ENVIRONMENTAL ASSESSMENT REGISTRATION DOCUMENT FOR THE TOUQUOY GOLD PROJECT

MOOSE RIVER GOLD MINES, NOVA SCOTIA

Prepared For:

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“We will see the day when the region is not the place where you visit your grandparents, but instead more often than not the place where you visit your grandchildren.”

Attributed to Stephen Harper, 2004
in *Visiting Grandchildren: Economic Development in the Maritimes*
Donald Savoie. University of Toronto Press, 2006.

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GLOSSARY OF TERMS AND ABBREVIATIONS

ABA	Acid-base accounting
ACACIA Reactor	A machine used in mine processing to recover gold from gravity concentrates
ACCDC	Atlantic Canada Conservation Data Centre
AN	Ammonium nitrate
ANFO	Ammonium nitrate fuel oil
Angle of repose	The maximum slope, measured in degrees from the horizontal, at which loose solid material will remain in place without sliding.
AP	Acid producing
Argillites	Highly compacted sedimentary or slightly metamorphic rocks consisting primarily of particles of clay or silt
Arsenosis	Arsenic poisoning
As (III)	Trivalent arsenate
As (V)	Pentavalent arsenate
ATV	All-terrain vehicle
Biomagnify	to increase in concentration with increasing position in ecological webs
Bullion	gold in the form of bars or ingots
C & D	Construction and Demolition
$CaCO_3$	Calcium carbonate
CaNP	Calcium net producing
CaO	Calcium oxide
CCME	Canadian Council of Ministers of the Environment
CEAA	Canadian Environmental Assessment Act
CFM	Cubic foot per minute
CIL	Carbon-in-leach
CLC	Community Liaison Committee
CN	Cyanide
CN_{free}	Free Cyanide
CN_{tot}	Total Cyanide
CN_{WAD}	Weak-acid-dissociable Cyanide
CO	Carbon monoxide
CO_2	Carbon dioxide
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
CPR	Cardiopulmonary Resuscitation
CRA	Conestoga-Rovers and Associates
CRM	Cultural Resource Management Group
C-TPAT/PIP	Customs Trade Partnership against Terrorism (US) / Partners in Protection (Canada)
$CuSO_4$	Copper Sulphate

Cyanidation circuit	Step in the mining process in which cyanide is added to the slurry to leach gold from it
Cyanobacterium	Single-celled blue green alga
dB	Decibels
dBA	Decibel on the A-scale
DDVG	DDV Gold Limited
DFO	Fisheries and Oceans Canada
DO	Dissolved oxygen
DOAF	Department of Agriculture and Fisheries
Doré	A mixture of gold in cast bars, as bullion.
Drumlin	An elongated hill or ridge of glacial drift.
EA	Environmental Assessment
EARD	Environmental Assessment Registration Document
EC	Environment Canada
EEM	Environmental Effects Monitoring
EPA	Environmental Protection Agency
EPP	Environmental Protection Plan
ER	Emergency Response
ERAP	Emergency Response Assistance Plan
$FeAsO_4$	Ferric arsenate
Ferrocyanides	Iron-cyanide compounds
Flocculant	A compound which aids in the adhesion and settling of particle sin suspension (flocculation)
FWAL	Freshwater and Aquatic Life
g/cm^3	grams per cubic centimeter
g/t	grams per tonne
H_2O_2	Hydrogen peroxide
ha	Hectare
HCl	Hydrochloric acid
HCN	Hydrogen cyanide
HCN	Hydrogen cyanide
HDPE	High-density polyethylene
HIC	High intensity cyanidation
IA	Industrial Approval
IBC	Individual bulk containers
ISQG	Interim sediment quality guideline
kg	Kilogram
kl	Kilolitre
kv	Kilovolts
l/hr	litres per hour

loams	Rich soils containing a relatively equal mixture of sand and silt and a somewhat smaller proportion of clay.
LPG	Liquefied petroleum gas
Masl	Metres above sea level
MBCA	Migratory Bird Convention Act
mg/kg	milligrams per kilogram
Mm^3	million cubic metres
MMER	Metal Mining Effluent Regulations
MMSD	Mining, Minerals and Sustainable Development
MSC	Meteorological Service of Canada
Mtpa	Metric tones per annum
MW	Megawatt
MW hr/yr	Megawatt- hour per year
NAAQS	National Ambient Air Quality Standard
NaCn	Sodium cyanide (NaCN)
NaOH	Sodium hydroxide
NAPS	National Air Pollution Surveillance
neutralizing potential ratio	the ratio of acidity and
NH_3	Ammonia
NH_4	Ammonium
NOx	Nitrogen oxide
NP	Net producing
NSDNR	Nova Scotia Department of Natural Resources
NSEL	Nova Scotia Environment and Labour
NSESA	Nova Scotia Endangered Species Act
NSM	Nova Scotia Museum
NSTPW	Nova Scotia Department of Transportation and Public Works
OCN^-	Cyanate
OH& S	Occupational Health & Safety
Oligotrophic	Nutrient-limited
Oxyanionic	Negatively charged polyatomic ion containing oxides
PEL	Probable effects level
PID	Property Identification Number
PM	Particulate matter
ppm	parts per million
ROM	Run-of-mine
SARA	Species at Risk Act
SLM	Sound level monitor
SO_2	Sulphur dioxide
SO_x	Sulphur oxides

SPL	Sound pressure levels
stamp mills	A type of mine which utilizes crushing rather than grinding to extract metals from ore
T	Tonnes
tailings	Mining residue
tills	Glacial drift composed of an unconsolidated, heterogeneous mixture of clay, sand, pebbles, cobbles, and boulders.
TMF	Tailings Management Facility
tpd	tonnes per day
TSP	Total suspended particulates
TWB	Touquoy West Bottom - area of pit
UN	United Nations
USEPA	United States Environmental Protection Agency
VEC	Valued Environmental Component
VOC	Volatile organic compound
WSC	Water Survey of Canada
ww	wet weight
°K	Degrees Kelvin
μg	microgram

EXECUTIVE SUMMARY

DDV Gold (DDVG) Limited proposes to undertake a surface gold mine and reclamation project (the Project) at Moose River Gold Mines in Halifax County, Nova Scotia. The undertaking requires a Class I Environmental Assessment under the Nova Scotia *Environment Act* and *Environmental Assessment Regulations*. The proposed undertaking involves the operation of a surface mine to excavate gold-bearing ore, and on-site processing facilities for extraction of almost 0.5 million ounces (oz) of gold over the six-year production phase. Conventional surface mining methods as well as innovative gold extraction methods will be employed. The project will create 170 jobs during the production phase of the mine, with up to 400 employed during the construction phase. It has the potential to benefit taxpayers through increased payments to governments for royalties, taxes and further economic spin-offs. Timing of final closure and reclamation plans will be dependent on monitoring results and discussions with the appropriate regulators.

Conestoga-Rovers & Associates Ltd. (CRA) prepared this registration document on behalf of DDVG. As required by the *Environment Act*, it assesses the potential environmental effects of the Project on biophysical and socio-economic Valued Environmental Components (VECs). This assessment was based on inputs from members of the public, the Mi'kmaq community, government regulators and the professional judgement of the study team.

The following VESCs were identified for this undertaking:

- Air Quality;
- Noise;
- Surface Water Resources;
- Geology and Hydrogeology;
- Terrestrial Resources;
- Wetlands;
- Archaeological and Cultural Resources; and
- Population and Economy.

Species of special concern were also considered within each applicable VEC.

Emissions from the mine site activities during construction and operation will include fugitive and process gases and dust, solid wastes, and tailings effluent. All emissions will be monitored, reported and treated in accordance with provincial regulations. Tailings effluent will be strictly monitored through the mandatory federal Metal Mining Effluent Regulations. A reclamation plan addresses site conditions during decommissioning.

To date, consultations held to introduce the proponent and the Project have included three public meetings (two informal and one formal) in the Musquodoboit Valley. Additional consultation with various stakeholders will occur during the Project.

The document describes effective mitigation measures to minimize the adverse effects of the project on the identified VECs. A monitoring and follow-up plan is designed to ensure the implementation and effectiveness of the mitigation measures.

This environmental assessment concludes a finding of no significant adverse effects on the environment arising from Project activities or accidental events, as proposed. Potential adverse effects on the above VECs will be short term and/or highly localised and can be effectively mitigated through the application of technically feasible mitigation and standard mining health, safety and environment procedures noted in this report.

PREFACE

This Environmental Assessment Registration document has been prepared for DDV Gold Limited in support of environmental registration for a proposed surface gold mine in Moose River Gold Mines, Halifax Regional Municipality. The report has been prepared using the advice and input from the general public, volunteer organizations, municipal, provincial and federal governments, First Nations and consultants, including:

General Public
Informal and Formal Public Consultation Sessions
Site Visitors

Volunteer Organizations
Musquodoboit Valley Tourism Association

Municipal Government
Halifax Regional Municipality – Planning Department
Steve Streatch – HRM Councilor for District 1, Eastern Shore-Musquodoboit Valley

Provincial Government
Nova Scotia Department of Transportation and Public Works
Nova Scotia Department of Environment and Labour
Nova Scotia Department of Natural Resources

Federal Government
Canadian Environmental Assessment Agency – Atlantic Region
Environment Canada
Fisheries and Oceans Canada

Consultants and Suppliers

Nova Scotia Based
Archibald Drilling and Blasting
Atlantic Explosives Limited
Conestoga-Rovers and Associates Limited
Confederacy of Mainland Mi'kmaq – Environmental Services
Cultural Resource Management Group
Dillon Consulting Limited
Hugdtec Consulting

Inspec-Sol
Logan Drilling
Maritime Diamond Drilling
Maxxam Analytics
Minerals Engineering Centre – Dalhousie University
Nova Scotia Power Inc.

Canadian and International
ALS Chemex
Ausenco Limited
CyPlus Corporation
Hellman and Schofield Pty Ltd.
Peter Clifton and Associates
Peter Lewis and Associates
Peter O'Bryan and Associates
Gemell Mining Engineers
Golder and Associates
SGS Lakefield Research Limited

DDV Gold wishes to acknowledge and thank all the various contributors.

1.0 INTRODUCTION

1.1 PROPONENT INFORMATION

The Proponent is DDV Gold Limited (DDVG), a wholly-owned, New Brunswick registered subsidiary of Atlantic Gold NL. Atlantic Gold NL is an Australian resource company listed on the Australian Stock Exchange. In June, 2005 its name was changed from Diamond Ventures NL.

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The principals of Atlantic Gold Ltd were former directors and executives of Plutonic Resources Ltd, which through the 1990s became one of the largest gold mining companies in Australia. During 1989 to 1998, before its takeover by the large US-based Homestake Mining Company, Plutonic Resources owned, developed and operated six gold mines, each with its own dedicated processing plant, in Western Australia with a combined annual production of about 500,000 ounces gold (about six times the expected annual production from the Touquoy Gold Project). The six mines are Plutonic, Darlot-Centenary, Lawlers, Mt Morgans, Peak Hill and Bellevue. The former three are still in production, and are now owned and operated by Canada's Barrick Gold Corporation. Plutonic Resources mined by both open pit and underground methods at the first four operations, whereas Peak Hill was open pit only and Bellevue was underground only.

Plutonic Resources' attendance to environmental management at these sites can be appreciated by reference to the following excerpt from its 1996 Annual Report:

"Plutonic has a strong commitment to excellence in environmental performance. Particular emphasis is placed on the elimination of unnecessary disturbance of the natural environment and appropriate rehabilitation of areas affected by mining activity. The Company fosters an environmentally responsible culture within its workforce by integrating environmental management into all areas of operations from the exploration phase through to mining and, ultimately, decommissioning.

During the year, the first formal environmental audit of each managed site was completed. These audits and regular environmental reviews discovered no new environmental issues of significance. Issues which receive the highest priority are the rehabilitation of waste dumps and tailings dams and the minimization of groundwater contamination from tailings facilities.

Major waste dump rehabilitation programs were completed at the Lawlers and Mt Morgans Gold Mines. Significant portions of the waste dumps which were rehabilitated resulted from mining activities prior to Plutonic's ownership of these sites.

Areas rehabilitated and new surface disturbance statistics for 1996 for managed mines are summarized below:

Area Rehabilitated:	*323 hectares*
New Area Disturbed:	*147 hectares*
Rehabilitation Expenditure:	*$1.8 million (AUS)*

In this same year (1996) Plutonic Resources received a "Golden Gecko Award" from the Western Australian Department of Mining and Exploration for its environmental management at its Mt Morgans Gold Mine. Only several such awards are made each year with very many mining operations within the State from which to choose.

Plutonic Resources' routine practice was to rehabilitate disturbed lands during mining by re-contouring inactive waste rock slopes, replacing topsoil and re-vegetating with native species. An innovative program of seed collection was developed with local Aboriginals and new methods of dust suppression were introduced.

DDV Gold is committed to continue to apply this same culture of environmental management to the Touquoy Gold Project.

1.2 REASON FOR THE UNDERTAKING

DDVG proposes to operate a surface gold mine in the Moose River Gold Mines region of Halifax County, in the central part of Nova Scotia. The development area includes the Touquoy Gold Deposit and consists of a complex network of land parcels covering an area of approximately 400 hectares. The site has been mined in the past, with a network of small underground workings and open pits dating from 1866 to 1936, and a surface excavation from which a 57,000 tonne bulk sample was mined and processed by other parties in 1989.

DDVG has recognized that the quantity and unusual style of gold mineralization at Touquoy will support a commercially viable surface mining operation with on-site processing of ore. The amount of gold expected to be recovered will represent more than one-third of the gold produced from the historic goldfields of Nova Scotia since the 1860s. DDVG wishes to develop this resource in line with all applicable regulatory requirements and recognizes the significant benefits to the local citizens, the Province of Nova Scotia and the company in completing this Project. DDVG has designed a project that is in line with the intent of the Nova Scotia Department of Natural Resources for efficient use of mineral resources and to "*promote the concepts of environmental responsibility and sustainable development, stewardship of the mineral resource sector and integrated resource planning.*"

1.3 REGULATORY ENVIRONMENT

Federal and provincial environmental acts and regulations apply to DDVG in regards to the design, site preparation, operation, and rehabilitation of the proposed mine. In addition to the environmental legislation, other acts and regulations relating to labour standards, mining practices, and other phases are applicable to the Project.

DDVG is well aware of the applicable acts and regulations that pertain to the proposed undertaking at Moose River Gold Mines. DDVG personnel have demonstrated the ability to prepare the necessary information and design plans required to obtain permits and approvals, as well as the ability to operate within the requirements of such acts and regulations at previously completed surface mining projects in other first world jurisdictions.

The following provides a listing of some pertinent acts that may be applicable for the undertaking and/or were considered in the preparation of this Environmental Assessment Registration Document (EARD).

Federal Legislation

- Canada Wildlife Act and Regulations
- Canadian Environmental Assessment Act and Regulations
- Canadian Environmental Protection Act and Regulations
- Fisheries Act and Regulations
- Migratory Birds Convention Act and Regulations
- Transportation of Dangerous Goods Act and Regulations
- Species at Risk Act

Provincial Legislation

- Environment Act and Regulations
- Dangerous Goods Transportation Act and Regulations
- Endangered Species Act and Regulations
- Labour Standards Code
- Mineral Resources Act and Regulations
- Crown Lands Act and Regulations
- Occupational Health and Safety Act and Regulations
- Wildlife Act and Regulations

1.3.1 FEDERAL REGULATIONS

The *Canadian Environmental Assessment Act* (*CEAA*) prescribes the federal environmental assessment process. Federal departments and agencies and other regulated bodies become Responsible Authorities if they have a decision to take (i.e. funding, land transfer, permit/authorization) in regard to a "Project" as defined by the Act. The Touquoy Gold Project as designed is not thought to invoke any federal triggers listed under *CEAA*. No federal funding or federal land is sought for this Project. Under the federal *Species at Risk Act* (SARA), Fisheries and Oceans Canada (DFO) is responsible for aquatic habitat and species at risk and Environment Canada is responsible for all other species at risk, with the exception of those within national parks and protected areas.

There will be no direct impacts to aquatic habitat on the Project property. No federally listed species have been identified within the study area.

1.3.2 PROVINCIAL REGULATIONS

The government of Nova Scotia employs a "One Window" process for reviewing, permitting and monitoring mine development projects in the province. This approach formalizes how government departments (including federal authorities) involved with mine development activities act collectively to streamline the review process for both government and industry.

The Project is classified as a Class I undertaking under Schedule A of the Nova Scotia *Environmental Assessment Regulations* and if approved would have an Environmental Assessment Approval issued with Conditions of Release. The Project will also require a provincial Industrial Approval, Mineral Lease, Water Withdrawal Approval, and Crown Land Leases. On-site Sewage Approvals may be needed if Site conditions allow.

Industrial Approval:	An Industrial Approval (IA) defines specific operational conditions and limitations, including dust, noise, surface water and groundwater discharge criteria and monitoring plans. An IA application would be made by DDVG when/if EA approval is received.
Water Withdrawal Approval:	This approval will be needed for extraction of water from Square Lake for initial ore processing until the tailings pond contains sufficient water for that purpose. The required data collection from Square Lake has been completed and the application would be made following issuance of the EA approval.
On-Site Sewage Approval:	This permit is required to install a septic tank and / or disposal system in Nova Scotia. The Province requires that this permit be obtained before approval can be given to install a disposal system on a building lot.
Mineral Lease:	Application for a Mineral Lease granting mineral rights for gold for 20 years from the date of issue is to be made.

Crown Land Leases:	DDVG has made application for six Crown Land Leases, two of which comprise the Moose River Park (provincial crown land) in the Project.

1.3.3 MUNICIPAL REGULATIONS

DDVG is aware of the Municipal legislation applicable to this Project. DDVG has briefed Halifax Regional Municipality (HRM) on the Project.

2.0 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.

2.1 MINE HISTORY

The site is centered on an area characterized by substantial historical (gold) mining disturbance. The official name of the settlement, Moose River Gold Mines, owes its origin to these activities. Following the initial discovery of gold at Moose River in 1866 as many as fifteen shafts and eight pits were established with documented production amounting to approximately 26,000 oz from an estimated 80,000 tonnes of ore. These shafts and pits are located within the footprint of the proposed open pit. Three stamp mills and associated dams to provide power were believed to have been established on Moose River itself in the immediate vicinity of the workings and a substantial quantity of ore is said to have been hauled to Caribou, 10 km to the north, for processing. A revival of the underground mining operations was attempted in the mid 1930s, but this was abandoned following collapse of the main ingress shaft in Easter (April) 1936 and the rescue of two persons trapped underground became a celebrated media event. During the latter half of the 1980s substantial exploration and resource delineation drilling was undertaken by Seabright Exploration Incorporated and in 1989 a 57,000 tonne bulk sample was excavated from an area within the proposed open pit and trucked off-site for processing. A further round of drilling was completed in 1996 by Moose River Resources Inc.

DDVG commenced exploration activities on the property in mid-2003 with a staged program consisting of 130 drill holes for 10,500 metres of drilling.

2.2 SCHEDULE

The anticipated schedule leading to production is indicated (Table 2.1). It is emphasized that implementation of each activity is dependent on successful completion of the former.

TABLE 2.1: PROJECT SCHEDULE – PART 1/3 (2003-2008)

YEAR	2003		2004				2005				2006				2007				2008			
QUARTER	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
ACTIVITY																						
Advanced Exploration																						
Public Participation																						
Environmental Baseline Studies																						
Permitting																						
Feasibility Study																						
Site Development																						
Construction																						
Mill Commissioning																						
Commercial Production																						
Rehabilitation																						
Decommissioning																						
Reclamation																						
Compliance Monitoring																						

TABLE 2.1: PROJECT SCHEDULE – PART 2/3 (2009-2013)

YEAR	2009				2010				2011				2012				2013			
QUARTER	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
ACTIVITY																				
Advanced Exploration																				
Public Participation																				
Environmental Baseline Studies																				
Permitting																				
Feasibility Study																				
Site Development																				
Construction																				
Mill Commissioning																				
Commercial Production																				
Rehabilitation																				
Decommissioning																				
Reclamation																				
Compliance Monitoring																				

TABLE 2.1: PROJECT SCHEDULE – PART 3/3 (2014-2016)

YEAR	2014				2015				2016			
QUARTER	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
ACTIVITY												
Advanced Exploration												
Public Participation												
Environmental Baseline Studies												
Permitting												
Feasibility Study												
Site Development												
Construction												
Mill Commissioning												
Commercial Production												
Rehabilitation												
Decommissioning												
Reclamation												
Compliance Monitoring												

2.3 LOCATION

The Project site is located at Moose River Gold Mines in Halifax County (Figure 2.1). 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.

2.4 SITE DESCRIPTION

The Project area is located within relatively flat topography with maximum relief of 25 m. Elevations within the catchments vary from approximately 160 masl (metres above sea level) in the headwater areas to approximately 110 masl at the outlet. Local tills will provide stable foundation for much of the infrastructure. The mine site infrastructure will close together in order to facilitate appropriate operational control.

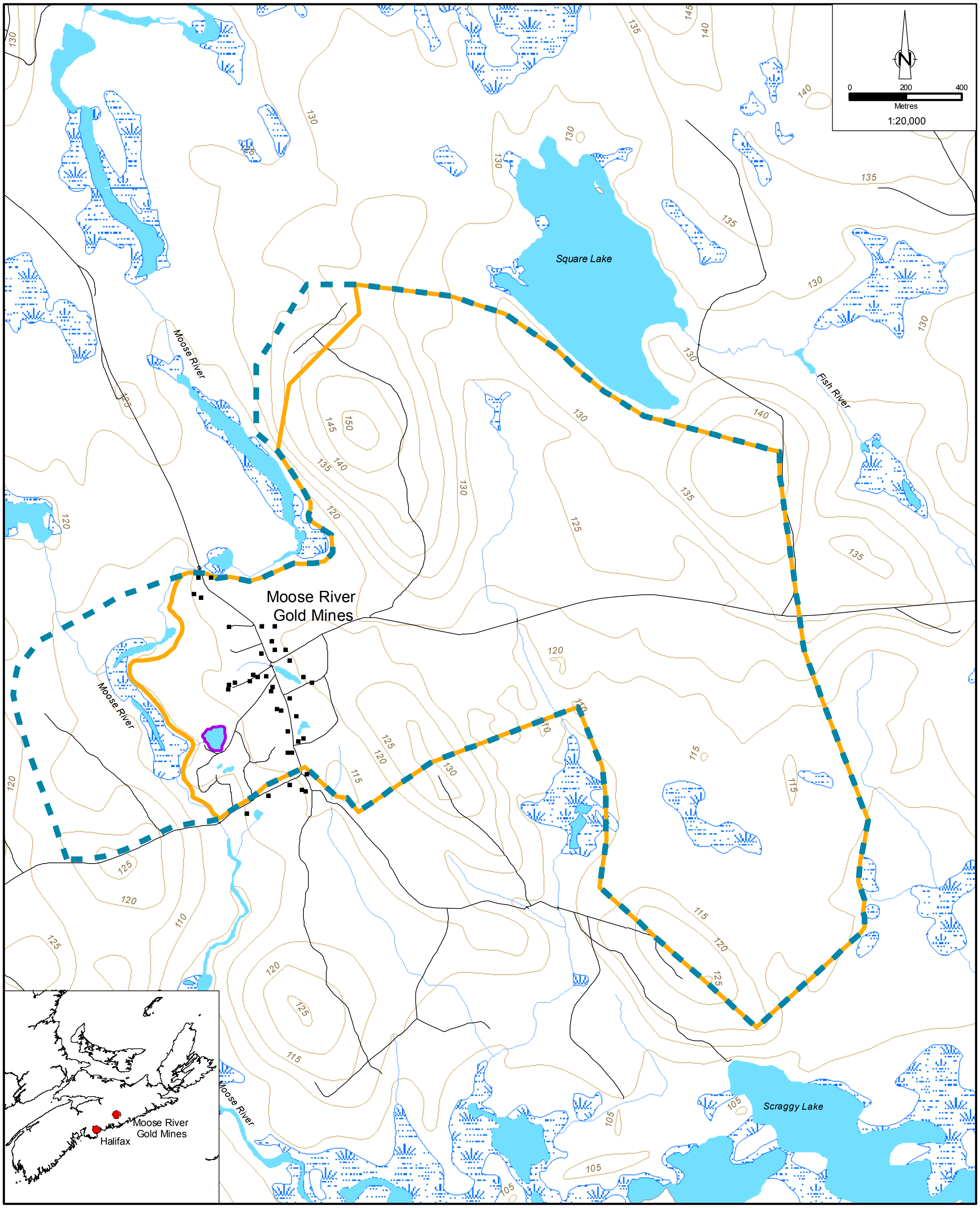
The site is characterized by low relief, hummocky type terrain, with frequent drumlins and numerous lakes, ponds, streams and wetland areas. At the present time the property is occupied by approximately 85% standing regrowth forest, 10% by clear-cut land, and 5% by cleared residential or built-up lots.

Figure 2.2 shows the contributing drainage area above the mine site, based on 1:50,000 scale topographic mapping. Given the low relief and complex network of wetland areas, the drainage boundary shown may vary slightly based on actual field conditions. The boundary as shown covers an area of approximately 41 km^2. The catchment area is drained by Moose River and its tributaries, from north to south adjacent to the proposed mining area.

2.5 SITE PREPARATION AND CONSTRUCTION

2.5.1 CLEARING AND GRUBBING

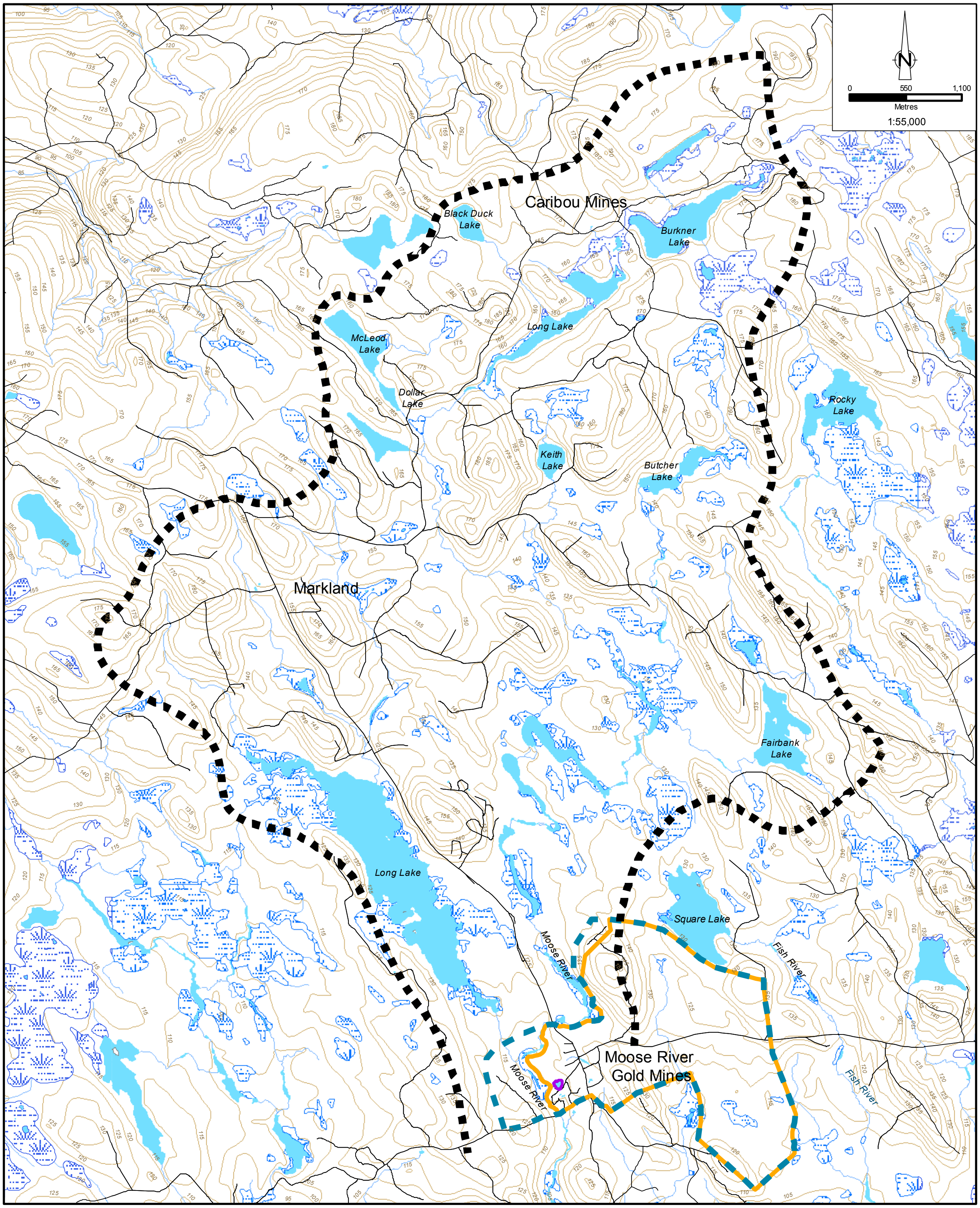
Prior to development, trees will be removed from the affected area and roots will be grubbed out. Merchantable timber will be sold and the remaining materials used to the greatest extent possible for site activities including reclamation. Existing buildings will also be removed.



Building
Road
Rivers and Streams
Existing Pit Extent
Surface Contour Line (10 m)
Project Site Boundary
Study Site Boundary
Wetlands
Lake

Nova Scotia Topographic information supplied by Service Nova Scotia & Municipal Relations and copyright Her Majesty the Queen in Right of the Province of Nova Scotia.
Produced by Conestoga-Rovers & Associates under license with the Province of Nova Scotia, 2007.
Data projected to UTM (Zone 20T) NAD83

Figure 2.1
LOCATION MAP
Touquoy Gold Project, DDV Gold Ltd.
Halifax County, Nova Scotia



Road
Rivers and Streams
Existing Pit Extent
Surface Contour Line (10 m)
Watershed Boundary
Project Site Boundary
Study Site Boundary
Wetlands
Lake

Figure 2.2
CONTRIBUTING DRAINAGE AREA
Touquoy Gold Project, DDV Gold Ltd.
Halifax County, Nova Scotia

Data projected to UTM (Zone 20T) NAD83

820933(REP004)GIS-WA002 March 8, 2007

There are presently 27 houses plus outbuildings remaining of the Moose River Gold Mines settlement and the permanent population is currently eight. The population has been steadily declining since the early 1900s from its peak as a gold mining community.

Option agreements to purchase most of the private properties have been negotiated and discussions are underway regarding the remainder. Locations of the various dwellings and buildings are shown on Figure 2.1. There is no feasible option to implement the mine plan should any of these residential dwellings and buildings remain in place. DDVG understands the need, at the Industrial Approval stage, to either own or have a lease in place for all properties included in the project undertaking.

Prior to removal of these existing buildings, a hazardous material survey would be completed. This would include visual inspection and sampling / analysis, as required, for hazardous materials such as asbestos, lead, and mould, as well as petroleum hydrocarbons (e.g., from domestic home heating oil systems).

The demolition of the existing buildings and associated structures would create construction and demolition (C&D) debris. Where possible, this material would be recycled and reused; however, much of it would be transported to a permitted C&D waste management facility.

Septic tanks would be emptied and all septage would be transported to a permitted facility by a licensed contractor. The septic tanks and beds would be decommissioned according to standard practices, including removal and proper disposal of associated infrastructure from the site, and backfilling with clean fill, as required.

Should petroleum impacted soil or groundwater be identified, the site will be handled in accordance with NSEL's *Domestic Fuel Oil Spill Policy* (2005). Where hazardous materials were identified, this material would be handled, transported, and disposed according to appropriate legislation, standards and guidelines.

The topsoil material overlying the ore deposit is part of the Danesville and Wolfville series, consisting primarily of loams, sandy loams and sandy clay loams with some gravely and stony areas. Topsoil will be stockpiled for use in reclamation. Underlying till, approximately 400,000 m^3 in this first stage, will be used to construct the safety berms surrounding the pit (located 30 m outside the pit perimeter), for the tailings dam core and for general site leveling. Rock material excavated during the initial pit development will also be used to build roads, prepare the plant site, and construct the body of the tailings dam.

Material directly beneath the unconsolidated till will be drilled and blasted for excavation only where required.

Construction of the tailings basin and the polishing pond will involve clearing trees only where required and, over the perimeter dam footprints, clearing, stripping and grubbing trees with excavation to suitable soil or rock foundation. The dam walls will be constructed primarily using benign waste rock and local fill materials appropriately sized via on-site screening to provide a low permeability barrier.

The existing scrub plant material and debris will be re-used in the reclamation as a growing medium placed as the final layer on top of the contoured lands. Excess organic material will be disposed of in appropriate locations.

Clearing and grubbing will be conducted progressively to limit total land disturbance at any given time and coordinate development with operating activities. Similarly, reclamation will be undertaken whenever activities in a particular area have concluded in order to rehabilitate disturbed land as soon as possible.

2.5.2 DESIGN STANDARDS

The design of the Touquoy Gold Project is being based on internationally, nationally and provincially accepted design standards and criteria. The Project will be constructed and operated in accordance with all applicable national, provincial and municipal legislation for mining and construction projects in Nova Scotia. In particular, the National Building Code, Nova Scotia codes and the Nova Scotia Environment and Labour (NSEL) Sediment and Erosion Control Handbook have been used in the design and will be used through the life of the Project. All construction activities will be completed under the supervision of qualified staff with the appropriate credentials for work in Nova Scotia.

A significant body of work has been completed to use in the Project design including the following:

- Assessment program to gather information to assist in the development of preliminary mine design and site drawings;
- Review of baseline sampling of surface water, soils, and sediment;
- Groundwater impact assessment based on groundwater level data in monitoring wells in the area;

- Stormwater management planning to confirm sizing and design of surface water diversion and treatment facilities;
- Terrestrial ecology evaluation;
- Environmental screening (desktop assessment of cultural and natural heritage resources in the area) completed by the Nova Scotia Museum (NSM) in 2004;
- Mi'kmaq Knowledge Study;
- Testing of representative materials (rock and till units) for acid production/consumption properties;
- Visual evaluation of proposed development on adjacent properties and roadways;
- Open house and public information sessions for the general public held in August 2004, December 2005 and September 2006;
- Ongoing discussions with elected officials and staff of various levels of government including Municipal, Provincial, Federal and Mi'Kmaq about the proposed undertaking; and,
- Evaluation of past experiences with reclamation, mining and mitigative measures to attain environmental protection goals.

