chemically inert waste rock which provides support for clay core and resists collapse
150	Analysis for material quality	BH assays will identify chemically inert rock to construct the portion of dam downstream from clay core

151	Use of waste rock minimizes disturbance	Use of mine waste for dam construction eliminates the need to create a borrow pit to provide the 3 Mt of material required
152	Earthquake resistance	Dam is designed to withstand 80% of the 1/10,000 year earthquake; a similar event striking Halifax would devastate city
153	Design standard exceeds requirements	Dam designed to standards used to protect human life even though threat is largely to environment
154	Design prepared by best design firm	Golder Associates is a Canadian firm acknowledged as the leader in TMF design in the mining industry worldwide
155	Designer to oversee construction	Design firm will oversee dam construction and confirm that QA/QC is satisfactory
156	Stand-alone design	Tailings storage does not make use of natural lake causing destruction of existing habitat
TMF Seepage Control		
157	Clay core to prevent seepage	Compacted clay core 6 m wide extends the full height of the dam to inhibit seepage
158	Clay core keyed into ground	The clay core is "keyed" 1.5 m into bedrock or impermeable soils to enhance stability and create a very low conductivity barrier
159	Dam foundation sealed with concrete	Core key trench is slush grouted with lean concrete to seal cracks before placement of clay core
160	Filter material protects clay core	Layer of granular filter material protects the clay core from wash out or disruption by water pressure in the dam
161	Impermeable subsurface conditions	Geotechnical investigation shows tailings basin very low permeability
162	Low hydraulic head reduces seepage	Design pond volumes are limited to ensure that hydraulic head is minimized and does not exceed permeability of basin foundation
163	Seepage collection ditches	Ditches are provided on east and west sides of TMF; Polishing Pond serves same purpose to south of tailings impoundment
164	Design seepage low	TMF seepage estimated at 18 m^3/day per linear kilometer of dam; about the volume of a home oil delivery truck for an area of 130 ha
165	Seepage to be pumped back	Seepage in collection ditches will be pumped back into the TMF if analysis indicates contamination
166	Groundwater wells	A minimum of three wells (one on each side) will be used to monitor groundwater quality and detect seepage
167	Curtain grouting in event of seepage	A geologic structure providing a path for seepage can be drilled and grouted to seal it
168	Piezometers in dam	Piezometers in dam body will measure water level in dam and ensure it is within design tolerances
TMF Extreme Weather Management		
169	Dam design able to contain 1/200 year storm	At any time, the TMF can accommodate the inflow of 200,000 m^3 in 24 hours from the 1/200 year storm
170	Dam design able to contain 1/100	At any time, the TMF can accommodate the inflow

	year wet year	of 220,000 m^3 in 24 hours during the wettest month (April) in the 1/100 wet year
171	Spillways designed to protect dams	Inflows in excess of 220,000 m^3 will activate the spillways which will permit water to overflow into the Polishing Pond
172	Polishing Pond provides additional storage capacity	At any time, the Polishing Pond possesses an additional 150,000 m^3 of storage capacity for overflow from the tailings impoundment
173	Drained Polishing Pond provides further storage capacity	When the Polishing Pond is drained in March it can provide up to 600,000 m^3 of storage capacity in the event of excessive runoff
174	Main dams are built up one year ahead of time	Dam will be built up one year ahead of time providing a minimum of 1.4 M m^3 of excess storage capacity in the TMF
175	Build-up procedure provides massive additional storage capacity	The excess storage capacity in the TMF is 3x the maximum probable flood and 5x the heaviest rainfall event occurring in the last 55 years.
TMF Contingency Plans		
176	Emergency Response Plan (ERP)	The TMF operating manual defines the procedures to be followed in the event of an emergency
177	Increased monitoring frequency in the event of extreme weather	If the pond level rises to within 1 m of the bottom of the spillways monitoring on and off-site is increased from daily to hourly
178	ERP activated if pond level rises too quickly	If the pond level rate of rise exceeds 10 mm/hr an emergency is declared and mitigation measures are invoked
179	Notification procedure	Procedure established to notify appropriate persons on and off-site depending on the severity of the emergency
180	Evacuation	In the event of an incident or if an emergency is declared affected areas will be cleared including downstream if appropriate
181	Siltation barrier deployed in Scraggy Lake	A removable siltation barrier will be drawn across the narrows in Scraggy Lake to trap sediment in the north end if failure occurs
182	Lower pond level by pumping into pit	Reclaim water line can be relocated to lower the TMF water level by transferring water into the open pit
183	Mine fleet used to effect containment and repairs	Mine equipment will haul waste material from stockpile to repair dams or build containment in the event of a failure
TMF Dam Failure		
184	Low probability of dam failure	Probability of dam failure is 1/10,000 or 0.01% in any given year
185	Limited release of tailings in event of failure	At maximum storage, only 10% of tailings, 500,000 m^3, would escape containment due to the 4 barrier design
186	Limited physical impact on Scraggy Lake due to failure	Lake level would rise 0.35 m and tailings would occupy 2% of the lake volume
187	Limited impact on downstream	Acute harm to aquatic life would be confined to

	watershed due to failure	Scraggy Lake as contaminant levels would be at or near MMER levels
188	Contaminants would be flushed through watershed	At 1 m^3/s, a maximum of 2 M m^3 of contaminated water would take 3 weeks to flow through watershed
189	Company will insure to address harm caused by a failure	Multi-million dollar insurance policy, not required by legislation, will be carried to address harm and clean-up for a failure or uncontrolled release
Tailings Line		
190	Dual-containment tailings line	Pipeline between plant and TMF contained in sealed concrete trough
191	Physical protection	Concrete trough protects line from damage by snow plow or from vehicle impact
192	Topless trough	Topless trough permits visual inspection
193	Water crossings	The pipeline trough is fully enclosed where it crosses streams
194	Sealed trough sections	Trough sections are sealed to contain slurry in the event of a leak
195	Leak response	If a leak is detected the mill is shutdown immediately and repairs are effected
196	Reclaim water line shares trough	Tailings line and reclaim water line both lie in the trough so if the water line breaks it doesn't wash out the tailings line
Tailings Discharge		
197	Tailings used to inhibit seepage	Tailings are deposited against the east and west dam walls to inhibit seepage
198	3-spigot header	Distribution header will enable tailings to be placed over 150 m length of dam before repositioning
199	Frequent spigot moves	Discharge header will be repositioned every 7-14 days to ensure most efficient and effective placement of tailings
200	Erosion protection	Use of coarse rock to protect the upstream face of the dam will prevent erosion of the dam body
201	Tailings velocity reduction	Piles of coarse rock will be placed at each discharge location to reduce the velocity of the inflowing tailings and aid deposition
202	Emergency discharge point	Bypass discharge point is provided at the NW corner of TMF so tailings can be discharged into containment while pipe is moved
Cyanide Destruction		
203	Three complementary treatment processes	Cyanide destruction system, settling and natural degradation, and effluent treatment
204	Best cyanide destruction technology	INCO SO_2/Air process; Canadian designed process acknowledged as the most effective method to detoxify tailings after cyanidation
205	Products of cyanide destruction are harmless	SO_2/Air turns cyanide into cyanate which is 100x less toxic and readily decomposes into CO_2 and ammonium (NH4)
206	Ammonia (NH3) not a cyanate decomposition product at	Cyanate will decompose into NH4 rather than NH3 as TMF pH is neutral (7-8) and receiving water pH

	Touquoy	is naturally acidic (4-5)
207	Cyanide concentration in tailings exceeds highest world standard	CN$_{WAD}$ (toxic form) in tailings will be approximately 3 ppm, one third of the 10 ppm limit recently specified by the EU for TMFs
208	Tailings water no threat to wildlife	Cyanide concentrations less than 50 ppm are acknowledged as not harmful to terrestrial or avian lifeforms
209	Cyanide decomposes naturally	Ultraviolet radiation causes cyanate to break down and free cyanide to volatize in harmless concentrations
210	No hazard from free cyanide volatilization	Studies have shown when volatilization is used to attenuate cyanide toxicity, HCN concentration not measurable above pond
211	Cyanide decomposes rapidly	Aging tests showed that in 45 days, CNWAD decreased from 3.5 ppm to < 0.2 ppm in a sealed, covered container
212	Generous retention time for natural degradation	Tailings water will be retained in the TMF 30-60 days prior to recycling or treatment and discharge
213	Tailings impoundment acts as settling pond	Sediment and other suspended solids settle out in tailings impoundment
214	Long-lived cyanide compounds not toxic	Only cyanide compounds stable enough to persist over time are metal complexes (used by industry as additives in foodstuffs)
215	Cyanide concentration at discharge far lower than MMER	Aging tests show cyanide concentration reduced to < 0.2 ppm, 5x lower than MMER requirement of 1.0 ppm
Effluent Treatment (ET)		
216	Water discharged to control pond level	1.5 M m^3 is discharged annually ensuring that pond level remains within design limits
217	Conservative plant design	Effluent treatment plant (ETP) is designed to handle 40% more water (2.5 M m^3) than in a typical year
218	ETP can handle 1/200 year storm	ETP has sufficient capacity to handle inflows from the 1/100 year wet year and 1/200 year storm
219	Polishing Ponds provide additional storage	Polishing Ponds will be drained in winter providing an additional 300,000 m^3 of surge capacity in the event of excessive runoff
220	Treatment only planned for 8 months of year	Discharge is planned for April - November but discharge can be carried out year round, conditions permitting
221	Treatment will meet or exceed discharge standards	Treatment will permit the project to meet or exceed all water quality discharge requirements prescribed by MMER
222	Treatment will reduce arsenic far below regulated limits	Treatment will reduce total arsenic from 0.5 ppm to 0.018 ppm 25x lower than MMER requirements
223	Treatment will remove other contaminants	Treatment will result in co-precipitation of other dissolved metals and flocculation of suspended solids
224	Treatment will remove residual cyanide	Residual cyanide will be co-precipitated as ferro-cyanates lowering total cyanide concentration
225	Water to be held and tested	Treated effluent will be held in the Polishing Pond