Social and environmental concerns have been considered in the planning and preliminary design of the Project. These are detailed in this assessment of potential effects on valued environmental and social-economic concerns. To support this assessment, additional information sources pertinent to the review of mining projects were consulted.

A key resource includes the *Seven Questions to Sustainability: How to Assess the Contribution of Mining and Minerals Activities* (International Institute for Sustainable Development, 2002). This document was created from an initiative by Mining, Minerals and Sustainable Development (MMSD) in order to satisfy the second task of MMSD – North America. The task involves developing "a set of practical principles, criteria and/or indicators that could be used to guide or test the exploration for, design, operation and performance monitoring of individual operations, existing or proposed, in terms of their compatibility with concepts of sustainability".

Based on consultations within the mining industry and stakeholders, a framework was developed. The framework's objective is to guide the assessment of the mining Project's sustainability. Seven components were identified; these are engagement, people, environment, economy, traditional and non-market activities, institutional arrangements and governance, and synthesis and continuous learning.

For each, a question was posed in order to assess the net positive or negative contribution to sustainability of a mining project. These questions and their corresponding principles, criteria and metrics are discussed in the MMSD report. This framework is intended for guidance to proponents and stakeholders of mining / mineral projects of all sizes. MMSD has recommended pilot testing of this framework in various scenarios followed by incorporation of lessons learning and review of implementation approaches.

Within the planning, preliminary design, and assessment of the Touquoy Gold Project, the guidance of this framework has been used to assess the long term effects on social and environmental concerns. These considerations are mirrored in many of the mitigation and monitoring practices proposed in this EARD. The proponent, DDVG, is committed to utilizing this framework as guidance throughout the operations and reclamation activities. The continual evolution of the work of MMSD will be followed as this framework is tested and refined.

2.6 OPERATIONS

2.6.1 PROJECT PERSONNEL AND WORK SCHEDULE

A workforce of up to 400 will be required during the 12 month construction and mine development phase of the Project. A workforce of 170 will be required during the six year production phase of the mine. Bussing arrangements from surrounding collection points may be organized to reduce traffic flow on the Mooseland and Moose River Roads if congestion becomes an issue. Wherever possible, DDVG has a preference to train and employ local people for this Project. Table 2.2 outlines the preliminary work force projection for mining, treatment plant and administration personnel required, assuming some outsourcing and an owner-operated fleet – although other options (eg. contract mining) may become available.

TABLE 2.2: PROJECTED SITE PERSONNEL REQUIREMENTS - PRODUCTION PHASE

MINING – TOTAL 174					
Mine Superintendent	1	Heavy Duty Mechanic	12	Utility Operator	2
Mine Operations General Foreman	1	Light Vehicle Mechanic	2	Dump Truck Driver	2
Foreman	4	Welder	8	Fuel Farm attendant	4
Trainer	1	Serviceman	8	Crane Operator	2
Clerk	1	Washbay Attendant	4	Rigger	4
		Partsman	4		
Total	**8**	**Total**	**38**	**Total**	**14**
Chief Engineer	1	Excavator Operator	8	Maintenance General Foreman	1
Mine Engineer	1	Loader Operator	4	Maintenance Planner	1
Mine Technician	2	Truck Driver	28	Foreman	4
Geologist	1	Dozer Operator	12	Clerk	1
Ore Control Technician	4	Grader Operator	8	**Total**	**7**
Surveyor	2	Water Truck Driver	4		
Clerk	1	Spare	8	Drill Operator	8
Total	**12**	**Total**	**72**	Drill Helper	8
				Blast Foreman	1
				Blaster	6
				Total	**23**
MILLING – TOTAL 77					
Mill Superintendent	1	Crusher Operator	8	Millwright	8
Mill General Foreman	1	Grinding Operator	4	Welder	4
Metallurgist	1	Carbon-in-Leach Operator	4	Electrician	4
Metallurgical Technician	1	Detoxification Operator	4	Instrument Technician	4
Foreman	4	Gold Room Operator	1	Plumber	1
Gold Room Foreman	1	Spare	8	Carpenter	1
Clerk	1				
Total	**10**	**Total**	**29**	**Total**	**22**
Chief Assayer	1	Mill Maintenance General Foreman	1		
Assayer	1	Mill Maintenance Planner	1		
Lab Technician	2	Foreman	4		
Sample Bucker	4	Clerk	1		
Clerk	1				
Totals	**9**		**7**		
ADMINISTRATION – TOTAL 42					
General Manager	1	Procurement Manager	1	Health Safety & Environmental Manager	1
		Warehouse Supervisor	1	Safety Officer	2
		Buyer	2	Environmental Technician	1
		Warehouseman	8	First Aid Attendant	4
		Clerk	1		
Total	**1**	**Total**	**13**	**Total**	**8**
Administration/Human Resources Manager	1	Chief Accountant	1		
Human Resources Clerk	1	Cost Accountant	1		
Reception/Clerk	2	Payroll Clerk	1		
Courier Driver	4	Accounts Payable/Accounts Receivable Clerk	1		
Cleaners	8				
Total	**16**	**Total**	**4**		

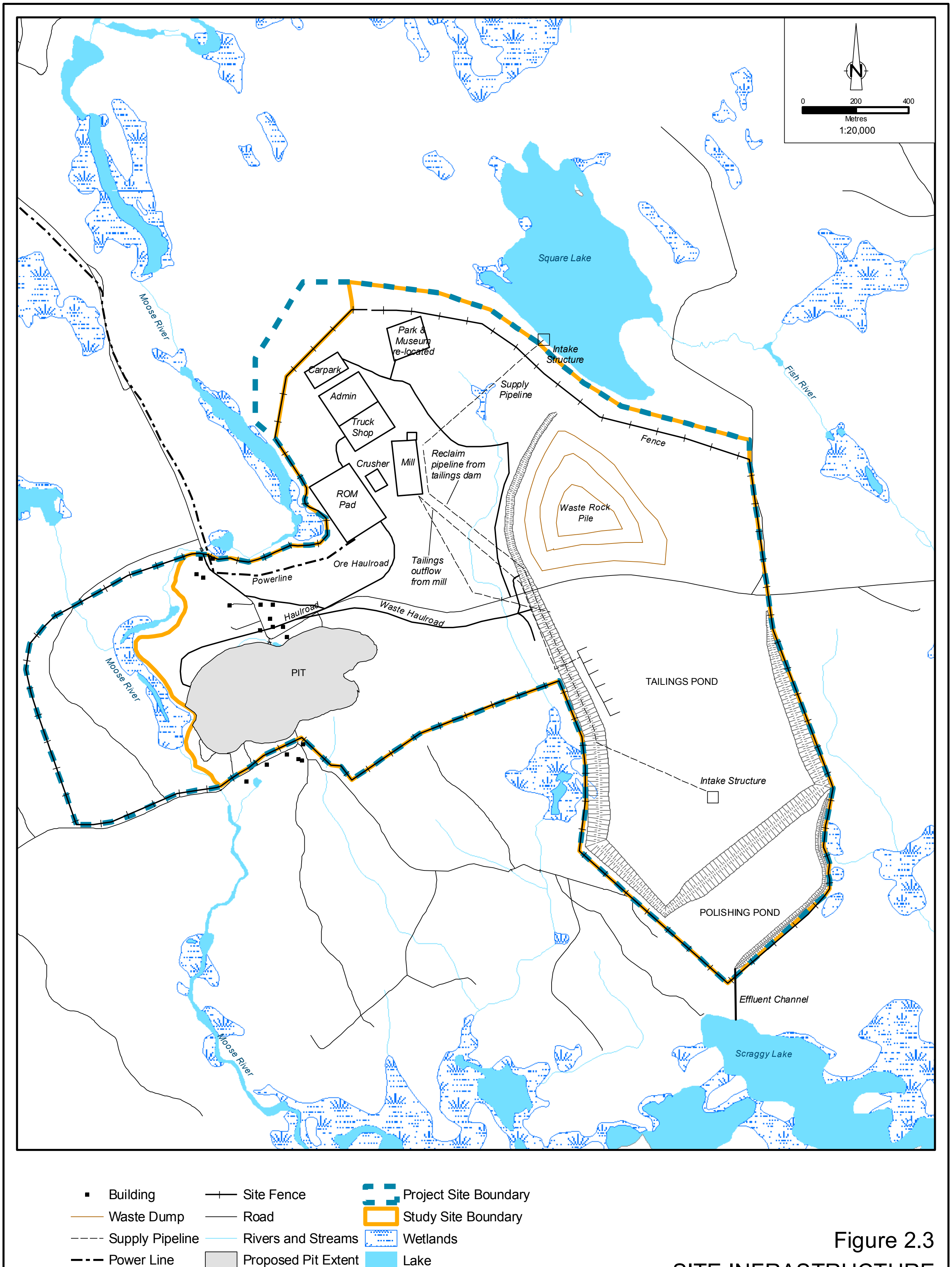
It is intended that all buildings and dwellings in the settlement of Moose River Gold Mines will be removed or relocated. With no residents remaining in the vicinity of the mine, both mining and milling will be conducted as a 24 hour a day/seven day per week operation. All mine and mill positions are expected to be scheduled for 2 x 12 hour per day shifts on a 4-days-on/4-days-off roster. Administration personnel would work 8-hour shifts on a 5-days-on/2-days-off roster.

2.6.2 PROJECT SCOPE AND OPERATIONS OVERVIEW

The Project will involve the development of an open pit and associated infrastructure centered on the previous areas of mining activity at Moose River Gold Mines. The extent of the Project facilities and expansion of the open pit throughout the Project life are shown in Figures 2.3 and 2.4. The Project facilities include an open pit, process plant, tailings storage facility, waste rock piles (Note: waste rock piles will also contain some minor amounts of till and local fill), power and water supply systems, offices, and service support complex (Figure 2.3). The total area affected by Project development is approximately 265 ha as detailed below.

- Open pit and haul roads (40 ha)
- Process plant and service complex (60 ha)
- Tailings management facilities (130ha)
- Waste rock pile (35 ha)

Ore will be mined from the open pit and delivered to the mill for processing. Waste associated with the ore will be stored in dumps. Processing will involve size reduction of the ore by crushing and grinding and recovery of the contained gold by mechanical and chemical processes. Tailings and waste from ore processing will be deposited in a storage facility. Water associated with the tailings will be recycled for use in processing with the excess subject to treatment and released to the environment in accordance with existing regulations. At closure, all facilities will be removed, disturbed lands rehabilitated, and the property returned to otherwise functional use.



Data projected to UTM (Zone 20T) NAD83

Figure 2.3
SITE INFRASTRUCTURE
Touquoy Gold Project, DDV Gold Ltd.
Halifax County, Nova Scotia

820933(REP004)GIS-WA005 March 12, 2007

2.6.3 MINING

2.6.3.1 OPEN PIT DESCRIPTION

The final pit measures 600 metres in length (E-W), 300 metres in width (N-S) and 125 m in depth at the deepest point. Preliminary pit wall slopes have been derived from the results of geotechnical studies performed by external consultants on diamond drill core from 12 selected drillholes. Bench face angles are 60° to 70°, inter-ramp angles 50° to 60°, and overall pit slopes including the flattening effect of haul roads 40° to 45°. No requirements to artificially enhance wall stability are anticipated.

The design provides for intermediate safety berms, six metres in width, every 15 vertical metres and 15 metre wide safety benches, accessible for mechanized cleaning, every 45 vertical metres. The pit is accessed by a 22 metre wide dual-lane haul road above a depth of 70 metres and a 15 metre wide single lane road below 70 metres depth. Ramps will be constructed at a grade of 10% with a ditch for drainage and a barrier berm on the open side for safety. Radio communication, lower production rates, and a small equipment fleet will ensure safety on the single-lane ramps. A plan of the open pit is shown in Figure 2.5.

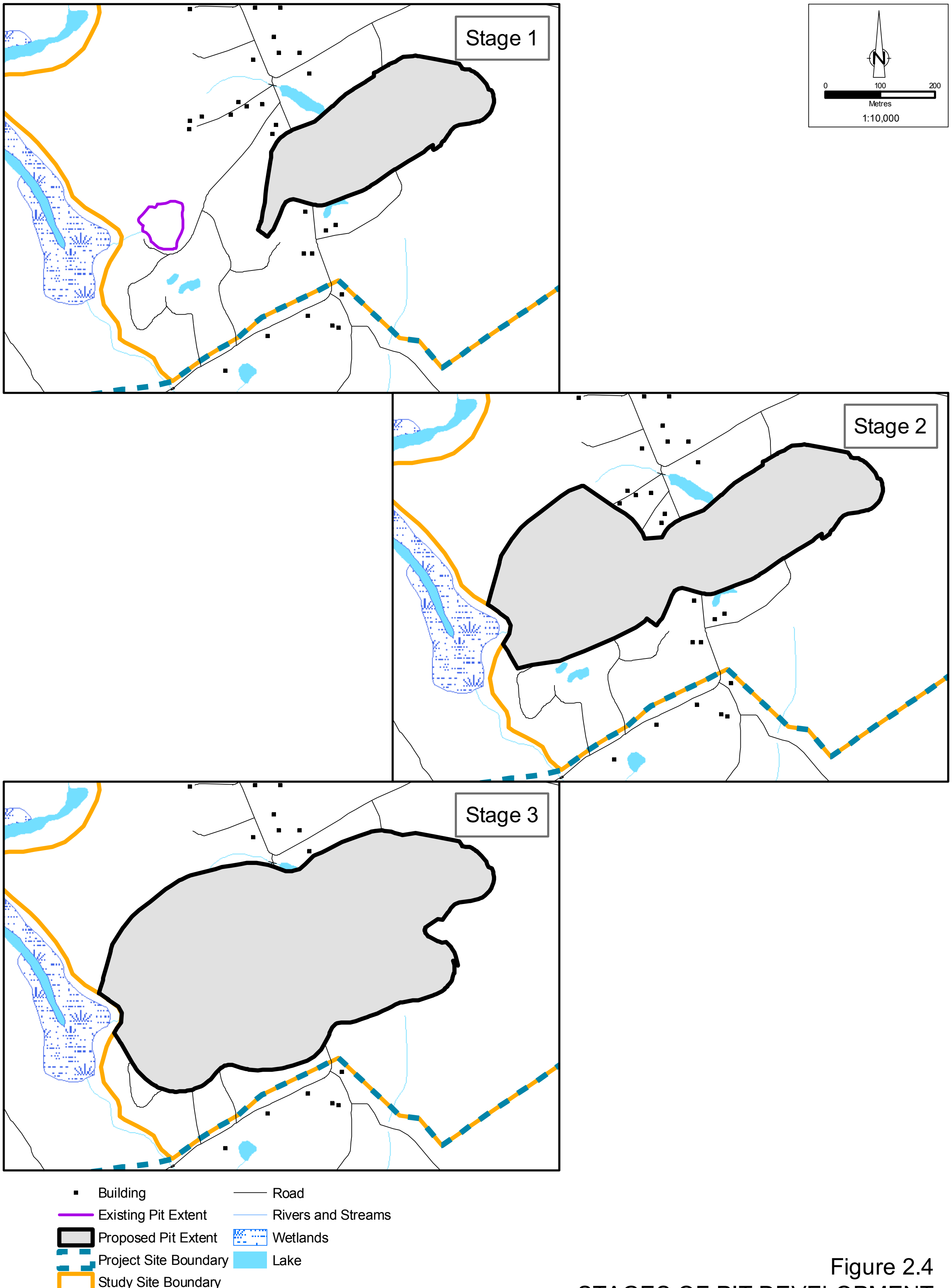
2.6.3.2 OPEN PIT DEVELOPMENT PLAN

The pit will be developed in three stages to smooth production schedules and optimize Project economics (Figure 2.4). The first stage will focus on the eastern portion of the pit, the second stage will develop the western portion of the pit, and the third stage will entail a general expansion to the south and deepening.

Mined tonnage over the life of the mine is expected to total 27 million tonnes of ore and waste rock. In general, the pit development will progress from east to west. Table 2.3 indicates the development stage and anticipated volume mined by year over the Project life.

TABLE 2.3: ANTICIPATED MINING PRODUCTION SCHEDULE

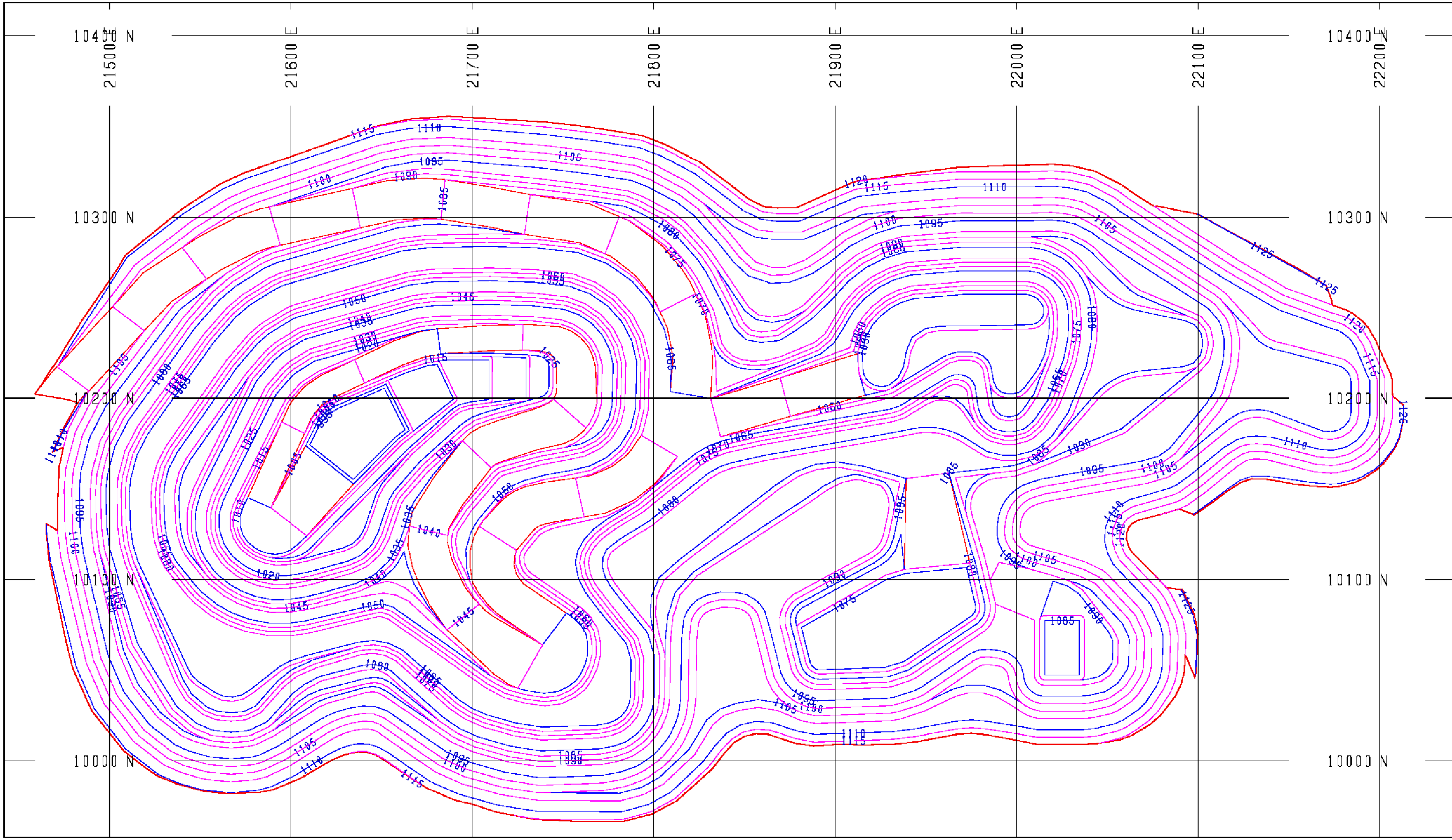
Year	2008	2009	2010	2011	2012	2013	2014	Total
Pit Stage	1	1	2	3	3	3	3	
Tonnage (Mt)	1.0	5.0	5.0	5.0	4.0	4.0	3.0	27.0



Produced by Conestoga-Rovers & Associates under license with
the Province of Nova Scotia, 2007.
Data projected to UTM (Zone 20T) NAD83

Figure 2.4
STAGES OF PIT DEVELOPMENT
Touquoy Gold Project, DDV Gold Ltd.
Halifax County, Nova Scotia

820933(REP004)GIS-WA003 March 8, 2007



Elevations shown are Mine Elevations which are 1000 metres above sea level. Ex. Mine elevation 1130 equates to 130 metres above sea level.

Figure 2.5
PRELIMINARY PIT DEVELOPMENT
Touquoy Gold Project, DDV Gold Ltd.
Halifax County, Nova Scotia

Original drawing prepared by Mining Solutions Consultancy, October 17, 2006.

2.6.3.3 MINING OPERATIONS

The mine will employ a fleet of two (2) hydraulic excavators, five (5) 35 tonne trucks, one (1) front-end loader, two (2) bulldozers, one (1) grader and contractor equipment such as a blasthole drill to conduct mining. The production fleet will be supported by various service vehicles, including a water truck as required. Mining activities will entail the following unit operations:

- Drill/blast
- Grade control
- Load/haul
- Ore supply management
- Waste dumping
- Mining through underground workings

Drill/Blast

Blastholes will be drilled with a diameter of 150 mm on a 4 m x 4 m pattern to a depth of six metres including one metre of subgrade to ensure a level bench floor. A powder factor of 0.50 to 0.75 kg/cubic metre is anticipated using ammonium nitrate-fuel oil (ANFO) loaded in water-proof plastic liners. Fragmentation will generate material, on average, less than 600 mm in size. Blasting will be conducted every one to two days at a regular time providing 15,000 to 30,000 tonnes of broken rock per blast.

Bulk ammonium nitrate (AN) will be secured on site for storage. Fuel oil (FO), which makes the ANFO mixture potentially explosive, will not be added until the mixture is delivered into each blasthole. A magazine will be appropriately designed and sited for storage of detonators and blasting accessories.

All appropriate safety measures including prescribed signage, pre-blast siren warnings, restricting access to the blast area, and inspections for blast-site clearance of public and site personnel will be employed as prescribed by federal and provincial law. Fly-rock is expected to be limited to within 200 metres of the open pit and only essential personnel and equipment will be permitted within 500 metres of any blast.

Given that no residential dwellings will remain at Moose River Gold Mines there will be no anticipated direct external social impact arising from site activity. Noise and blast vibration monitoring will be conducted as per Occupational Health and Safety (OH&S)

requirements and relevant mitigation measures employed as necessary to ensure the well-being of site.

Grade Control and Excavation

The majority of the ore is visually indistinguishable from waste rock. Therefore, drill cuttings from blastholes will be assayed to determine gold content prior to blasting. After blasting, ore-waste boundaries will be surveyed and staked. Ore and waste rock will be separated during excavation, ore being sent to the run-of-mine (ROM) pad and waste rock pile.

Hydraulic excavators will mine ore and waste rock in 2.5 metre high lifts to ensure digging selectivity. Two passes will be required to fully remove a single five metre bench. The front-end loader will load trucks when one of the excavators is on maintenance or performing other duties. Excavation will conform to the grade control digging plan to separate ore and waste rock.

Ore Supply Management

Excavated ore will be dispatched to the ROM pad. Trucks will routinely dump ore directly into the ROM bin which feeds the primary crusher. On some occasions, trucks may dump to a stockpile on the ROM pad to facilitate maintenance or blending activities. Stockpiled ore will be fed into the ROM bin by a front-end loader on an as required basis.

Project economics may be enhanced by stockpiling low grade ore to preferentially process higher grade material first. In this event the lower grade ore would be stockpiled near the crusher. All ore is scheduled to be processed, irrespective of grade, and any ore stockpiles will be temporary.

Waste Rock Management

Approximately 18 million tonnes of waste rock will be extracted from the open-pit during the life of the operation. Between 15 to 20% of this material will be used in construction of the tailings facility and other site earthworks. The remainder will be stored approximately 1.5 km east of the pit, north of the existing Mooseland Road and adjacent to the tailings management area. A perimeter ditch will capture run-off from the waste rock pile and direct it into the tailings pond.

The waste rock pile will be constructed in ten metre high lifts with active slopes designed at 37°, the angle of repose. The ultimate dump height is expected to be 30 to 40 metres and will be determined based on the trade-off between aesthetics (height) and disturbance (area). Throughout operations, completed dump slopes will be re-contoured and flattened to 3:1 (horizontal:vertical), covered with topsoil, and re-vegetated.

The potential for acid rock drainage from the waste rock pile is negligible, owing to the presence of acid-soluble carbonate as an alteration product associated with the gold mineralization. Results from static leach testing of 84 drill core samples of waste rock independently collected by Golder Associates returned an average "neutralizing potential ratio" of 11, well above the threshold of four, considered to be the benchmark above which rock is considered non-acid producing. Ongoing kinetic test results support the conclusions drawn from the earlier analytical work.

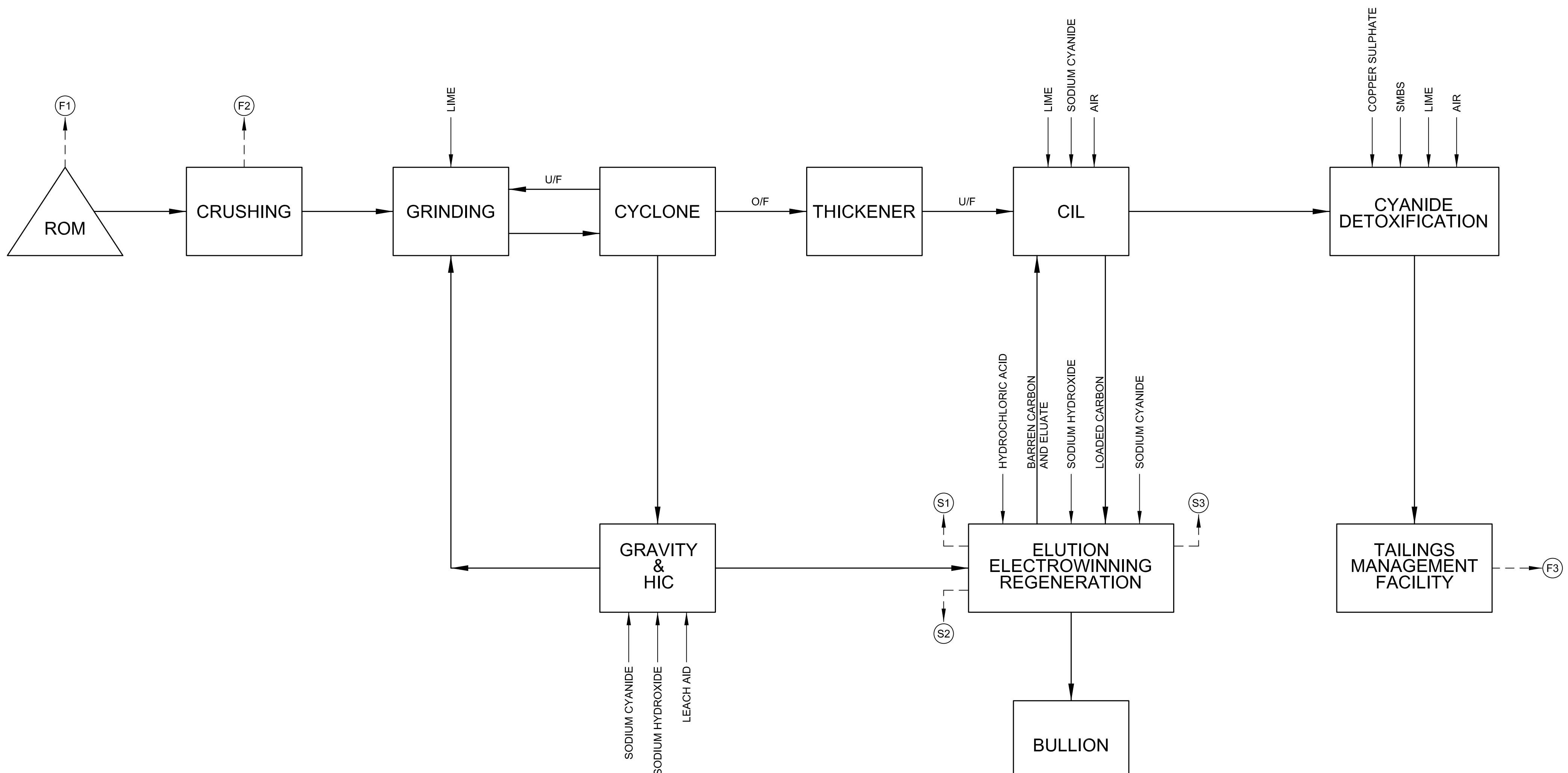
Mining Through Underground Workings

Particular precautions will be taken to locate and make-safe operations in the pit around historic workings. DDVG sees the removal of these numerous workings as a project benefit to public safety. Survey detail of historical workings has been incorporated into present drill sections and plans and reconciled with open stopes encountered during resource drilling, however, it is acknowledged that some workings may have never been documented. Exposure of historic workings in modern open pits is a relatively common occurrence in Nova Scotia and generally worldwide and DDVG will implement practices and procedures which will ensure that voids and openings are collapsed or backfilled prior mining to maximize operating safety and efficiency.

2.6.4 PROCESSING

Gold recovery will involve the processing of 4,500 tonnes per day (tpd) of ore over a minimum 6-year period. Processing entails the following unit operations as depicted in Figure 2.6:

- Crushing
- Grinding/Classification
- Gravity Concentration
- Carbon-in-Leach (CIL)
- Elution and Carbon Regeneration



LEGEND

F1	FUGITIVE EMISSIONS
S1	STACK EMISSIONS
CIL	CARBON-IN-LEACH PROCESS
HIC	HIGH INTENSITY CYANIDATION
MMER	METAL MINING EFFLUENT REGULATIONS
SMBS	SODIUM METABISULPHITE
U/F	UNDERFLOW
O/F	OVERFLOW
——►	PROCESS INPUTS
◄– – –	EMISSIONS

EMISSIONS

F1 and F2	PARTICULATE
F3	TREATED EFFLUENT
S1	HEAT, WATER VAPOUR, CO AND CO_2 FROM CARBON REGENERATION KILN
S2	HEAT, WATER VAPOUR AND LOW CONCENTRATIONS OF NH_3 AND SO_2 FROM ELECTROWINNING CELLS
S3	NH_3, SO_2, PROPANE EXHAUST (CO, CO_2, NO_x, H_2S, TRACE METALS) AND PARTICULATE FROM SMELTING PROCESS

NOTE: DRAWING ADAPTED FROM AUSENCO LTD. DRAWING NO. 1666-F-100

figure 2.6

PROCESS FLOW DIAGRAM
TOUQUOY GOLD PROJECT, DDV GOLD LTD.
Halifax County, Nova Scotia

820933-00(MEMO001)GN-DA001 MAR 12/2007

- Electro-winning and Smelting
- Cyanide Destruction

2.6.4.1 CRUSHING

Run-of-mine (ROM) ore will be delivered to the crushing circuit via the ROM bin by trucks or the front-end loader. The primary jaw crusher will reduce 600 mm (24″) material to 80% passing 150 mm. Second and third stage crushing will further reduce the ore to 30 mm (1 ¼″) and finally 10 mm (3/8″). A triple-deck screen in closed circuit with the secondary and tertiary crushers will ensure that fines are bypassed directly to the crushed ore stockpile.

The crushed product will be conveyed to a 15,000 tonne covered stockpile which will provide 72 hours of surge capacity ahead of the ball mill in the event of shutdown of the crushing circuit for maintenance or weather. Vibrating feeders located beneath the stockpile will reclaim crushed ore onto a conveyor which feeds the ball mill.

2.6.4.2 GRINDING AND CLASSIFICATION

The ball mill is a large rotating steel drum filled with several tonnes of 75 mm (3″) steel balls which grind the crushed ore, mixed with water, to the consistency of coarse sand. The ball mill product is pumped through hydro-cyclone classifiers which separate the particles in the slurry on the basis of relative weight. 100% of the cyclone overflow (light material) is directed to the leach circuit, 30% of the underflow (heavy material) is directed to the gravity concentration circuit, and the remainder is re-circulated to the ball mill for re-grinding.

2.6.4.3 GRAVITY CONCENTRATION AND HIC

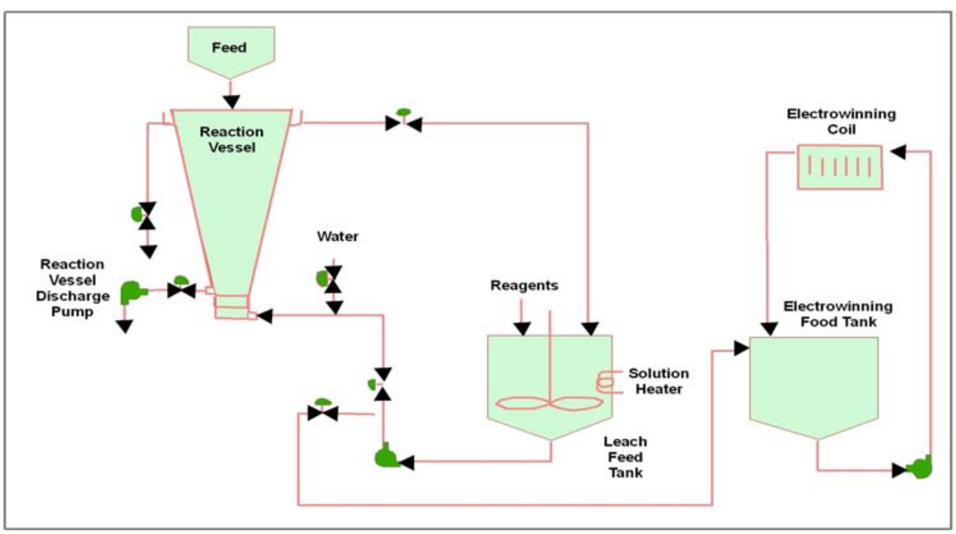
Thirty percent of the cyclone underflow is screened and directed to the gravity concentrators which use centrifugal forces and the difference in the specific gravity between and the associated materials to separate the light and heavy fractions of the feed. This process is extremely efficient with only several tonnes at the most, from the daily throughput of 4,500 tonnes, separated as gravity concentrate. The tailings (light) fraction is pumped back to the ball mill while the concentrate is subjected to high-intensity cyanidation (HIC) to extract the gold in solution.

In some mines arsenopyrite, a dense arsenic-bearing mineral often associated with gold (as it is at Touquoy) can be removed from the process flow by gravity concentration. At Touquoy this is not possible as the efficiency of the gravity concentration process ensures that the gold, with a specific gravity of 12 to 20 g/cm^{3,} is effectively separated from the arsenopyrite with a specific gravity of about 6 g/cm^3.

HIC is a conventional, accelerated batch leach process used to dissolve the gold collected during gravity concentration. Several tonnes of gravity concentrate is accumulated over a 24 hour period and then exposed to a steady, circulating flow of leach solution over a subsequent 16 hour period in an enclosed leach vessel called an ACACIA Reactor. The ACACIA Reactor is compact – about 3 m^3 in size. Additional information is available at the website noted below.

The leach solution is made up in the Reaction Vessel Feed Tank by combining potable water with sodium cyanide, caustic soda, and LeachAid. Approximately 10 kg of sodium cyanide is used per batch. Caustic soda is used to adjust pH and LeachAid (lead nitrate) provides a source of lead which accelerates the reaction. At the conclusion of an HIC run, the pregnant (gold-bearing) solution is sampled for gold content and pumped to a holding tank where it is available for electro-winning. The residual solids are rinsed and discharged to the grinding circuit. A typical HIC flow sheet is shown in Figure 2.7.

Figure 2.7 Typical High-Intensity Cyanidation Flow Sheet



Reference: www.knelsongravitysolutions.com

2.6.4.4 CARBON-IN-LEACH (CIL)

Overflow from the cyclones is screened and thickened to 50% solids in a pre-leach thickener with the aid of a polymer-type flocculant. Thickening prior to leaching permits water, uncontaminated with cyanide, to be recycled to the ball mill and the size of the leach circuit to be minimized. Pre-leach thickening is possible as the low-cyanide consuming nature of the ore eliminates the need to recover cyanide after leaching.

The thickener underflow will then be pumped to the CIL circuit where gold dissolution and adsorption occurs. Cyanide is added only in the CIL circuit and is done so by means of a pipeline which permits transfer from the mixing tank to the CIL feed box where dosing occurs automatically. The leach circuit is composed of six CIL tanks, each approximately 900 m^3 in volume measuring 12 metres in diameter and 12 metres high. Leaching occurs primarily in the first tank. Lime is added to maintain a slurry pH of 10 to 11 to prevent the cyanide from volatilizing. The slurry is agitated and aerated to accelerate leaching which will occur over a 16 to 24 hour period.

Activated carbon is added to the last CIL tank and progressively pumped forward from tank to tank counter to the slurry flow. The carbon adsorbs gold from solution as it moves forward in the circuit until it is fully "loaded" when it reaches the first CIL tank. The loaded carbon is removed from the CIL circuit at the first tank, screened, and transferred to the elution circuit for stripping. The barren slurry is screened to capture transient carbon and treated in the cyanide destruction circuit prior to release to the TMF.

2.6.4.5 CYANIDE DESTRUCTION

The widely used INCO SO_2/air process will be employed to destroy almost all of the residual cyanide in CIL tailings prior to disposal. Testwork completed indicates that the Touquoy ore, having been processed for gold recovery, responds extremely well to the cyanide destruction process. The cyanide destruction reaction is described by the following equation:

$$CN^-_{Free} + SO_2 + O_2 + H_2O = OCN^- + H_2SO_4$$

Sodium meta-bisulphite will be added to the tailings in two agitated and aerated tanks to provide sulphur dioxide (SO_2) which transforms the toxic free cyanide ion to more stable cyanate (OCN^-). Copper sulphate is used to catalyze the reaction while pH control is maintained through lime addition. Laboratory testing employing the INCO

SO_2/Air process indicates that cyanide concentration in the tailings can be reduced from more than 160 ppm to less than 1.0 ppm CN_{WAD} (weak-acid dissociable cyanide) in less than 90 minutes using relatively low concentrations of reagents. The results of the testwork are shown in Table 2.4.

TABLE 2.4: SUMMARY OF AMMTEC TAILINGS DETOXIFICATION TEST RESULTS

Test No.	Slurry Density (% solids w/w)	Test Conditions					Solution Assays	
		pH	Retention Time (minutes)	Reagents Used			Feed Effluent CN_{WAD} (mg/L)	Avg Treated Effluent CN_{WAD} (mg/L)
				SO_2 (g/g CN_{WAD})	Cu^{2+} (mg/L)	Lime (g/g SO_2)		
D1	44.8	9.06	80.2	4.52	19.3	1.05	163	0.75
D2	44.4	9.10	85.7	2.76	21.5	0.89	163	0.50
D3	50.0	8.18	83.3	2.75	21.5	0.68	163	1.17

The cyanide destruction testwork was conducted by AMMTEC Limited of Australia. It is documented in the report, "Carbon Kinetics, Loading Capacity, and Cyanide Detoxification Testwork Associated with the Touquoy Gold Project for Atlantic Gold Exploration Pty", Report No. A10174, June 2006. The full report is found in Appendix A. AMMTEC is the largest metallurgical services company in Australia and a recognized global leader in metallurgical testing. The results of this testing were corroborated by work performed by SGS Environmental Services of Lakefield, Ontario.

The cyanide destruction circuit in the Touquoy mill is conservatively designed to reduce tailings cyanide concentrations from 100 ppm to 10 ppm CN_{WAD} with two hours of residence time. Laboratory test results indicate that the design may exceed performance expectations. The cyanide destruction circuit will be designed using industry-standard criteria. The process design criteria are shown in Table 2.5.

TABLE 2.5: CYANIDE DESTRUCTION DESIGN CRITERIA

Parameter	Units	Value
Feed Source	---	CIL Tailings
Feed Density	w:w, %	50
CN Concentration	ppm	100
Detoxification Target	ppm, CN_{WAD}	10
SO_2 (required)	g/g CN_{WAD}	4 – 6
Copper (required)	mg/L $CuSO_4$	80.2
Lime (required)	g @ 71% CaO/g SO_2	1.48

The SO_2/Air process also offers the opportunity to precipitate any ferrocyanides which may be present in the tailings through contact with the free copper ions used to catalyze the parent reaction. Precipitation is limited, however, due to the high pH required to oxidize the free cyanide. This process will be employed to full effect at the effluent treatment facility where the addition of acidified ferric sulphate, providing ferric irons and low pH, precipitates arsenic and associated metal-cyanide complexes.

The use of the INCO SO_2/air process will permit the Touquoy Project to discharge tailings to the tailings facility at concentrations five times less than the generally accepted level (50 ppm CN_{WAD}) below which no harm to terrestrial life forms will occur and equal to the most stringent existing world standards, most recently set by the European Union.

2.6.4.6 ELUTION AND CARBON REGENERATION

The loaded carbon transferred from the CIL circuit is washed with dilute (3%) hydrochloric acid in the acid wash column to remove inorganic contaminants. Used acid is discharged to the tailings management facility (TMF) where it is neutralized by the lime in the tailings. The gold is then "stripped" from the carbon under heat and pressure in a circulating, dilute solution of caustic soda and sodium cyanide.

Once elution is complete, the barren carbon is then screened and heated in a kiln to 700°C to reactivate the carbon surfaces. The reactivated carbon is recycled to the last CIL tank to be re-used. An exhaust vent above the kiln will extract hot air and water vapour.

2.6.4.7 ELECTROWINNING AND SMELTING

During elution, the gold-rich (pregnant) solution from the elution circuit is circulated through an electrolytic, or "electrowinning", cell. The gold is deposited in the form of a thick sludge on stainless steel wool cathodes via an electro-chemical process. The pregnant solution from the HIC circuit is similarly treated on a batch basis in a separate, dedicated electrowinning cell. After electrowinning is complete, the barren solution (eluate) is discharged to the CIL circuit.

The sludge recovered by electrowinning is dewatered and the resulting filter cake dried in an oven (calcined) prior to smelting. The calcined filter cake is then charged in an induction furnace together with a standard flux mixture and heated to 1100 C for 6-7 hours. Impurities are separated from the molten metal and doré (near pure gold) is poured into bars. No mercury or amalgams are used in the gold recovery process.

Extraction fans above the electrowinning cells and the smelting furnace remove particulate matter and any off-gases (low concentrations of ammonia and sulphur dioxide) from the gold room. Emissions from electrowinning and smelting activities are relatively minor given the intermittent nature of these operations and the small volume of solution and calcine treated. Particulate matter is removed from the exhaust by scrubbers and the large volume of air drawn by the fans ensures concentrations of off-gases in the work area meet OH&S requirements.

2.6.5 TAILINGS MANAGEMENT

The tailings management facility (TMF) serves three functions: (1) stores waste from processing (tailings) and keeps it contained from the surrounding environment, (2) treats tailings water and site runoff so it can be safely released into natural watercourses, and (3) recycles water for processing minimizing the amount of water withdrawn from lakes and streams. The TMF is composed of the following facilities:

- Tailings Impoundment
- Effluent Treatment Plant
- Reclaim Water System

2.6.5.1 TAILINGS IMPOUNDMENT – TAILINGS POND AND POLISHING POND

The Tailings Impoundment will be comprised of a "U-shaped" earthfill dam in which tailings from the process plant are deposited by pipeline. It is the largest component of the TMF which covers a total area of 130 ha. The tailings impoundment will be located approximately 1,100 metres east of the open pit such that its impact is confined to a single watershed, impact on wetlands is minimized, and there is no conflict with identified fish habitat. The entire TMF will be surrounded with a two metre high steel mesh stock fence to prevent wildlife from entering the facility.

Tailings Dam Description

The tailings dam will be 3,000 metres in length. The dam body will be composed of waste rock generated by mining, and enclosing a low-permeability clay core. The dam body will have a maximum height of 20 metres, a base width of 65 metres and a final crest width of eight metres. Slopes will be angle of repose, 37°, during operation and will be flattened at closure to facilitate reclamation. The clay core will be six metres wide and keyed into bedrock or low permeability soil at its base to minimize seepage.

Seepage collection ditches will be constructed on the east and west sides of the dam. Runoff and seepage captured in these structures will be pumped back into the impoundment. Water will be transferred from the tailings pond to a treatment pond – a structure within the polishing pond and further described below – via gravity flow spillway. A second spillway will permit release of water from the tailings pond in the event of an overfill condition without endangering the integrity of the dam.

The polishing pond located south of the tailings impoundment will serve to collect seepage on that side of the facility. The polishing pond serves as a final storage area for treated water prior to release.

DDVG recognizes the need for final design drawings of outflow and inflow structures to be submitted to DFO and NSEL as part of the application for an Industrial Approval for Site Operations.

Tailings Impoundment Design and Construction

All aspects of the TMF will comply with guidelines published by the Canadian Dam Association and the Mining Association of Canada for the design and operation of tailings and water retaining dams. The design is being prepared by Golder Associates, a Canadian firm recognized as a global leader in the design, construction, and operation of tailings management facilities.

The initial tailings dam will be constructed to hold two years of tailings and will be raised each year such that the dam crest always remains one year ahead of the deposition plan. The plan to integrate mine waste rock disposal with dam construction allows for year-round construction that ensures that the dam is actively managed and maintained and expenditures are timed to meet project needs as required. The clay that will form the core of the TMF dams will be generated during pre-stripping of the open pit and will be stockpiled in the waste dump area until needed. No borrow pits will be required for dam construction limiting disturbance to only that originally envisioned for mining.

Construction of the tailings dam to its final height during the initial project construction imposes an unnecessary financial burden on the Project which may affect economic viability and would entail development of a borrow source equal to the entire dam volume which would significantly increase the disturbance associated with the Project. The facility is being designed, and operating procedures planned, to manage extreme precipitation events; thus no further benefit is provided in terms of additional containment by having the dam built to final height from the start of operations.

The dam is designed to manage inflows from the projected 1/100 year storm event in a wet year over a 24 hour period. The likelihood of the facility being exposed to such an event is minimized by the relatively short mine life. The emergency spillways previously mentioned ensure that inflows in excess of these amounts can be managed in extreme circumstances. The operating plan calls for the treatment and polishing ponds to be drained each winter. This will ensure that additional holding capacity is available during the spring melt if required.

Tailings Impoundment Operation

Tailings will be delivered to the TMF from the process plant by gravity flow via a 250 mm (10 inch) diameter, double-walled, high-density polyethylene (HDPE) pipeline. Tailings will be discharged into the pond and will accumulate against the dam wall to provide an additional low-permeability layer to resist seepage. The discharge point will be moved periodically to build a uniform beach which does not impede water reclaim and keeps the tailings beach moist to prevent dust migration.

The operation of the TMF will be based on the deterministic flow model (water balance) developed during the design of the facility by Golder Associates. Table 2.6 summarizes the results of the model which indicates that 90% of the water in tailings is recycled for re-use but twice that amount, as a result of runoff and precipitation, must be treated and discharged.

TABLE 2.6: TMF WATER BALANCE

In-Flow	Volume (1000 x m3/yr)
Water in Tailings	1,440
Water from Plant Site	220
Water from Open Pit	500
Water from Waste Dump	500
Precipitation/runoff direct to TMF	1,750
Losses	
Water Retained in Tailings	450
TMF Seepage and Evaporation	200
Out-Flow	
Recycle to Plant	1,290
Treatment and Discharge	2,470

The detailed facility water balance will be provided to DDVG by Golder Associates as part of the final TMF design report in March 2007 and will comprise a key component of the application for Industrial Approval.

2.6.5.2 EFFLUENT TREATMENT

Effluent Treatment Facility Description

The effluent treatment facility is composed of a treatment and polishing pond located directly adjacent to and south of the tailings impoundment. The ponds will be of similar construction to the tailings dam itself but lower in height, 10 to 15 metres, and fully constructed at the outset of operations.

The effluent treatment facility will also include the treatment plant itself, a small structure where ferric sulphate is mixed and added to water flowing from the tailings impoundment to the treatment pond to precipitate arsenic and any remnant cyanide metal complexes. A substation will be located adjacent to the treatment plant to provide power for the plant, seepage collection, and reclaim water pumps.

Effluent Treatment Processes

The effluent treatment processes occurring at the TMF are (1) natural degradation of cyanide, (2) precipitation of dissolved and suspended arsenic solids, and (3) co-precipitation of cyanide-metal complexes.

Upon deposition in the TMF, tailings pH trends downwards from 9 to 7 and the cyanate ion created by the INCO SO2/Air process breaks down rapidly under the effects of hydrolysis and sunlight into ammonium and carbon dioxide. Remaining low levels (<10ppm) of free and weak acid dissociable (WAD) cyanide under the same influence volatilize into barely detectable amounts of hydrogen cyanide gas, HCN, where its dilution and eventual degradation in the atmosphere render it harmless. This natural degradation is integral to the total cyanide destruction process and will reduce concentrations of cyanide in tailings water from 10 ppm to less than 1 ppm CN (WAD) in 30 to 45 days.

More information regarding the mechanisms which render cyanide harmless can be found in Appendix B, Cyanide Information. Results of laboratory testing of the natural degradation of cyanide in Touquoy tailings conducted by SGS Lakefield Research Limited of Lakefield, Ontario are shown in Table 2.7. Appendix C contains a report by Golder and Associates which provides additional information on Static Testing of Waste Rock at Touquoy.

TABLE 2.7: TAILINGS AGING TEST RESULTS FOR NATURAL CYANIDE DEGRADATION

Date	Days	CN_{TOT} (mg/L)	CN_{FREE} (mg/L)	CN_{WAD} (mg/L)	NH_3/NH_4 (mg/L)
22/09	0	1.27	<0.10	0.94	51.9
23/09	1	0.32	<0.03	0.03	29.3
25/09	3	0.32	<0.05	0.04	45.8
29/09	8	0.20	<0.04	0.03	3.1
06/10	15	0.18	<0.04	0.04	26.5
06/11	45	---	<0.04	0.04	---

Active effluent treatment at the TMF is focused on the precipitation of dissolved arsenic and arsenic occurring in suspended solids in the tailings water. Arsenic occurs at the Touquoy Project site in both ore and waste rock as well as runoff from minewater and natural watercourses. Arsenic content of the solid tailings within the tailings dam is predicted to be about 0.1%, or 1000 ppm. This is the mean value for all material sampled from the site. Ferric sulphate will be added to the tailings water to precipitate arsenic and iron as ferric arsenate, $FeAsO_4 \cdot x\ Fe(OH)_3$, which will accumulate in the bottom of the treatment pond. Ferric ions will also preferentially combine with free and weak acid dissociable cyanide ions to form the highly stable, insoluble compound ferric cyanate. This promotes the further reduction of dissolved cyanide in tailings water and contributes to achievement of the Metal Mining Effluent Regulations (MMER) limits for discharge of 1 ppm CN_{TOT}.

Co-precipitation is recognized as the most effective and practical method of removing arsenic from mine water and offers the potential to remove other heavy metal contaminants during the process like cyanide-metal complexes as previously mentioned. Typically the technology can reduce arsenic concentrations in water to <0.05 ppm and, in some cases, will reduce concentrations to <0.01 ppm. The use of a flocculant to assist in precipitation will be determined when the process design is completed in March 2007.

Additional geochemical testing is presently (March 2007) underway which will examine the mobility of arsenic under various pH conditions, further aspects of cyanide attenuation, and the chemical behavior of the exposed tailings beach at closure. Static testing results for this work will be available in May 2007 while kinetic test results and the summary of final test results will be ready in August 2007. This testing is expected to confirm preliminary results that indicate effective treatment will be achieved by the site facilities described in this document.

Effluent Treatment Operation

Ferric sulphate will be added to tailings water flowing by gravity from the tailings impoundment to the treatment pond. Treated water will overflow into the adjacent polishing pond where quality will assessed prior to release. Gravity discharge will be conducted for eight months each year, from April to December, and total approximately 2.5 M m^3 of water annually.

Treatment will generate approximately 2,500 t of sludge for disposal each year. At the end of each treatment season, the treatment/polishing ponds will be drained and the precipitated arsenic salts excavated and buried in a designated section of the tailings impoundment to reduce the likelihood of reduction-oxidation and subsequent re-mobilization.

2.6.5.3 TAILINGS WATER RECLAIM

Approximately 1.3 M m^3 of tailings water will be reclaimed from the TMF each year for re-use in processing. Water will be reclaimed via the decant tower, a perforated, pre-cast concrete structure, in which the submersible reclaim pumps will be suspended. The decant tower will be located at the end of a short, 50 metre, causeway extending from the divider dam between the tailings impoundment and the polishing pond. Water will be pumped, year-round, from the TMF via a 250 mm (10 inch) HDPE pipeline to the plant for re-use. The trace quantities of cyanide in the water do not affect its ability to be used for processing or present a health hazard for employees.

2.6.5.4 POWER REQUIREMENTS

The operation is expected to consume 22,000 MWhr/yr (megawatt hours per year) at a maximum demand rate of 5.5 MW. Due to the nature of the operation consumption is expected to be maintained at steady levels following commissioning. In order to deliver three phase power to the site a six kilometre extension of the 25 kV (kilovolt) supply from Caribou (located north of Moose River) will be required. Additionally there will be a need to upgrade five kilometres of existing lines along the Moose River Road.

The Project is expected to have a maximum power demand rate of 5.5 MW per year. Nova Scotia Power generates 2293 MW of electricity per year. Thus the Project's power requirements are less than 0.24% of the total power consumed in Nova Scotia each year. This very slight increase in power consumption due to the Project will not result in a significant increase in greenhouse gas emissions in Nova Scotia.

2.6.6 REAGENT MANAGEMENT

2.6.6.1 PROCESS REAGENTS

It is currently planned that all the reagents (lime, sodium cyanide, sodium hydroxide, copper sulphate, sodium metabisulphite, hydrochloric acid and flocculant) and consumables (activated carbon, fluxes and grinding balls) will be delivered to site in bulk bags or drums in compliance with statutory regulations. If available, lime will be supplied in bulk tankers. Liquefied petroleum gas (LPG) for use in the smelting furnace and for heating of the strip solution used in carbon elution furnace will be delivered in bulk and stored in vendor supplied tanks an appropriate form.

The reagent solutions will be prepared with fresh water in dedicated mixing facilities, prior to being transferred to storage tanks for distribution to the required locations in the plant. The estimated reagents usage during processing are shown in Table 2.3.

An appropriate inventory of each reagent and consumable will be maintained on site to avoid any supply delays that would affect continuity of production and as part of the site environmental management program. The actual inventories will depend on the sources of supply and the minimum delivered quantities.

All reagents and the LPG will be transported to site in accordance with recognized industry transportation codes and stored in appropriate facilities designed to meet applicable health and safety standards. Major reagents will be kept in covered, unheated, well ventilated storage, in silos, or storage tanks. Materials shipped in one tonne IBCs (individual bulk containers) or one tonne bulk bags will stored on the reagent pad. The pad is a concrete slab designed with curbs to contain spills. Drainage from the pad will permit neutralized materials to be flushed to the tails line for disposal. IBCs will be stacked no more than 3 metres high.

Reactive materials such as cyanide and acids (hydrochloric acid, copper sulphate, ferric sulphate, and sodium meta-bisulphite) will be separated to prevent accidental contact. Hydrated lime and sodium hydroxide will be stored between cyanide and acids to provide neutralizing potential and prevent the generation of HCN gas in the event of a cyanide spill. Carbon will also be stored on the reagent pad.

TABLE 2.8: REAGENT MATERIAL USAGE

REAGENT	FUNCTION	AREA	USAGE				INVENTORY
			kg/t milled	kg/d	Kg/wk	kg/yr	kg
Sodium Cyanide	Gold leaching	CIL,Elution,HIC	0.540	2,430	17,010	816,480	34,020
Hydrated Lime	pH control	CIL, Detox	1.400	6,300	44,100	2,116,800	88,200
Hydrochloric Acid	Carbon wash	Elution	0.042	189	1,323	63,504	2,646
Sodium Hydroxide	pH control	Elution, EW	0.045	203	1,418	68,040	2,835
Flocculant	Thickening	Pre-leach	0.027	122	851	40,824	1,701
Carbon	Adsorption	CIL	0.032	144	1,008	48,384	2,016
Sodium Metabisulphite	CN destruction	Detox	1.240	5,580	39,060	1,874,880	78,120
Copper Sulphate	Catalyst	Detox	0.070	315	2,205	105,840	4,410
Ferric Sulphate	As precipitation	TMF	To be determined based on test work currently in progress				
LeachAid	Accelerant	HIC	---	1	7	336	14
Silica	Flux	Smelting	---	2	14	672	28
Borax	Flux	Smelting	---	2	14	672	28
Nitre	Flux	Smelting	---	2	14	672	28
Sodium Carbonate	Flux	Smelting	---	2	14	672	28
OTHER							
Diesel Fuel	Fuel	Vehicles, heat	1.440	6,480	45,360	2,177,280	90,720
Propane	Fuel	Kiln, furnace	0.250	1,125	7,875	378,000	15,750
Grinding Media	Media	Grinding	0.227	1,022	7,151	343,224	14,301

TABLE 2.9: FATE OF PROCESS REAGENTS

Contaminant	Source	Hazard	Potential Contamination	Mitigation	Fate
Sodium Cyanide	CIL	Toxic	Workplace air, discharge water.	Maintain appropriately high pH in process. Destroy residue.	Dedicated and natural destruction to ammonia/ammonium, CO_2 end-products.
Hydrated Lime	CIL and cyanide destruction	Degrades water quality	Discharge water can be beneficial to soil	Containment in TMF	Readily precipitates as calcium salts and releases water
Hydrochloric Acid	Loaded carbon acid rinse	Degrades water quality	Discharge water	Containment in TMF Neutralization Minor quantities	Breaks down into water and metal chlorides which later precipitate releasing chlorine
Sodium Hydroxide	Elution and electrowinning	Degrades water quality	Discharge water	Containment in TMF Neutralization Minor quantities	Breaks down into water and sodium salts
Flocculant	Thickening	None	Discharge water	Containment in TMF Minor quantities	Decomposes into water and harmless carbon compounds
Sodium Metabisulphite	Cyanide destruction	Produces SO_2 gas Acidic, can burn skin	Discharge water Workplace air	Adequate ventilation Operating procedures Containment in TMF	Decomposes into insoluble sodium salts and SO_2
Copper Sulphate	Cyanide destruction	Acidic Introduces soluble metals to water	Discharge water	Containment in TMF Precipitation with arsenic and iron Minor quantities	Decomposes into insoluble metallic salts or complexes with CN
Ferric Sulphate	Arsenic treatment	Acidic Introduces soluble metals to water	Discharge water	Added to tailings water for arsenic treatment	Complexes with CN and metals to form insoluble, stable compounds
Lead Nitrate	HIC	Toxic	Discharge water May volatize during smelting	Containment in TMF Minor quantities Scrubber on furnace	Precipitates as lead salts or remains in solution in harmless quantities
Carbon	CIL	None	Can be beneficial to soil	Containment in TMF	Enters carbon cycle
Silica	Smelting	None	Soil	Minor quantities	Containment in TMF No breakdown
Borax	Smelting	None	Soil	Minor quantities	Containment in TMF No breakdown
Nitre	Smelting	None	Discharge water	Minor quantities Dilution	Dissolves and exists as soluble ions at harmless levels
Sodium Carbonate	Smelting	None	Discharge water	Minor quantities Dilution	Sodium precipitates as insoluble salt, releases CO_2

Materials used in smaller quantities such as fluxes, leach accelerant, and flocculant will be stored in the gold room or near the thickener respectively in 25 kg bags. Bulk materials such as lime and ammonium nitrate (for blasting) will be stored in silos and diesel fuel and gasoline will be stored in tanks in suitable containment at the fueling area. All reagent and bulk material storage will be locked when unattended.

One tonne IBCs will be transported from the reagent pad to mixing areas by forklift or boom truck. Reagents supplied in liquid form such as hydrochloric acid and ferric sulphate will be pumped from IBCs into holding tanks for distribution.

Reagents requiring mixing will be raised over mixing tanks in their bulk bag containers. The bags will be opened by lowering onto purpose-built bag-breakers allowing the contents to fall into the tank for dissolution. Reagent mixing personnel will wear appropriate personal protective equipment during transport and handling.

Ammonium nitrate [for blasting] and bulk lime will be blown into silos pneumatically from transport tanker trucks. Ammonium nitrate will be loaded directly into the bulk truck for mixing while lime will be transferred from its storage silo by auger to a mix tank. Fuel will similarly be transferred from bulk tankers to storage tanks from which it will be distributed to vehicles as required. All mixing and handling areas will be well ventilated, provided with containment for spills, provisions for clean-up by neutralization and washing, and secure from spark or open flame.

DDVG understands the need to provide additional specific information relative to reagent storage and handling including information on transfer, mixing and secondary containment at the Industrial Approval Application stage of the project.

2.6.6.2 CYANIDE

Sodium cyanide (NaCN) is the essential reagent used worldwide in the dissolution of gold from gold ores. Sodium cyanide will be shipped to Halifax in solid form, as briquettes the size of barbecue charcoal briquettes. It will be packaged in one tonne plastic-lined bulker bags contained within wooden boxes. Delivery will be via 6 metre shipping containers, each containing 20 boxes. The containers will be trucked directly to site, at the rate of one container every week, with approximately two weeks' production requirement (about 35 tonnes) stored on site. Land transportation service would be contracted to specialist accredited haulage contractors.

Sodium cyanide will be mixed as a 20% solution from solid form in a dedicated mixing facility designed to applicable health and safety standards. This solution is then added incrementally, with lime, to the leach tanks.

Cyanide will be contained during use through both design and by physical structures. By design, the use of a pre-leach thickener means that cyanide is only present in high concentrations (> 50 ppm) from the CIL feed box to the cyanide destruction circuit. Upstream of the CIL circuit, the only cyanide present is the trace amounts remaining in water recycled from the tailings pond and added to the ball mill. This recycled water is expected to be at or near discharge quality.

Every vessel which utilizes high concentrations of cyanide is subject to containment in the form of a concrete pad bordered with a curb 20-40 cm in height. Containment is designed to contain 110% of the volume held in the largest, single vessel within the contained area. Containment is designed for the cyanide mix tank, CIL leach and adsorption tanks, elution strip vessel, Acacia Reactor, and eluate storage tank.

In addition, the area surrounding the CIL carbon safety screens will be contained in the event that the screens overflow. All tanks used in cyanide destruction are similarly contained. Cyanide undergoes rapid decomposition through various natural processes described elsewhere in this document. As such, the accumulation of harmful levels of toxic forms of cyanide in containment materials such as concrete is not anticipated.

As a producer, DDVG will commit to being a signatory to the International Cyanide Management Code. Other signatories to the Code, for example, include Barrick Gold Corporation, Newmont Mining Corporation and Kinross Gold Corporation.

Table 2.10 presents the Touquoy Gold Project as comparable to other major successfully operating gold mine processing plants elsewhere in Canada.

TABLE 2.10: CANADIAN GOLD MINING OPERATIONS

Operation	Operator	Location	Mine Type	tpd	Process	Effluent treatment
Campbell	Goldcorp	Balmertown, Ont	UG	1,850	Gravity/float pressure ox/CIP	SO_2-air
Red Lake Complex	Goldcorp	Balmertown, Ont	UG	800	Gravity/CIL/float	Inco air-SO_2
Dome (Porcupine JV)	Goldcorp/Kinross	Timmins, Ont	OP	12,500	Gravity/CIL	Inco air-SO_2
Musselwhite	Goldcorp/Kinross	Thunder Bay, Ont	UG	3,000	Gravity/CIP	Wash, then Inco air-SO_2
Williams	Barrick/Teck	Hemlo, Ont	UG/OP	9,600	Gravity/CIL	Natural degradation, ferric.
David Bell	Barrick/Teck	Hemlo, Ont	UG	1,370	Milled at Williams	
Doyon	Iamgold	Preissac	UG	2,300	CIP/CIL	H_2O_2 or natural degradation
Sleeping Giant	Iamgold	Val d'Or/Amos, PQ	UG	910	CIL	H_2O_2
Holt McDermott	St Andrew Goldfields	Matheson, Ont	UG	3,000	CIL	Natural degradation
Holloway	St Andrew Goldfields	Matheson, Ont	UG	1,500	Milled at Holt McDermott	
Stock Mill	St Andrew Goldfields	Timmins, Ont	UG/OP	1,500	Gravity/CIL	Inco air-SO_2
Macassa	Kirkland Lake Gold	Kirkland Lake, Ont	UG	1,600	CIP	Natural degradation, ferric.
Eagle River	Wesdome Gold Mines	Wawa, Ont	UG	1,000	Gravity/Merrill Crowe	H_2O_2
Kiena Mill	Wesdome Gold Mines	Dubuisson, PQ		2,000	CIP	H_2O_2
Seabee	Claude Resources	La Ronge, Sask.	UG	1,100	CIP	Natural degradation
Sigma-Lamaque	Century Mining	Val d'Or, PQ	OP	5,000	Gravity/CIL	Natural degradation
Casa Berardi	Aurizon Mines	Casa Berardi, PQ	UG	2,200	Gravity/CIP	Inco air-SO_2
Touquoy	**DDV Gold**	**Moose River**	**OP**	**4,500**	**Gravity/CIL**	**Inco air-SO_2**

Notes: UG Underground
OP Open Pit

2.6.7 PROJECT EMISSIONS

Effluent

Four primary sources of water contamination are related to the Touquoy Gold Project. They are:

- Process Reagents
- Ore and waste rock components
- Hydrocarbons
- Sewage

All process reagents and the chemicals resulting from their breakdown ultimately report to the tailings facility for containment and storage or treatment and discharge. The primary reagent of concern is sodium cyanide. As described previously, tailings containing cyanide generated in the CIL circuit are detoxified by use of the INCO SO_2/Air process in the cyanide destruction circuit. This reduces the concentration of cyanide in the tailings discharged to the TMF to 10 ppm CN_{WAD} or less.

Natural degradation of free and weak acid dissociable cyanide resulting from exposure to sunlight further lowers the concentration of cyanide in tailings water to 1 ppm CN_{WAD} or less in a period of 30-45 days. The addition of ferric sulphate during treatment of tailings water for arsenic results in co-precipitation of insoluble, non-toxic, ferro-cyanide complexes in the treatment pond leaving total cyanide in TMF discharge at MMER levels of 1 ppm CN_{TOT} or less. Dilution and additional natural degradation will reduce the free cyanide concentration in receiving waters to 0.005 ppm CN_{FREE} as per CCME standards.

The fate of other process reagents is to breakdown into harmless gases which volatize, soluble compounds which are discharged at permissible levels with treated tailings water, or insoluble products which remain deposited in the tailings sediments. Table 2.11 describes the fate of process reagents other than cyanide. All discharges from containment will meet MMER and CCME standards. DDVG understands the need to specify discharge concentrations for all potential contaminants and will do so at the Industrial Approval stage of permitting.