	before release	7-30 days to ensure quality meets discharge criteria
226	Retreatment for water not meeting standards	Effluent not meeting standards will be pumped back into the TMF and be subject to retreatment
227	Treatment will minimize downstream impacts	Treatment will lower contaminant concentrations at discharge so that there is minimal impact of receiving water quality
228	Special storage for treatment waste	Treatment waste will be stored in containment cells in the TMF designed to prevent the remobilization of contaminants
229	Containment cell design	Cells are purpose-built rockfill structures lined with clay to provide a stable chemical environment for waste disposal
230	No need to transport hazardous waste	On-site storage of treatment waste eliminates the need to ship hazardous material by road to another site for disposal
231	Cells to contain historic mine tailings	Contaminated soil from historic mining will be safely disposed of with treatment waste
Wetland Purification		
232	Will further limit impact on downstream watershed	Purification of effluent in an engineered wetland will permit discharge to meet CCME standards in receiving waters
233	Allows pH adjustment	Discharge into an engineered wetland will permit pH of effluent to adjust downwards minimizing shock on receiving environment
234	Highly effective in removing residual nitrates and metals	Demonstrated efficiencies for removal of metals and nitrates range from 40-60%; particularly effective for removal of dissolved solids
235	Proven, natural method of treatment	Use of wetlands as a means to attenuate contamination in effluent is a documented, proven method of treatment
236	Tertiary treatment provides additional security	Wetland treatment provides third level of water treatment which cannot fail; natural attenuation processes work unmanaged
237	Creates additional wetland habitat	Engineered wetland will provide a minimum additional 2.4 ha of additional wetland habitat
Acid Rock Drainage		
238	Host rocks at Touquoy neutralize acidity	Unlike many locations in Nova Scotia, the rocks at Touquoy contain carbonate minerals with high neutralizing potential
239	Little acid generating potential among samples	Only 2% of samples collected showed any acid generating potential
240	Even at lower neutralizing ratios, neutral pHs tend to prevail	Even at neutralizing ratios of 2-4 neutral pHs prevail due to the high buffering capacity of the primary carbonate mineral, calcite
241	Net acid generation testing performed	All samples showed neutral to alkaline NAG-pH values indicating little long-term potential for acidity
242	Kinetic testing showed little acid generating potential	After 20 weeks, humidity cells resulted with leachate pH of 6.6-7.7
243	Long-term acid generation	Calculations indicate that sulphides will likely

	unlikely	deplete before neutralizing potential is exhausted
244	Mini-pit provides "living laboratory" for ARD	Test pit mined by Seabright Resources in 1989 in ore zone exhibits a slightly alkaline pH and hosts fish population
245	Tailings not expected to be acid generating	Expect no acid generation from tailings due to lack of sulphide minerals and excess neutralizing capacity; confirmed by testing
246	Procedure for handling high-sulphide waste	High sulphide waste will be identified by BH assay and stored in waste rock stockpile with high carbonate material
247	Any acidity managed through treatment	All runoff is directed to the TMF where pH is adjusted during treatment by lime addition
	Water Quality Monitoring	
248	Cyanide destruction circuit	Performance will be monitored hourly on a continuous basis
249	Effluent treatment circuit	Performance will be monitored hourly on a continuous basis
250	Polishing Pond water quality	Quality will be monitored daily to ensure water is ready for discharge
251	Discharge water quality	Quality of water discharged from the Polishing Pond will be monitored daily
252	Groundwater quality	Groundwater wells around the TMF will be sampled monthly
253	Seepage water quality	Water from seepage collection ditches will be sampled monthly
254	Natural stream water quality	Natural stream waters will be sampled monthly and results compared to baseline (includes Square Lake and Moose River)
255	Acute toxicity testing to be conducted	Acute toxicity testing to be carried out on discharged effluent once a month or as otherwise specified by MMER
256	Effluent characterization to be performed	Effluent characterization is to be performed 4 times a year or as otherwise specified by MMER
257	Sub-lethal toxicity testing to be conducted	Sub-lethal toxicity testing to be conducted once a year or as otherwise specified by MMER
258	Biological studies to be conducted for MMER	Biological studies to be conducted to determine the impact of effluent discharge on the downstream environment
259	Water quality testing to be conducted for MMER	Quality of receiving waters will be determined four times a year or as otherwise specified by MMER
	Flow Monitoring	
260	Tailings inflow	Flow rates will be monitored continuously to ensure a line break doesn't occur and to meet the needs of operations
261	Reclaim water flows	Flow rates will be monitored continuously to ensure a line break doesn't occur and to meet the needs of operations
262	Effluent Treatment inflow and outflow	Flow rates will be monitored continuously to ensure a line break doesn't occur and to meet the needs of operations

263	Natural stream flows	Natural stream flows will be measured monthly including Moose River and Fish River(s)
TMF Physical Parameter Monitoring		
264	Ponds levels measured	TMF and Polishing Pond levels will be measured daily
265	Water table level	Water table level in TMF area will be monitored monthly
266	Dam phreatic surface measured	Piezometers in the dam will measure the phreatic surface (water level) in the dam monthly
267	Topographic surveys	Survey pick-ups of the TMF will be conducted monthly to detect any deformation and record construction progress
268	Settlement surveys	Settlement plates in the dam body will be read monthly to ensure settling is within design tolerances
269	Tailings beach surveys	The crest of the tailings beach will be surveyed monthly to ensure the slope, extent, and density of the beach are as planned
270	Bathymetric surveys	The bottom of the tailings impoundment and Polishing Pond will be surveyed twice a year to direct the tailings deposition plan
TMF Inspections		
271	OMS manual developed prior to start-up	Procedures for operation of the TMF have been documented BEFORE facility constructed
272	Prescribed reporting procedure	OMS manual prescribes procedure for reporting inspections and addressing deficiencies
273	Inspection schedule developed	Schedule developed designating nature, frequency, and responsibility of required inspections
274	Tailings line inspection	The main delivery line, distribution line, and spigots will be inspected visually every shift
275	Tailings line thickness testing	Thickness testing will be conducted periodically to ensure that pipe wear is monitored and addressed as required
276	Dam inspection	The main tails dam, polishing pond dams, divider dykes and all associated roads will be inspected each shift
277	Ditch and spillway inspection	All ditches and spillways will be inspected each shift
278	Discharge channel inspection	Discharge channel from Polishing Pond to be inspected every shift
279	Reclaim water system inspection	Decant tower, ET feed line, and reclaim water line will be inspected every shift
280	TMF infrastructure inspection	The ET Plant, substation, powerline, and on-dam power distribution system will be visually inspected every shift
281	Mechanical equipment inspections	All mechanical equipment at the TMF will be inspected regularly as part of the planned maintenance program
282	Electrical equipment inspections	All electrical equipment at the TMF will be inspected regularly as part of the planned

		maintenance program
Reclamation		
283	Progressive reclamation to be employed	Primary principle of progressive reclamation is to minimize operating disturbance rather correcting the disturbance later
284	Waste Rock Stockpile to be reclaimed during construction	Each 10 m lift completed will be re-sloped and seeded while the subsequent lift is under construction
285	Waste Rock Stockpile designed to resist erosion	2 m wide shelfs are designed between each 10 m high lift sloped to 2.5:1 to absorb surface water flow and prevent soil erosion
286	Disturbed wetlands will be replaced	Wetlands will be replaced in the same watershed at a ratio agreed with NSDNR
287	Re-vegetation will utilize native species	Native species will be used to re-vegetate during operations and at closure
288	Barrier berm around pit to be sloped and re-vegetated	The barrier berm around the open pit will be sloped and seeded shortly after construction for aesthetic reasons
289	Interpretive Centre area to be landscaped	The area adjacent to the pit housing the Interpretive Centre and relocated park will be landscaped shortly after construction
290	Permanent embankments to be reclaimed early	Slopes of permanent infrastructure such as the crusher road and ETP site will be reclaimed during the mine life
291	Site will NOT be clear cut	Existing trees will remain as much as possible to screen facilities from view and provide a barrier for noise and dust
292	Use of existing cleared land to be maximized	Facilities will be fit into existing clear cut areas as much as possible
293	TMF discharge channel to be natural but "improved"	Natural channel for discharge of treated effluent will be improved to handle increased flow but will retain natural appearance
294	Moose River shoreline to be restored	Riparian habitat along banks of the Moose River damaged by previous human activity will be restored prior to closure
295	Watercourses to be protected	A 30 m minimum width will be left on either side of streams flowing through the property
296	Bottomless culverts to be used	All stream crossings will employ bottomless culverts to protect aquatic habitat
Closure		
297	Pit allowed to flood at closure	Open pit will become a lake at closure; alternatives to speed filling expected to take 20 years being considered
298	Wetland habitat to be created along pit shoreline	Top bench will be sloped so that a 10 m wide band of shallows will be formed around the pit perimeter creating wetland habitat
299	TMF to be reclaimed at closure	TMF will be drained, dams re-sloped, and tailings capped with filter material and soil and vegetated
300	Runoff to be diverted from TMF	Flows will be diverted around the TMF to protect tailings from erosion and minimize contamination

		of runoff
301	Treatment to continue after closure	Treatment will continue until the quality of water draining through the site returns to that which existed before development
302	Facilities to be removed at closure	All above ground facilities will be removed at closure
303	Roads to be reclaimed at closure	Roads considered to add no value to the site after closure will be capped with soil and seeded
304	Closure plan will reflect community needs	The site will be reclaimed in a way that provides the greatest value to the community AT THE TIME OF CLOSURE
Townsite Removal and Remediation		
305	Removal of Moose River Townsite	Buildings will be dismantled and materials disposed of in an approved dump site; some buildings may be reused
306	Hazardous materials management survey	Survey will conducted of all constructions to be removed to identify hazardous materials (ie asbestos) and means of disposal
307	Clean-up of hydrocarbon contamination	During the removal of the townsite, soil contaminated by old heating oil systems will be disposed of in an approved manner
308	Clean-up of historic mine tailings	Soils in the pit area identified as contaminated by historic mining activity will be removed and placed in containment in TMF
309	Risk assessment approach to historic tailings	Historic tailings NOT in the pit will be subject to risk assessment to determine if there is a net benefit to removing them
310	Provide model for historic tailings clean-up	Company will partner with DNR to document site clean-up as a model for use elsewhere in Nova Scotia

Monitoring Programs

The following table outlines the various monitoring programs that have been proposed for the project in both the Environmental Assessment Registration Document and the Focus Report. The purpose of this outline is to provide a general sense of the monitoring programs proposed for the project. A description of the monitoring components is available in the Environmental Assessment Registration Document and this Focus Study Report.