TABLE 2.11: FATE OF PROCESS REAGENTS

Contaminant	Source	Hazard	Potential Contamination	Mitigation	Fate
Hydrated Lime	CIL and cyanide destruction	Degrades water quality	Discharge water Can be beneficial to soil	Containment in TMF	Readily precipitates as calcium salts and releases water
Hydrochloric Acid	Loaded carbon acid rinse	Degrades water quality	Discharge water	Containment in TMF Neutralization Minor quantities	Breakdown into water and metal chlorides which later precip releasing chlorine
Sodium Hydroxide	Elution and electrowinning	Degrades water quality	Discharge water	Containment in TMF Neutralization Minor quantities	Breaks down into water and sodium salts
Flocculant	Thickening	None	Discharge water	Containment in TMF Minor quantities	Decomposes into water and harmless carbon compounds
Sodium Metabisulphate	Cyanide destruction	Produces SO_2 gas Acidic, can burn skin	Discharge water workplace air	Adequate ventilation Operating procedures Containment in TMF	Decomposes into insoluble sodium salts and SO_2
Copper Sulphate	Cyanide destruction	Acidic Introduces soluble metals to water	Discharge water	Containment in TMF Precipitation with arsenic and iron Minor quantities	Decomposes into insoluble metallic salts or complexes with CN
Ferric Sulphate	Arsenic treatment	Acidic Introduces soluble metals to water	Discharge water	Added to tailings water for arsenic treatment	Complexes with CN and metals to form insoluble, stable compounds
Lead Nitrate	HIC	Toxic	Discharge water May volatize during smelting	Containment in TMF Minor quantities Scrubber on furnace	Precipitates as lead salts or remains in solution in harmless quantities
Carbon	CIL	None	Can be beneficial to soil	Containment in TMF	Enters carbon cycle
Silica	Smelting	None	Soil	Minor quanitites	Containment in TMF No breakdown
Borax	Smelting	None	Soil	Minor quanitites	Containment in TMF No breakdown
Nitre	Smelting	None	Discharge water	Minor quanitites Dilution	Disolves and exists as soluble ions at harmless levels
Sodium Carbonate	Smelting	None	Discharge water	Minor quanitites Dilution	Sodium precipitates as insoluble salt, releases CO_2

Various naturally occurring elements in the ore and waste rock contribute contaminants to mine water. The most significant among these is arsenic which exists throughout the deposit in the mineral form, arsenopyrite. Arsenic is present in process tailings, water from the open pit, and runoff from the waste dump. As described previously, arsenic is treated by dosing tailings water with ferric sulphate to precipitate a highly stable arsenic complex which is collected and stored in a segregated area of the tailings pond. This process has the added benefit of co-precipitating other metals, metal-cyanide complexes, and suspended solids which reduce water quality.

Used oil will be collected and re-cycled or burned for heating purposes. Hydro-carbon waste from the wash pad will be collected in an oil-water separator and disposed of offsite. Hydro-carbon contaminated soil will similarly be disposed of at an approved facility offsite.

Grey water will be directed to the tailings pond with other plant runoff. Run-off from vehicle and mobile equipment washing at a dedicated wash-down area at the plant site will be contained and directed to the tailings dam after being subject to oil-water separation. No soap or detergent will be used for vehicle washing. Low-phosphate soap will be used in showers and laundry.

Any wash or waste water not suited for disposal in the TMF will be collected and disposed of with sewage. Sewage produced on the mine site will be stored in holding tanks. The holding tanks will be buried adjacent to buildings with toilet facilities. Sewage will be collected and transported to appropriate disposal facilities off-site.

Solid Waste

Tailings will enter the tailings dam from the plant at 50% solids. These finely ground solids will settle and be retained within the tailings management facility.

Waste rock from the pit will be used, as appropriate, for infrastructure development (tailings dam walls, for example) with the excess being stored in the waste rock stockpile. Garbage produced on the mine site will be sorted into recyclable, compostable, and waste streams and trucked away for appropriate reuse or disposal.

Building removal will create construction and demolition (C&D) waste which will be sent to a permitted C&D facility, or where hazardous materials are identified, another appropriately approved facility will be used for disposal (e.g., asbestos, lead, mould, or petroleum impacted soil from domestic fuel oil heating systems).

Airborne Emissions

Vehicle exhaust will be the dominant air emission at the site. Emissions produced will include carbon monoxide, carbon dioxide, oxides of nitrogen, sulphur dioxide, and dust. Site heating will emit a nominal quantity of similar compounds to the atmosphere. Emissions from the burning of hydrocarbons will be managed through the use of clean burning low-sulphur diesel fuel and propane.

Blasting produces similar emissions to vehicle exhaust plus dust and hydrogen sulphide. Blasting gases readily dissipate in the atmosphere following detonation. Dust and particulates are confined to the open pit area. Any gases dissolving in mine water ultimately get pumped to the TMF as part of dewatering.

Dust will be generated in the open pit, on haul roads, stockpiles, the tailings beach, and the crushing circuit. In every instance, the moist climate which provides measurable precipitation on average every second day, will prevent dust generation. Haul and site roads will be watered as required and the blasthole drill will employ a dust suppression system. Dust from blasting will be confined to the open pit and minimized by the damp conditions. Dust collectors will be installed as required on the crushing circuit and the crushed ore stockpile will be enclosed in a building. Periodic relocation of the tailings discharge at the TMF will ensure that the beach stays wet.

Low levels of HCN gas will be generated above the CIL tanks. Concentrations will be managed by maintaining a pH of more than 10 in the circuit and will always be below the TLV of 10 ppm. The CIL tanks are designed without an enclosure to maximize ventilation. This principle is similarly employed at the tailings pond where HCN produced through the volatilization of cyanide is immediately diluted to harmless levels in the atmosphere. Studies have shown that HCN levels above tailings ponds typically measure less than 1 ppm and pose no threat to human or animal life in the vicinity.

Table 2.12 provides an overview of possible emissions and sources.

TABLE 2.12: TOUQUOY GOLD PROJECT AIR EMISSIONS

Area	Source	CO	CO_2	NO_x	SO_2	Dust	Other	Control
Mine	Vehicles	X	X	X	X	X	H_2O	Low sulphur diesel, dust suppression
Mine	Blasting	X	X	X	X	X	H_2S	Reduced powder factor, atmospheric dissipation
Mine	Waste dumps, stockpiles					X		Moist climate, concurrent reclamation, covered ore SP
Mill	Crushing					X		Dust collection, PPE
Mill	Smelting furnace Electrowinning	X	X	X	X		Metals NH_3	Propane fuel, exhaust scrubber
Mill	Kiln	X	X				H_2O	Propane fuel, exhaust scrubber
Mill	Elution heater	X	X				H_2O	Propane fuel
Mill	CIL						HCN	Atmospheric dissipation
TMF	Beach					X		Deposition plan keeps beach wet
TMF	Tailings Pond					X	HCN,NH_3	Atmospheric dissipation
Site	Heating	X	X	X	X		H_2O	Propane and electric sources

Stack emissions from the process plant other than heating are confined to the elution heater and kiln which burn propane and the electrowinning cells and smelting furnace. The electrowinning cells can produce hydrogen sulfide and ammonia as a result of the electrolysis of the pregnant strip and HIC solutions. The smelting furnace also produces trace amounts of metals and metal compounds which are removed prior to exhaust.

Extraction fans pass electrowinning and smelting gases through scrubbers before release to the atmosphere. Both activities operate intermittently further reducing the quantity of emissions. DDVG will ensure that airborne emissions comply with the standards specified in the Canadian Environmental Protection Act, "Environmental Code of Practice for Base Metal Smelters and Refineries", 1999.

Noise Emissions

The Project will create pit, blasting, and processing noise. The main contributors to noise at site will be outside equipment such as the crushers and other mining equipment such as excavators, drills and haul trucks. The plant will be largely enclosed and insulated, with lesser resultant noise. There will also be noise created by small vehicles onsite and by pumps, such as those at the tailings dam and Square Lake.

DDVG will control operations and equipment to ensure noise levels are kept within recommended limits for surface mining operations. Mine site noise will be periodically measured at the property boundaries to ensure regulation levels are not exceeded.

Liquid Emissions - Effluents

All effluent associated with processing of the ore will be treated through a dedicated cyanide destruction circuit, with will destroy about 95% of the residual cyanide, prior to direction to the tailings pond. Cyanide will undergo further attenuation via natural degradation effected by oxidation, hyrolysis and sunlight in the tailings pond with final retention and monitoring in the polishing pond to ensure that the quality of water released into the natural drainage meets Metal Mining Effluent Regulations (MMER) specifications under the federal Fisheries Act.

The cyanide destruction testwork was conducted by AMMETEC Limited of Australia. AMMTEC is the largest metallurgical services company in Australia and a recognized global leader in metallurgical testing. Testing employed the SO_2/Air cyanide destruction process. The results are summarized in Table 2.13 and the full report can be found in Appendix A.

TABLE 2.13: SUMMARY OF CYANIDE DETOXIFICATION TEST RESULTS

Test No.	Slurry Density (% solids w/w)	Test Conditions					Solution Assays	
		pH	Retention Time (minutes)	SO_2 (g/g CN_{WAD})	Cu^{2+} (mg/L)	Lime (g/g SO_2)	Feed Effluent CN_{WAD} (mg/L)	Avg Treated Effluent CN_{WAD} (mg/L)
D1	44.8	9.06	80.2	4.52	19.3	1.05	163	0.75
D2	44.4	9.10	85.7	2.76	21.5	0.89	163	0.50
D3	50.0	8.18	83.3	2.75	21.5	0.68	163	1.17

The results indicate that in less than 90 minutes CN_{WAD} was reduced in effluent from 163 ppm to 1 ppm or less using relatively low concentrations of reagents.

Similar testwork was also undertaken by SGS Lakefield Research Limited in February 2007.

Aging tests to examine natural degradation of cyanide were conducted by SGS Lakefield on tailings samples which indicated that after 45 days, the cyanide levels in samples with initial concentrations of >1.0 ppm CN_{TOT} and approximately 1.0 ppm CN_{WAD} had dropped below detectable limits with most reduction occurring in the first day. Results are summarized in Table 2.14. Additional aging tests will be started in February 2007 to examine the degradation of cyanide in tailings with starting concentrations of 10 ppm.

TABLE 2.14: TAILINGS AGING TEST RESULTS FOR NATURAL CYANIDE DEGRADATION

Date	Days	CN_{TOT} (mg/L)	CN_{FREE} (mg/L)	CN_{WAD} (mg/L)	NH_3/NH_4 (mg/L)
22/09	0	1.27	<0.10	0.94	51.9
23/09	1	0.32	<0.03	0.03	29.3
25/09	3	0.32	<0.05	0.04	45.8
29/09	8	0.20	<0.04	0.03	3.1
06/10	15	0.18	<0.04	0.04	26.5
06/11	45	---	<0.04	0.04	---

Note: --- below detection limit

The fluctuation in results for free and CN (WAD) after one day reflects the inherent lack of precision associated with measuring cyanide at such low concentrations. The fluctuation in ammonia levels shows that the generation of ammonia from cyanate and its subsequent breakdown does not follow the breakdown of cyanide in a linear fashion.

Heavy metal concentrations (copper, lead, zinc and nickel) in the tailings solution will meet MMER specifications upon leaving the processing plant and passing into the tailings dam with the exception of arsenic. A dedicated water treatment plant between the tailings dam and the polishing pond will reduce arsenic to acceptable levels from the tailings water. This is accomplished by addition of ferric sulphate or ferric chloride to precipitate stable and insoluble arsenic salts.

Run-off from the waste rock stockpile and the plant site will be directed into the tailings management facility. Run-off from vehicle and mobile equipment washing at from a dedicated wash-down area at the plant site will be contained and directed to the tailings dam. Used oil will be contained and re-cycled.

Sewage produced on the mine site will be stored in holding tanks. The holding tanks will be buried adjacent to buildings with toilet facilities. Sewage will be collected and transported to appropriate disposal facilities off-site.

2.6.8 EMERGENCY RESPONSE AND CONTINGENCY PLANNING

DDVG has completed preliminary planning for emergency responses and contingency operations. This document contains elements of plans that DDVG will submit at the Industrial Approval stage as is typical.

Emergency Response Planning

Preliminary emergency response (ER) planning has been conducted including an initial review of incidents requiring ER was performed. Twelve (12) situations potentially requiring ER were identified for the general site, mine, mill, tailings management facility (TMF), and during transportation of hazardous goods to site.

A listing of these situations is provided in Table 2.15. They include for anywhere on site, any serious injury or vehicle accident; in the mine, a flood of the open pit by the Moose River, a wall failure, or unplanned detonation; in the plant area, a fire or explosion, chemical spill, or power failure; at the TMF, a tailings line break, dam failure, or overflow of the tailings dam; and on road routes to the site, an accident involving the transport of hazardous materials.

TABLE 2.15: EMERGENCY RESPONSE – ACTION AND RESOURCES

Area	Event	Response	Site Resources	Off-Site Resources
Site	Serious Injury	Notification	First Aid Training	Fire Dept
		Assessment		Ambulance
		Rescue		Hospital
		First Aid		NSEL
	Vehicle Accident	Notification	First Aid Training	Fire Dept
		Assessment	Heavy Equipment	Ambulance
		Rescue		Hospital
		First Aid		NSEL
Mill	Fire or Explosion	Evacuate	Alarms	Fire Dept
		Notification	Sprinkler System	Emergency Serv
		Assessment	Extinguishers	NSEL
		Fight Fire	MSDS	
	Chemical Spill	Containment	Reagent operators	Contractors
		Notification	Heavy Equipment	NSEL
		Clean-up	MSDS	
	Power Failure	Notification	Shift electrician	NS Power
		Emergency Power		
Mine	Open Pit Flood	Stop mining	Heavy Equipment	Contractors
		Notification		NSEL
		Repair dyke		
	Wall Failure	Clear pit	Heavy Equipment	Geotech Eng
		Assessment		NSEL
		Stabilize failure		NSNR
	Unplanned Detonation	Ensure site safe	Blasters	Ambulance
		First Aid		Hospital
		Notification		Explosives Vendor
				NSEL
TMF	Tailings Line Break	Stop milling	Heavy Equipment	Contractors
		Containment		NSEL
		Notification		
	Dam Breach	Stop milling	Heavy Equipment	Contractors
		Containment		NSEL
		Notification		
	Dam Overflow	Stop milling	Operating procedure	NSEL
		Utilize spillway		Dam Designer
		Notification		
Off-Site	Hazardous Material Transport Accident	Containment	Heavy Equipment	Fire Dept
		Notification	MSDS	Haz Materials Mgmt
		Clean-up	MSDS	CN Supplier
				NSEL

DDVG will employ site personnel to provide first response in an emergency situation until professional local emergency services including fire departments, ambulance services, and hospitals can respond. Procedures will be established for notification of authorities and emergency service providers in the event of an emergency.

The mine site will conduct training and exercises with local emergency service providers to ensure that company and local professional procedures for ER are appropriate and aligned. It is likely that specialist emergency response expertise will exist among employees who are members of local volunteer fire departments. Once start-up is complete, the mine will begin to develop its own mine rescue capability from among the workforce. This will be a continuous process which seeks to enable the company to provide a better first response to emergencies.

Medical Services

All employees will be trained in first aid and CPR. The ambulance service based in Middle Musquodoboit is expected to be able to respond to an accident at the mine site in 20 minutes. The Middle Musquodoboit hospital can provide life-saving medical services on a 24 hour basis prior to evacuation to a larger facility in the Halifax Regional Municipality. It is located approximately 20 minutes from the site. Hospital facilities are also available in Sheet Harbour located about 40 minutes from site.

Fire Fighting

The first response to a fire at the mine site will be in the form of alarms, sprinklers, and extinguishers. Heavy equipment will be equipped with fire suppression systems. Employees will be trained in basic fire fighting. The raw water system will have the capability of supplying 200,000 L/hr of water which can be made available for fire fighting. All basic fire protection systems required by law and as a requirement of insurance will be provided.

The volunteer fire departments in Middle and Upper Musquodoboit will provide the primary fire fighting services to the site. These fire departments currently provide protection for several industrial sites, including sawmills and quarries, in the area. Response time is expected to be 20-30 minutes.

The Mooseland and Sheet Habour fire departments, through the system of "mutual-aid", will be able to support the primary response from Middle and Upper

Musquodoboit. These locations would not be relied on for primary response due to the small size of Mooseland and distance to Sheet Harbour.

Site Resources

Emergencies resulting in an uncontrolled release of contamination into the environment generally require containment prior to clean-up. Equipment from the open pit is available to respond immediately to an emergency as the mine will operate on a continuous, 24-hour basis.

Containment will be provided by pushing up berms or dumping material to prevent the spread of an uncontrolled release. Similarly, waste rock can be used to create barrier dykes in the event of an overflow of the Moose River or failure of the tailings dam. The same equipment will ultimately be used to clean up any contamination and dispose of it in the TMF. Local contractors will be able to provide additional equipment on short notice if necessary.

Transportation of Hazardous Materials

The operation of the process plant is dependent on the use of various hazardous materials. These include diesel and propane fuel, various chemical reagents, including sodium cyanide. The process will consume approximately 17 metric tons of sodium cyanide each week. This material will be shipped by truck from the port in Halifax via Highway 7 to the mine site.

DDVG will coordinate the training of local emergency service providers by the product vendor with the regional authority and its hazardous materials management group to ensure that in the event of a vehicular accident during transport appropriate ER procedures will be employed. DDVG will ensure that ER capability exists along the transport route to respond to an incident related to the transport of materials to the Project site either through existing public or vendor supplied services.

Containers carrying cyanide will arrive in the Port of Halifax in compliance with the International Maritime Dangerous Goods Code (IMDG). The port will keep the sea containers with cyanide segregated from other cargo in a secure area for storage of hazardous materials. The cyanide bags/boxes are UN approved packages for international shipments in 20' sea containers and/or truck transport. The package is tested (drop, drag, etc.) to assure that the package does not break open during transit. The cyanide manufacturer/supplier will have a copy of the certificate that the bag/box passed the testing. There are normally 18-20 bag boxes per sea container depending on local road weight restrictions. The sea container is locked and sealed. The seal is tamper proof to meet C-TPAT/PIP (Customs Trade Partnership against Terrorism (US) / Partners in Protection (Canada) requirements. The serial number is checked by customs upon entry to Canada.

The containers will then be transported by road on a route approved by Transport Canada for hazardous goods. The trucking company will be licensed to transport dangerous goods by Transport Canada, recognized as a "Responsible Care Carrier" by the Canadian Chemical Producers Association, and hold appropriate insurance.

The bag/box is made of reinforced plywood with a forklift pallet attached to the bottom of the box. The inner-bag consists of a polyethylene vapor seal liner and a woven polypropylene bag with lift straps. The wooden box is dismantled and returned to the cyanide manufacturer for re-use. The inner liner and bag are washed after use and burned or buried in the tailings facility depending on local regulations for disposal.

The cyanide manufacturer/supplier, under Canadian law, is held responsible for any incident no matter who is at fault. The manufacturer/supplier will conduct periodic audits and employee background checks of the carrier's operations and personnel. This entity's responsibility for each shipment will end with delivery at the mine site. Unloading and storage of cyanide will be according to operating procedures established by DDVG in accordance with guidelines set down in the International Cyanide Management Code.

The manufacturer/supplier's emergency response contractor will be Newalta Inc. Newalta operates throughout Canada and the Maritimes providing waste management services, including hazardous materials, for the industrial sector. Newalta is approved by Transport Canada and, in Nova Scotia, is based in Dartmouth making it ideally located to provide emergency response service for the transport of sodium cyanide from the Port of Halifax to the Touquoy Mine.

In the event of an incident, Newalta will implement the ERAP, the Emergency Response Assistance Plan, registered with Canutec, a division of Transport Canada. They will notify all local emergency service providers, appropriate regulatory agencies, and the manufacturer/supplier's internal emergency response group.

The local fire department will manage Isolation, Evacuation and Incident Control in accordance with the guidelines in Transport Canada's 2004 Emergency Response

Guidebook. Newalta would effect containment and clean-up in cooperation with local authorities.

DDVG will coordinate training and resources provided by the cyanide supplier with local emergency service groups (fire departments, hospitals, paramedic/ambulance, police) to ensure that an effective response capability exists both at the mine site and in the communities along the route upon which cyanide will be transported.

Environmental Impact of Emergency Situations

Emergency situations may have short or long-term impact on the environment in the event of a chemical spill either on site or during transport or an uncontrolled release of water or tailings from the TMF.

Generally, a chemical spill on site will have limited impact. Reagents will be stored in high-strength, 1 tonne bulk containers on a covered, concrete pad or bulk tanks or silos equipped with containment berms. Mixing will take place inside the plant in tanks also provided with containment. Distribution will be by means of a "ring main" pumping system that pumps direct from the mix or storage tank to the point of use where dosing is performed automatically. A spill of reagents during transport from storage to the mix area will be dealt with using appropriate procedures for personnel safety, neutralization, and clean up. Contaminated soil will be disposed of in the TMF.

A chemical spill during transport to site has the potential to involve larger quantities of materials and affect the public, consequently impact could greater. All reagents will be shipped in bulk tankers or individual bulk containers (IBCs) in steel shipping containers. Solid product is preferred as it simplifies containment and clean-up if a spill occurs and reduces the likelihood of the material being quickly dispersed. A spill in a waterway would have significant immediate impact depending on the material but would be diluted quickly and, based on the reagents in question, have no lasting long-term effects.

An overflow of the tailings dam would employ spillways to maintain the integrity of the dam structure. Such an event would require an unprecedented amount of rainfall or snow melt over a short period of time. Although an overflow would result in an uncontrolled release to the environment, the volume of water would largely dilute the level of CN_{WAD} which is typically expected to be < 3 ppm due to the operation of the cyanide destruction circuit and natural degradation.

A failure of the tailings dam wall is the last scenario in which an emergency situation could result in significant environmental impact. A dam wall failure could result in the release of both tailings water and solid tailings and though large in scale, would be managed the same as any other breach of containment; the release would be contained, the spill cleaned-up and re-deposited in the tailings impoundment, and the dam structure repaired. Monitoring would be conducted to determine the extent and severity of the impact and guide remediation efforts.

Dam wall failures are rare and are generally a result of poor operating practice, design, and unexpected conditions coinciding. The dam has been designed with factors of safety appropriate for local seismic conditions and the waste rock used for construction is structurally stronger than the gravels or clay often available. Design was done by an industry-leading engineering firm and operation will be in accordance with the Canadian Mining Association's guidelines for best practice in TMF operation. By making dam construction an ongoing part of operations, the possibility of a failure developing before corrective action can be taken is very remote.

2.7 MINE DECOMMISSIONING AND RECLAMATION

DDVG considers the goal and responsibilities of reclaiming mined sites to be a key element of the Project plan. Reclamation is understood as not only operational activities of overburden removal and stock piling, backfilling overburden, contouring and placing of topsoil and re-vegetation, but also as an integral part of project planning that keeps future land use foremost in mind.

The reclamation plan will be integrated with the mine plan and will address the key areas of land use, water resources, restructuring and re-contouring, re-vegetation, restoration of services, aesthetics and safety, and future land use.

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 comment 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 6 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 6 to 7 years will have passed from the Reclamation Plan to the Final Reclamation Plan. This process is favoured by regulators, proponents and the public as it allows flexibility in the reclamation planning and objectives.

DDVG has developed a conceptual closure plan. The plan calls for the removal of all site facilities. The open pit will be allowed to fill with water forming a lake. The waste rock pile and tailings facility will be capped with topsoil and re-seeded and all disturbed areas will be re-vegetated. Water draining through the tailings area will be monitored and treated until treatment is no longer required. Monitoring data will be reviewed continuously to determine if water quality (surface water or groundwater) improvements need to be made. 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.

Open Pit

The open pit will be allowed to flood. Based on the existing water balance, annual runoff depth for the site is 0.825 m/m^2. The pit and its immediate drainage area comprise about 50 ha, thus, approximately 410,000 m^3 of runoff will report to the open pit each year. Given the volume of the pit as 9 M m^3, filling will take about 20 years.

The water in the pit will rise quickly in the initial years and slow as the pit widens. This will immerse sulphide mineralization in the walls of the pit bottom eliminating potential for acid generation. If the quality of the pit water deteriorates relative to background levels, batch treatment with lime or ferric sulphate may be employed.

The flooding of the open pit will create a lake approximately 15 ha in size with edge habitat. The existing mini-pit, excavated during the early 1990s to sample ore grade mineralization, serves as a model for the filling of the final open pit. The mini-pit currently provides a habitat for introduced trout which suggests that water quality will not be an issue when the open pit floods. It is noted that water presently contained within the mini-pit, itself located within the proposed open pit, has pH of 7.92 (non-acidic) and arsenic content of 0.032mg/L (well below MMER limit of 0.5mg/L). This suggests that natural water quality in the final pit after reclamation will probably be similar.

The barrier berm around the open pit will remain in place but access will possible at various locations. By the time closure occurs, the berm will have been contoured and re-seeded. The ring drain surrounding the pit will be modified so that runoff will be directed into the pit hastening filling.

Stockpiles and Waste Rock Piles

No low grade stockpiles are expected to remain at the end of the minelife. The cutoff grade is 0.5 g/t. The current production plan calls for all material above cutoff to be milled. DDVG will hedge (sell forward) a portion of its production to ensure that any interim stockpiles that may exist during the minelife can be processed profitably in the event that the mine was to close early. Any stockpiles not processed at the end of the mine life will be rehandled into the mined-out pit prior to flooding.

Waste dump slopes will be constructed at angle of repose in 10 m lifts with construction proceeding from south to north. During mining, as a lift is completed, the dump slope will be pushed from 1.4:1 (horizontal:vertical) down to 3:1 (h:v) to permit covering with soil and re-seeding. This approach will enable DDVG to minimize the amount of land disturbed at any given time.

Topsoil for re-vegetation will be stockpiled adjacent to the waste rock pile and other disturbed areas during construction. Topsoil will be used to facilitate re-vegetation at the end of the minelife and, when practical, during operations. Disturbed areas will be re-vegetated using local and native species.

Drainage from the waste rock pile will continue to be directed to the TMF after closure so that runoff can be treated if necessary. It is expected that covering and re-vegetating the waste rock pile will provide an environment which inhibits the mobility of arsenic or other deleterious substances.

Infrastructure

Buildings, equipment, and other infrastructure will be dismantled and salvaged or sold as scrap depending on condition and markets. All equipment, whether re-sold or scrapped, will be completely dismantled to recover secreted gold trapped in mill equipment particularly the ball mill. Concrete foundations will be destroyed and/or buried. Minor excavations will be filled or barriers erected to eliminate hazard to the public or wildlife. Ancillary facilities (truck shop, fuel farm) will be used to support reclamation activities at the open pit, waste rock pile, and TMF before final decommissioning.

If soil is encountered that is contaminated with hydrocarbons from the fuel farm and shop areas it will be disposed of at an approved soil recycling facility. Dismantling procedures for all plant equipment and facilities will ensure that workers and the public are not exposed to hazardous materials or products used in or resulting from process operations.

The relocated public road will continue to serve as the main public thoroughfare after closure. The loose-surface, all weather roads established on the site to facilitate operations will remain in place to enable closure activities, monitoring, and provide access for commercial and recreational activities after closure is completed.

Major power lines will be removed from the edge of the property to the plant site. Low voltage power will be required to run pumps and equipment at the water treatment facility until treatment is no longer required. Fences will be removed once the majority of closure activities are completed. Fencing of the TMF will be the last to be removed with those around the water treatment facilities remaining until treatment is completed.

Tailing Management Facility (TMF)

At closure, all water in the tailings pond will be transferred to treatment and subsequently discharged. The pH of surface waters draining through the facility is expected to trend rapidly towards existing background levels of 6 to 7 which will limit the mobility of dissolved arsenic. The exposed tailings will be capped with topsoil and hydroseeded limiting the exposure of tailings to reducing-oxidizing conditions. Covering the tailings with the local soil will inhibit arsenic mobility and complete the bio-degradation of any possible residual cyanide compounds.

The downstream slopes of the dam will be flattened using waste from mining. This material may be placed during operations rather than rehandling it at closure. Flatter slopes will provide additional stability to the dam wall after decommissioning and facilitate re-vegetation. A drainage diversion will be established to direct runoff from outside the TMF away from the tailings and runoff from the waste dump and tailings themselves to the treatment ponds. Spillways will convey water draining through the tailings area to the treatment pond.

Treatment of tailings water will continue until measurements indicate that concentrations of any deleterious substances have dropped to acceptable levels. Treatment is expected to be reduced from a continuous process to a batch process over the first five years. Monitoring will then determine if and when periodic batch treatment of water in holding ponds is required prior to release. Once water quality reaches background levels, releases can occur via the spillway rather than pumping. Monitoring will continue into the future to ensure the integrity of the impoundment and that discharge water quality remains acceptable.

Schedule

The site will be decommissioned in phases: (1) open pit, stockpiles, and waste rock piles, (2) tailings facility, (3) ancillary facilities, (4) process plant, and (5) water treatment facilities. The timing of the sale of the process plant and related equipment is expected within two years of the end of operations. The schedule for the closure plan will be developed one year before production ceases (2013).

Future Land Use

The Project site will be returned to a natural woodland environment after closure. It is expected that within five years the land will be available for recreational uses such as hunting and fishing. Re-vegetation of disturbed areas such as the waste rock piles, plant site, and tailings facility should permit commercial timber cutting to resume in 15-20 years. The infrastructure constructed for the mine (power line, water supply, buildings) could be used to support alternate industrial activities such as a quarry or sawmill following closure.

DDVG understands the legislation in Nova Scotia associated with mine reclamation and the need to submit a detailed Final Reclamation Plan prior to mine closure.

3.0 ANALYSIS OF ALTERNATIVES

Environmental management is a priority to DDVG. It is the corporate objective for operations to meet and/or exceed the current standards to achieve a high level of environmental performance. This EARD presents these environmental goals and outlines DDVG's methodology to continue to protect the environment. DDVG personnel have the proven ability to meet environmental goals while efficiently mining gold reserves.

3.1 ALTERNATIVES TO THE UNDERTAKING

Alternatives to the undertaking are defined as functionally different ways of achieving the same end. There is no viable alternative to mining for mineral extraction. Gold is not found in any other raw form other than embedded in the earth's crust. The location of the mine is fixed by the gold resource.

One alternative to the undertaking is a "do nothing" alternative. A "do nothing" approach results in no gold being extracted for this area. The high demand for gold worldwide necessitates continued mining. The "do-nothing" alternative would have effects on potential government revenues that would not be realised; potential employment and skills development associated with the Project that would not occur, and potential opportunities for local contractors and businesses in the Musquodoboit Valley and elsewhere that would not occur.

3.2 ALTERNATIVE METHODS OF CARRYING OUT THE UNDERTAKING

Alternative methods of carrying out the undertaking are defined as means of similar technical character or methods that are functionally the same. The analysis addresses alternatives to extraction methods, mine site layout and infrastructure configuration; processing options; and roadways.

3.2.1 EXTRACTION METHODS - UNDERGROUND VS. OPEN PIT

Gold mining can be undertaken by either underground or open pit methods. In this particular instance the gold is relatively uniformly distributed, and at relatively low grades, throughout the local rock mass to the extent that large scale, high volume throughput from an open pit is commercially viable. Concentrations of gold of sufficient grade, continuity or predictability in quartz veins or other specific sites at Moose River

Gold Mines to support a commercial underground operation have not been identified during exploration to date. Commercial underground gold mining for the Touquoy Gold Deposit is not currently an option.

3.2.2 MINE LAYOUT AND SITE INFRASTRUCTURE CONFIGURATION OPTIONS

There are no options for re-positioning the open pit – the gold deposit is fixed.

Three options for placement of the waste rock, tailings dam and polishing pond, and three options for placement of the processing plant and associated infrastructure have been considered. The preferred waste rock, tailings dam and polishing pond configuration is incorporated in the final site layout, sets the waste rock storage area east of the open pit and north of the existing Mooseland Road with the tailings dam immediately to the south, though south of the Mooseland Road. The polishing pond is located south of and below the tailings dam. This site configuration is specifically designed to avoid any impact with drainage and any interference with aquatic habitat, albeit marginal, and hence it is the preferred option. It is also the most expensive option of the three examined in detail by DDVG.

The second and third options contemplate location of the waste rock storage area immediately south of the pit, its proximity to the pit effecting reduced waste rock haulage costs. Option 2 considered the tailings dam east of the pit and north of the present Mooseland Road with the polishing pond situated immediately to the south though south of the Mooseland Road. Option 2 presented a slightly smaller footprint than the other two options, but impacts the modest drainage and, as with Option 1, involves substantial earthworks for construction of the tailings dam.

Option 3 included both the tailings dam and the polishing pond south of the present Mooseland Road. This option, like Option 2 slightly impacts drainage but makes best use of existing topography for tailings storage. Commercially it is most economic option however it negatively impacts local water courses.

Having selected Option 1 as the optimal waste rock, tailings dam and polishing pond configuration, three options for location of the processing plant and associated infrastructure were considered – east of the pit, south of the pit and north of the pit. The northern location, as indicated on Figure 2.3 is preferred and the relative advantages are shown in Table 3.4.

TABLE 3.4: SITE LAYOUT OPTIONS AND SELECTION CRITERIA

SELECTION CRITERIA	SITE 1 East of Pit	SITE 2 South of Pit	SITE 3 North Hill Preferred	COMMENTS
PUBLIC SAFETY				
Maximize safe blast distance to facilities	No	Yes	Yes	Minimum 500 m from final pit limits to facilities
Facilitates effective security	No	No	Yes	Site 3 has single direct access from public road to main gate
Restrict access to operating areas	No	No	No	Therefore site 3 requires traffic control on Mooseland Road
Facilitate Park & Museum Relocation	No	No	Yes	Original plans had park located within operating area, on north side of pit
ENVIRONMENTAL IMPACT				
Avoids fish habitat disturbance	No	No	Yes	Site 1 mill and Sites 1 & 2 stockpiles disturb fish habitat
Gravity flow of runoff to tailings management facility	No	No	Yes	Sites 1 & 2 would require additional collection and pumping
Confine runoff to single watershed	No	No	Yes	Sites 1 & 2 generate runoff in 2 watersheds
Minimize construction disturbance	No	Yes	Yes	Excavation at Sites 2 & 3 will eliminate need for extra borrow pits
Minimize watercourse crossings	Yes	Yes	Yes	All sites involve a single stream crossing
CAPITAL COST				
Foundation costs for mill and facilities	Low	High	High	Greater till depth at Sites 2 & 3
Length of power line	Mod	Long	Short	Site 3 minimizes infrastructure costs
Length of water line	Mod	Long	Short	
Length of tailings line	Short	Moderate	Short	
Length of reclaim water line	Mod	Short	Long	
Cost to expand tailings capacity, if required	High	Moderate	Low	Site 3 not affected by future tailings management facility expansion
OPERATING COST				
Minimize waste rock and ore haul distance	Low	Low	Moderate	Site 3 plan hauls further to avoid disturbing fish habitat & runoff issues
Gravity tailings flow (no pumping)	No	No	Yes	Sites 1 & 2 incur cost for pumping tailings to tailings management facility

In summary, the selected North Hill site configuration of meets the following provisions:

- Processing plant, waste rock stockpile and tailings management facility are located primarily in the same drainage catchment.

- Processing plant and waste rock stockpile are located at higher elevation up-drainage from the tailings management facility to maximize control of site water collection, drainage and discharge.
- Impact on fish habitat is avoided.
- Waste rock stockpile and tailings management facility are of sufficient size to accommodate life-of-mine process.
- Processing plant, waste rock stockpile and tailings management facility are proximal to the open pit to minimize haulage and pumping costs.
- Maintenance of public access to areas of existing access south and west of the mine site , though in part restricted during blasting (one blast every one or two days). No other options considered satisfy these constraints.

With the key elements of the mine layout and site infrastructure so configured existing public access to those areas west of Moose River and south of the minesite is to be maintained. A new access road, of logging road standard, around the western perimeter of the site, west of Moose River, is the only viable means of meeting this requirement. Since the latter route passes within the potential flyrock zone of the pit access restrictions during the short scheduled blasting period would need to be applied.

3.2.3 ALTERNATIVE PROCESSING OPTIONS

The gravity/CIL processing methodology described above represents by far the most conventional processing option. It is the preferred processing option in Canada and is used worldwide in almost all major gold mining/processing operations. Two independent experienced consultant gold metallurgists have determined that gravity CIL is extremely well suited to this particular ore in that gold recoveries are very high (about 95%) resulting in maximum use of the resource, and the cyanide destruction process is highly efficient. Furthermore, gold doré is produced on site, with minimal off-site value-adding.

Nevertheless, a second processing option, gravity/flotation with either intense cyanidation or smelting of the flotation concentrate, has been meaningfully explored. Gravity/flotation recoveries are also very high (about 95%), with the flotation concentrate comprising 4 to 5% of the total throughput. On the basis of expected daily throughput about 200 tonnes of concentrate per day would be produced. The gold in the flotation concentrate may be recovered either by high intensity cyanidation or by off-site smelting.

High intensity cyanidation of the float concentrate will require at least the same quantity of sodium cyanide as conventional CIL (since the same amount of gold is available for dissolution) and possibly more. This multi-stage process is unorthodox, inherently more complex than conventional CIL processing and commercially unattractive with no perceived advantage.

This multi-stage process could potentially be undertaken off site with the concentrate transported to an existing CIL plant for contract treatment, the closest plants being in Quebec and Ontario. Enquiries have been made to eleven such operations with no availability offered. Indicative costs, including freight, determined from this exercise show this option to be commercially unattractive, with the added disadvantage of substantial off-site value-adding and reduced benefits to Nova Scotia.

The flotation concentrate could also potentially be transported elsewhere for smelting to recover the gold. Indicative costs for freight and contract treatment of the concentrate at Falconbridge's Horne smelter in Rouyn-Noranda have been obtained and these confirm this option to be commercially unviable, and again with substantial resultant off-site value-adding and reduced benefits to Nova Scotia.

Having carefully examined the above processing options DDVG has selected conventional gravity/CIL as its preferred processing methodology.

3.2.4 ROADWAYS

Traffic Management

The existing Mooseland Road which runs through the operating area will continue to provide public access between Tangier/Sheet Harbour and Middle Musquodoboit. The mine operation will require modifications to the existing roads at Moose River Gold Mines. DDVG is working closely with Nova Scotia Department of Transportation and Public Works to design the optimal solution. Once formed, the CLC will assist in this process as well.

Traffic on the road through the operating area will need to be controlled and at two points: (1) the Moose River Bridge directly north of the existing settlement and (2) the Square Lake turnoff from the Mooseland Road.

Traffic would be delayed for temporarily during blasting. A single blast will be conducted at regular times every one or two days.

An upgrading of an existing logging road around the western perimeter of the site, west of Moose River Gold Mines, is also required to maintain existing public access to those areas west of Moose River Gold Mines and south of the minesite. Since the latter route passes within the potential flyrock zone of the pit access restrictions during the short scheduled blasting period would be applied – as for the Mooseland Road (above).

Blasting Safety

Blasting operations are expected to be conducted routinely Monday to Friday between 12-1 pm or 3-4 pm or as agreed upon with the CLC. During these times the public road will be blocked and no public access through the site will be permitted. Signs will be posted at the Hwy 7 turnoff at Tangier, Mooseland, Higginsville, and at the Hwy 277 turnoff to Moose River warning travelers of the potential for brief road closures at these times. As traffic in the area is light, it is expected that local residents will be able to schedule their use of the road to avoid these periods without undue inconvenience.

Road Configuration

A minor re-alignment of the public road will be required to ensure that public traffic remains at least 200 metres from the open pit. The re-alignment does not involve any stream or water crossings. The sections of the road that will bear heavy equipment traffic total approximately 30 m in length. These sections will be protected to ensure that the condition of the road surface is not degraded.

Earth berms will be constructed along the length of the public road where it crosses through the mining area. These berms will be sloped and re-vegetated immediately upon construction to ensure that aethestics are maintained. Where possible, trees will be left to screen the waste rock pile and tailings facility from view.

4.0 ASSESSMENT METHODOLOGY

4.1 SCOPE

This document serves to provide information required for NSEL to approve the surface mining of the Touquoy Gold Mine with appropriate conditions. This Project requires an Environmental Registration to be completed and must be registered as a Class I Undertaking.

The scope of this document has been determined by DDVG and Conestoga-Rovers & Associates (CRA), being based on the Project components, activities, field studies and regulatory consultations. Regulatory officials from both NSDEL and NSDNR have been aware of DDVG's intention to submit the EARD for this undertaking. Regulators have assisted in scoping by bringing forth issues of concern and/or uncertainty. The One Window process has assisted in this communication and information exchange. One Window Committee meetings (August 2004 and November 2005) held with Provincial and Federal regulators did not reveal a *Canadian Environmental Assessment Act (CEAA)* trigger. *CEAA* staff will coordinate review of the EARD by other federal agencies at the time of the Provincial EA registration and provide a response as to whether additional scrutiny is required via the federal EA process.

Methodologies and approaches to reflect current environmental and socio-economic conditions are contained in this EARD, as are results and implications of the completed formal public consultation program. Baseline information includes data collected by DDVG as a part of preparation of this EARD. Additional information was found in publicly available documents related to the area and data collected by the proponent and consultants on existing environmental conditions. The approach to site operations, including environmental management and monitoring, is based on knowledge gathered from past surface mining projects. DDVG personnel have specific knowledge gained from activities at the site since May 2003 and have experience in conducting surface mining while meeting environmental criteria.

4.2 STAKEHOLDER CONSULTATION

Informal public consultation has been ongoing since the planning stages of the Project. Informal public meetings were held in August 2004 (40 attendees) and December 2005 (25 attendees) in the community of Moose River Gold Mines. The public was provided with information on the Project location, Project schedule, geology, environmental baseline studies and other information specific to the Project. DDVG solicited input from attendees on the information presented and used this in planning subsequent site activities and the mine design.

A formal Public Information Session was held on September 13, 2006 from 2 PM to 9 PM at the Upper Musquodoboit Community Center on Highway 224. The meeting was held to provide information on DDVG's proposed surface gold mine at Moose River Gold Mines, Nova Scotia to the public. The meeting was organized and publicized to meet NSEL public consultation requirements. CRA, which is acting in a permitting management role for DDVG, determined holding one meeting within the Musquodoboit Valley in close proximity to Moose River would meet NSEL requirements.

Notices were posted at local businesses and public locations including Reid's Diner and the Nova Scotia Liquor Commission store in Middle Musquodoboit, and the Irving Service Station, Fire Hall and public school in Upper Musquodoboit. Approximately 50 individuals or families known to have an interest in the Project, including present and former residents of Moose River Gold Mines, were notified of the Public Information Session by phone or in person. A notice was also published in the Eastern Shore Observer in advance of the Session. Local municipal officials were made aware of the Public Information Session as were NSDNR and NSEL.

A series of panels was available for viewing which explained the following:

Poster Name	Poster Description
Welcome	Outline of the textual and illustrated presentation.
Summary	Thumbnail of site history, the Project, the proponent and the time frame.
Who is DDVG?	Introduction to the company, its resources and its directors and management.
Who owns Touquoy?	Outline of ownership of the mineral rights.
Geology	Explanation of the geological difference between Touquoy Gold Deposit and most other Nova Scotian gold deposits.
Resource Estimate	Explanation of the drilling, geological interpretation and resource calculation process leading to the estimation of the size of the gold resource.
Schedule of Activities	A time-line of past and future activities leading to eventual gold production.
Feasibility Study	Description of the various elements of the Feasibility Study, either completed or pending.
Permitting	Outline of the government approvals required to undertake mining and processing of the ore.
Mining	Explanation of how mining of the ore and waste rock within the pit would be conducted, and how mining was conducted in the past.

Poster Name	Poster Description
Ore Processing	Description of the ore processing methodology, with flowsheet, from crushing and grinding through the chemical process to the pouring of gold bars.
Waste Rock Management	The plan for the storage of waste rock and the treatment and safe storage of tailings, with site layout map.
Site Water Management	Summary of the water usage requirements, with water sourcing, re-cycling, circulation and safe discharge noted.
Reclamation	Outline of the process to return the site, during and after mining, to a state at least equal to that prior to disturbance.
Personnel	A schedule of the number and type of jobs expected during construction and life-of-mine.

The panels were supplemented with additional information on aspects of the Project by representatives of potential suppliers and consultants to the Project. These individuals provided information on topics such as blasting (provided by Atlantic Explosives), cyanide use, storage and disposal (provided by CyPlus Corporation), and tailings dam design and operation (provided by Golder Associates), and archaeology and cultural resource management (provided by Cultural Resource Management Group). Drill core from the Touquoy Gold Deposit was also displayed as were several historic photos of the Moose River Gold Mines area.

Participants were asked to sign in to the Session and then were provided with a quick overview of the panels and structure of the Session. A summary of the number of participants and their home community is provided below. Participants then viewed the various panels and information and were assisted by company representatives and the aforementioned suppliers and consultants with any questions that they had. Comments from the participants were recorded on flipcharts for other participants to view. This format allows all participants to get a sense of the primary issues/concerns and for DDVG to use this information to refine aspects of the Project. A summary of the comments is provided below.

A total of 54 participants attended the session with a breakdown of their home communities shown in Table 4.1.

TABLE 4.1: COMMUNITIES OF PUBLIC INFORMATION SESSION PARTICIPANTS

Location	Number of People
Moose River	7
Middle Musquodoboit	5
Upper Stewiacke	3
Upper Musquodoboit	13
Wentworth	1
Hildon	1
East Chezzetcook	2
Musquodoboit Hbr	1
Sutherland's Lake	1
Lake Echo	1
Halifax	5
Truro	2
Elmsdale	2
Musquodoboit	1
Dartmouth	1
Enfield	2
Mooseland	4
Unspecified Location	2
Total	**54**

The participants represented a good local and regional coverage and brought up a number of items they felt were important in the consideration of the mine design and planning. As previously noted a record was kept and the results are summarized below.

4.3 ISSUES AND CONCERNS

Table 4.2 lists the issues and concerns raised by area residents at the Public Information Session.

TABLE 4.2: SUMMARY OF COMMENTS AND CONCERNS RAISED BY STAKEHOLDERS

Question/Issue	Response
When is the start-up date for activities at the mine?	Answer given was early 2007 with favourable permitting. This question was raised by 22 of the participants.
What will be done with the current Moose River Museum?	Answer given was that DDVG's mining plan does not need the Museum to be moved but DDVG is in discussions with the local heritage group and community to determine the possibility of enhancing the role of the Museum locally. This could involve moving the Museum to a permanent location and providing interpretive panels and viewing opportunities to see the new mine in operation while being able to view artifacts of past mining and information on the history of the area. This question was raised by 11 of the participants.
What is the plan for reclaiming the site when mining is finished?	Answer given was that all disturbed areas will be shaped to promote water retention and seeded with appropriate vegetation mixes. Use of existing natural vegetation will be promoted and used where possible through replanting and use of stockpiled organics. The pit area will flood and be a lake with revegetated sides and re-shaped edges in key areas to allow for potential person and animal access and egress as well as nearshore vegetation growth. This issue was raised by 7 of the participants.
What are the Mooseland Road and access road to the west side of Moose River realignment plans? Will the re-alignment plans allow for 24 hour access?	Answer given was that a realignment of the Mooseland Road is planned with an equal or better road than at present. The re-alignment is north of its present path and will not require a stop to access the Moose River Road as is the case now. All other access roads to get to forestry and recreational lands to the west and south of the site will be re-aligned but maintain equal or better access on a 24 hour a day basis subject to blasting schedules. DDVG would be responsible for the forestry and access road maintenance during the Project lifetime. This issue was raised by 6 of the participants.
Is the tailing management area designed for long term protection of the local environment, particularly after mine operations end?	Answer given was that the tailings management must be able to create water discharge that meets all provincial and federal regulation and a comprehensive compliance and environmental effects program will be designed and reviewed by DFO, Environment Canada and NSEL. DDVG will design a facility that provides long term protection of the local environment during and after conclusion of the mining and processing operations. This issue was raised by 5 of the participants.
Will there be vegetation and visual buffers around the tailings management areas and other disturbed areas such as stockpiles?	Answer given was vegetation will remain in all areas of the mine development unless required to be removed. Certain areas around the tailings management facility may have to have the vegetation removed so as not to have trees, rock and soils slump into the tailings management area. All attempts will be made to leave vegetated buffers in place as they assist with erosion control, visual effects and surface water quality. This issue was raised by 3 of the participants.

4.4 ENVIRONMENTAL EFFECTS EVALUATION

The approach to this evaluation has been to address the regulatory requirements of the environmental assessment regulations of the Nova Scotia Environment Act and to produce an assessment document that:

- Is focused on the issues of greatest concern;
- Clearly addresses the regulatory requirements;
- Integrates engineering design and mitigative measures into a comprehensive environmental management planning process; and
- Integrates cumulative effects assessment into the overall assessment of environmental effects.

The VECs analysis is based on the project description, the environmental setting, and stakeholder input. The environmental assessment evaluates the potential effects, including cumulative effects, of each Project phase, (i.e., construction, operation and decommissioning), as well as malfunctions and accidents, with regard to each identified Valued Environmental Component (VEC).

The proposed Project has been in the design phase for about two years since 2005 and field surveys have been undertaken following each modification in site layout to describe the existing environment and to provide feedback into the design to minimize environmental effects. Dates of field studies are provided in the individual Valued Environment Components (VEC) section. VECs are chosen based on issues raised by the public and regulators and from experience and professional judgement of the study team. Mitigation measures and modifications of Project site layout were effected based on field survey findings to minimize impacts to the environment. Surveys consisted of archaeological surveys, breeding bird surveys, vegetation surveys, air quality surveys, soil and sediment surveys, groundwater and hydrology surveys, wetland surveys mammal surveys, herpetile surveys, and fish and fish habitat surveys. The latest site reconfiguration resulted in vegetation surveys in new areas conducted in September 2006.

DDVG recognizes that additional biological surveys will need to be completed in 2007 prior to disturbance. Information was also obtained through the review of aerial photography and regulatory consultation with regional biologists (NSDNR), Atlantic Canada Conservation Data Centre (ACCDC) and the Nova Scotia Museum (NSM).

An important factor in the assessment process is the determination of spatial and temporal boundaries, i.e., those periods during which, and the areas within which, the VECS are likely to interact with, or be influenced by, the Project. Temporal boundaries encompass the times that Project activities, and their effects, overlap with the presence of a VEC. Spatial boundaries are the areas within which the Project activities are undertaken and the facilities are located, and the zone of influence of effects of the Project, i.e., of footprint and emissions. Such boundaries are identified for each VEC as an integral part of the analysis. The environmental boundaries are confined to the immediate area of the site and the down gradient receptors. With respect to socio-economic components and locomotive terrestrial species, a wider study area is used as appropriate.

The significance of the predicted environmental effects of the Project is evaluated based on a set of environmental effects evaluation criteria and significance definitions developed for each VEC. Significance is defined as per the Environmental Assessment Regulations, with respect to an environmental effect, an adverse impact in the context of its magnitude, geographic extent, duration, frequency, degree of reversibility, possibility of occurrence or any combination of the foregoing. Residual environmental effects rating criteria have been established based on information obtained in issues scoping, available information on the status and characteristics of the VEC, and environmental standards, guidelines or objectives, where these are available, and by drawing on the experience and professional judgment of the study team. Environmental effects are evaluated as either significant or not significant, based on significance definitions. Significant environmental effects are those adverse effects that will cause a change in the VEC that will alter its status or integrity beyond an acceptable level.

Each analysis has also incorporated ecological and, where applicable, socio-economic considerations. Ecological evaluation has taken into account recognized ecological processes that capture ecological functioning

- negative effects on the health of biota;
- loss of rare or endangered species;
- reductions in biological diversity;
- loss of critical/productive habitat;
- fragmentation of habitat or interruption of movement corridors and migration routes;
- transformation of natural landscapes;
- discharge of persistent and/or toxic chemicals;
- toxicity effects on human health;

- reductions in the capacity of renewable resources to meet the needs of present and future generations; and
- loss of current use of lands and resources for traditional purposes by Aboriginal persons.

5.0 AIR QUALITY

5.1 EXISTING ENVIRONMENT

Meteorology

The Project is located within the Eastern Nova Scotia climatic region, which is generally characterized by high rainfall and cool temperatures, due to the influence of the Nova Scotia Current. The nearest climate station with historical 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).

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 Halifax Airport climate station (MSC ID# 202250), which is located approximately 45 km west of the mine site. This is the closest station to the site for which wind data exists.

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.

Wind direction is generally westerly to northerly in January through April, southerly in May through October, and again more westerly to northerly in November and December. Wind speeds average approximately 16.5 km/h, with an average range of 13.3 km/h in August to 18.5 km/h in March. Maximum hourly speeds can range from 56 km/h in August to 89 km/h in February, with maximum gusts of up to 132 km/h recorded.

Generally the meteorological data from MSC is sufficient for mine design and operation. DDVG looks forward to working with Environment Canada's Atmospheric and Meteorological Services staff relative to the use and analysis of data collected from the site's meteorological station. DDVG intends to use the site specific data collected to periodically review the original design and the need for refinements based on the site meteorological data. Should site specific information be required, DDVG would install a meteorological station at the site and collect appropriate data.

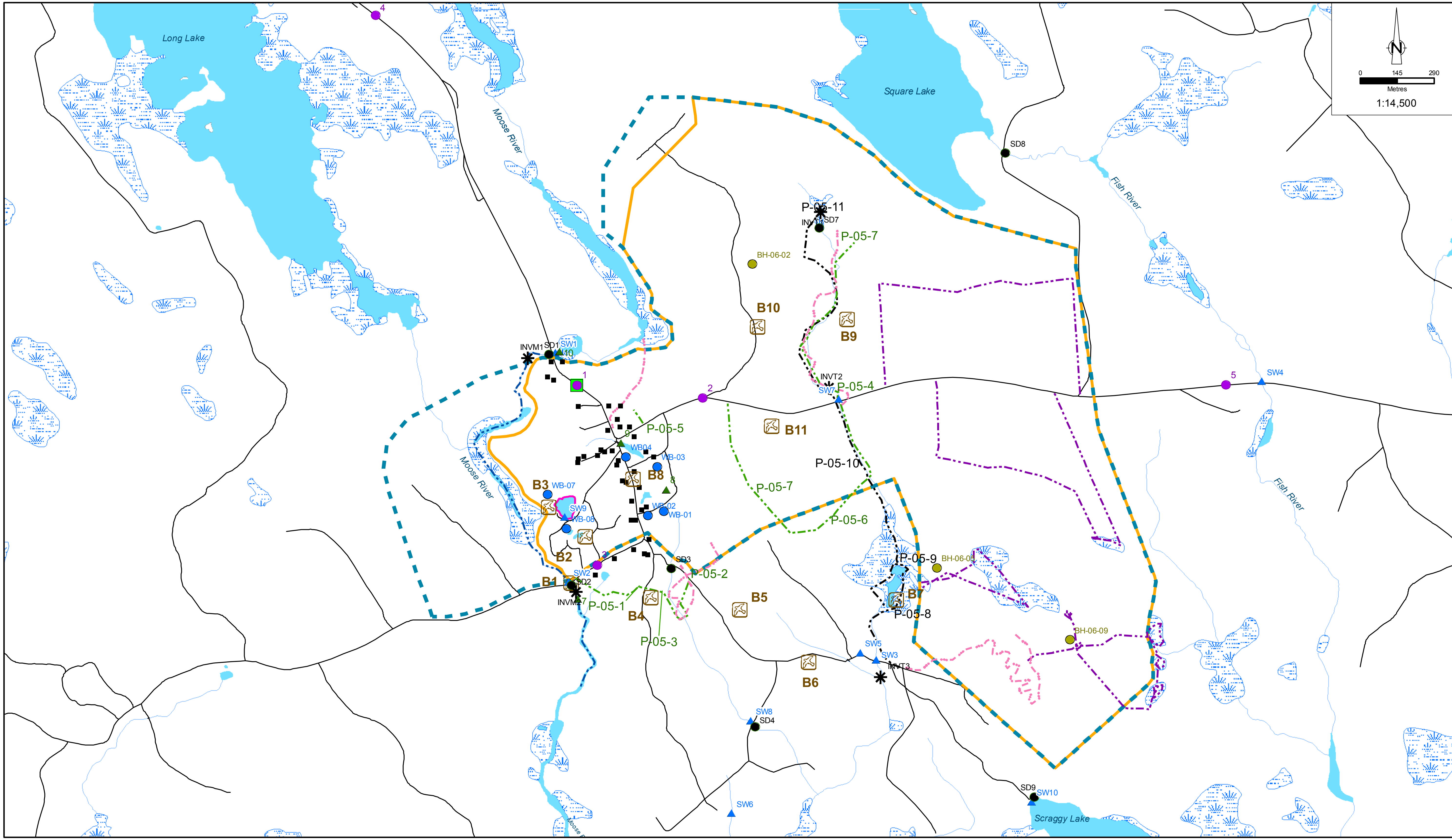
Total Suspended Particulate

The sampling program for total suspended particulate (TSP) was carried out in accordance with United States Environmental Protection Agency Code of Federal Regulations (USEPA CFR) (http://epa.gov/ttn/amtic/40cfr50.html) 40 part 50 - *Regulations for Ambient Particulate Sampling*. Sampling equipment utilized by CRA consisted of three high volume air samplers equipped with 8 inch X 10 inch glass fiber filters for sample collection. Approximately 40 cubic feet of ambient air is drawn through the filter during a 24-hour sampling period. The particulate is trapped on a pre-weighed glass fiber filter. The samplers were calibrated according to the referenced method as well as manufacturers' specifications. Sampler flow calibration sheets and calculated flow rates are provided in Appendix E.

Sampling locations were determined based on meteorological forecasts for the sampling period and the proximity to the proposed open pit construction area. Three of the sampling locations were located near the proposed open pit area and the two other locations were located north and east on Moose Land Road. Figure 5.1 shows the monitoring locations. Meteorological conditions for each sampling event were obtained from Environment Canada's Halifax International Airport Station, and are presented in Appendix E.

After each sampling event filters were stored in a clean dry area. Upon completion of the program samples were shipped to Maxxam Analytics for analysis in accordance with the appropriate method. The laboratory results and certificate of analysis are provided in Appendix E.

TSP values range from 10.5 $\mu g/m^3$ to 16.1 $\mu g/m^3$. The calculated TSP values reported as ug/m^3 are presented in Table 5.1. Flow rate calculations and final sampling volumes are presented in Table 5.2. All calculated values are below the maximum permissible ground level concentration of 120 $\mu g/m^3$ outlined in Schedule A of the *Nova Scotia Air Quality Regulations*.



- Building
- Invertebrate Sample 06&09/05
- Soil Samples
- Air Monitoring Stations
- Sediment Sample
- Groundwater Sample
- Historic Surface Water Sample
- Surface Water Sample
- Noise Sample
- 2006 Breeding Bird Survey 06/06
- 2007 Lichen Survey Transect
- 2006 Groundwater Upwelling Survey Transect
- 2006 Plant, Mammal & Herptile Survey Transect
- 2005 Plant SurveyTransect 05/05
- 2005 Plant SurveyTransect 07/05
- Existing Pit Extent
- Road
- Rivers and Streams
- Project Site Boundary
- Study Site Boundary
- Wetlands
- Lake

Data projected to UTM (Zone 20T) NAD83

CRA

Figure 5.1
SAMPLING AND SURVEY LOCATIONS
Touquoy Gold Project, DDV Gold Ltd.
Halifax County, Nova Scotia

TABLE 5.1: TSP VALUES CALCULATED AS µg/m³

Sample ID	Volume Sampled (m3)	Results in µg	Results in µg/m³
Location #1	1725.97	20000	11.6
Location #2	2100.46	22000	10.5
Location #3	1710.94	24000	14.0
Location #4	1991.19	32000	16.1
Location #5	2153.96	31000	14.4

TABLE 5.2: TSP FLOW CALCULATIONS

Sampler	X Coefficients	Temperature Factor (°K)	Regression Constant
W00-01	36.61	298	6.10
W00-02	47.01	298	2.24
W00-03	39.53	298	4.68

EPA accepted criteria 30-60CFM

Sample ID	Sampler Used	Daily Average Temperature (°K)	Sample Time(min)	Average Chart Reading	Flow (m3/min)	Flow (CFM)	Total Volume (m3)
Location 1	W00-03	278.4	1450	50.0	1.190	41.816	1725.97
Location 2	W00-01	278.4	1397	59.1	1.504	52.820	2100.46
Location 3	W00-03	277.5	1454	49.4	1.177	41.338	1710.94
Location 4	W00-02	277.5	1463	63.9	1.361	47.813	1991.19
Location 5	W00-01	277.5	1463	57.9	1.472	51.722	2153.96

5.2 POTENTIAL EFFECTS, PROPOSED MITIGATION, AND FOLLOW-UP MONITORING

Construction and Mining Operations

Air-borne particulate matter will be generated during construction and operation phases of the Project. Airborne particulate matter is a complex mixture of organic and inorganic materials. Size and particle distribution can be categorized as either coarse particles, >2.5 microns (µm) in size, or fine particles, <2.5 microns (µm) in size. Total suspended particulates include dust, dirt, soot, smoke and liquid droplets directly emitted into the air by sources such as factories, power plants, cars, construction activity, fires and natural windblown dust. Particles formed in the atmosphere by condensation or the transformation of emitted gases such as SO_2 and volatile organic carbons (VOCs) are also considered particulate matter.

During clearing and grubbing activities, topsoil will be stockpiled for use in progressive and final reclamation activities. This material is rich in organics and will retain moisture from precipitation. Should dust be a problem during dry periods, DDVG will wet the stockpiles as needed.

The control of fugitive dust from the mining operations must centre on provision of moisture control measures, such as spraying with water as required. In-pit operations will not generally have much direct offsite impact, but could contribute to general dust levels at critical times if not controlled.

The ROM ore will be delivered from the open pit directly to either the ROM pad or the 3-stage crusher as described in Section 2.6.3.3. The ore stockpile is covered to minimize wind and rain erosion. The crusher, conveyors, ball mill and subsequent processing are located in a building, and therefore, it is not exposed to the elements and subject to wind.

The National Air Pollution Surveillance (NAPS) network is a cooperative program that measures air quality across Canada. The closest NAPS monitoring location to the Moose River is at Lake Major, approximately 90 km away. At present NSEL monitors PM 2.5 levels at that location. Monthly PM 2.5 measurements for 2005 ranged from 3 ug/m^3 -7 ug/m^3. Currently USEPA regulates PM 2.5 under the National Ambient Air Quality Standard (NAAQS) at 35 µg/m^3 for a 24 hour sample and an annual average of 15 ug/m^3.

Given that most of the fugitive dust generated at the site will be from crushing processes, mechanical processes and dust generated from trucking operations, most of suspended particulates generated will be in the coarser fraction (>2.5 microns). TSP values measured in and around the mine site all measured less than the EPA NAAQS standard. Hence it is most likely that baseline values of PM 2.5 all though not measured will be below the PM 2.5 NAAQS criteria value as well.

Blasting, on site vehicle operations, crushing, and wind erosion from waste rock piles all could contribute to increased particulate levels. Several mitigative measures will be utilized to reduce particulate emissions.

- Wet suppression controls on unpaved surfaces
- Speed reduction to keep dust levels at minimum
- Stabilized slopes of either mulch or vegetation for waste rock stockpiles.

A significant adverse environmental effect with respect to TSP is one that would reduce air quality, such that the level of TSP exceeds 120 $\mu g/m^3$ over a 24 hour averaging period or 70 $\mu g/m^3$ over an annual averaging period.

Given that there will be no residential buildings located near the proposed open pit area, increases in suspended particulate matter, although adverse, will not affect residents in that area. Additional TSP monitoring would be required to measure the full effects on suspended particulate matter once mine operations begin. An audit program of the same sampling sites originally chosen for the baseline monitoring can be implemented. Three sampling locations were within 300 to 600 m of the open pit area and two were 2 to 3 km north and east.

The primary air quality impact requiring consideration is the control of fugitive dust from the site and related trucking operations. Dust control requires careful and consistently applied mitigative measures throughout the Project, if non-compliant or nuisance levels are to be avoided. The proposed mitigation measures for various process components are outlined below. These are similar to measures routinely used at most other Nova Scotia surface mine operations. DDVG personnel are very familiar with regulatory requirements relating to air quality.

Processing Operations

Intermittent emissions of propane exhaust (CO, CO_2, NO_X), SO_2 and ammonia from the smelting furnace, and SO_2 and ammonia from the electrowinning cells will be controlled through use of exhaust scrubbers. The large volume of air drawn by the fans above these operations ensures very low concentrations of any off-gases. Water vapour, CO and CO_2 are similarly extracted from the carbon regeneration kiln. These emissions will be less than the aggregate emissions from site vehicles. Solid waste or slag from the smelting furnace, in the order of 10 kilograms per day, will be crushed and returned to the ball mill for reprocessing.

Process emissions of residual reagents and their products will be further characterized by dispersion modeling at the Industrial Approval phase. Relative emission concentrations will be determined at that time. Operations will ensure that air pollutant concentrations will fall within the guidelines specified in the "Environmental Code of Practice for Base Metal Smelters and Refineries, Code of Practice, Canadian Environmental Protection Act,1999".

On-site Vehicle Operations

To minimize dust produced by on-site vehicle operations, the following may be used as required:

- Wet suppression controls on unpaved surfaces;
- Hardened surfaces where practical;
- Speed reduction; and,
- Use of large haul vehicles so as to minimize trip frequency;
- Low sulphur diesel.

Waste Rock Piles

Wind erosion from elevated waste rock piles containing finely divided material can be a major source of dust at mine sites. Slopes will be stabilized with mulching and / or vegetation, where appropriate. Waste rock piles will be sprayed as necessary to minimize emissions.

DDVG may vary the mitigations depending on specifics of the situation so long as the dust levels are in accordance with the regulatory approval. DDVG is aware that the proposed Project will be regulated by the Nova Scotia Air Quality Regulations and will ensure that operations meet these requirements.

5.3 SUMMARY

In summary, assuming appropriated mitigation to minimize dust generation and transport, significant Project-related effects on air quality are not likely to occur during construction and operation phases.

All process emissions will meet the specifications outlined in the NSDEL Pit and Quarry Guidelines, 1999 as well as the Nova Scotia Air Quality Regulation. Operations will also ensure that air pollutant concentrations will fall within the guidelines specified in the "Environmental Code of Practice for Base Metal Smelters and Refineries, Code of Practice, Canadian Environmental Protection Act,1999".

Given that there will be residential buildings located near the proposed open pit area, increases in suspended particulate matter and other emissions, although adverse ,will not effect residents in that area and will be considered insignificant. Additional TSP and emissions monitoring would be required to measure the full effects on suspended particulate matter and exhaust emissions once mine operations begin. Dispersion modeling may be conducted at the Industrial Approval phase to predict emission levels and to determine appropriate monitoring locations for particulates.

6.0 NOISE

6.1 EXISTING ENVIRONMENT

CRA conducted longterm sound level monitoring for DDVG on January 9, 2007 through January 12, in order to determine the ambient background sound levels. The monitoring location chosen was just north of the proposed open pit area on Moose River Road (Figure 5.1).

Noise measurements at the Moose River site were obtained for the period of January 9, 2007 through to January 12, 2007. As specified in the Noise Measurement and Assessment Guidelines , L_{eq} 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.

Continuous, one–hour L_{eq} values were observed throughout the above specified time intervals. The lowest measured one-hour L_{eq} 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

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 Table 6.1.