Table 7.2-2 Overview of Monitoring Programs

Component	Item	Suggested Frequency	Details
Groundwater Monitoring	Static water level	Monthly, once construction phase begins	Final locations of groundwater monitoring wells to be determined in consultation with regulators at the Industrial Approval Application stage.
	Water quality monitoring	Monthly, once construction phase begins	Laboratory testing will consist of RCAp MS testing
Surface Water Monitoring	Flow monitoring of nearby streams	Monthly, once construction phase begins	Monitoring of stream discharge and water level
	Water quality monitoring of nearby streams	Monthly, once construction phase begins	Final locations of surface water monitoring locations to be determined in consultation with regulators at the Industrial Approval Application stage. Water to be tested for RCAp MS, TSS, arsenic, and cyanide.
Noise Monitoring	Noise monitoring at surface clearing and construction stage	One time at property boundaries and/or sensitive receptors	To collect representative noise level data during those phases
	Mine site noise monitoring	Quarterly basis and/or if there are noise complaints	Measured at property boundaries and points of reception to ensure regulations are not exceeded
Air Emission Monitoring	Particulate Monitoring	Quarterly Monitoring and /or if complaints	Monitoring at Property boundaries and sensitive receptors
Blast Monitoring	Initial Blast Monitoring survey conducted to establish baseline	Baseline monitoring /yearly monitoring	Initial monitoring to establish baseline/yearly monitoring to ensure compliance
	Pre-blast moose survey	As blasting occurs	Visual survey for moose on site prior to blasting
Biological Monitoring	Cyanolichens	One time	Additional cyanolichen survey off the Project site
	Moose	As occurs	• DDV Gold will catalogue and report all moose sightings to NSDNR during the construction, operation, and decommissioning phases. • Habitat assessments will be conducted at each moose sighting location and the data will provided to NSDNR.
Tailings Management	Visual inspections	Daily/monthly/quarterly	
	Water level	Daily, once operations	Water level in TMF to be

Table 7.2-2 Overview of Monitoring Programs

Component	Item	Suggested Frequency	Details
Facility	measurements	begin	monitored using a manual staff gauge and/or a continuous pressure transducer logger
	CN destruction circuit performance	Hourly once operations begin	
	Effluent treatment performance	Hourly once operations begin	
	Discharge water quality	Daily once operations begin	• Monitored for TSS, cyanide, arsenic. RCAP-MS analysis. • Compliant with MMER effluent monitoring program regulations
	Groundwater wells	Weekly once operations begin	
	Structural settlement surveys	Monthly once operations begin	
	Environmental Effects	Monthly/quarterly once operations begin	As per MMER EEM program
	Deleterious Substances and pH Testing of effluent	Weekly or monthly	As per MMER EEM program
	Flow/discharge monitoring	Continuous	As per MMER EEM program

RCAp MS – general water chemistry and metals analysis
TSS – total suspended solids
MMER EEM – Metal Mining Effluent Regulations, Environmental Effects Monitoring

The proposed monitoring programs will incorporate input from the CLC and relevant regulatory agencies, and are subject to review and approval by NSEL and/or NSDNR. Consultation with these agencies will take place during the Industrial Approval application phase of the permitting process.

7.3 MITIGATION FOR FOCUS REPORT TERMS OF REFERENCE ITEMS

The Touquoy Gold Project has been designed with specific attention to the minimization of damage to the environment. There are situations associated with any large project that involve land disturbance that could cause environmental impact. DDV Gold has in its approach sought to avoid these situations through a) technical design, (described in Section 2.0) b) mitigation where the opportunity exists to minimize impacts (described in 7.1 and 7.2) and, c) compensation where damage is unavoidable and cannot be adequately mitigated (described in Section 7.5). The TOR for the Focus Report makes specific reference in Section 5 to a requirement to address all VEC's identified in Section 3 including the following:

1. Flora and Fauna/Rare Species and Species-at-risk
2. Aquatic Resources
3. Atmospheric Resources
4. Surface Waters and Wetlands
5. Ambient Light and Noise Levels
6. Ecological Value
7. Recreational Value

Specific aspects of the Project where compensation has been put forward as a means to address unavoidable impacts are provided in Section 7.5. Also provided is some background on the approach taken and specific efforts to develop the compensation details.

7.3.1 Flora And Fauna/Rare Species And Species-At-Risk

Background

Baseline work of flora and fauna, rare species and species-at-risk have been outlined in Section 3. In accordance with *SARA* (2003), specific impacts that are unavoidable for provincially red- and yellow-listed species have been described below with specific mitigation measures.

Plant Species and Mitigation Measures

None of the plant species listed by the ACCC within 100 Km of the FRSA were reported during field surveys in the Touquoy Project site and thus should not be impacted by mine development. Potential habitat for several red- and yellow-listed plant species may exist in the FRSA; however, none of the available habitat outside the Touquoy Gold Project site will be impacted. Therefore, mitigation measures are not required in regards to rare or uncommon plant species in the area of the Touquoy Gold Project.

Lichen Species and Mitigation Measures

Recognizing that some individual lichens will be removed by the proposed Project, DDV Gold proposes to conduct additional lichen surveys in the area of Moose River Gold

Mines to compensate for lost individuals. Given that the listed species known from the site have specific habitat requirements and distributions are rather poorly known, additional surveys of suitable habitat in the local area would contribute to the collective knowledge of these species within the Province. The remoteness of the area has resulted in little targeted surveying for lichens being conducted in this area by the Province or private ventures.

Mammal Species and Mitigation Measures

The only species-at-risk mammal known to occur in the FRSA that may be impacted by mine development, and thus require mitigation measures, is the Eastern Moose. The potential impacts to moose in the FRSA and appropriate mitigation measures, where applicable, are addressed below.

The potential impacts of the proposed Touquoy Gold Project mine development to moose include disturbance of reproductive or feeding activities (generally due to noise or site activity), habitat loss, fragmentation and alteration, direct mortality due to vehicle collisions, and increased depredation, disease and poaching; however, the effects of the mine are expected to extend only marginally beyond the Touquoy Gold Project footprint and therefore will not impact moose in the greater FRSA.

Seasonal habitat use by moose is considerably variable and ranges from dense coniferous forests for winter protection to early successional forests for foraging to standing water wetlands for calving (Parker 2003, Snaith and Beazely 2004). Moose habitat is present throughout the FRSA; however, is minimal in the area of the Touquoy Gold Project site. The low density of moose in the area, small proportion of wetland area on the site, and the small proportion of available area occupied by the site within the FRSA results in the proposed development having a very low potential to affect moose populations in the FRSA.

Disturbance and displacement of moose in the vicinity of the site may potentially result from site activities such as use of heavy equipment, blasting or general human activities/presence. Moose are generally tolerant of disturbance and will avoid roads and active areas except possibly during rutting season. It order to mitigate disturbance to seasonal habitat use by moose, DDV Gold will consult NSDNR to implement a no wildlife harassment and an avoidance of active wintering/calving areas control policy on site (*i.e.* disturbance will not occur in areas of active wintering and/or calving periods).

Habitat fragmentation, alteration and loss of habitat is only expected to impact moose in the immediate vicinity of the Project site and not the entire FRSA, given the scale of moose habitat and existing disturbance in the area. The area to be disturbed represents < 1% of the moose habitat available in eastern Halifax County, and habitat quality on the Project site is marginal.

Habitat connectivity maintaining moose movements in an east-west direction may be impeded by the Project area; however, given the recent large scale clearing to the west of the proposed tailings pond and northeast of Moose River Gold Mines, moose movements have already been impeded and some of the habitat connectivity lost. Although these areas provide good moose browse, they will likely not provide suitable cover (mature forest) for the duration of the mine development. Moose will not make use of available forage in large areas created through clear-cutting and void of mature forest patches for 10 to 15 years post-harvest (Monthey 1984, Potvin *et al.* 1999; as cited in Snaith and Beazley 2004) and will not move more than 80 to 200 m from forest cover (Peek *et al*. 1987, Jackson *et al*. 1991, Thompson *et al.* 1995; as cited in Snaith and Beazley 2004). In the event of moose movement in an east-west direction, habitat connectivity will be maintained at the effluent discharge channel between Scraggy Lake and the tailings pond. Moose movements in a north-south direction are not expected to be impeded by the Project area given the habitat connectivity on the east and west sides of the development, except for the existing road through the Project area.

Loss of portions of habitat will be mitigated by collaborative monitoring strategies for moose and will be developed in consultation with NSDNR, CMM, Nova Scotia Mainland Moose Recovery Team and researchers on appropriate habitat restoration. Such restoration may include maintaining vegetative buffers and travel corridors that will provide moose browse and shelter whenever possible. Provision of open water in the form of ponds or still waters with associated wetland habitat may be part of the wetland compensation. This could provide a source of aquatic forage as well as a means of relief from insects and escape for calves from predators such as black bears and coyotes.

Mortality due to vehicle collisions has been outlined by the NSDNR as a potential threat to the recovery plan for mainland moose populations (NSDNR 2007). The area of the proposed mine site is currently intersected by an existing paved road (Moose River Road) and by forestry roads which may be used by all-terrain vehicle users. The density of roads in the FRSA will not increase, as the creation on the road to the west of the development site will replace the existing road through Moose River Gold Mines. Disruption of movement patterns for moose may include some temporary disruption of seasonal/foraging habitat; however, the area to be affected is a relatively small proportion of the larger available habitat in the immediate area and it is expected that foraging habits of moose are somewhat flexible resulting in this effect not being significant. Traffic flow (*i.e.* supplies and equipment) is expected to increase, however to mitigate potential impacts to moose population and minimize mortality due to vehicle collisions, traffic will come from the north along Moose River Road from Route 224, thus avoiding the higher density of moose to the south of the development site. Additionally, mine vehicles will have a 50 km/h speed limit do avoid collisions with moose; however, there should not be any moose within the development site. Staff will not be permitted to use ATVs on-site other than use required for mining related activities.

In order to mitigate increased access by the general public and predators, public access will not be permitted in the active mine/processing area unless accompanied by mine site staff. Any changes to the proposed operating plan will include consideration of moose and moose habitat. DDV Gold will consult with NSDNR during the Project, and development of the Land Management Plan and Reclamation Plan. Direct impacts to moose will be mitigated by measures such as limiting moose access to the pit areas using berms and fencing and further consulting with the appropriate government department on the success.

The creation of the development site should not increase the white-tailed deer population in the FRSA given the entire area impacted will be contained within the Project footprint with the majority being converted into a tailings pond and mine pit. Therefore, increased prevalence of the parasitic nematode, *Paralephostrongylus tenuis*, is not expected to occur.

In summary, the development site will have minimal effects on moose within the larger FRSA. DDV Gold acknowledges the demand for proper mitigation for moose and moose habitat. Further initiatives will be implemented to ensure consideration of moose and moose habitat. In particular, DDV Gold can provide stewardship, provide public awareness, partner with various environmental groups, support research on mainland moose populations in Nova Scotia, and discourage poaching through signs, fences and employee involvement.

Bird Species and Mitigation Measures

There is some potential for habitat important to individual birds, such as nesting areas, snags and cavity trees within the forested area and edge feeding areas in the proposed development area. Potential impacts to migratory and permanent resident birds could include loss of habitat, habitat fragmentation or disruption of reproduction in the proposed development site; however, the habitat types within the Project area are well represented in FRSA and will not be greatly reduced in the landscape.

Four yellow-listed bird species, the Canada Warbler, Common Loon, Common Nighthawk and Barn Swallow, were all noted during field surveys. Habitat for Canada Warblers is well represented throughout the FRSA and therefore should have minimal effect on breeding populations and require no mitigation measures. Male Common Loons were heard calling from both Square and Scraggy Lakes during wetland and vegetation surveys. As fish levels are low in both these lakes (see Section 3, Aquatic Resources), it is unlikely Common Loons are nesting in either lake as they generally nest were abundant food resources are available (McIntyre and Barr 1997). The loons are likely visiting from surrounding lakes during the breeding season, and therefore, disturbance should be negligible. A Common Nighthawk was heard flying over the northern end of the Project site. Common Nighthawks have a considerable home range during the breeding season (Poulin *et al.* 1996) and may not be using the Project Site for breeding purposes. Many of the breeding habitat requirements for Common Nighthawks are well represented outside of the development area, and therefore, should have negligible effects on breeding populations in the FRSA. Barn Swallows are generally tolerant of human activity and will likely breed on buildings and bridges within the development site even with moderate disturbance levels (Brown and Brown 1999); therefore, it is unlikely the development will have a significant effect of Barn Swallows. In the event Barn Swallows nest on human structures in the development area, mitigation measures will be implemented to minimize disturbance to nesting birds.

To comply with the *Migratory Bird Act* (1994) and the *Wildlife Act* (1996) regulations, direct impacts to migratory and permanent resident bird will be mitigated by reducing clearing and grubbing activities during the breeding season (April 1 to August 1) so that the eggs and flightless young of birds are not inadvertently destroyed. If for some reason clearing activities must occur between April 1 and August 1, a nesting bird survey of areas to be cleared shall be conducted prior to any site disturbance.

Herpetile Species and Mitigation Measures

None of the herpetile species listed by the ACCC within 100 Km of the FRSA were reported during field surveys in the Touquoy Project site and thus should not be impacted by mine development. Potential habitat for wood turtles may exist in the FRSA; however, no breeding, hibernating or foraging habitat will be impacted by mine development. Therefore, mitigation measures are not required in regards to rare or uncommon herpetile species in the area of the Touquoy Gold Project.

Odonate Species and Mitigation Measures

None of the odonate species listed by the ACCC within 100 Km of the FRSA were reported during field surveys in the Touquoy Project site and thus should not be impacted by mine development. Breeding and foraging habitat may exist within the FRSA, however, no streams, rivers, ponds or lakes will be physically disturbed during mine development. Therefore, mitigation measures are not required in regards to rare or uncommon odonate species in the area of the Touquoy Gold Project.

7.3.2 Aquatic Resources

Baseline work has been outlined in Section 3 and the assessment of impacts in Section 4 that outlines known and predicted effects. Mitigation has been previously described in Section 7.1 and 7.2.

7.3.3 Atmospheric Resources

Baseline work has been outlined in Section 3 and the assessment of impacts in Section 4 that outlines minimal known and predicted effects. Mitigation has been previously described in Section 7.1 and 7.2.

7.3.4 Surface Waters And Wetlands

Baseline work has been outlined in Section 3 and the assessment of impacts in Section 4 that outlines minimal known and predicted effects. Mitigation has been described in Section 7.1 and 7.2.

7.3.5 Ambient Light And Noise Levels

Baseline work has been outlined in Section 3 and the assessment of impacts in Section 4 that outlines minimal known and predicted effects. Mitigation has been described in Section 7.1 and 7.2.

7.3.6 Ecological Value

Baseline work has been outlined in Section 3 and the assessment of impacts in Section 4 that outlines minimal known and predicted effects. Mitigation has been described in Section 7.1 and 7.2.

7.3.7 Recreational Value

Assessment work outlined in Section 3 has determined minimum predicted impacts.

7.4 CONTINGENCY PLANNING AND PLANS

Contingency plans are the fourth element in the project safety and environmental management philosophy. Contingency plans are activated when mitigation and management through design, operating procedures, and monitoring fail. Contingency plans can address disaster situations, accidents, or deviations from desired operating performance.

The project emergency response plan (ERP) will address all possible emergency situations for the project. The complete ERP will be developed following EA approval for the Industrial Approval phase of permitting. This timing is appropriate as only after EA approval will all the conditions of operation be known.

The Focus Report Terms of Reference has required an explanation of contingency plans as they relate to incidents that could result in downstream impact. The incidents that could result in downstream impact are:

- Treatment failure
- Seepage
- Overflow
- Dam Failure

Other incidents that could result in environmental impact due to a loss of containment do not have potential to impact the downstream area. These would include a tailings line break and a vehicular accident involving the transport of sodium cyanide.

The tailings line is contained in a concrete, open-topped utility trench which provides secondary containment while permitting visual inspections. It is located over 2 km from the north end of Scraggy Lake and therefore presents no threat even if secondary containment was lost.

The transport route to the site for sodium cyanide avoids all downstream areas and was selected by the supplier to limit exposure of area residents to the possible consequences of a vehicle accident causing a loss of containment. The route is described in Section 6 and the route assessment is provided in Appendix Y. In the event of an accident during transport, the supplier's emergency response plan, presently on file with Transport Canada, will be activated.

7.4.1 Treatment Failure

Treatment failure would entail water being treated and then discharged from the polishing pond at contaminant levels such that there would be a negative impact on the downstream environment. Such a failure is improbable as treatment performance is monitored continuously.

Furthermore, treated water is retained in the polishing pond 7-30 days where quality is repeatedly checked prior to discharge. Even if a problem with treatment went undetected for several days the water would not be discharged before analysis showed that a deviation from plan had occurred and action could be taken.

In the event of a treatment failure, discharge would cease and treated water not meeting requirements would be pumped back into the tailings impoundment for re-treatment. Design surge capacity in the polishing pond (150,000 m^3) would be sufficient to store treated water for two weeks if treatment continued and water, for some reason, could not be pumped back into the tailings impoundment

Lastly, the untreated water in the tailings pond already meets MMER discharge standards before treatment and all discharged water flows through the engineered wetland before entering Scraggy Lake. Thus, even if a treatment failure did occur, impact would be partially mitigated and no immediate toxic or sub-lethal effects would occur. Any potential effect would be long-term and would be assessed through the prescribed MMER monitoring programs

7.4.2 Seepage

Seepage resulting in contamination of downstream waters is highly unlikely. Design seepage for the TMF is 18 m^3/d of water. This amount of seepage is based on the established transmissivity of the top 3 m of weathered bedrock. This amount of seepage, roughly the equivalent of a running garden hose, for an area of approximately 100 ha is miniscule

The geotechnical investigation beneath the tailings basin indicates that from 3-10 m the transmissivity of the bedrock decreases by a factor of 100. Below 10 m the transmissivity of the bedrock decreases by a further factor of 100. Thus at depths more than 10 m beneath the tailings dam, the bedrock is 10,000x less permeable than the rock near surface. Therefore, from a design perspective, significant seepage through the basin foundation is not anticipated.

Operating practices will be employed to further reduce seepage. Tailings will be deposited against the dams to provide an additional barrier. The pond level will be managed to minimize the hydraulic head available to promote seepage.

Monitoring will be conducted regularly, weekly and monthly, to ensure that seepage is not occurring. This will include sampling and analysis of water from:

- seepage collection ditches on the east and west sides of the tailings basin
- groundwater monitoring wells located on the east, west, and south sides of the TMF

If seepage is detected in collection ditches the water will be pumped back into the tailings impoundment and monitoring frequency will be increased until seepage is no longer detected.

Chronic, near surface seepage can be managed by drilling boreholes from the downstream toe of the dam to identify the structure permitting the transfer of water. If the structure can be identified, grout (cement) can injected into the boreholes to seal the structure.

If the seepage is chronic and deep-seated, as indicated by groundwater monitoring wells, additional wells can be sunk to determine if the problem is widespread or narrowly focused. Narrowly focused, deep-seated seepage can also be addressed through grouting.

Widespread seepage can be addressed by establishment of a wellfield, a line of groundwater wells, whose combined "draw down cone" would form a barrier to the passage of ground water. Groundwater would be pumped continuously from these wells and returned to the tailings impoundment.

Continued tailings deposition and a reduction of the amount of free water in the pond would be expected to reduce deep-seated seepage over time. If seepage persisted, eventually the draining of the tailings pond at closure would resolve the issue. There would be no long term seepage related legacy.

7.4.3 Overflow

Possibility of overflow is extremely remote. As detailed in Section 6, the tailings impoundment is designed to contain 200,000 m^3 of additional inflow when the facility is completely full. This is in excess of the inflow expected from the 1/200 year storm.

The polishing pond provides an additional 150,000 m^3 of surge capacity when filled to normal operating capacity. The design surge capacity in the tailings impoundment and the polishing pond totals a minimum of 350,000 m^3. This is 20% more than the largest 48 hour precipitation event which has occurred in Nova Scotia in the last 55 years.

The manner in which the tailings dam is raised each year provides additional containment over and above that designed into the facility. As detailed in Section 6, the dam is raised one year ahead of time so that the capacity to contain all the tailings to be generated in the coming year is already in place at the start of each year (September).

Each month some of this capacity is filled up but the yet unused capacity is available to provide additional containment in the event an unexpectedly large inflow. By the middle of the year, dam raising begins again so that once more, at the start of the new year, the capacity to contain all the next year's tailings is in place.

The result of this process is that there is never less than 1.4 M m^3 of surge capacity available to contain an unexpected inflow. This volume is almost 3x the Probable Maximum Flood (PMF), the largest conceivable inflow in 24 hours used to design the dam spillways, and 7x the precipitation from the 1/200 year storm.

The inflow that could possibly overflow the tailings facility would amount to approximately 1500 mm of water in 24 hours. There is no credible scientific or engineering basis for such an event occurring at Moose River. No event of this nature has ever occurred in Nova Scotia in recorded history. Never-the-less, the following contingency plans are in place to manage such an event.

If extreme precipitation caused the pond level to rise within 1 m of the bottom of the dam spillway the Elevated Inflow Protocol would be activated that would increase pond level monitoring frequency to once every hour. If the rate of rise of the pond level exceeds 10 mm/hour an emergency would be declared.

The Emergency Response Procedure would be activated. On-site personnel would be notified and operations would be shut down. The tailings facility and downstream area (Scraggy Lake) would be evacuated of civilians and all but essential personnel. Municipal, provincial, and federal authorities would be notified of the potential danger as appropriate.

The reclaim water and tailings lines would be relocated to allow water to pumped from the TMF to the open pit to lower the pond level. A siltation barrier would be deployed in Scraggy Lake to prevent suspended sediment associated with an overflow from moving downstream. Mine equipment would start hauling waste rock from the waste rock stockpile to the dam to buttress existing dam walls or provide spill containment. Frequency of downstream water quality monitoring would be increased

Excerpts from the Operations, Maintenance, and Surveillance (OMS) manual can be found in Appendix AA which describes in further detail the measures to be taken in the event of a possible or actual overflow.

Any impact from an overflow would be largely mitigated by:

- Quality of the water in the tailings impoundment already meets discharge requirements
- Significant dilution occurring in all downstream areas resulting from the same precipitation that caused the overflow

7.4.4 Dam Failure

The possibility of dam failure is even more remote than overflow. The dams are designed to withstand a magnitude 8 earthquake, over 1000x times higher than the standard for other civil construction in Nova Scotia. No magnitude 8 earthquake has ever occurred in Nova Scotia in recorded history.

In addition, the dam design provides for four barriers between the tailings and the areas downstream of the facility. Damage to one or more of these barriers would not mean a release of containment due to the redundancy.

The dam is designed by the leading engineering firm in the field worldwide, the designer will oversee construction, and appropriate QA/QC procedures will be implemented to ensure quality. Monitoring of flows, water levels, settlement, displacement, and seepage will ensure that the dams perform within design parameters.