TABLE 6.1: AVERAGE HOURLY NOISE MEASUREMENTS/TEMPERATURES/WIND SPEED

Average Hourly Interval	Average Hourly Noise Measurement(dBA)	Noise Measurement Criteria (Leq dBA)	Average Hourly Temperature (°C)	Average Hourly Wind Speed(km/hr)
1/9/2007 19:00-19:59	44.6	Leq ≤ 60	4.1	28.2
1/9/2007 20:00-20:59	44.9		4.8	29.1
1/9/2007 21:00-21:59	44.7		4.3	39.1
1/9/2007 22:00-22:59	45.1		4.1	41.5
1/10/2007 07:00-07:59	46.8	Leq ≤ 65	2.6	23.4
1/10/2007 08:00-08:59	46.2		2.6	20.2
1/10/2007 09:00-09:59	45.4		2.9	19.6
1/10/2007 10:00-10:59	45.5		3.3	22.2
1/10/2007 11:00-11:59	44.2		3.2	17.5
1/10/2007 12:00-12:59	43.3		2.4	12.4

TABLE 6.1: AVERAGE HOURLY NOISE MEASUREMENTS/TEMPERATURES/WIND SPEED

Average Hourly Interval	Average Hourly Noise Measurement(dBA)	Noise Measurement Criteria (Leq dBA)	Average Hourly Temperature (°C)	Average Hourly Wind Speed(km/hr)
1/10/2007 13:00-13:59	43.6		2.2	4.8
1/10/2007 14:00-14:59	44.4		1.7	10.2
1/10/2007 15:00-15:16	43.6	Leq ≤ 60	2.2	8.8
1/10/2007 19:00-19:59	40.4		2.8	9.4
1/10/2007 20:00-20:59	40.7		2.7	5.5
1/10/2007 21:00-21:59	40.2		2.6	7.7
1/10/2007 22:00-22:59	40.0		2.3	8.5
1/10/2007 23:00-23:59	40.2		1.9	7.3
1/11/2007 0.00- 0:59	40.3	Leq ≤ 55	1.8	9.9
1/11/2007 01:00-1:59	39.8		0.8	19.5
1/11/2007 02:00-02:59	40.4		0.0	18.6
1/11/2007 03:00-03:59	39.6		0.4	15.6
1/11/2007 04:00-04:59	39.7		0.0	21.3
1/11/2007 05:00-05:59	39.9		0.0	20.1
1/11/2007 06:00-06:59	41.4		-1.0	28.1
1/11/2007 07:00-07:59	41.7	Leq ≤ 65	-1.4	32.8
1/11/2007 08:00-08:59	40.3		-1.7	32.8
1/11/2007 09:00-09:59	42.3		-1.8	27.4
1/11/2007 10:00-10:59	43.6		-2.4	26.4
1/11/2007 11:00-11:59	43.0		-4.3	25.2
1/11/200712:00-12:59	43.9		-4.4	35.2
1/11/200713:00-13:59	44.4		-4.5	34.7
1/11/2007 14:00-14:59	43.1		-5.0	35.2
1/11/2007 15:00-15:59	43.7		-4.1	34.7
1/11/2007 16:00-16:59	43.8		-4.0	27.9
1/11/2007 17:00-17:59	42.6		-3.3	29.7
1/11/2007 18:00-18:59	42.2		-3.1	29.1
1/11/2007 19:00-19:59	42.0	Leq ≤ 60	-3.1	30.0
1/11/2007 20:00-20:59	41.3		-3.8	27.8
1/11/2007 21:00-21:59	41.0		-4.6	28.0
1/11/2007 22:00-22:59	41.3		-4.8	30.9
1/11/2007 23:00-23:59	40.9	Leq ≤ 55	-4.5	20.8
11/12/2007 0.00-0:59	40.5		-4.1	20.2
1/12/2007 01:00-01:59	40.1		-3.8	26.6
1/12/2007 01:00-01:59	40.3		-3.7	30.6
1/12/2007 03:00-03:59	40.7		-3.1	28.9
1/12/2007 04:00-04:59	40.8		-2.6	29.0
1/12/2007 05:00-05:59	40.6		-2.1	28.3
1/12/2007 06:00-06:59	41.8		-0.3	25.1

The long-term sound level monitoring was conducted using a microphone and data logging system. The sound level measurements were taken using a Quest Sound Pro-DL Class 1 Precision Integrating Sound Level Monitor (Serial Number BIF030021). The system was calibrated at 114 decibels (dBA) before and after the measurement period using a Quest Acoustic Calibrator. The meteorological conditions during the monitoring periods consisted of low winds (> 20km/hour), temperatures between 3-4 degrees Celsius, rain showers and light flurries. Careful precautions were taken to ensure measurements were obtained between periods of flurries and showers. Meteorological conditions were obtained from Environment Canada's Halifax International Airport station and used to assess adverse weather conditions that could have affected the noise measurements. The weather conditions were considered in order to validate the minimum background sound levels. Continuous 1-hour sound level measurements were taken with the detector in slow response using the A-weighting (dBA).

6.2 POTENTIAL EFFECTS, PROPOSED MITIGATION, AND FOLLOW-UP MONITORING

The Project will create pit, blasting, and processing noise. Noise is defined as any unwanted sound which may be hazardous to health, interfere with speech and verbal communications or is otherwise disturbing, irritating or annoying. Noise is measured as sound pressure levels (SPL) in decibels (dB). This scale is "A" weighted to approximate the way the human ear hears. Noise measurements are therefore represented as dBA units. In general an increase in noise levels from 1 to 3 dBA will not be noticeable, 3 to 5 dBA will be noticeable by most people, 5 to 7 dBA will be easily heard and an increase of 7 to 10 dBA will be considered by most to be twice as loud (USEPA Reference-1974). Because the decibel scale is logarithmic, doubling of the number of noise sources will increase noise levels by 3 dBA. A tenfold increase in the number of noise sources will add 10 dBA to the noise level.

Sources of Project related noise may include blasting, rock crushing, onsite heavy truck traffic and operation of other heavy machinery. Typical short term maximum noise levels for trucks and heavy equipment are up to 85 dBA at 15 m from the source. Noise levels for stationary construction equipment will decrease by approximately 6 dBA at a doubling of the distance from the source.

Should the Project be completed as described the nearest dwelling will be approximately six kilometres from the site and buffered by forest. The likelihood of any dwellings in this rural area being occasionally impacted by sound from the site, as well as by vehicular traffic to and from the site is very low. The majority of mining operations will occur in the pit well below ground surface thereby provide excellent noise shielding.

DDVG will control operations and equipment to ensure noise levels are kept within recommended limits for surface mining operations. Mine site noise will be periodically measured at the property boundaries to ensure regulation levels are not exceeded. A sampling program to collect representative noise level data will be undertaken when surface clearing and construction begins.

Noise from the equipment and lack of effective mufflers is a source of noise. Regular maintenance of the equipment will reduce noise levels. This combination of measures will adequately mitigate potential noise impacts. Noise monitoring will be conducted and the results submitted to regulators as requested. The mitigation procedures may vary as long as noise levels are in accordance with the regulatory approval.

6.3 SUMMARY

All noise emissions will meet the specifications outlined in the NSDEL Pit and Quarry Guidelines, 1999, as well as the Guidelines for Environmental Noise Measurement and Assessment, 1990. In consideration that there are no nearby residents or commercial facilities, and appropriate mitigation to minimise noise levels to reasonable levels will be made, no significant Project-related effects on noise are likely to occur during construction, operation and decommissioning phases. Additional noise level monitoring would be required to measure the effects once mine operations begin. Monitoring stations will be set up along the property line as directed by NSEL at the Industrial Approval stage.

7.0 SURFACE WATER RESOURCES

7.1 EXISTING ENVIRONMENT

7.1.1 HYDROLOGY

The Touquoy Gold Project lies within the Moose River drainage basin, which is directly east of the large Musquodoboit River Valley system. This area is located in a region of the province characterized by rolling till plains, drumlin fields, extensive rockland, and numerous freshwater lakes, streams, bogs and wetlands. The area can be further characterized as having relatively low relief, hummocky type terrain. Forests are predominantly coniferous of red and black spruce. This inland area is removed from the immediate climatic influence of the Atlantic Ocean and is characterized by warmer summers and cooler winters.

The Moose River drainage basin is drained by the Moose River and its tributaries, from north to south. Elevations within the catchment vary from approximately 160 masl (metres above sea level) in the headwater areas to approximately 110 masl at the outlet. The headwaters of the drainage basin are located along the topographic divide separating the Musquodoboit River valley to the north and west. The complex system of streams, lakes, bogs and wetlands 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 is retained on the surface, often called a 'deranged' drainage pattern. The basin ultimately drains to the south via the Moose River, and discharge peaks are likely attenuated to a large extent by the numerous lakes and wetlands through which runoff is routed.

Summary hydrologic budget data for the region was obtained from a simple hydrologic budget model. The model is operated by MSC and is based on the Thornthwaite and Mather water balance procedure (Johnstone & Louie, 1983). The procedure accounts for temperature, precipitation, snow storage and melt, evapotranspiration, and soil water holding capacity for a basin. Model input consists of mean daily temperature and precipitation data for the station and period of interest, station latitude, and site soil and vegetation cover information (used to estimate soil water holding capacity). The model was run using the Middle Musquodoboit climate station data as input, along with an assumed soil water holding capacity of 150 mm.

Figure 7.1 summarizes the model output 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 7.1, 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 7.1 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 7.2 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 7.2 indicates that average evaporation losses peak at approximately 112 mm in July. Lake evaporation is approximately equal to evapotranspiration losses, which is typical.

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 compared to data averaged over the same period from the hydrologic budget model. The averaged monthly flows for the gauge data were then divided by the drainage area for the gauge to determine an equivalent average monthly runoff depth. This depth is plotted along with the runoff

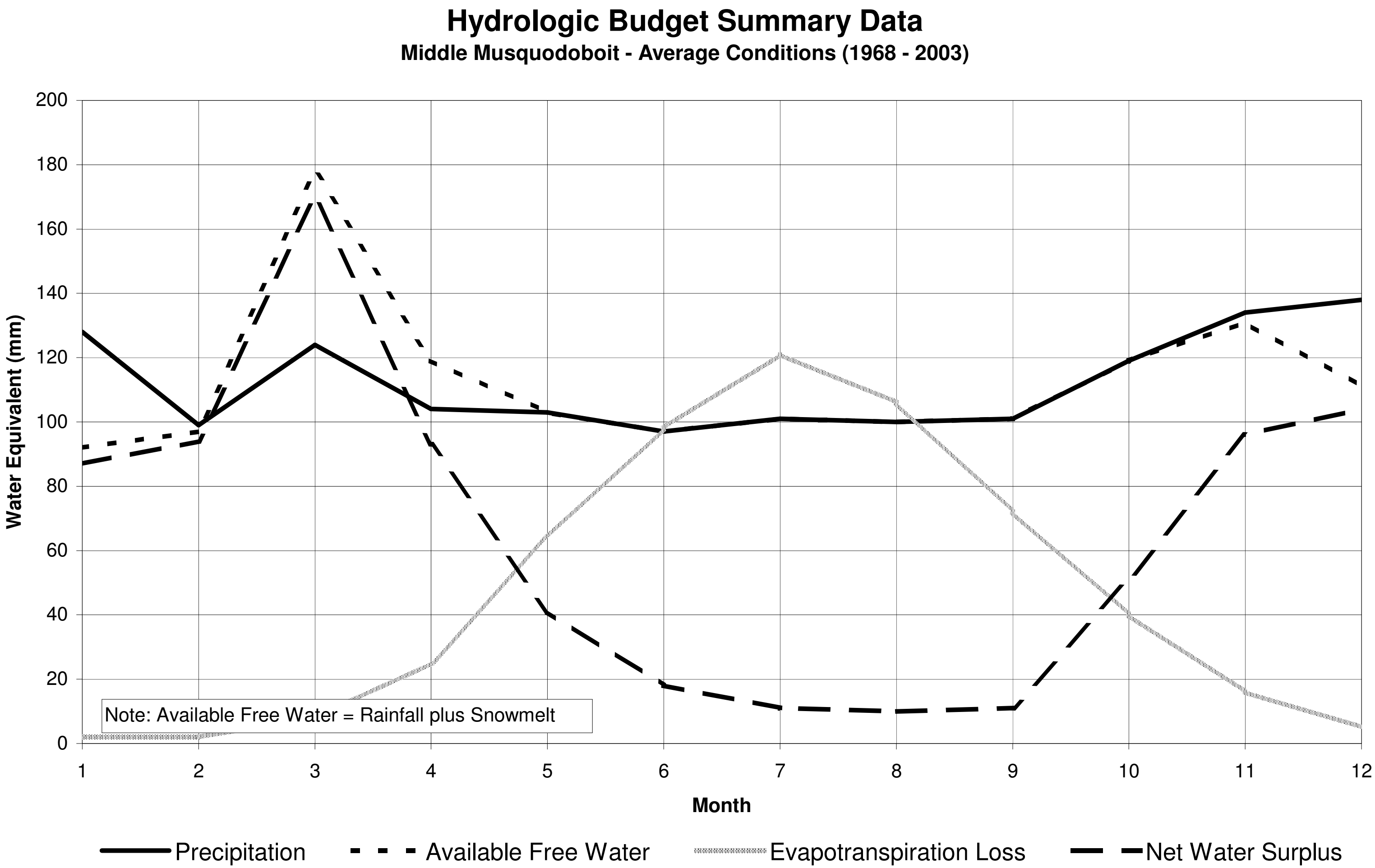


Figure 7.1
Hydrologic Budget Summary Data
Touquoy Gold Project, DDV Gold Ltd.
Halifax County, Nova Scotia

CRA 820933 - February 2007

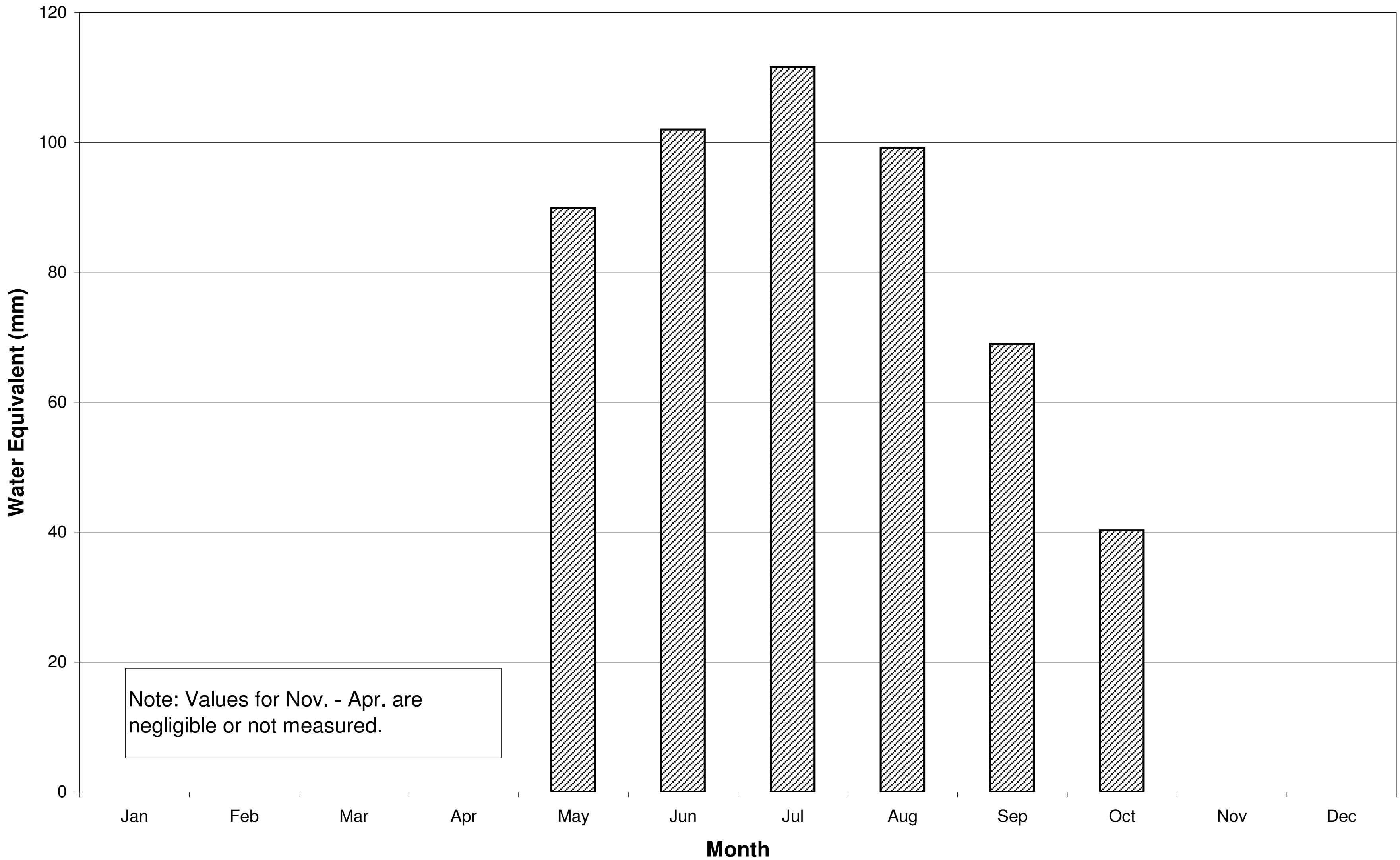


Figure 7.2
Average Lake Evaporation Data
Touquoy Gold Project, DDV Gold Ltd.
Halifax County, Nova Scotia

depth calculated from the hydrologic budget in Figure 7.3. As shown in the figure, runoff amounts compare well, indicating that the hydrologic budget calculations are representative for the area and for the purposes of this analysis.

It should be noted that actual flow response within the Moose River drainage basin would likely be somewhat different than for the much larger drainage basin draining to the 01EK001 gauge, given the numerous lakes, streams, bogs and wetlands which would act to attenuate flows, and the smaller basin size. The hydrologic budget approach allows for estimation of runoff based on climatological parameters, rather than interpolation from a much larger gauged basin.

7.1.2 FISH HABITAT

The mine site layout has been designed to avoid direct impacts to watercourses and fish habitat. There is one exception, the treated effluent from the tailing management facility will be discharged via a manmade channel to Scraggy Lake. There are several watercourses in the vicinity of the study area (Figure 7.4). Moose River is the largest watercourse adjacent to the property; it flows along the western border. An unnamed tributary to the Moose River flows south through the property, between the pit and proposed tailing management area. A first order unnamed tributary to this latter tributary starts south of the proposed pit and flows southward. The catchment area for both of these small tributaries has been recently logged. Square Lake is located northeast of the property and it will be a water supply source for the mine site. Fish River drains Square Lake to Scraggy Lake and both lakes are part of the Fish River Watershed which flows west and then south into Lake Charlotte, eventually emptying into Ship Harbour. The Fish River Watershed river system is significant for trout, gaspereau and Atlantic salmon populations (D. Archibald, NSDNR, pers. com.).

Tributary to Moose River

Fish habitat is protected under the federal *Fisheries Act*. The initial baseline aquatic habitat assessments documented existing conditions and identified specific habitat sensitivities adjacent to or within the Project footprint. Aquatic habitat was examined in June and September of 2005, and again in 2006 as the Project site design changed to avoid altering fish habitat. Habitat assessments were conducted using standard Department of Fisheries and Oceans (DFO) parameters such as channel width, water depth, substrate type and cover. Electrofishing was conducted as spot checks to determine species present. Based on the current footprint and mapping, a tributary to Moose River is located within the footprint (Figure 7.4), but will remain unaltered and a

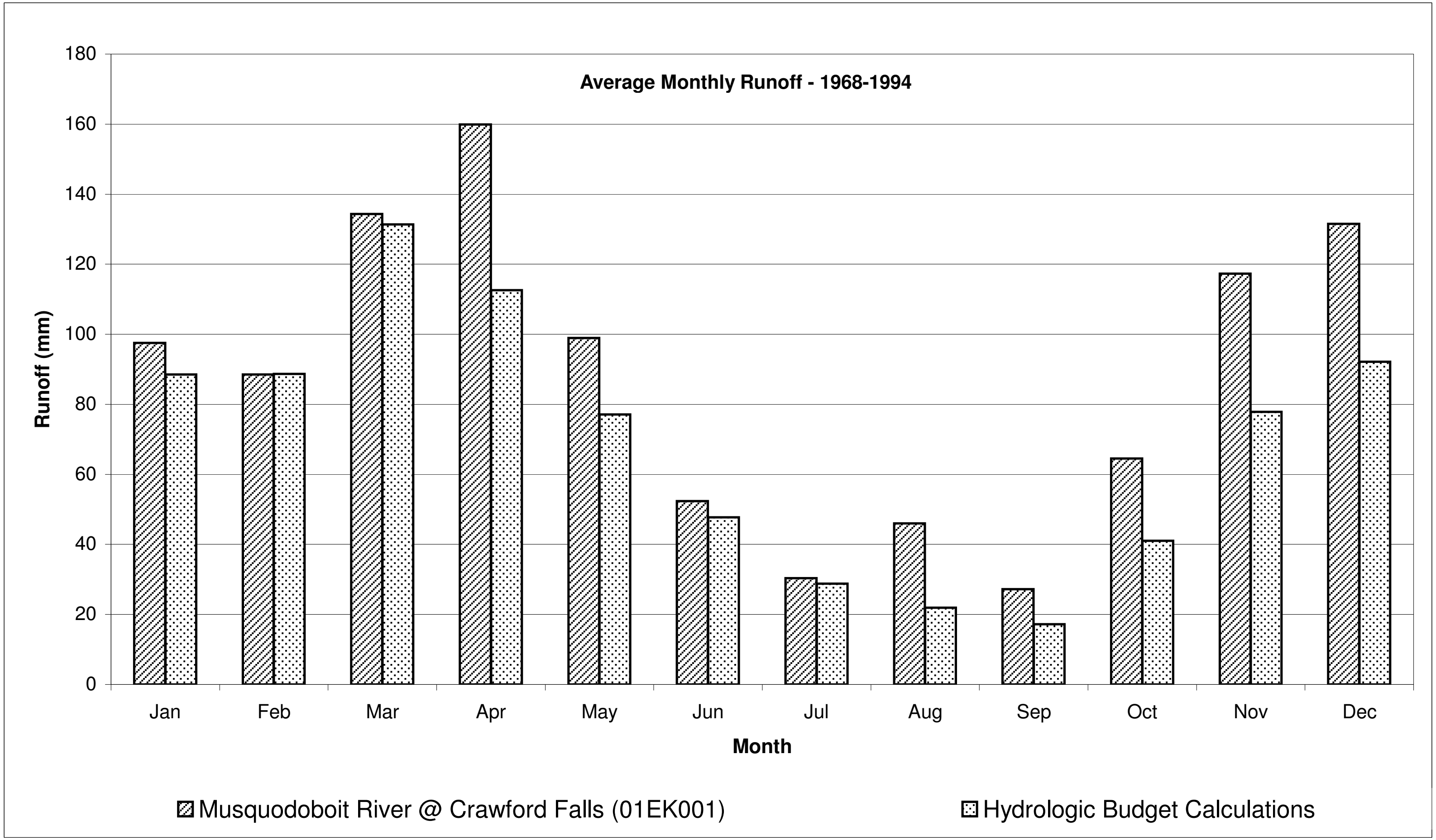


Figure 7.3
Runoff Estimate Comparison
Touquoy Gold Project, DDV Gold Ltd.
Halifax County, Nova Scotia

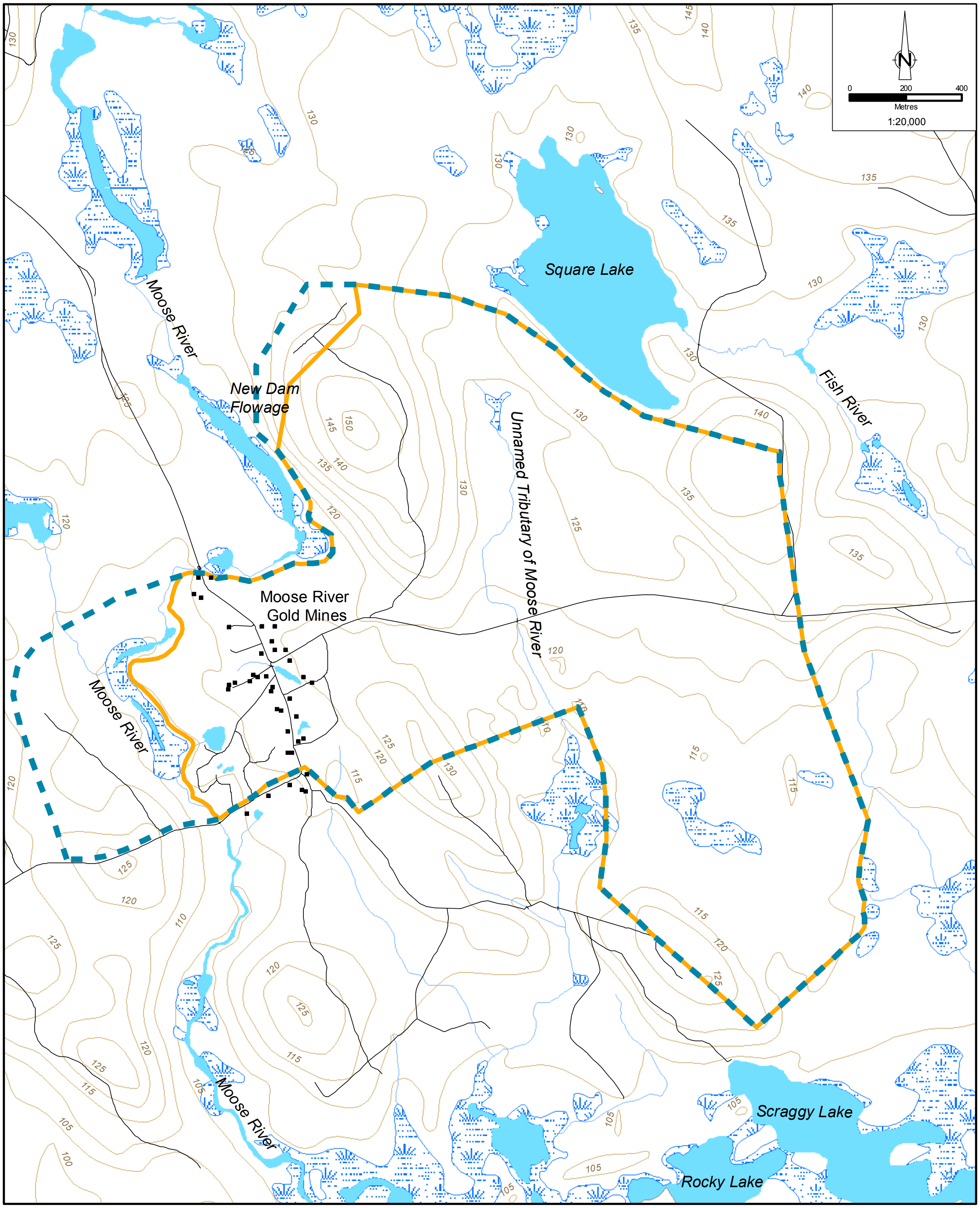


Figure 7.4
WATERCOURSES AND LAKES
Touquoy Gold Project
Halifax County, Nova Scotia

Data projected to UTM (Zone 20T) NAD83

30 m buffer zone will be left intact. The tributary to Moose River is very small north of the Mooseland Road and was dry for much of 2005 and 2006. Fish habitat is marginal, dependant on surface flow, and at flow levels observed in 2005 and 2006, expected to be limited to fish excursions during high flows. The culvert at the Mooseland Road was installed incorrectly and is hung, thus preventing fish passage during average and low flow conditions. From the wetland area (see Figure 7.4), downstream there is limited potential for seasonal brook trout habitat. Two small juvenile brook trout were captured just downstream of the woods road (south of the wetland). The area between the wetland and the woods road was also dry in September 2004.

Photo 1. Tributary to Moose River – Upstream of Mooseland Road in June 2005

Photo 2. Tributary to Moose River – Upstream of Mooseland Road in September 2005.

Aquatic invertebrate data was collected in the spring and fall of 2005 at stations upstream and downstream from the proposed 2005 study area (Figure 5.1). The Moose River tributary was diversely populated with large numbers of midge larvae (chironomids), mayflies and stoneflies. Given the habitat type, it is unlikely that the *Aeshna* dragonflies identified are the variety listed as at-risk by NSDNR.

Moose River

Moose River is a medium sized watercourse with good riparian (watercourse edge habitat) vegetation. Streamside vegetation consists of horsetails and rushes. Surveys conducted in 2005 found the section of Moose River adjacent to the study area provided habitat for a wide variety of fish species including Atlantic salmon and brook trout. Numerous juvenile Atlantic salmon were observed in the area, which provides good juvenile and rearing habitat and potential spawning habitat. It is likely that the salmon observed were landlocked specimens based on the vicinity to a known landlocked salmon population in Scraggy Lake and on the coloring and size of the fish captured. Moose River was also determined to be good adult and juvenile brook trout feeding habitat, fair rearing habitat and potential spawning habitat. Other fish species observed included American eel (*Anguilla rostrata),* white sucker (*Catostomus commersonii),* and minnow species.

Photo 3. Moose River Habitat

Photo 4. Moose River Habitat

Square Lake

Square Lake, located north of the study site, has been identified as a make-up water source for the mine site. The runoff catchment area for the lake is shown in Figure 7.5. The surface water catchment area draining directly to the lake is approximately 124 ha. The lake has a surface area of approximately 33 ha, with a mean water surface elevation of 129 m. Given the small size of the catchment area and local topography, it is likely that there is also significant groundwater input to the lake. This lake is a headwater as there is no significant input watercourse to the lake shown in the mapping or found during field surveys. The outlet is at the southeast corner of the lake, flowing into the Fish River which eventually drains into Scraggy Lake.

DDVG recognizes the need for final design drawings of outflow and inflow structures to be submitted to DFO and NSDEL as part of the application for an Industrial Approval for Site Operations.

Scraggy Lake

Scraggy Lake will be the receiving waterbody for the treated mine water released from the polishing pond. Scraggy Lake is characterized by dozens of small coves and islands. The lake outlet is dammed and likely the cause for the high shoreline development value with a shoreline length of 52,558m. Most of the islands, located primarily in the eastern and northwestern arms of the lake, are owned by the Crown. To date, the lake is largely undeveloped, even on the privately owned portions. In 1975, nine camps were established around the lake. This lake has high value for recreational purposes and is valued for its canoeing opportunities. The lake has a surface area of 644.5 ha and a maximum depth of 13 m. 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. Again, damming the outlet has resulted in a flooded shallow basin. The flushing rate is low at 1.8 times per year.

A fisheries resource study was undertaken in July 1975 by Nova Scotia Department of Agriculture and Fisheries. Gill netting and shoreline seining produced white suckers, white perch, brown bullheads, golden shiners, brook trout, American eel, lake chub, banded killifish and gaspereau. The latter species must bypass the dam at high water in spring. Atlantic salmon smolts were recorded in a 1979 creel census. Fingerling landlocked Atlantic salmon were stocked between 1998 and 2000. Brook trout were stocked between 1994 and 1996. The surface pH in October 2000 was 4.4. The success of pH sensitive salmonids in Scraggy Lake is questionable. 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.

On behalf of the NS Department of Fisheries and Agriculture, the Centre of Estuarine Research at Acadia University complied 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.

Existing data on water temperatures (Inland Fisheries Division, Nova Scotia Department of Agriculture and Fisheries-DOF, 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. Data for Scraggy Lake are limited to July 15, 1975. Baseline monitoring will be undertaken seasonally, as well as ongoing site monitoring to meet the MMER.

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.

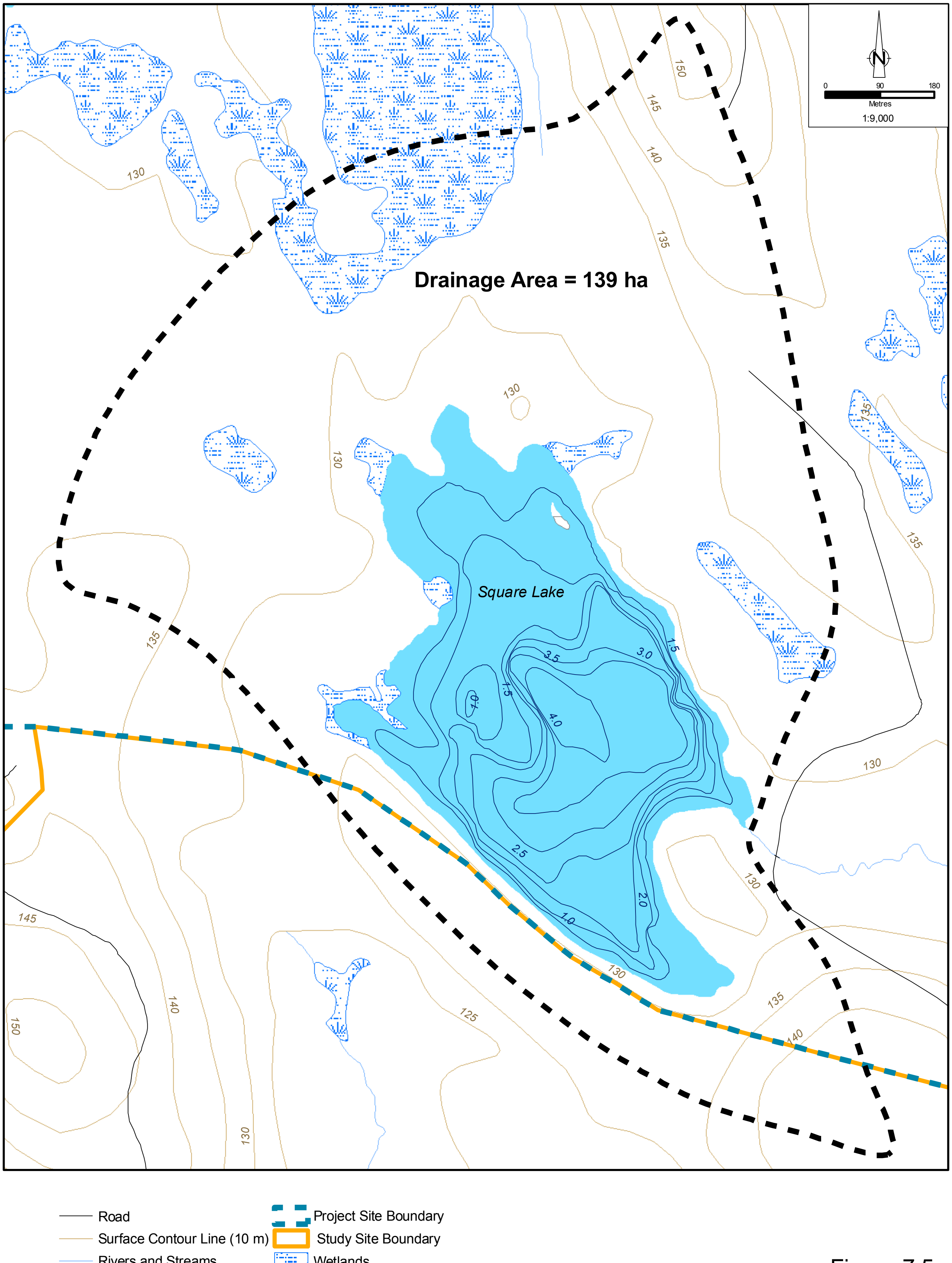


Figure 7.5
SQUARE LAKE CONTRIBUTING DRAINAGE AREA
Touquoy Gold Project, DDV Gold Ltd.
Halifax County, Nova Scotia

Data projected to UTM (Zone 20T) NAD83

820933(REP004)GIS-WA013 March 9, 2007

Water Quality

Baseline surface water (SW) samples have been collected area and analysed at seven sampling locations throughout the Project and surrounding area on a monthly basis since September 2004 (Figure 5.1). An eighth station was added in July 2006. A single sample was collected from the existing mine pit and Scraggy Lake in January 2007. Historical data from 1988 for Moose River was available and reviewed as well. Table 7.1 provides a summary of minimum and maximum values for the eight stations. Appendix F provides the raw data for each sampling station. All concentrations are total values for unfiltered samples.

The water quality is characterized as relatively pristine, with very little influence from past mining activities, road salting or from the local residents. Nutrients were, for the majority, below or slightly above non-detectable concentrations. Three inorganic nutrients were measured: ammonia, nitrite, nitrate and phosphate. Also organic nutrients were measured including kjeldahl nitrogen, total nitrogen and total phosphorus.

Conductivity, total dissolved solids, anion and cation concentrations are low. Dissolved ions are derived from the weathering of rocks and from precipitation. The site is far enough removed from the Atlantic Ocean, such that sea spray is not an influence. The watersheds are not heavily urbanized, thus the influences of salt, lime and fertilizers were not evident. The watersheds have been logged extensively, yet turbidity and total suspended solids are low indicating a lack silt in the soils and or little erosion from logging practice. The water is very soft in this area, indicating little mineral content. The colour is relatively low and fluctuates with some tea stained contributions from wetlands during heavy precipitation events.

Alkalinity is low at all stations, the surficial geology being resistant to weathering and containing little carbonate. Lime applied to lawns and gardens increases alkalinity, but this practice is not evident by the water quality data.

pH measures are highly variable, in particular on Moose River, where on several sampling events at the two sampling stations the pH varies by two orders of magnitude. There seems to be no obvious acidifying source; however, a red flocculant plume was observed emerging from a bank. Sulphate is not correlated to the fluctuations at any of the sampling locations. A potential source will be investigated further.

TABLE 7.1: MINIMUM AND MAXIMUM VALUES OF SURFACE WATER PARAMETERS MEASURED AT EIGHT SAMPLING LOCATIONS ON THE TOUQUOY GOLD PROJECT SITE BETWEEN 1 SEPTEMBER 2004 AND 18 JANUARY 2007

	Units	RDL	CCME 2003*	SW1		SW2		SW3		SW4		SW5		SW6		SW7		SW8	
				MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX
INORGANICS																			
Total Alkalinity (Total as CaCO3)	mg/L	5	-	<5	<5	<5	<5	<5.0	<5	<5	<5	<5	12	<5	6	<5	<5	<5	<5
Color	TCU	5	-	19	540	8	90	23	130	19	110	34	170	23	120	25	95	61	200
Dissolved Hardness (CaCO3)	mg/L	1	-	3.8	6.7	4	8.5	3.9	15	3.5	10	4	37	4	14	4	8	6	10
Nitrate + Nitrite (as N)	mg/L	0.05	-	<0.05	0.14	<0.05	0.42	<0.05	0.14	<0.05	0.14	<0.05	0.09	<0.05	0.12	<0.05	0.12	<0.05	0.19
Nitrate (as N)	mg/L	0.05	13	<0.05	0.14	<0.05	0.41	<0.05	0.14	0.05	0.14	<0.05	0.09	0.06	0.12	<0.05	0.12	<0.05	0.19
Nitrite (N)	mg/L	0.01	0.06	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Nitrogen (Ammonia Nitrogen)	mg/L	0.05	-	<0.05	0.08	<0.05	0.07	<0.05	<0.05	<0.05	0.07	<0.05	<0.05	<0.05	0.05	<0.05	<0.05	<0.05	0.06
Total Kjeldahl Nitrogen (TKN)	mg/L	0.1		0.3	0.5	0.3	2	0.3	1.2	0.3	2	0	0	0.3	0.9	0.3	0.5	0.4	1.1
Total Nitrogen	mg/L			0.21	0.41	0.2	0.28	0.21	0.37	0.21	0.57	0	0	0.17	0.32	0.16	0.29	0.31	0.55
Total Org. Carbon (by UV)	mg/L	0.5	-	3.2	15	4.4	14	3	23	5.1	18	4.4	28	4	20	3.2	18	11	32
Ortho Phosphate (as P)	mg/L	0.01	-	<0.01	<0.01	<0.01	0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.02	<0.01	0.01
Phosphorus	mg/L	0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	5.3	<0.1	<0.1	<0.1	0.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
pH	units	0.1	>6.5;<9.0	5.11	7.65	4.88	7.45	4.65	6.57	4.65	6.22	4.47	6.32	4.69	6.6	4.92	6.12	4.85	5.81
Reactive Silica (as SiO_2)	mg/L	0.5	-	<0.5	2.4	<0.5	2.3	0.8	3.5	<0.5	3.8	0.7	5.1	1.9	10	0.5	3.4	2.6	3.9
Dissolved Chloride (Cl)	mg/L	1	-	3	6	3	8	4	12	3	8	4	9.4	3	8	3	5	4	6
Calcium	mg/L	0.1	-	0.9	1.6	1	2.4	0.9	3.7	0.8	2.4	1	11	1	3.6	1	1.8	1.6	2.8
Magnesium	mg/L	0.1	-	0.4	0.7	0.4	0.7	0.4	1.3	0.3	1	0.5	2.2	0.5	1.2	0.5	0.8	0.5	0.7
Potassium	mg/L	0.1	-	0.2	0.4	0.2	0.4	0.1	0.5	0.2	0.6	1.1	4.1	0.3	0.6	0.1	0.4	0.7	0.9
Sodium	mg/L	0.1	-	2.1	3.9	2.2	6.1	2.3	6.8	2	15	2.4	4.4	2.3	4.3	2.2	2.8	2.1	3.5
Dissolved Sulphate (SO4)	mg/L	2	-	<2	4	2	4	<2.0	10	3	6.6	<2	<2	<2	9.2	<2	<2	<2	<2
Conductivity	uS/cm	1	-	22	36	23	37	26	59	20	41	27	59	25	49	23	33	31	37
Turbidity	NTU	0.1	-	0.5	9.1	0.5	3.7	0.2	3.1	0.3	2.1	0.3	5.3	0.2	36	0.2	2.2	0.3	1.6
Total Suspended Solids	mg/L	2	-	<1	50	<1	11	1.6	12	1	10	<2	220	<1	31	<2	13	2	120
RCAP CALCULATIONS																			
Anion Sum	meq/L	-	-	0.0816	0.36	0.0722	0.34	0.1	0.537	0.0836	0.39	0.0989	0.49	0.0841	0.316	0.0789	0.143	0.0994	0.173
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	1	-	<1	<1	0	0	<1.0	5	<1	<1	<1	12.3	<1	6	<1	<1	<1	<1
Calculated TDS	mg/L	0.1	-	8	20	8	22	12	36	8	28	11	59.2	11	27.7	8	14	13	16
Carb. Alkalinity (calc. as CaCO3)	mg/L	1	-	<1	<1	<1	<1	<1.0	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Cation Sum	meq/L	0.10	-	0.191	0.313	0.216	0.45	0.2	0.587	0.181	0.79	0.253	1.34	0.204	0.502	0.21	0.288	0.254	0.402
Elements (ICP-MS)																			
Total Aluminum (Al)	µg/L	10	5-100 (Range)	72	325	80	284	65	446	<2.0	320	167	3000	159	650	113	385	211	559
Total Antimony (Sb)	µg/L	2	-	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2	<2	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Arsenic (As)	µg/L	2	5	4.4	39.9	5.1	54.2	<2.0	3.7	<2.0	2.8	2	6.6	2.1	25.5	<2.0	4.7	2.5	8.1
Total Barium (Ba)	µg/L	5	-	<5	6.9	<5.0	6.6	<5.0	7.6	<5.0	6.8	5.5	130	5.2	25	<5.0	7.3	5	7.3
Total Beryllium (Be)	µg/L	2	-	<2.0	<2.0	<2.0	<2.0	<2.0	<2	<2.0	<2.0	<2	<2	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Bismuth (Bi)	µg/L	2	-	2.2	2.2	<2.0	<2.0	<2.0	2	<2.0	<2.0	<2	<2	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Boron (B)	µg/L	5	-	<5.0	13.6	<5.0	9.7	<5.0	9	<5.0	9	5	10.4	<5.0	12	<5.0	7	<5.0	9.3
Total Cadmium (Cd)	µg/L	0.3	0.017	0.018	0.049	0.02	0.035	<0.017	0.036	<0.017	0.09	0.03	0.062	0.018	0.074	<0.017	0.04	0.024	0.045
Total Chromium (Cr)	µg/L	2	3.5	>2.0	>2.0	<2.0	6	<2.0	<2.0	<2.0	4	<2	<2	<2.0	3.4	<2.0	<2.0	<2.0	<2.0
Total Cobalt (Co)	µg/L	<0.4	-	<0.40	0.51	<0.40	0.5	<0.40	0.91	<0.40	2.8	0.45	25	<0.40	0.5	<0.40	0.63	<0.40	0.66
Total Copper (Cu)	µg/L	2	2-4 (Range)	<2.0	2.3	<2.0	<2.0	<2.0	<2.0	<2.0	4.1	<2	4.9	3.5	3.5	<2.0	<2.0	<2.0	<2.0
Total Iron (Fe)	µg/L	50	300	186	1200	170	1080	91	610	151	1180	212	8900	119	1200	115	418	309	979

TABLE 7.1: MINIMUM AND MAXIMUM VALUES OF SURFACE WATER PARAMETERS MEASURED AT EIGHT SAMPLING LOCATIONS ON THE TOUQUOY GOLD PROJECT SITE BETWEEN 1 SEPTEMBER 2004 AND 18 JANUARY 2007

	Units	RDL	CCME 2003*	SW1		SW2		SW3		SW4		SW5		SW6		SW7		SW8	
				MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX
Total Lead (Pb)	µg/L	0.5	1-7 (Range)	0.5	0.95	<0.50	3.4	<0.50	0.97	<0.50	2	<.5	23	<0.50	1.7	<0.50	0.62	0.52	1.28
Total Manganese (Mn)	µg/L	2	-	18.4	112	31	105	12.9	141	36	480	191	7600	27.3	90	33.8	147	56.6	133
Total Mercury (Hg)	µg/L	0.01	0.1	<0.01	0.01	<0.01	0.01	<0.01	<0.01	<0.01	<0.1	<0.01	<0.01	<0.01	<0.1	<0.01	<0.01	0.02	0.02
Total Molybdenum (Mo)	µg/L	2	73	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2	<2	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Nickel (Ni)	µg/L	2	25-150 (Range)	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	17	17	<2	4.6	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Selenium (Se)	µg/L	2	1	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.6	1.6	<1	2.7	1.2	1.2	<1.0	<1.0	<1.0	<1.0
Total Silver (Ag)	µg/L	0.5	0.1	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<.1	<.1	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Total Strontium (Sr)	µg/L	5	-	5	10	5.4	9	<5	16	5	12	<5	55	6.5	26	5.2	7.6	8	12.2
Total Thallium (Tl)	µg/L	0.1	0.8	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<.1	<.1	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Total Tin (Sn)	µg/L	2	-	<0.10	<0.10	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2	<2	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Titanium (Ti)	µg/L	2	-	<2.0	3	<2.0	3.8	<2.0	4	<2.0	6.5	<2	34	2	13	<2.0	2.3	2.9	7
Total Uranium (U)	µg/L	0.1	-	<0.10	0.1	<0.10	<0.10	<0.10	0.1	<0.10	<0.10	0.4	0.4	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Total Vanadium (V)	µg/L	2	-	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2	3.8	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Zinc (Zn)	µg/L	5	30	<5	52	<5	36	<5.0	48	5	55	6.5	35	5.1	20	<5.0	12.2	8.8	13.3
Strong Acid Dissoc. Cyanide (CN)	mg/L	0.002		<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	0.002	0	0	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
E. Coli (Colilert)	MPN/100ml			0	12	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Total Coliform (Colilert)	MPN/100ml			0	0	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

NC = Non-calculable
NS= Not sampled
RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
1. Maximum Acceptable Concentration
2. Asthetic Objective
3. Interim Maximum Acceptable Concentration

The majority of metal levels are below detectable levels. Aluminum, iron and manganese exceed the Canadian Council of the Ministries of Environment (CCME) guidelines for freshwater aquatic life (FWAL) at all stations, a feature of Nova Scotia surface waters. Arsenic concentrations fluctuate in the sampling stations, in particular in Moose River where in the summer (lower water flow) this metal was elevated above the CCME guidelines for freshwater aquatic life. Arsenopyrite is common in the geology of the area. Lead, cadmium and copper fluctuate throughout the year at most stations and sometimes slightly exceeding the CCME FWAL guideline.

Mercury was only detected at SW station 8 (0.02 mg/L) at near detection limits (0.01 mg/L).

Sediment Quality

Single surficial sediment grab samples were collected on January 25, 2007 from ten locations on the Project and surrounding area watercourses (Figure 5.1). Three of these locations had organic substrate not suitable for chemical analysis for soils. Table 7.2 shows the baseline concentrations of metals, percent moisture, and grain size analysis and compares the values with CCME freshwater sediment quality guidelines. All concentrations of metals are total values.

Table 7.2: Metals Concentrations in Sediments Collected from the Touquoy Gold Project Site on January 25, 2007

	Units	RDL	ISQG - PEL	SED 1	SED 2	SED 3	SED 4	SED 7	SED 8	SED 9
Metals										
Total Aluminum (Al)	mg/kg	100		58000	64000	70000	25000	70000	72000	36000
Total Antimony (Sb)	mg/kg	2		<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Arsenic (As)	mg/kg	2	5.9-17.0	66	340	200	15	23	17	15
Total Barium (Ba)	mg/kg	5		370	380	540	150	470	410	280
Total Beryllium (Be)	mg/kg	2		<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Cadmium (Cd)	mg/kg	0.15	0.6-3.5	<0.15	<0.15	0.33	<0.15	<0.15	<0.15	0.58
Total Chromium (Cr)	mg/kg	2	37.3-90.0	46	47	52	17	48	51	71
Total Cobalt (Co)	mg/kg	1		26	15	22	1.9	15	7.1	9.1
Total Copper (Cu)	mg/kg	2	35.7-197.0	15	21	23	4	11	19	42
Total Cyanide (CN)	mg/kg	0.5		ND	ND	ND	ND	ND	ND	2.1
Total Iron (Fe)	mg/kg	50		27000	33000	33000	4400	33000	28000	57000
Total Lead (Pb)	mg/kg	0.5	35.0-91.3	20	16	45	10	18	15	1100
Total Manganese (Mn)	mg/kg	2		2500	1200	2000	180	560	500	600
Total Mercury (Hg)	mg/kg	0.01	0.17-0.48	<0.01	0.52	0.44	0.16	0.07	0.04	0.22
Total Molybdenum (Mo)	mg/kg	2		<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Nickel (Ni)	mg/kg	2		38	18	23	2.8	17	17	9.7
Total Selenium (Se)	mg/kg	2		<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0

Table 7.2: Metals Concentrations in Sediments Collected from the Touquoy Gold Project Site on January 25, 2007

	Units	RDL	ISQG - PEL	SED 1	SED 2	SED 3	SED 4	SED 7	SED 8	SED 9
Total Strontium (Sr)	mg/kg	5		70	55	85	57	69	75	57
Total Thallium (Tl)	mg/kg	0.1		0.4	0.47	0.51	0.2	0.55	0.47	0.28
Total Tin (Sn)	mg/kg	2		<2.0	2.1	2.9	<2.0	2.5	2.1	9.8
Total Uranium (U)	mg/kg	0.1		1.8	1.3	2	0.72	1.4	1.8	1
Total Vanadium (V)	mg/kg	2		57	70	77	29	77	78	50
Total Zinc (Zn)	mg/kg	5	123.0-315.0	79	71	91	17	62	65	150
Physical Parameters										
% Moisture	%			11	24	19	75	48	35	84
Grain Size	% gravel			36	43	22	0	3	48	1
	% sand			61	54	33	83	70	36	55
	% fines			3	3	45	17	27	16	44

Note: samples 5,6,and 10 100% organic

As described in the Section 2.1, following the initial discovery of gold at Moose River in 1866 as many as fifteen shafts and eight pits were established. Three stamp mills and associated dams to provide power were established on Moose River itself in the immediate vicinity of the workings. The mine stopped operating in 1936. Therefore, it can be assumed there was a likely anthropogenic effect on Moose River aquatic life and habitat from the operations at that time. However, Moose River sediments are coarse, gravel, cobbles and boulders with very little fines. Sediment transport would have moved much of any contaminated sediments downstream over the past 70 years. Overall, there was considerable variety in sediment quality between sampling stations.

Arsenic levels above the CCME probable effects level (PEL) were found at Sediment Sites 1, 2, 3, 5, 6, 7 and 8. Sites 1, 6, 7 and 8 are above the existing open pit or in a different catchment. All the locations exceed the CCME interim sediment quality guideline (ISQG). Arsenic is a naturally occurring element in the earth's crust, and is found throughout the environment, there fore, being a gold mining area rich in compounds containing arsenic (*eg*. arsenopyrite), these concentrations indicate natural geological levels (Section 8.0 Geology). Arsenic concentrations in soils around mine sites have been reported as high as 4,700 ppm. The levels of arsenic in the 100s of mg/kg indicate further investigation through monitoring is warranted.

Only Station 5 (0.81 mg/kg) exceeds the ISGQ (0.6 mg/kg) but not the PEL (3.5 mg/kg) limits for cadmium. Station 9 along the shore of Scraggy Lake is close to the ISGQ at 0.58 mg/kg.

Sediment at Site 3, 5, 6 and 10 exceed the ISQG limit (35 mg/kg Pb) for lead but not the PEL limit (91.3 mg/kg Pb). Sediment from the shore at Scraggy Lake far exceeded both limits at 1100 mg/kg Pb. Such a high concentration in a relatively pristine area appears to be anomalous and suggests that the lake requires further investigation.

Mercury deposits occur in all types of rocks and present in the atmosphere as metallic mercury vapours and as volatized organic mercury compounds. Mercury is used in the chlor-alkali industry, pulp and paper manufacture, thermometers, electrical equipment, dental amalgams and some medicinal compounds. Mercury-based pesticides are no longer used and no mining of mercury in Canada has occurred since 1975. Mercury was found at Sites 3 and 9 at concentrations above the ISQG limit (0.17 mg/kg), and at Site 2 (0.52 mg/kg) above the PEL (0.48 mg/kg). It was detected at all sites between concentrations of 0.02 to 0.16 mg/kg.

The concentration of zinc was relatively consistent across all sites. Site 9 at 150 mg/kg was elevated above the ISQG limit of 123.0 mg/kg, but well below the PEL of 315.0 mg/kg.

Cyanide was included in the analysis to monitor for its presence once the mine is operating. Cyanide is naturally present in some foods and in certain plants such as cassava (tropical). Cyanide is contained in over 800 plant species, some foods and a great number of microorganisms, cigarette smoke and the combustion products of synthetic materials such as plastics. In manufacturing, cyanide is used to make paper, textiles, and plastics. It is present in the chemicals used to develop photographs. Cyanide salts are used in metallurgy for electroplating, metal cleaning, and removing gold from its ore. Cyanide gas is used to exterminate pests and vermin in ships and buildings. If accidentally ingested (swallowed), chemicals found in acetonitrile-based products that are used to remove artificial nails can produce cyanide. Cyanide was not used in the previous milling operations.

Cyanide was detected at low levels in Sites 5, 9 and 10, all sites that are well removed from the existing open pit. It was below detection limit of 0.5 mg/kg at all other sites.

7.2 POTENTIAL EFFECTS, PROPOSED MITIGATION, AND FOLLOW-UP MONITORING

Potential Project-related effects on surface water include:

- Reduced water quality from sedimentation/siltation, deposition of fines during construction, operation and decommissioning;
- Introduction of contaminants (*e.g.*, nitrate) from blasting operations and pit dewatering;
- Contaminated effluent released into Scraggy Lake from the tailings and polishing ponds;
- Excessive water withdrawal from Square Lake; and
- Contamination of surface water from spills of hazardous materials stored on site during mine construction and operation.

DFO developed the Policy for the Management of Fish Habitat (1986) which applies to all Projects and activities, large or small, in or near water that could alter, disrupt or destroy fish habitats by chemical, physical or biological means. The guiding principle of this policy is to achieve no net loss of the productive capacity of fish habitats. The policy is regulated by Sections 20 to 42 of the federal *Fisheries Act*.

Erosion and Sediment Control

A small tributary of the Moose River runs through the mine site. All pipelines *(i.e.* supply pipeline from Square Lake, reclaim pipeline and tailings outflow pipeline) will be double walled and suspended by supports over the watercourse to avoid disturbance.

A new haul road will be constructed south of and parallel to the existing Mooseland Road. A concrete bottomless box culvert will be installed well beyond the banks of the tributary to avoid harmful effects to fish habitat. Erosion and sedimentation controls will be practiced as per the NSEL Erosion and Sedimentation Control Handbook for Construction Sites.

An obsolete logging road on the west side of Moose River is proposed to be upgraded to permit public access around the mine site on the east side of Moose River. A tributary to the Moose River flows across this road. The watercourse is narrow and shallow, no more than one metre wide at the crossing location and is not navigable (Photo 5). This watercourse was crossed without a protective crossing device. The proposed water crossing over the proposed access road on the west side of the Moose River will entail an open bottom bridging (*i.e.* box culvert) structure and to be installed outside of the watercourse channel.

Photo 5. Small tributary to Moose River (east of Moose River).

Clearing, grubbing, and topsoil stripping activities during construction can increase the potential for sediment erosion and deposition downgradient, particularly during periods of heavy rainfall or snowmelt. Site surface runoff will be directed to the pit floor and the tailings pond for containment. During construction, operation and decommissioning all mitigation and monitoring in accordance with the NSEL *Erosion and Sedimentation Control: Handbook for Construction Sites* will be taken to minimise erosion and resulting sedimentation on the site. All required steps will be taken to prevent silt-laden water from entering watercourses in the area. Drainage ditches will be built around the toes of stockpiled material to minimise transport of sediment on site, and to reduce the amount of sediment-laden runoff entering watercourses. Water collected from on-site drainage ditches will be diverted to the tailings management area or other on-site sedimentation ponds.

Blasting

Blasting adjacent to Moose River could cause direct deleterious effects on fish health, death or damage to fish eggs and fry, excessive dust deposited in streams, and or disturbance to the habitat. All discharges from the pit will be directed to the tailings pond. Blasting shall be conducted in accordance with the Pit and Quarry Guidelines and the Guidelines for use of Explosives in or Near Canadian Fisheries Waters (Wright and Hopky 1998). In addition, blasting may result in chemical impacts on fish (*e.g.*, due to release of ammonia). Although ammonia is a nutrient required for life, ammonia is toxic in its ionic form, which occurs in high pH environments. Experiments have shown that the lethal concentration for a variety of fish species ranges from 0.2 to 2.0 mg/l. At present, no regulatory agency has identified a separation distance between an area in which ammonia-based explosives are used and a waterbody. Water quality will continue to be monitored on a monthly basis to evaluate the effects of nitrate on the local watercourses.

Pit Dewatering

A preliminary review and prediction on the resultant water quality in the Pit after re-filling was completed. The inputs to the Pit refilling are roughly equal between direct precipitation, groundwater and surface water regimes and will therefore result in water quality similar to that of the waterbodies on the area. The best indication of what the resultant final water quality after mining will be to assess pit water quality during the first few years of operations. This will be when direct precipitation, limited surface water inputs and groundwater will all be mixing in the Pit sumps. DDVG intends to monitor the water removed form the Pit as part of the dewatering programs and will therefore have abundant information to better define the predicted water quality in the Pit after mine operations cease. As previously noted the site features are such that the amount of surface water inputs to the Pit refilling can be modified to assist in creating a water quality that is similar to local waterbodies and therefore able to support aquatic life.

Tailings Effluent

The effects of past gold mining activities in the Shubenacadie River headwaters (*i.e.* Waverley area) is likely prevalent on most regulators minds. An assessment of the impacts of past practices was studied and reported by Environment Canada. During the 1800s and until the 1930s there were no regulations governing the disposal operations of mill tailings. Mine tailings were dumped directly into wetlands, stream and rivers resulting in widespread contamination in groundwater, sediments and aquatic biota. Tailings were also used for road, railway and construction. Movement of acid mine drainage through abandoned shafts mobilized metals into the groundwater. These resulting effects of poor mining management is a practice of the past and will not occur on this Project.

Wastewater generated at the mine, including mill water, will be directed to the tailings management area. All releases from the tailing management area will be monitored for compliance with established regulatory criteria for water quality. The discharge of treated effluent from the Tailings Management Facility will be monitored under a mandatory environmental effects monitoring (EEM) program prescribed by Environment Canada. The Metal Mining Effluent Regulations (MMER) has a prescriptive EEM program that all metal mines must follow. Scraggy Lake will be subjected to extensive evaluations of fish health, sediment, and water quality.

The operating plan for the TMF makes it an integral part of site operation. The tailings dam will be raised and water reclaimed for process activities year-round. Treatment of tailings water for arsenic and subsequent release will be conducted from April to December each year. Measurement of flows to the tailings pond, treatment facility, reclaim, and discharge will be continuous to ensure that operations comply with the guidelines specified in the facility water balance.

The TMF will be subject to active management which will entail visual inspections on a shift-to-shift basis and documented monthly and seasonal inspections. Ongoing monitoring will include measurement of dam wall settlement, phreatic and pond water levels, seepage, and water quality. Periodic monitoring on a bi-annual basis will measure pond depth, tailings beach angle, and tailings density to ensure that facility performance is consistent with the TMF management plan.

The dam is designed to manage inflows from the projected 1/100 year storm event in a wet year over a 24 hour period. Spillways are designed into the dam structures to ensure that inflows in excess of these amounts can be managed in extreme circumstances. The operating plan calls for the draining of the treatment/polishing ponds each winter. This will ensure that additional holding capacity is available during the spring melt if required.

The TMF dam will be constructed of mine waste rock for structural strength and designed to provide an adequate factor of safety under prevailing seismic conditions. Dam walls will possess a low-permeability clay core keyed into bedrock to inhibit seepage. Tailings will be discharged along the inside of the dam wall to create a low permeability barrier layer that will further reduce the passage of water through the dam wall. Seepage collection ditches will be built with collected water accumulating there being pumped back into the tailings pond.

Impacts on surrounding areas from dusting of the tailings beach are expected to be minimal given the moist climate in the region. In the event that dusting does become an issue tailings discharge will relocated to ensure that the beach remains wet and that dusting is minimized.

To ensure appropriate mitigation of potential effects of Project activities on fish habitat in the tributaries to Moose River and Moose River, baseline conditions will continue to be monitored, with monitoring to continue through the life of the Project. Further baseline surveys are required for Square Lake and Scraggy Lake on fish species presence, fish habitat and water and sediment quality.

The dispersion and settling of fine particulate matter in the streams and lakes from blasting or discharge of water from the quarry site, may over the life of the Project, result in an alteration of water quality and stream and lake substrates. Suspended particulate matter levels in air are regulated through the province. A buffer will be left along the tributaries to Moose River, the Moose River. Square Lake and Scraggy Lake are far removed from the mine footprint. A dust monitoring program will be implemented with monitoring parameters and locations determined in consultation with NSEL and submitted in the Industrial Approval. Potential impacts to the water quality of Scraggy Lakes will be considered when determining the appropriate monitoring locations for the MMER. The water sampling program component commences after the 90 day production evaluation period from the first day of operation.

Mitigative measures to prevent and/or minimize erosion and subsequent sedimentation include:

- provide suitable area for settling ponds and an appropriate time period for the settling of suspended materials prior to discharge;
- direct clean surface water away from exposed/disturbed areas, to the extent practical;
- placement of free-draining material (*i.e.*, blasted rock) over disturbed work areas;
- stabilization of stockpiled overburden and topsoil with hydroseed and/or mulch for future use during reclamation; and

- implement a progressive rehabilitation plan to ensure inactive/depleted areas are reclaimed and stabilized/revegetated.

Arsenic in the water and sediment is accumulated in the biota and does not appear to biomagnify (Eaton and Clair 1985). There is no clear correlation between fish morphology and tissue concentration. Mercury and arsenic are bound to the suspended particles in the water column and will settle into the sediment. High grade metamorphic rock (*e.g.*, gneiss) coupled with oligotrophic lake conditions (*i.e.*, alkalinity as $CaCO_3$ < 30 ppm and pH < 7) create conditions favourable for inorganic mercury to become soluble in water. Alkalinity in watercourses is low due to the acidic precipitation and the surrounding igneous and metamorphic geological settings which is resistant to weathering and contain little carbonate. The local geology is not considered to be a significant producer of mercury; therefore, mercury levels are not anticipated to increase above present levels in the sediments and fish as a result of mining. The proposed Project is not expected to result in increased levels of mercury and arsenic in area lakes.

All on-site fuels and lubricants will be properly handled and stored at the required distance from all watercourses and ditches. Any hazardous material spilled onsite will be contained within the pit and property boundaries and handled in accordance with DDVG's Hazardous Materials Response and Contingency Plans. DDVG's Hazardous Materials Response Plan will provide procedures for fuelling of equipment and handling/storage of hazardous material on site to prevent contamination of the environment. Timely and effective cleanup of such material will mitigate any potential downstream effect. Also, due to distance, significant impacts are not anticipated due to natural attenuation primarily by dilution and dispersion along the groundwater pathways. Site monitoring (*i.e.*, parameters and frequency) will be conducted in accordance with NSEL approval conditions.

Water Withdrawal From Square Lake

Water withdrawal from Square Lake is proposed for use in initial ore processing until the tailings pond contains sufficient water for that purpose. A shoreline intake will be constructed and installed in accordance with DFO Freshwater Intake End-of-Pipe Fish Screen Guideline (1995). Estimates of water requirements provided by DDVG are for an average of 4,500 m^3/d during the period from October through March only, and only for the first year of operation. In subsequent years, sufficient supply will exist in the tailings pond, however, occasional use of up to 50 m^3/d may be required.

A bathymetry survey was completed in the summer of 2006 for Square Lake to estimate available water volume contained in the Lake at varying lake depth. The survey indicated that lake volume is approximately 630,000 m^3, at normal lake level (approximately 129 masl). Maximum lake depth is approximately 4 m and lake surface area is approximately 33 ha.

Based on the hydrologic budget completed for the mine site area, sustainability of the water supply from Square Lake was examined. A simple monthly water balance for the lake was developed, accounting for inputs from precipitation, snowmelt, and runoff from the contributing drainage area, as predicted using the water budget model. Losses included lake evaporation and the proposed water withdrawal.

In addition to supply from Square Lake, use of water from the existing pit on site was also incorporated into the calculations to satisfy demand. It is estimated that the pit currently contains approximately 40,000 m^3 of water available for use. It is proposed to withdraw water from this pit first, before withdrawals are made from Square Lake. The existing volume should satisfy about one month of initial start-up demand. Subsequently, recharge from rainfall and runoff to this pit can also be used to supplement demand.

With inclusion of existing pit water, results indicate that under average climate conditions (based on the period from 1968 to 2003), the cumulative withdrawal rate over the 6 month period from October to March would not result in any significant loss of water from Square Lake, as the initial pit volume satisfies demand the first month and the inputs from rain/melt/runoff for the lake and pit offset the demand each subsequent month. Table 7.3 summarizes the input volumes to Square Lake and the existing pit for each month during the proposed withdrawal period. The table also indicates impacts on Square Lake volume and water level, given the net inputs and proposed water withdrawal. As shown in the table, a maximum volume loss of 6% could occur during the month of February, but rebound to normal levels in March. This assumes that the lake is at its average level at the start of the withdrawal period. Additional calculation details are provided in Appendix G.

TABLE 7.3: SQUARE LAKE WATER WITHDRAWAL SUMMARY

	Volumes (m^3)	Sep	Oct	Nov	Dec	Jan	Feb	Mar
Square Lake	Rain/Melt Input[1]	33,372	39,375	43,157	36,522	30,234	31,966	58,886
	Runoff Input[2]	13,843	30,085	58,558	76,677	78,118	82,014	118,549
	Evaporation[3]	22,770	13,299	0	0	0	0	0
	Net Input	24,446	56,160	101,715	113,199	108,353	113,980	177,435
Existing Pit	Rain/Melt Input[1]	526	620	680	575	476	504	928
	Runoff Input[2]	761	1,653	3,217	4,213	4,292	4,506	6,514
	Evaporation[3]	359	210	0	0	0	0	0
	Net Input	928	2,064	3,898	4,789	4,769	5,010	7,442
Total Inputs[4]		25,373	183,224	105,612	117,988	113,121	118,990	184,876
Water Withdrawal		0	135,000	135,000	135,000	135,000	135,000	135,000
Existing Pit Volume[5]		125,000	0	0	0	0	0	0
Square Lake Volume[5]		627,225	675,449	646,062	629,050	607,171	591,161	641,037
Square Lake Level (m)		129.0	129.2	129.1	129.0	129.0	128.9	129.1
% of Original Lake Volume		100	108	103	100	97	94	102

Notes:
1. Represents rainfall input and snowmelt directly above lake/pit surface area.
2. Represents runoff input from surrounding catchment area.
3. Represents evaporation from water surface area.
4. Net combined monthly inputs to Square Lake and existing pit. For October, input also includes the existing volume in the pit.
5. Volume remaining at end of month

The above analysis indicates that under average conditions, sufficient water would be available in Square Lake to meet demand during the initial 6 month period. This withdrawal would have a negligible effect on the flow in Fish River. Subsequent demand is estimated to be 90 times less (i.e. 50 m^3/d) and thus would have a negligible impact on water levels in and outflows from Square Lake.

7.3 SUMMARY

In summary, assuming that the mitigation measures to control erosion and sedimentation are applied, significant adverse effects from construction and operation of the Touquoy Project are not anticipated on surface water resources. Water withdrawal from Square Lake will only occur during initial site set-up over a five month period and only periodically on an as-needed basis of such low volumes as to be negligible to measurable. Only for two months where six and three percent of the lake volume will be required, therefore, no significant adverse effects on Square Lake aquatic resources are expected. The discharge of treated mine effluent is controlled by legislation under Environment Canada for metal mines. The effluent must meet the limit put in place to protect the aquatic environment and the effects monitoring program will ensure that operational discharges are compliant. Therefore, no significant adverse effects on fish resources from tailings effluent on Scraggy Lake are expected.