Flow and water levels will be controlled and seepage will be managed as described previously. Settlement will be measured by high-precision survey. Excessive displacement will be analyzed and an engineering solution formulated typically involving stabilization through buttressing of the dam wall.

If a dam failure resulted from excessive inflow resulting in overtopping there would be opportunity to follow the same procedure as described above for overflow. If the dam failure was purely the result of an earthquake, the siltation barrier would be deployed after the fact but would still be effective in reducing sedimentation downstream.

An earthquake induced failure would not provide an opportunity to reduce the pond level by discharging into the open and would place far greater importance on mine equipment being available to buttress dam walls and block a breach. Never-the-less, it is important to reiterate that a seismic event such as that capable of causing the tailings dam to fail has never occurred in Nova Scotia. Contingency plans are essential, however, the most effective means to manage catastrophic events is through prevention based on appropriate design standards and operating procedures.

7.5 COMPENSATION PLANS

Specific Compensation Plans - Lichen Species

Compensatory surveys supported by DDV Gold are proposed to cover an area equivalent to the area of the proposed Project footprint, roughly 550 hectares. DDV Gold will work with NSEL and NSDNR to determine optimal locations, timing and methods and would take into account issues such as hunting seasons, land ownership and other issues. Mapping of potential boreal felt lichen habitat, which may be available from

NSDNR, could be utilized in selecting survey areas, as many of the listed species known from the site are species which grow in similar habitat as the boreal felt lichen (COSEWIC 2002).

Specific Compensation Plans - Atmospheric Resources

Based on the minimal known and predicted impacts no specific compensation plans were put forward in the EARD or are being put forward in this Focus Report. DDV Gold recognizes that this is an aspect of the Project that will require on-going monitoring and liaison with Environment Canada, NSDNR and NSEL and as such recognizes that future compensation is possible but unlikely as mitigative measures available should adequately address any issues that arise during the operation and reclamation of the Touquoy Project. Note as well that DDV Gold will have an on-site meteorological station that will collect data that DDV Gold intends to make available to the CLC, Environment Canada and any other organization that request the information subject to a review of the intended data use.

Specific Compensation Plans - Surface Water and Wetlands

DDV Gold recognizes the value of wetlands and as such the Project footprint has been adjusted so as to minimize impacts to wetlands and watercourses in the area. Wetlands removed by the Project will be compensated at a ratio determined in consultation with NSDNR and NSEL. DDV Gold will work with NSDNR and NSEL to develop the required mitigation measures including wetland compensation. Application of this program will mitigate the loss of habitat based on function and relative value. DDV Gold is considering various approaches to the wetland compensation issue. The first approach, preferred by NSDNR, is to create wetland habitat within the same watershed as the wetland which is to be altered. DDV Gold is considering creating wetland habitat onsite once mine operations are completed by ensuring that the flooded pit has sufficiently shallow edges to support wetland vegetation. If this is not possible, DDV Gold will support a wetland enhancement or creation project outside of the local watershed. Contribution to wetland education and/or protection programs may also be considered.

Specific Compensation Plans - Ambient Light and Noise Levels

Based on the minimal known and predicted impacts no specific compensation plans were put forward in the EARD or are being put forward in this Focus Report. DDV Gold recognizes that this is an aspect of the Project that will require on-going monitoring and liaison with residents, cottage owners, NSDNR and NSEL and as such recognizes that future compensation is possible but unlikely as mitigative measures available should adequately address any issues that arise during the operation and reclamation of the Touquoy Project.

Specific Compensation Plans - Ecological Value

The limited impacts do not necessitate compensation plans.

Specific Compensation Plans - Recreational Value

Based on minimal known and predicted effects there are no specific compensation plans for recreational aspects as losses have not been identified. DDV Gold recognizes that this is an aspect of the Project that will require on-going monitoring and liaison with recreational users of site and adjacent lands (fishers, hikers, watercraft users, hunters, cottage users, etc.) and as such recognizes that future compensation is possible but unlikely as mitigative measures available should adequately address any issues that arise during the operation and reclamation of the Touquoy Project. The CLC will play an integral role in identifying opportunities for enhanced recreational use in the area that DDV Gold can assist in. Mining companies routinely contribute "in-kind" equipment time for earthworks projects such as boat ramps, parking areas and trail/road development that enhance recreational use of lands.

Interpretative Centre

Subject to stakeholder input and public safety and environmental considerations, DDV Gold intends to provide a facility that incorporates the existing museum contents in an upgraded structure with proper parking, lighting, and multi-media exhibits to allow a greater number of visitors and for those visitors to experience a more meaningful visit in terms of gaining a sense of the historical significance of the Moose River Gold Mines area. As is common with many areas where historic and modern mining operations share similar footprints, this facility could celebrate the history and provide a look at the modern aspects of gold mining. The facility may be located in close proximity to the pit area where viewing opportunities of modern operations will be possible along with site tours of the processing plant and other aspects of the operations to the extent that safety and liability constraints allow. DDV Gold personnel anticipate that the modern and historic aspects will draw visitors to the area and therefore expanding tourism opportunities. DDV Gold remains open to suggestions from the wider community on aspects of this proposed re-location and improvements to its interpretative value.

7.6 RECLAMATION AND CLOSURE

The conceptual reclamation plan as discussed in the EARD is unchanged. The plan remains conceptual in nature and will be finalized in detail six months prior to closure as specified by legislation. A detailed reclamation plan is not required until shortly before shutdown because the exact conditions at closure will be better predicted after more experience is gained in the future. Also, generating a detailed reclamation plan now presumes that the needs and desires of the community, in terms of how it wants to see the site reclaimed, will not change. The following reviews the various elements of the reclamation and closure plan.

Open Pit

At closure, the open pit will be allowed to flood forming a lake. The condition of the mini-pit indicates that there will be no acidification. It is expected that the flooded pit will develop into a viable aquatic habitat as the mini-pit has.

As is usual with open pit mines backfilling the pit is neither economically feasible nor prudent from a future perspective. It would cost in the order of $15 million to backfill the pit with waste rock at cessation of mining. This cost would render the project economically unattractive. Deepening of the pit or a switch to underground mining at some point well into the future as a result of new information or changed economic conditions would not be an option if the pit were to be backfilled.

Current projections are that it will take 20 years for the pit to flood. The company will consider options in cooperation with regulatory authorities to speed this process up. For example, it is possible that excess water during spring runoff could be diverted to accelerate filling.

The viability of such a scheme would be highly dependent on the expected impacts to the surrounding environment. Such impacts could only be properly anticipated through the use of site specific data collected throughout the course of the project life. This indicates the importance of gathering information during operations to support the final closure plan.

The area surrounding the mini-pit shows how the disturbed land naturally reclaimed itself over a period of 18 years. Active reclamation will speed this process up considerably. In addition, there is potential to develop wetlands in the pit area despite the depth of the excavation. The crest of the top bench can be dozed down to create a 10 m wide shallow zone around the perimeter of the pit. This shallow zone will promote the establishment of plants that will provide a basis for colonization of the pit waters by other flora and fauna.

Facilities

The buildings and other facilities will be removed down to concrete foundations within the first two years after closure. Power and water lines will remain and may facilitate industrial use of the site for other purposes after closure. Roads will remain as are deemed to add value to the site. Unneeded roads will be capped with topsoil and seeded.

Waste Rock Stockpile

The waste rock stockpile will be re-sloped (landformed) from angle of repose to 2.5:1 (h:v). The flattened slopes will be covered with soil and seeded. Vegetation will inhibit erosion, generation of dust, and prevent leaching of contaminants into runoff. The stockpile at closure will be no higher than the surrounding hills and will be indistinguishable once reforestation is complete.

The waste rock stockpile will be constructed in 10 m lifts (layers). When each lift is completed it will be re-sloped and seeded while the next lift is under construction. Progressive reclamation of this nature means that at the end of the mine life the majority of the stockpile is already reclaimed. Early re-vegetation also minimizes dust and erosion throughout the period of operations.

Native species (grasses and shrubs) best suited to colonizing disturbed areas will be established first to fix the soil. Trees and other plants will be introduced when conditions are amenable to promoting robust growth.

Tailings Facility

At closure the slopes of the dams will be flattened from angle of repose to 2.5:1 (h:v) to enhance stability. The tailings impoundment will be drained. Drainage from other areas will be diverted away from the TMF and runoff from the facility itself will be directed by ditches to treatment. The tailings will be capped with clay, covered with topsoil, and vegetated.

Removing the water from the tailings impoundment makes the facility even less susceptible to earthquake. Also, as there is little potential for long-term acid generation there is no need to store the tailings under water, however, submerging tailings could promote the dissolution of contaminants in the water. This would be mitigated in part by the purifying effect of the wetland but would not be an issue if the facility is drained.

Treatment will continue until the water draining through the facility returns to the quality which existed prior to development. The static testing and humidity cells indicate that the potential for both long-term acid generation and dissolution of contaminants is very low. On this basis, water treatment is expected to be continued less than five years.

Progressive Reclamation

Progressive reclamation is the practice of reclaiming disturbed land prior to the end of production. By reclaiming the site during production, the company can be more profitable than waiting to the end of the project life to clean up. Such an approach is now considered "best practice" in the industry worldwide.

The primary tenet of progressive reclamation is to plan and conduct activities with both the immediate (production) and ultimate (reclamation) result in mind. For example, if all trees are cut down to develop the site the developer has to bear the cost of clearing, managing erosion, possibly providing alternate habitat, and eventually re-vegetation. If development is planned for minimal disturbance then those costs may never have to be borne.

Examples of progressive reclamation would be the ongoing re-sloping and seeding of the waste rock stockpile during production and similar treatment of all permanent embankments, berms, roads, and ditches.

Topsoil will be stockpiled near areas where it is to be used so that its replacement can be integrated into the production activity at little or no additional cost. Organic matter from grubbing (roots and stumps) will be mulched to provide source biomass for re-vegetation rather than burned.

Numerous clear cuts at the proposed mill site will be utilized to accommodate the site facilities. Facility layouts will be modified to fit into existing cleared areas and topography rather than creating more disturbance at greater cost to modify conditions to match a design that does not take into account site specific conditions.

Funding Closure Obligations

The company will post a reclamation bond as per legislation. The value of the bond will be based on the amount of disturbed area and is expected to be on the order of $2 M. The plant and equipment will still have value as either salvage or scrap at closure. This value belongs to the owner but provides additional assurance that funds will be available to complete reclamation.

Other mechanisms exist to ensure that funds will be available at closure to reclaim the site. The company can "sell forward" some of its production to lock in current high gold prices and ensure the project economics. This will be a requirement of the lenders to ensure that the return on their investment is secure but it also serves to make certain that the company will have sufficient funds to meet its future environmental obligations.

Progressive reclamation also provides assurance that reclamation costs will not exceed available funds. With a large part of reclamation costs being borne during operations, less money is required at the end of the project life to reclaim the site and therefore less possibility exists of the reclamation bond being inadequate.

Ultimate Closure

The company is responsible until a mine closure certificate is granted by the regulatory authorities. A mine closure certificate is issued when regulators are satisfied that all obligations related to the closure plan have been fulfilled and no long-term liabilities remain. Once a mine closure certificate is issued responsibility for the site reverts to the province. Until closed mine status is granted the company will be responsible for all monitoring and remediation activities.

Uses for the site after closure are presently envisioned to be the same as those uses for the site in the recent past, namely recreation (hunting and fishing) and forestry. Recreation will likely be permitted within 3-5 years of closure. Commercial forestry will probably resume in 15-20 years given typical rates of growth.

8.0 FOCUS REPORT SUMMARY AND CONCLUSIONS

DDV Gold Limited (DDV) submitted an Environmental Assessment Registration Document (EARD) on March 15, 2007. This document provided project details to seek an Environmental Assessment Approval. Following a public and regulatory review of the EARD, the Minister, on April 10, 2007, required DDV to prepare a Focus Report to provide additional details on certain aspects of the project. The Terms of Reference for the Focus Report issued by the Minister defined what DDV was to provide for the designated Study Area for the Focus Report. DDV has provided these details in this document. The Table of Concordance listed in Section 1.5 shows how DDV Gold has addressed the requirements. A significant body of work was completed that demonstrates a commitment to the public engagement process and has aided in completing a Focus Report that meets the requirements set by the Minister.

The Focus Report examines potential impacts of the proposed Project on the recreational, wilderness, and ecological value of the Scraggy Lake, Fish River, and Moose River system and lands to the southwest (watershed 1EL-5) with particular attention focused on the potential release of contaminants to this downstream environment. Impacts of noise, dust and aesthetics on both this region and the Tangier Grand Lake Wilderness Area have been examined and found to be minimal.

The project design has incorporated public and regulator input in every aspect of the final design presented in the EARD and further described in the Focus Report. The project development scheme is dictated by the physical nature of the deposit in terms of size, location, geology, and metallurgy. The chosen development scheme is most desirable in terms of minimizing both on and off-site environmental impacts.

A relatively small open pit supplying a 4,000-5,000 tpd process plant employing gravity/CIL gold recovery is the most viable means of developing the property. Assessment of the environmental impacts for the various options available leads to the following conclusions:

- The most significant impact from the development of the open pit is the removal of the existing community

- The chosen waste rock storage pile (WRSP2) location avoids impact to fish habitat and facilitates effective management of site runoff

- The plant location (P3) best addresses safety issues with regard to the proximity of the facility to the open pit and offers site specific opportunities to minimize disturbance and manage runoff

- The tailings management facility (TMF3) location is superior to the alternatives as it presents no risk to Moose River, Square Lake, and the public road while avoiding destruction of fish habitat on site

- Given the proposed operating plan and design standards, discharge to Scraggy Lake does not present an undue risk for downstream impact nor diminish the value of the adjacent lands

- The final facility layout is not the lowest cost but represents the design which best mitigates environmental impacts for the chosen development scheme

A detailed description of adverse effects and environmental effects on Valued Ecosystem Components (VECs), including socio-economic, community and bio-physical environmental impacts, within the Touquoy Gold Project site and the Focus Report Study Area (FRSA) have been discussed. Potential effects of lighting, noise and blasting, air emissions and dust on the FRSA have been characterized. Visual impacts, impacts to surface and ground water and potential soil contamination on the site and in the FRSA have been addressed. Impacts to flora and fauna/rare species and species-at-risk including mitigation measures are discussed.

Additional studies, modeling and analysis have been completed to predict impacts. A summary of the potential effects is listed below.

Light

- Background light levels were below detection and predicted light levels are all below applicable guidelines

- The surrounding forest will inhibit light migration

- Sensitive receptors in the FRSA will not be negatively affected

Noise and Blasting

- Modeling results indicate potential increases at sensitive receptors in FRSA to be 2 to 3 dBA which is not detectable to most people

- Blasting associated impacts are short term (a few seconds) and are not anticipated to affect moose, birds or humans using the FRSA

Air Emissions and Dust

- Total suspended particulate emissions from the proposed Project processing facility will not have a significant adverse effect on any listed lichen species in the region

- In all instances, ground level concentrations of airborne contaminants are significantly below permissible limits

Visual Impact

- The analysis is a snap shot in time based on full height and footprint of the waste rock storage pile with no progressive reclamation in the current conditions (terrain, tree height)

- Based on this scenario the waste pile may be visible from very few remote vantage points and may only be in view close to the actual development

- Given the current conditions, it is expected that the proposed Project will visually impact less than two percent of the FRSA

Impacts to Surface and Groundwater

- The Project employs four separate, complementary water treatment processes which include cyanide destruction, settling and natural degradation, effluent treatment, and wetland purification

- All parameters governed by Metal Mining Effluent Regulations (MMER) are below allowable limits at discharge from containment at the TMF

- In only one instance out of 25 parameters considered in three major downstream water bodies are contaminant concentrations projected to marginally exceed CCME standards for the protection of aquatic life

- Monitoring as prescribed under federal regulations will ensure that downstream water quality is such that no hazard to human safety or aquatic life will occur

Soil Contamination

- A Historic Tailings Management Plan has been developed with the objective of identifying the most appropriate disposal option for Historic Tailings that will be disturbed during mining operations

- A risk assessment procedure is recommended to decide the fate of the historic tailings that will not otherwise be disturbed during mining operations

- Soils analyzed for metals show existing levels naturally exceed CCME guidelines on the Project site and regionally in the FRSA.

In addition, the potential for the Project tailings management facility to present an undue risk to areas downstream of the property has been addressed in several ways:

- The facility employs a multi-fail safe design with four barriers between the stored tailings and downstream areas

- The standards used in the tailings dam design provide resistance to earthquake more than 1000 times higher than that employed for any other civil construction in Nova Scotia

- The facility has sufficient capacity at any given time to contain 3x the Maximum Probable Flood and 6x the 1 in 200 year storm making the probability of overflow minimal

In summary, the Touquoy Gold Project has been developed with the utmost attention to public and regulator input. The Project design has been enhanced since the EARD stage as a result of this approach leading to a development plan that minimizes negative impacts and seeks to maximize benefits for all Nova Scotians.

9.0 REFERENCES

Alstrup, V. 1986. Contributions to the lichen flora of Greenland. – International Journal of Mycology and Lichenology 3: 1-16.

Atlantic Canada Conservation Council Database. Data request to Stephan Gerriets, 2007.

ADI 2007

Beazley, K.F., T.V. Snaith, F. MacKinnon and D. Colville. 2004. Road density and potential impacts on wildlife species such as American moose in mainland Nova Scotia. Proceedings of the Nova Scotian Institute of Science 42:339-357.

Birch, P.B., Ph.D. and H.E. Pressley (eds.), 1992. *Stormwater Management Manual for the Puget Sound Basin*. Review Draft. Dept. of Ecology. Publication no. 90-73.

Blett, T, L. Geiser, and E. Porter, 2003. Air Pollution-Related Lichen Monitoring in National Parks, Forests, and Refuges: Guidelines for Studies Intended for Regulatory and Management Purposes National Park Service Air Resources Division U.S. Forest Service Air Resource Management Program U.S. Fish and Wildlife Service Air Quality Branch. 32 pp.

Brodo, I. M., S. D. Sharnoff, and S. Sharnoff. 2001. Lichens of North America. Yale University Press, New Haven. 828 pp.

Brown, C. R. and M. B. Brown. 1999. Barn Swallow (*Hirundo rustica*). *In* The Birds of North America, No. 452 (A. Poole and F. Gill, eds.). The Birds of North America, Inc., Philadelphia, PA.

Brylinsky, M. 2002. Nova Scotia Lake Hypolimnion Project. Acadia Centre for Estuarine Research. Wolfville. Nova Scotia. For the Nova Scotia Department of Fisheries and Agriculture. 41 p.

Cameron, R. 2004. A second location for the rare boreal felt lichen in Nova Scotia. Evansia 21(1): 40-42.

Cameron, R.P. 2004. Lichen indicators of ecosystem health in Nova Scotia's protected areas. In N.W.P. Munro, T.B. Herman, K. Beazley, P. Deardon (*Eds.*). Making Ecosystem-based Management Work. Proceedings of the Fifth International Conference on Science and the Management of Protected Areas, Victoria, BC, May 2003. Science and the Management of Protected Areas Association, Wolfville, BC, Canada.

Cameron, R.P, T. Neily, and D.H.S. Richardson. 2007. Macrolichens as indicators of air quality for Nova Scotia. Northeastern Naturalist 14:1-14.
Cameron, R and D.H.S. Richardson. 2006. Occurrence and abundance of epiphytic cyanolichens in protected areas of Nova Scotia, Canada. Opuscula Philolichenum 3: 5-14.

Canadian Council of Ministers of the Environment (CCME) 2006. Canadian Water Quality Guidelines for the Protection of Aquatic Life. http://www.ccme.ca/assets/pdf/ceqg_aql_smrytbl_e_6.0.1.pdf

CCME 2006. Canadian Soil Quality Guidelines for Commercial Properties

Cheng, S., W. Grosse, F. Karrenbrock and M. Thoennessen. 2002. Efficiency of constructed wetlands in decontamination of water polluted by heavy metals. Ecological Engineering 18:317-325.

Colorado State University. Undated. Typical Construction Noise Levels: A Quick Reference Guide.

http://www.bernardino.colostate.edu/ohss/OHSSHandouts/21d_ConstructionNoiseLevels.pdf

Conestoga-Rovers & Asosociates Ltd. (CRA) 2007. Environmental Assessment Registration Document for the Touquoy Gold Project. March 2007.

Conway, C. J. 1999. Canada Warbler (*Wilsonia canadensis*). *In* The Birds of North America, No. 421. A. Poole and F. Gill (*eds.*). The Birds of North America, Inc., Philadelphia, Pennsylvania.

COSEWIC 2006. COSEWIC assessment and status report on the ghost antler lichen *Pseudevernia cladonia* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vii + 29 pp. (www.sararegistry.gc.ca/status/status_e.cfm).

COSEWIC 2002. COSEWIC assessment and status report on the boreal felt lichen *Erioderma pedicellatum* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. 1- 50 pp.

Czeczuga, B., and D. H. S. Richardson. 1989. Carotenoids in some lichen species from Ireland. The Lichenologist 21(4): 363-367.

Environmental Protection Agency. 2007. Emission Facts: Average Carbon Dioxide Emissions Resulting from Gasoline and Diesel Fuel. http://www.epa.gov/otaq/climate/420f05001.htm

Degelius, G 1954: The lichen genus *Collema* in Europe: Morphology, Taxonomy, Ecology. Symbolae Botanicae Upsalienses 13: 1-499.

Dey, J. P. 1978. Fruticose and foliose lichens of the high-mountain areas of the southern Appalachians. Bryologist 81: 1-93.

Dobson, F. (1979) Lichens: An Illustrated Guide. The Richmond Publishing Company Limited, Surrey.

Erskine, A.J. 1992. Atlas of Breeding Bird of the Maritime Provinces. Nova Scotia Museum.

Erskine, J.S. 1976. Common Lichens: In Forest and Field. The Nova Scotia Museum.

Ferry, B.W., S. Baddeley, D.L. Hawsworth (eds). 1973. Air Pollution and Lichens. London, Athlone Press. 389 pp.

Fisher, J, and M.C. Acreman. 2004. Wetland nutrient removal: a review of the evidence. Hydology and Earth System Science 8 (4):673-685.

Flenniken, D.G. 1999. The macrolichens in West Virginia. Carlisle Printing, Walnut Creek Sugar Creek, Ohio. 231 pp.

Garty, J., Y. Karary, and J. Harel. 1993. The impact of air pollution on the integrity of cell membranes and chlorophyll in the lichen *Ramalina duriaei* (De Not.) Bagl. transplanted to industrial sites in Israel. Archives of Environmental Contamination and Toxicology 24(4): 455-460.

Gauslaa, Y. 1995. The Lobarion, an Epiphytic Community of Ancient Forests Threatened by Acid Rain. – The Lichenologist 271: 59-76.

Gauslaa, Y., and K. A. Solhaug. 1998. The significance of thallus size for the water economy of the cyanobacterial old-forest lichen *Degelia plumbea* Oecologia 116(1-2): 76-84.

Gilbert, O.L. 1986. Field evidence for an acid rain effect on lichens. Environmental Pollution (Series A) 40: 227-231.

Gowan, S. and I.M. Brodo. 1988. The lichens of Fundy National Park, New Brunswick, Canada. The Bryologist 91(4): 255-325.

Goward, T., I.M. Brodo, and S.R. Clayden. 1998. Rare lichens of Canada: a review and provisional listing. Committee on the Status of Endangered Wildlife in Canada. Ottawa, Canada. 74 pp.

Global Biodiversity Information Facility. http://data.gbif.org/species/13219941. Accessed August 2007.

Golder Associates 2007. Geochemical Study: Static and Kinetic Testing of Waste Rock and Tailings Touquoy Project, Nova Scotia, Canada. Version 2. 159 pp.

Government of British Columbia. 2001. Visual Impact Assessment Guidebook. Second Edition.
[http://www.for.gov.bc.ca/TASB/LEGSREGS/FPC/FPCGUIDE/visual/httoc.htm]

Gries, C. 1996. Lichens as indicators of air pollution. Pp. 240-254 In Nash, T.H. III (*ed.*). Lichen Biology. Cambridge Univ. Press, New York.

Hale, M.E., Jr. 1979. How to Know the Lichens, 2nd Ed. Wm. C. Brown Company

Hallingback, T. 1989. Occurrence and ecology of the lichen *Lobaria scrobiculata* in southern Sweden. The Lichenologist 21: 331-341.

Harris, C. 1979. Handbook of Noise Control. McGraw-Hill Companies, 600 pp.

Hawksworth, D.L., and F. Rose. 1970. Qualitative scale for estimating sulphur dioxide pollution in England and Wales using epiphytic lichens. Nature (London) 227: 145-148.

Hawksworth, D.L., and F. Rose. 1976. Lichens as Pollution Monitors. The Institute of Biology's Studies in Biology, No.66. Edward Arnold Ltd, London.

Henderson, A. 1980. Literature on air-pollution and lichens. The Lichenologist 12: 397-402.

Hinch, P.R., and Underwood, J.K. 1985. A study of aquatic conditions in Lake Echo during 1984. Nova Scotia Department of Environment and Labour. Halifax, Nova Scotia. 38pp.

Holopainen, T.H. 1984. Cellular injuries in epiphytic lichens transplanted to air polluted areas. Nordic Journal of Botany 4: 393-408.

Holopainen, T. (1983). Ultrastructural changes in epiphytic lichens *Bryoria capillaris* and *Hypogymnia physodes* growing near a fertilizer plant and a pulp mill in central Finland. Annale Botanici Fennici 20: 169-185.

Holopainen, T., and L. Karenlampi. 1984. Injuries to lichen ultrastructure caused by sulphur dioxide fumigations. New Phytologist 98: 285-294.

Hoover, R. M. and R. H. Keith. 1996. Noise control for buildings, manufacturing plants, equipment, and products. Hoover and Keith, Inc. Houston, Texas.

Insarova, I. D., Insarov, G. E., Brakenhielm, S., Hultengren, S., Martinson, P.-O., Semenov, S. 1992. Lichen sensitivity and air pollution. Swedish Environment Protection Agency. Report 4007, Uppsala, 72 pp.

Inspec-Sol Inc. 2007. Historic Tailings Management Plan. Prepared for the Touquoy Gold Project Focus Report. __ pp. (GERARDO WILL KNOW PAGE # Wednesday)

Institut für Physik der Atmosphäre, 2007. Sound Propagation in the Atmosphere http://www.pa.op.dlr.de/acoustics/essay1/laerm_wenig_en.html

Jain, S.K., P. Vasudevan, and N.K. Jha (1989). Removal of some heavy metals from polluted water by aquatic plants: Studies on duckweed and water velvet. Biological Wastes 28: 115-126.

James, P.W. 1973. The effect of air pollutants other than hydrogen fluoride and sulphur dioxide on lichens. p. 143–175. *In* B.W. Ferry et al. (*ed.*) Air pollution and lichens. Athlone Press, London. 389 pp.

Jones, S. L., and J. E. Cornely. 2002. Vesper Sparrow (*Pooecetes gramineus*). In The Birds of North America, No. 624. A. Poole and F. Gill, (*eds.*). The Birds of North America, Inc., Philadelphia, Pennsylvania.

Jones & Stokes. 2002. Farad Diversion Dam Replacement Project Environmental Impact Report-Draft. Chapter 11, 8 pp. http://www.waterrights.ca.gov/EIRD/text/Ch11-Noise.pdf

Jørgensen, P.M. 1978. The lichen family Pannariaceae in Europe. - Opera botanica 45: 1-123.

Jørgensen, P.M. 1990. Trønderlav (*Erioderma pedicellatum*) - Norges mest gåtefulle plante? Blyttia 48: 119-123.

Jørgensen, P.M. 2000: Survey of the lichen family Pannariaceae on the American continent, north of Mexico. Bryologist 103: 670-704.

Kauppi, M. 1983. Role of lichens as air pollution monitors. Memoranda Societatis pro Fauna et Flora Fennica 59: 83-86.

Kauppi, M. (1980). The influence of nitrogen rich pollution components on lichens. Acta Universitas Ouluensis 9: 1-25.

Lange, O.L., W. Bilger, S. Rimke, and U. Schreiber. 1989. Chlorophyll fluorescence of lichens containing green and blue-green algae during hydration by water vapor uptake and by addition of liquid water. Botanica acta 102:306–313.

League for the Hard of Hearing. www. lhh.org

LeBlanc, S.C.F, and J. De Sloover. 1970. Relation between industrialization and the distribution and growth of epiphytic lichens and mosses in Montreal. Canadian Journal of Botany 48 :1485-1496.

Lewis, P.J. 2006. Gravity Concentration, Leaching, Flotation, and Other Testwork on Samples from the Touquoy Gold Deposit.

Lighting Design Knowledgebase. Lighting Design Glossary.
http://www.schorsch.com/kbase/glossary/illuminance.html. Accessed July 2007

Maass, W.S.G. 1986. *Moelleropsis* (Lecanorales) as a component of *Erioderma* habitats in Atlantic Canada. Proceedings of the Nova Scotian Institute of Science 37:21-36.

Maass, W.S.G. 1983. New observations on the occurrence of *Erioderma* in North America. Nordic Journal of Botany 3:567-576.

Maass, W.S.G. 1980b. *Erioderma pedicellatum* in North America: A Case Study of a Rare and Endangered Lichen. Proceedings of the Nova Scotian Institute of Science 30: 69-87.

Maass, W. and D. Yetman. 2002. COSEWIC assessment and status report on the boreal felt lichen (*Erioderma pedicellatum*) in Canada. Committee on the Status of Endangered Wildlife in Canada, Ottawa, Canada. 50 pp.

Maritime Breeding Birds Atlas (http://www.mba-aom.ca/jsp/map.jsp?lang=en). Accessed August 2007.

Maritime Resource Management Services, 1980. 1:50,000 Nova Scotia Watershed Area Maps.

Marsh, J.E., and T.H. Nash III. 1979. Lichens in relation to the Four Corners power plant in New Mexico. The Bryologist 82: 20-28.

Mayer, T., G. Kennedy. 2002. Natural and Constructed Wetlands in Canada: An Overview . Water Quality Research Journal of Canada 37(2): 295-51

McClenahan, J.R., D.D. Davis, and R.J. Hutnik. 2007. Macrolichens as biomonitors of air-quality change in western Pennsylvania. Northeastern Naturalist 14:15:26.

McCune, B. and L. Geiser. 1997. Macrolichens of the Pacific Northwest. Oregon State University Press. 386 pp.

McCune, B. and T. Goward. 1995. Macrolichens of the Northern Rocky Mountains. Mad River Press, Arcata, California. 208 pp.

McCune, B., J. Dey, J. Peck, K. Heiman, and S. Will-Wolf. 1997. Regional gradients in lichen communities of the southeast United States. The Bryologist 100:145-158.

Mcintyre, J.W. and J.F. Barr. 1997 . Common Loon (*Gavia immer*). *In* The Birds of North America, No. 313 (A. Poole, *Ed*.). The Birds of North America, Inc., Philadelphia, Pennsylvania.

McMullin, R.T. 2007. Epiphytic lichens of old-growth forests from southwestern Nova Scotia: diversity, status, and ecological relationships. Master of Environmental Science thesis, Dalhousie University, Halifax, Nova Scotia. 256 pp.

Metal Mining Effluent Regulations, http://laws.justice.gc.ca/en/F-14/SOR-2002-222/index.html

Millward, H. and D. Allen. 1994. The Scenic Resources of Nova Scotia: A Macro-Scale Landscape Assessment. Nova Scotia Agricultural College, Department of Humanities, Truro. (Rural Studies Working Papers No. 10)

Mineral Resources Forum.
http://www.mineralresourcesforum.org/technical/cyanide/cyanide_facts.htm.
Accessed October 2007

Mitsch, J.W. and J.G. Gosselink. 1986. Wetlands. Van Nostrand Reinhold Company, New York. 536 pp.

National Wetlands Working Group. 1997. The Canadian Wetland Classification System. Second Edition. B.G. Warner and C.D.A. Rubec (*eds.*) Wetlands Research Centre, University of Waterloo. Waterloo, ON. 68 pp.

NatureserveCanada, www.natureserve.org. Accessed August 2007

Nash III, T.H. 1996. Lichen Biology. Cambridge University Press, New York. 303 pp.

Nash, III, T. H., 1989. Metal tolerance in lichens. In: J. Shaw (*ed.*) Metal Tolerance in Plants: Evolutionary Aspects. CRC Press, Boca Raton, Florida, pp. 119-131.

Neily, P. D., E. Quigley, L. Benjamin, B. Stewart, and T. Duke. 2003. Ecological land classification for Nova Scotia, Volume 1 – mapping Nova Scotia's Terrestrial Ecosystems. Renewable Resources Branch, Nova Scotia Department of Natural Resources, Halifax, Canada. 83 pp.

Neitlich, P., P. Rogers, and R. Rosentreter. 2003. Lichen communities indicator results from Idaho: Baseline sampling. General Technical Report RMRS-GTR-103. US Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fort Collins, CO.

New Brunswick Museum. http://www.nbm-mnb.ca/. Accessed June 2007

New South Wales Mineral Council Ltd. 2006. Environmental Noise and the NSW Minerals Industry. http://www.nswmin.com.au/__data/assets/pdf_file/6946/Environmental_Noise_the_NSW_Minerals_Industry_Fact_Sheet_.pdf

New South Wales Minerals Council Ltd. 2006. Blasting and the New South Wales Minerals Industry. http://www.nswmin.com.au/__data/assets/pdf_file/0006/6945/Blasting_the_NSW_Minerals_Industry_Fact_Sheet__text_box__.pdf).

Nieboer, E.A., D.H.S. Richardson, and F.D. Tomassini. 1978. Mineral Uptake and Release by Lichens: An Overview. The Bryologist 81(2):226-246.

Northwest Lichenologists. www.nwlichens.org. Accessed June 2007

Nova Scotia Department of Environment and Labour (NSEL) 2002. Natural Landscapes Of Nova Scotia: Summary Descriptions. Nova Scotia Department of Environment and Labour, Protected Areas Branch. 104 pp.

Nova Scotia Department of the Environment (NSEL). 1999 (revised). Pit and Quarry Guidelines.

NSEL 1998. The State of the Nova Scotia Environment. Halifax, Nova Scotia. 44 pp.

Nova Scotia Department of Regional Economic Expansion (DREE). 1980. Map Sheet No. 3 of Pleistocene Geology for Central Nova Scotia.

Nova Scotia Department of Mines and Energy. 1965. Geological Map of the Province of Nova Scotia.

Nova Scotia Department of Natural Resources (NSDNR). 2007. Recovery Plan for Moose (*Alces alces americana*) in Mainland Nova Scotia. 37 pp.

Nova Scotia Department of Natural Resources. General Status Ranks of Wild Species in Nova Scotia. http://www.gov.ns.ca/natr/wildlife/genstatus/ranks.asp.

Nova Scotia Environmental Assessment Regulations (N.S. Reg. 44/2003). http://www.gov.ns.ca/JUST/REGULATIONS/regs/envassmt.htm

Nova Scotia Museum of Natural History. 1996. The Natural History of Nova Scotia (rev. ed.). D. Davis and S. Browne (*eds.*) Nova Scotia Museum. Nova Scotia, Canada.

Parker, G. 2003. Status Report on the Eastern Moose (*Alces alces americana* Clinton) in Mainland Nova Scotia. 77 pp.

Pattersson, R.B., J.P. Ball, K. Renhorn, P. Esseen, and K. Sjornberg. 1995. Invertebrate communities in boreal forest canopies as influenced by forestry and lichens with implications for passerine birds. Biological Conservation 74: 57-63.

Peter Clifton & Associates (PCA) 2006. Hydrogeological Investigation-Touquoy Gold Project, Nova Scotia. 31 pp.

Peterson, J, D. Schmoldt, D. Peterson, J. Eilers, R. Fisher, and R. Bachman. 1992. Guidelines for Evaluating Air pollution Impacts on Class I Wilderness Areas in the Pacific Northwest. USDA-Forest Service Pacific Northwest Research Station General Technical Report PNW-GTR-299.

Phillips, N., 1992. *Decisionmaker's Stormwater Handbook: A Primer*. The Terrene Institute. Washington, DC. 60pp.

Phinney, K. 2007b. Estimate Of Gas Emissions - Touquoy Gold Project. 2 pp.

Phinney, K. 2007a. Fate Of Cyanide Reagent - Touquoy Gold Project. 2 pp.

Pike, L.H. 1978 The importance of epiphytic lichens in mineral cycling. The Bryologist. 81: 247-257

Poulin, R. G., S. D. Grindal, and R. M. Brigham. 1996 . Common Nighthawk (*Chordeiles minor*). *In* The Birds of North America, No. 213 (A. Poole, Ed.). The Birds of North America, Inc., Philadelphia, PA.

Puckett KJ, Burton MAS. 1981. The effect of trace elements on lower plants. In: Lepp, N.W. (e*d*). Effect of heavy metal pollution on plants. London: Applied Science Publishers, 213–249.

Richardson, D. H. S. 1988. Understanding the pollution sensitivity of lichens. Botanical Journal of the Linnean Society 96:31-43.

Richardson, D. H. S., and C. M. Young. 1977. Lichens and vertebrates. In, M. R. D. Seward (ed.): Lichen Ecology. Academic Press, London, 121-144.

Richardson, D.H.S., and E. Nieboer. 1981. Lichens and pollution monitoring. Endeavour (New series) 5:127-133.

Richardson, D.H.S. 1992. Pollution monitoring with lichens. Richmond Publishing, Slough, United Kingdom. 76 pp.

Richardson, D.H.S., and R.P. Cameron. 2004. Cyanolichens: their response to pollution and possible management strategies for their conservation in northeastern North America. Northeastern Naturalist 11(1): 1-22.

Richardson, D.H.S., and E. Nieboer. 1983. Ecophysiological responses of lichens to sulfur dioxide. Journal of the Hattori Botanical Laboratory. 54: 331-351.

Rose F (1988) Phytogeographical and ecological aspects of Lobarion communities in Europe. Botanical Journal of the Linnean Society 96: 69±79

Rosentreter, R., and V. Ahmadjian. 1977. Effect of ozone on the lichen *Cladonia arbuscula* and the *Trebouxia* phycobiont of *Cladina stellaris*. The Bryologist 80: 600-605.

Sanz, M.J., C. Gries, and T.H. Nash III. 1992. Dose-response relationships for SO_2 fumigations in the lichens *Evernia prunastri* (L.) Ach. and *Ramalina fraxinea* (L.) Ach. The New Phytologist 122: 313-319.

Schueler, T. 1997. Comparative Pollutant Removal Capability of Urban BMPs: A reanalysis. Watershed Protection Techniques 2(2):379–383.

Schueler, T.R. 1987. *Controlling Urban Runoff: A Practical Manual for Planning and Designing Urban BMPs.* Metropolitan Washington Council of Governments, Washington, DC.

Schueler, T.R., P.A. Kumble, and M.A. Heraty. 1992. *A Current Assessment of Urban Best Management Practices: Techniques for Reducing Non-Point Source Pollution in the Coastal Zone.* Department of Environmental Programs, Metropolitan Washington Council of Governments, Washington, DC.

Seward, M. R.D. (*ed.*) 1977. Lichen Ecology. Academic Press. San Francisco. 550 pp.

Seward, M. R. D., A. Lynds, and D. H. S. Richardson. 1997. Lichens of Beaver Brook, Nova Scotia. Proceedings of the Nova Scotian Institute of Science 41(3): 90-92.

Selva, S.B. 1999. Epiphytic Lichens of Late Successional Northern Hardwoods Forests in Northern Cape Breton Island. Cape Breton Highlands National Park

Sharnoff, S. 1994. Use of lichens by wildlife in North America: a preliminary compilation. Resource Exploration 10: 370-384.

Sigal, L.L., and W.J. Johnston. 1986. Effects of acidic rain and ozone on nitrogen fixation and photosynthesis in the lichen *Lobaria pulmonaria* (L.) Hoffm. Environmental and Experimental Botany. 26: 59-64.

Sigal, L.L., and T.H. Nash III. 1983. Lichen communities on conifers in southern California: an ecological survey relative to oxidant air pollution. Ecology 64:1343-1354.

Snaith, T.V. and K.F. Beazley. 2004. The distribution, status and habitat association of moose in mainland Nova Scotia. Proceedings of the Nova Scotia Institute of Science. 42:263-317.

Stea, R.R. and J. R. Dickie, 1977. Pleistocene geology. Nova Scotia Department of Mines and Energy. Halifax, Nova Scotia

Takala, K., Olkkonen, H, and Krouse, H. R. 1991. Sulphur isotope composition of ephiphytic and terricolous lichens and pine bark in Finland . Environmental Pollution 69:337-48.

The Institution of Lighting Engineers (ILE) (2005). Guidance Notes for the Reduction of Obstrusive Light. = http://www.ile.org.uk/uploads/File/02_lightreduction.pdf

Thomson, J.W. 1984. American Arctic Lichens 1. The Macrolichens. Columbia University Press, New York. 504 pp.

Tufts, R. 1986. Birds of Nova Scotia. Nimbus Publishing, Nova Scotia. 209 pp. http://museum.gov.ns.ca/mnh/nature/nsbirds/index.htm

Tyler, G. 1989. Uptake, retention and toxicity of heavy metals in lichens. Water, air and Soil Pollution 47:321-33

United States Environmental Protection Agency (US EPA) 1990. Urban Targeting and BMP Selection. Information and Guidance Manual for State Nonpoint Source Program Staff Engineers and Managers. The Terrene Institute. EPA No. 68-C8-0034.

United States Environmental Protection Agency (USEPA) 1993. Impact Characterization of Noise Including Implication of Identifying and achieving levels of Cumulative Noise Exposure-EPA Report NTDI73.4.

United States Environmntal Protection Agency (USEPA) Office of Water - National Primary Drinking Water Regulations Consumer Factsheet on: CYANIDE. http://www.epa.gov/safewater/dwh/c-ioc/cyanide.html Accessed October 2007

United States Forest Service. National Lichens & Air Quality Database and Clearinghouse. http://gis.nacse.org/lichenair Accessed August 2007

United States Public Health Service, 2006. Toxicological Profile for Cyanide - July 2006 Update. Agency for Toxic Substances and Disease Registry. http://www.atsdr.cdc.gov/toxprofiles/tp8.pdf

Vymazal, J. 2005. Constructed wetlands for wastewater treatment. Ecological Engineering 25(5): 475-477.

Zinck, M. 1998. Roland's Flora of Nova Scotia. Nimbus Publishing and Nova Scotia Museum, Halifax, Nova Scotia. 2 vols.

Zhang, Z., J. Y. Tsou, and H. Lin. 2000. GIS for Visual Impact Assessment. Department of Architecture, Geography, The Chinese University of Hong Kong, Shatin, Hong Kong, China.

Personal Communications

Archibald, D. Nova Scotia Department of Natural Resources, 2006, 2007

Beazley, K.F. Dalhousie University, 2007

Elderkin, M. Nova Scotia Department of Natural Resources, 2006, 2007.

Hebda, A. Nova Scotia Museum of Natural History, 2006, 2007

Lavender, F. Local birding expert. 2007

Munro, M. Nova Scotia Museum of Natural History, 2006, 2007

Murphy, P. DDV Gold Ltd. 2007

Owen, T. Department of Fisheries and Oceans, 2007