8.0 GEOLOGY AND HYDROGEOLOGY

8.1 EXISTING ENVIRONMENT

8.1.1 BEDROCK GEOLOGY

The study area is located within the Meguma Group, a series of Cambro-Ordovician greywackes and argillites which underlie about half of the province of Nova Scotia. Unlike most gold deposits within the Meguma Group the Touquoy Gold Deposit is characterised by gold mineralization disseminated throughout the host argillites as well as within quartz veins. The resultant wide intervals of gold mineralization, therefore, lend this deposit well to open pit mining.

Areas containing elevated gold levels also tend to have elevated concentrations of arsenic. Arsenic is an oxyanionic, group V metalloid. In natural waters, the dominant species is trivalent arsenite, As (III), and pentavalent arsenate, As (V). Arsenic is ubiquitous in igneous, metamorphic, and sedimentary rocks and may be concentrated in sulphide mineral deposits. Arsenopyrite is the prevalent arsenic-sulphide mineral at Touquoy.

Geochemical analyses of 84 waste rock and 11 low grade ore samples from Touquoy drill core yielded arsenic concentrations varying from 8 to 15,000 ppm. The median value was 155 ppm and the average 1042 ppm. The difference between the median and mean values indicates that localized pockets of high arsenic concentration overprint lower grade, widely-distributed background levels. The figure of 0.1% arsenic by volume in the solids tailings reflects the average of all the samples tested. In addition, the six samples representing ore from five different areas of the pit and one master composite were analyzed for arsenic as part of the metallurgical test program conducted by METCON. Head assays for arsenic in the composites varied from 784 to 1815 ppm with the master composite returning a value of 1495 ppm.

Acid Rock Drainage

Static Testing

Table 8.1 indicates that the average neutralizing potential (NP) ratio for each material type exceeds 4.0. As such, the waste rock and marginal ore is considered unlikely to generate acidity using the guidelines outlined in Price (1997) and described in Section 3.2.1 of the Stage 1 Geochemical Study by Golder Associates.

TABLE 8.1: NP/AP RATIOS FOR VARIOUS MATERIAL TYPES

Material Type	NP/AP Ratio		
	Min	Max	Av
Argillite (5-49% Greywacke)	3.5	49.8	10.7
Argillite (< 5% Greywacke)	0.4	25.6	4.4
Composite	2.4	63.7	9.1
Greywacke (20-60% Argillite)	2.1	61.4	9.0
Greywacke (< 20% Argillite)	5.0	67.4	13.7
Tailings	---	---	6.3
Marginal Ore	---	---	4.4

Source: Table 5 of "Results of Stage 1 Geochemical Study, Static Testing of Waste Rock, Touquoy Project, Nova Scotia Canada" by Golder Associates.
Note: The data above is a summary, all NP/AP data is included in the Golder Report.

The tailings samples have a sufficient carbonate concentration (1.22%), which provides the majority of the neutralizing potential, to neutralize acid production as a result of sulphide oxidation. Using the Price classification system, the tailings did not have acid producing potential based on the CaNP/AP and NP/AP ratios.

Kinetic Testing

Arsenic can be mobile under mildly reducing conditions at high pH (9). Humidity cells have been established for one (1) tailings sample and nine (9) waste rock samples. All humidity cell testing to date shows that the pH of tailings will rapidly drop to a range of 7 to 8. This is a result of 1: the lowering of pH to 8.0-8.5 to facilitate the cyanide destruction reaction and 2: dilution and neutralization of tailings water in the TMF by runoff and precipitation which is mildly acidic.

Over 14 weeks, the tailings sample has shown a 6% decrease in pH from 7.8 to 7.4. Over four weeks the waste rock samples have shown an average decrease in pH of 1.5% all within the range of pH 7 to 8. These interim results are consistent with the ABA test results from the static leach tests and support the conclusion that there is little potential for acid rock drainage at Touquoy.

Humidity cell testing on tailings to date indicates that without treatment, dissolved arsenic reduces from 0.05 ppm to less than 0.005 ppm (CCME limit for receiving waters) over a period of 10 weeks at pHs ranging from 6.9 to 7.8.

Additional testwork to examine the mobility of arsenic in the TMF is also underway. This entails static leach tests on ground samples from each of the ore composites under varying pH conditions and full static and kinetic testing of the Touquoy West Bottom (area of the Pit) ore composite which will comprise the last ore processed and therefore the exposed surface of the beach at closure. Results are not expected to vary markedly from previous tailings leach testing conducted on the master ore composite. Similarly, arsenic mobility is expected to reduce as tailings pH drops upon deposition in the TMF.

8.1.2 SURFICIAL GEOLOGY

The surficial geology of the Project site consists mainly of quartzite till with drumlins developed from a mixture 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. The average thickness of the till is approximately three metres.

Surface soil samples collected in December 2006 from three locations were analyzed for metals, including mercury. Details of baseline soil metal concentrations are provided in Table 8.2. Sampling locations are depicted on Figure 5.1

TABLE 8.2: 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						
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
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**

Mercury was detected in all three 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 4800 to 27 000 mg/kg for iron and 2900 to 14 000 mg/kg for aluminum (Table 8.2).

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.

8.1.3 HYDROGEOLOGY

The Touquoy Gold Deposit site hydrogeology is described in detail in the Peter Clifton and Associates Report and provided in Appendix H. 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 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 Touquoy site, reflecting 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.

A series of geotechnical/hydrogeological drillholes (the WB Series) were sampled for groundwater quality in 2006 at the site in the Pit footprint (see Figure 5.1 for locations). The holes were purged using an airlift method and then sampled after fully developing and purging the well to obtain a representative groundwater sample. The water obtained from the drillholes represents groundwater from bedrock at the site. Groundwater samples from the 6 locations (WB-1, WB-2, WB-3, WB-4, WB-7 and WB-8) were analyzed for General Chemistry and metals. Results (included in Appendix I) indicate that groundwater is slightly basic (pH from 7.02 to 8.08) with elevated hardness (45- 160 mg/L) and possible road salt impacts at WB-8. Certain metals such as aluminum, arsenic, manganese, strontium and zinc are elevated relative to guidelines for drinking water in Canada but within ranges found in groundwater in Nova Scotia.

The actual volume of groundwater stored in the bedrock aquifer is 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. An ongoing testing program is expected to confirm earlier investigations that indicated the future mine operation will not negatively affect flow in the Moose River.

Geohydrological studies indicate that as the pit advances relatively minor de-watering will be required. Eight vertical monitoring 5½ inch diameter bores were drilled in December 2005 specifically, and successfully, targeting potential structural aquifers to depths beneath the optimized pit to evaluate groundwater flow in bedrock. Average depth of these bores was 108 m and the maximum depth 154 m. Air lift tests were conducted for up to 30 minutes at the completion of each hole. Water flows were negligible (zero to 0.5 litres per second) in seven of the holes with a maximum of five litres per second registered from the overburden in the eighth hole. With such modest groundwater flows in bedrock no boreholes were converted to trial production wells and no pump tests were conducted. With no substantial bedrock groundwater flows encountered within the pit shell dewatering of groundwater from the pit will likely commence by pumping from sumps. Groundwater data is provided in Appendix I.

Given the relatively shallow overburden (0 to 5 m) and the observation that only one hole of eight encountered any water in overburden, groundwater flow in till is expected to be minimal. Nevertheless, three – three metre deep trial pits were excavated during June 2006 at the western end of the proposed pit to evaluate groundwater flow in the till between the pit and Moose River, a minimum distance of 75 m, and to obtain a generalized estimate of expected inflow rates from till into the pit. With an estimated hydraulic conductivity of around 1m/day and a pit perimeter of 1800 m the expected daily inflow of 450 kl will be quite manageable with a ring drain and several sumps.

The main conclusion from the pit testing program is that the expected rates of groundwater seepage from the till into the open pit will be small. The rates of groundwater seepage into an open pit at Touquoy are expected to lie in the range between 100 kL/day (1.2 L/sec) to 1,000 kL/day (12 L/sec). Under ambient conditions only small variations in the amounts of water exchanged between the Moose River and the nearby shallow groundwater system can be expected. Groundwater yields from boreholes into the bedrock at the Touquoy site are likely to typically be much less than 1 L/sec.

Additional assessment work was completed at Moose River 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 and indicate temperatures from 16.9 to 19.6 °C and DO from 8.51 to 9.63 mg/L with no correlation between the two for this assessment.

This upwelling assessment data suggest that groundwater upwelling is not occurring through the portion of the Moose River that lies adjacent to the proposed Touquoy Pit.

This further indicates that the surface mine operation will not negatively affect flow in Moose River.

TABLE 8.3: SUMMARY OF UPWELLING POTENTIAL PARAMETERS

Station	Water Temperature (°C)	Dissolved Oxygen (mg/L)
Moose River Bridge	18.8	8.51
75 m d/s	17.9	8.50
140 m d/s	17.4	9.06
320 m d/s	16.4	9.06
510 m d/s	19.4	9.63
930 m d/s	19.6	9.47
1110 m/ds	19.6	9.47
1269 m d/s	19.6	9.47
1740 m d/s	19.6	9.47

d/s = distance downstream of Moose River bridge

8.2 POTENTIAL EFFECTS, PROPOSED MITIGATION, AND FOLLOW-UP MONITORING

Potential groundwater inflows from the glacial till above bedrock were investigated by digging test pits at four sites to the till/bedrock contact, and conducting pumping tests from these pits.

Potential effects on watercourses in the area may include:

- Increased erosion and sedimentation resulting from the construction and operation of the mine site;
- Potential changes to Moose River flow regimes associated with pit construction; and
- Potential groundwater contamination from the Tailings Management Facility

Waste rock piles will also be progressively revegetated to enhance soil stability and minimize sediment transport. Additional specific environmental mitigation plans will include:

- Erosion and Sedimentation Plan-Construction, Operation and Decommissioning
- Environmental Protection Plan (EPP) prior to construction
- Hazardous Materials Management Plan

- Emergency Response Plan
- Environmental Effects Monitoring Plan

Groundwater connectivity evaluation between the existing open 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. DDVG 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 potential for groundwater contamination from the Tailings Management Facility is low. The groundwater table in the area is near surface which will inhibit inflow by maintaining a low flow gradient. In addition, the permeability of the tailings is quite low and a perimeter cut-off will be included in the design. This cut-off will be part of the low permeability zone within the perimeter dam that will be tied into the underlying low permeability clay or solid bedrock. Seepage through the tailings dam wall is expected to be low. The clay core of the dam will exhibit permeability in the 1×10^{-6} m3/s range which will minimize the passage of tailings water through the dam wall. Tailings deposited along the inside of the dam wall will further reduce seepage. Any seepage which does occur will be captured in collection ditches and pumped back into the pond. For this reason, the impact of seepage on groundwater quality is expected to be negligible.

8.3 SUMMARY

In summary, significant adverse Project-related effects on groundwater resources from the Touquoy Project are not likely to occur.

9.0 TERRESTRIAL RESOURCES

9.1 EXISTING ENVIRONMENT

The following sub-sections describe the flora and fauna within the Project Study Area. Information on flora and fauna in the area was gained from many sources, including Roland's Flora of Nova Scotia, the Atlas of Breeding Birds of the Maritimes and the Nova Scotia Department of Natural Resources (NSDNR) regional biologist for the area. To augment this information, an environmental screening was completed by the Nova Scotia Museum (NSM) to overview known natural heritage resources in the general study area. Information on species at risk and species of concern from the Atlantic Canada Conservation Data Centre (ACCDC) and the NSDNR General Status Ranks of Wild Species in Nova Scotia and Significant Habitats and Species Databases were also included in this desktop review.

Field studies were conducted on the original Project site in 2004 and 2005 (Figure 5.1). Engineering studies and fish habitat considerations required modification of the original layout in early 2006 resulting in additional surveys being required to cover new areas not covered by the 2004 and 2005 surveys, most notably the improved location of the waste rock pile and tailings management area. Late summer surveys were conducted in the new waste rock area in 2006. Additional details on species and habitats present on the adjusted site were obtained via field studies in 2006 and 2007 (Figure 5.1). Further changes later in 2006 based on input from the Public Information Session included a road upgrading to the west of the existing pit. This upgrade will occur along currently-existing logging road, so the impact to flora and fauna will be minimized. Additional surveys will be conducted in 2007 to ensure the new areas are sufficiently assessed.

The Project site is approximately 10 km northwest of the Tangier Grand Lake Wilderness Area. This protected area consists of 16,000 ha of predominantly coniferous forest and has abundant lakes, wetlands, and waterways. Tangier Grand Lake is the most prominent feature of the area and is the largest of Nova Scotia's lakes without direct road access. The waterbodies within the wilderness area are contained within a separate watershed from that of the Project area which lies in the Fish River Watershed. As a result of its remoteness, the Tangier Grand Lake Wilderness Area is rich in wildlife, and is a popular destination for trout fishing and canoeing. This protected area is also home to a small herd of approximately 20 endangered mainland moose (*Alces alces americana*) ranging within the region encompassing the Tangier Grand Lake Wilderness Area (Parker 2003). Mainland moose are discussed further in Section 9.2.

Site
Major Drainage Area Boudaries
IEL-5 Nova Scotia Watershed Area Number
Expressway
Primary Highway
Water Areas
Wilderness Areas
Province of Nova Scotia

Figure 9.1
LOCATION OF TANGIER GRAND LAKE WILDERNESS AREA
Touquoy Gold Project, DDV Gold Ltd.
Halifax County, Nova Scotia

9.1.1 FLORA

Much of the vegetation on the site has been disturbed historically through forestry, mining, road building, housing activities, recreation and fire. As a result, there are a high percentage of coniferous trees as opposed to deciduous. While it is a mixed forest, it is dominated by spruce and balsam fir, with some maple, birch and aspen present in well-drained areas.

General habitats within the study area are located on Figure 9.2 (based on NSDNR cover types) and are described briefly below based on NSDNR airphoto interpretation and field surveys in 2004 and 2005 on the original Project site, and in 2006 on the adjusted Project site. A brief description of each habitat type present is provided below.

Coniferous Forest

Coniferous (softwood) forest consisting of red spruce (*Picea rubens*) and balsam fir (*Abies balsamea*) is the dominant forest habitat type within the study area. There are some areas dominated by white spruce (*Picea glauca*) near the existing mine area, while black spruce (*Picea mariana*) tends to dominate in wetter areas. These trees are generally second-growth. The understory/ground cover varies from open and moss-dominated to having typical groundcover species such as bunchberry (*Cornus canadensis*) and goldthread (*Coptis trifolia*).

Cutover Forest

There are also extensive areas of cutover forest, to the point that it is a common habitat type within the study area. Re-growth is predominantly shrub species, such as low-bush blueberry (*Vaccinium angustifolium)* and brambles (*Rubus* spp.), as well as black spruce. Cutovers prior to 2003 are presented in Figure 9.2. The areas in which the new proposed road development will occur on existing logging roads, therefore the land is currently disturbed.

Mixed Forest

A few small pockets of mixed wood forest occur within the southern portion of the study area. Forest cover is a mix of red spruce, balsam fir with red maple (*Acer rubrum*) and white birch (*Betula papyrifera*).

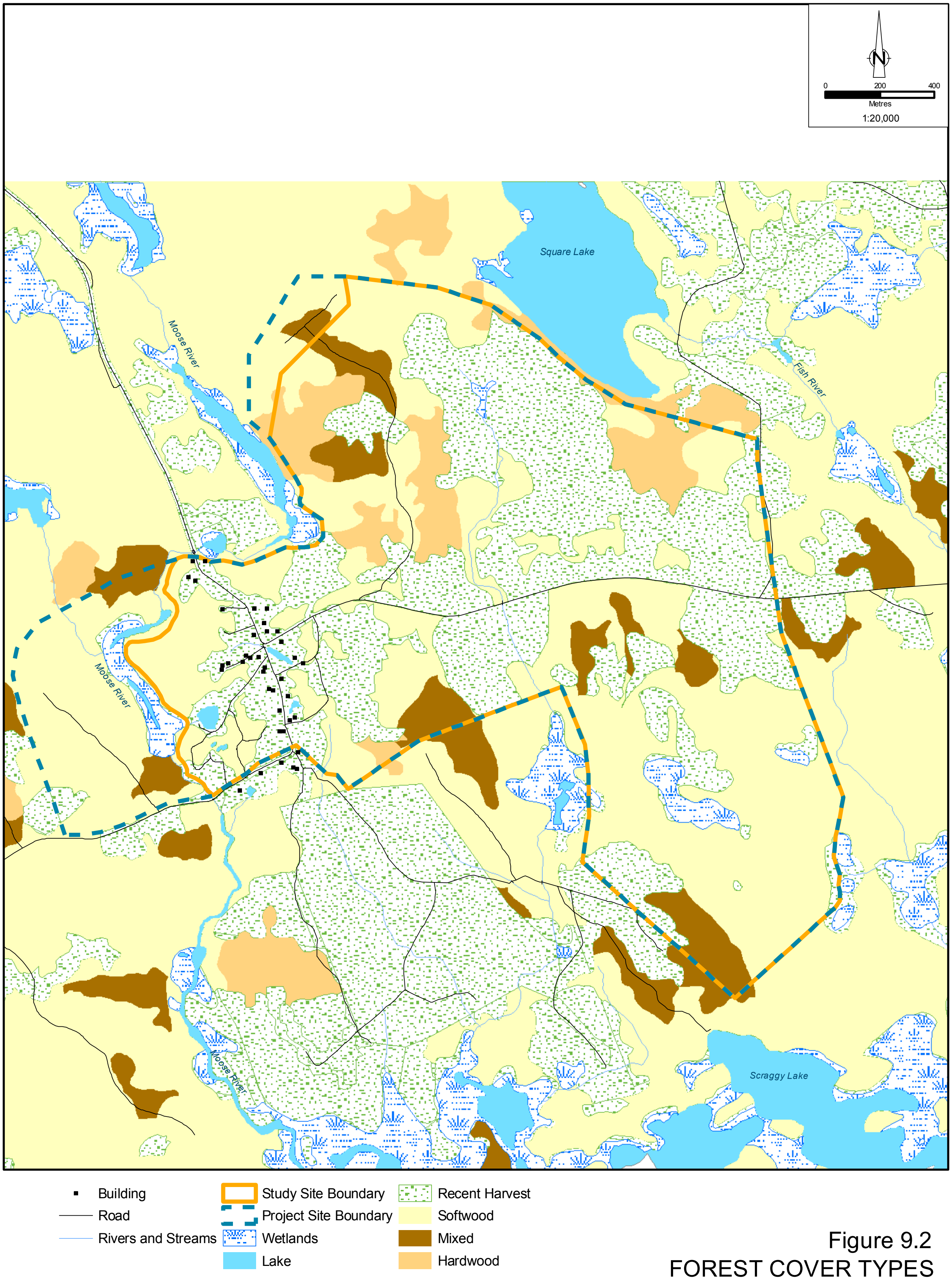


Figure 9.2
FOREST COVER TYPES
ON PROJECT SITE
Touquoy Gold Project, DDV Gold Ltd.
Halifax County, Nova Scotia

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Data projected to UTM (Zone 20T) NAD83

820933(REP004)GIS-WA014 March 9, 2007

Deciduous Forest

Small pockets of deciduous (hardwood) forest are located towards the northern boundaries of the study area. These stands are generally not mature and are dominated by red maple, large-tooth aspen (*Populus grandidentata*), and white birch. Yellow birch (*B. alleghaniensis*) and American beech (*Fagus grandifolia*) were also noted. Understory consisted of club-mosses, shrubs and ferns.

Rural Residential Areas

A variety of residential developed areas occur within the community of Moose River along the main road. Additional cleared areas are associated with the old mine development and current historical park.

Wetlands

The DNR Wetland database revealed the presence of four mapped wetlands on the Project site. Field surveys and air photo interpretation revealed the presence of two additional wetlands within the study site boundaries. A total of 4.33 ha of wetlands on the Project site will be impacted. Wetlands are further discussed in Section 10.

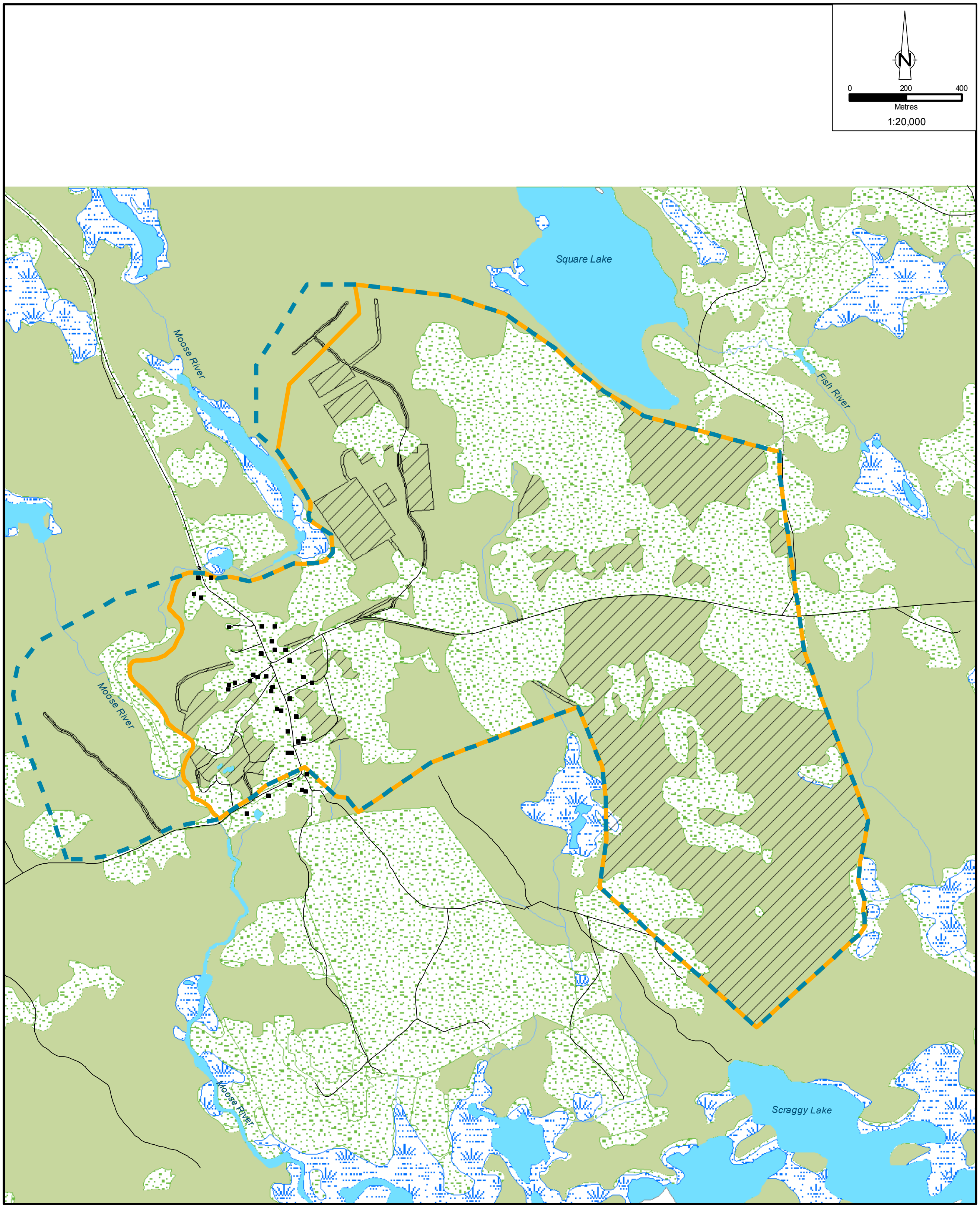
Area to be cleared

The Project property boundary encompasses approximately 400 ha and the active Project footprint is estimated to be 265 ha. Approximately 123 ha will be cleared for the Project (Figure 9.3) that is not presently cleared or used for residential properties or roads.

9.1.2 PLANT SPECIES OF SPECIAL STATUS

Vascular Plants

A desktop review of the ACCDC database for rare plant species records resulted in a list of 16 species that had potential to occur on site. Table 9.1 lists all rare or sensitive flora reported in the ACCDC database within 100 km of Moose River Gold Mines which have potential, based on habitat preferences and the modeling exercise, to be present on the site. The ACCDC database compiles locality data on very rare to uncommon species in Atlantic Canada, with a rarity rank and legal status for each. The complete list of all rare plants recorded within 100 km of Moose River Gold Mines in the ACCDC database may be found in Appendix J. Table 9.1 shows plants listed as rare by NSDNR and which



Building
Road
Rivers and Streams
Study Site Boundary
Project Site Boundary
Wetlands
Lake
Mature Forest
Cleared or Regrowth Area - Pre Construction
Cleared Area - Post Construction

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Updated based on Aerial Photography flown for DDV Gold, December 2006.
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the Province of Nova Scotia, 2007.
Data projected to UTM (Zone 20T) NAD83

Figure 9.3
EXISTING MATURE FOREST
ON PROJECT SITE
Touquoy Gold Project, DDV Gold Ltd.
Halifax County, Nova Scotia

820933(REP004)GIS-WA006 March 8, 2007

have been reported within 100 km of Moose River Gold Mines and have potential to be present on the site. None are listed as rare or endangered by the *Nova Scotia Endangered Species Act* (NSESA), the Committee on the Status of Endangered Wildlife (COSEWIC) or the *Species at Rick Act (SARA).*

TABLE 9.1: VASCULAR PLANTS LISTED AS RARE BY NSDNR WHICH WERE REPORTED IN THE 100 KM ACCDC SEARCH AND HAVE POTENTIAL TO OCCUR ON THE PROJECT SITE

Name	Common Name	NSDNR Status	Bloom Period	Habitat
Coeloglossum viride	Long-bract green orchis	Yellow	May-August	Boggy spots, damp mature (sugar maple) woods, fir or floodplain forest
Epilobium coloratum	Purple-leaf willow herb	Yellow	July-October	Low-lying ground, springy slope
Goodyera pubescens	Downy rattlesnake plantain	Red	July-Aug	Woodlands and thickets
Iris prismatica	Slender blue flag	Red	mid July	Wet ground near coast
Listera australis	Southern twayblade	Red	June	Sphagnum bog
Malaxis monophyllos	White adder's-mouth	Red	May-June	Moss cushions and wet mossy cliff edges
Panicum (Dichanthellum) linearifolium	Slim-leaved witchgrass	Yellow	May-July	Dry sandy soil
Planthaera flava	Southern rein orchid	Yellow	May-August	Sandy gravelly beach, wet peat, lake edge, bog
Salix pedicellaris	Bog willow	Yellow	Late May-Early June	Sphagnous lakeshore, acid bog
Salix sericea	Silky willow	Yellow	Late March-Early May	Wet thicket, stream edge, marsh
Spiranthes ochroleuca	Yellow nodding ladies' tresses	Yellow	Sept-Oct	Uplands
Utricularia gibba	Humped bladderwort	Yellow	Late June-Sept	Shallow lake edge, small pool, pond in peaty area
Vaccinium caespoitosum	Dwarf huckleberry	Yellow	May-Early July	Rocky cliffs, crevices, dry or wet acidic
Vaccinium uliginosum	Alpine blueberry	Yellow	Summer	Dry or wet organic or non-acidic soils
Zizia aurea	Common alexanders	Yellow	May-June	Edge stream , meadow , field

Based on ACCDC 100 km list (August 2005) and potential habitat for at-risk species.

None of these species were found on the Project site during vegetation surveys conducted on the original site in August 2004, and May and July 2005, or on the revised site in September 2006. Additional surveys will be conducted on the revised site in spring/early summer 2007 in areas not already assessed.

An environmental screening of all natural heritage resource in the area was also completed by the NSM in 2004. This report created a list of seven additional species known from the general area or from similar habitats. Of these, four species had potential to occur in habitats present on the Project site. The complete NSM Screening may be found in Appendix J. Table 9.2 shows plants listed as rare by NSDNR which were listed in the NSM Screening and have potential to be present on the site. None are listed as rare or endangered under *NSESA*, COSEWIC or *SARA*.

TABLE 9.2: VASCULAR PLANTS LISTED AS RARE BY NSDNR WHICH WERE LISTED IN NSM SCREENING

Name	Common Name	NSDNR Status	Bloom Period	Habitat
Betula michauxii	Michaux's dwarf birch	Yellow	June and July	Peat and sphagnous bogs
Megalodonta beckii	Beck water-marigold	Yellow	August and September	Shallow quiet waters, slow-moving streams and ponds
Viola nephrophylla	Northern bog violet	Yellow	May to July	Cool mossy bogs, borders of streams, and damp woods
Proserpinaca pectinata	Comb-leaved mermaid-weed	Yellow	June to October	Wet savannas, sphagnous swales, and the sand, gravelly or muddy borders of lakes and ponds

Surveys conducted in August 2004, May and July 2005 on the original Project site and in September 2006 on the revised site did not detect any of these plants. Additional surveys will be conducted on the revised site in spring/early summer 2007 in areas not already assessed.

Lichens

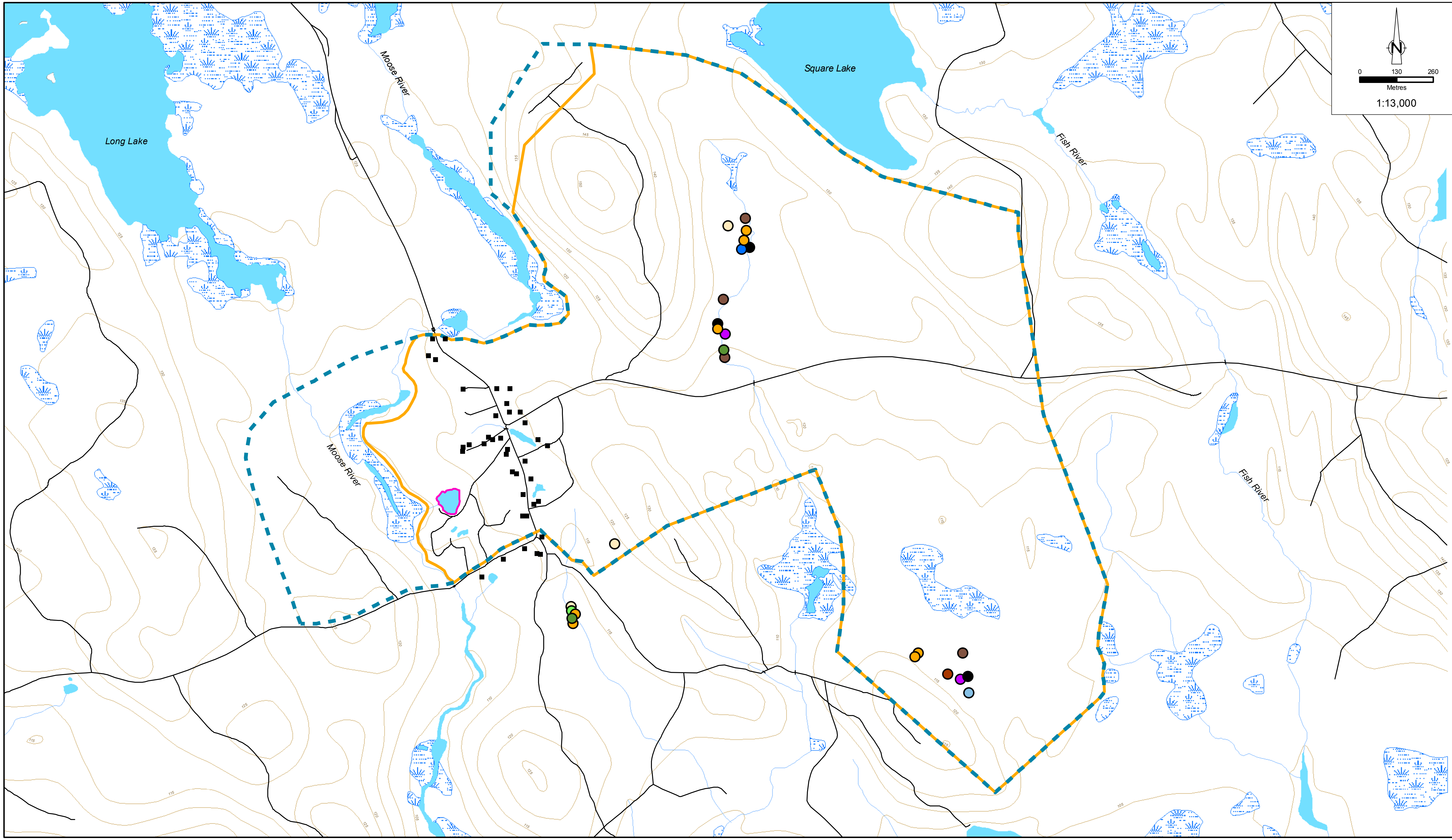
Lichen surveys were conducted on the original Project footprint in 2004 and 2005. These surveys aimed to investigate the potential presence of the rare boreal felt lichen (*Erioderma pedicellatum*), which is listed under both COSEWIC and the *NSESA* as an endangered species. Surveys conducted in 2004 by botanist Tom Neily, in collaboration with representatives from the NSEL and lichenologist Dr. David Richardson of St.

Mary's University, did not find the boreal felt lichen on the Project site. However, one rare cyanolichen, *Degelia plumbea,* was found. This species has been given a draft general status ranking of yellow (sensitive) by the province (Draft Cyanolichen Status List, NSDNR, unpublished) and is currently under review by COSEWIC (Mark Elderkin, NSDNR, pers. comm 2007). Additional surveying in 2005 confirmed a total of three occurrences of *Degelia plumbea* on the Project site. At the request of DNR, a survey was conducted at these three locations, on February 15, 2007, to determine the abundance and distribution of this species on the Project site. All areas considered to be suitable *D. plumbea* habitat were surveyed. Tom Neily and a CRA terrestrial ecologist conducted this survey, which also investigated additional potential habitat for boreal felt lichen in areas of the new footprint not assessed in earlier surveys. Other species, primarily cyanolichens, occurring on the adjusted Project footprint were also documented.

D. plumbea was found at the two known locations on the current Project site (Figure 9.4). The third location is no longer within the adjusted Project boundary, but is discussed later in this section. At the southern location, *D. plumbea* was observed growing on two mature red maples less than 10 m apart. Twelve specimens of *D. plumbea* were counted on the first tree, growing from 0.5 to 2 m above the ground. Most of these specimens were over 7 cm in diameter and had mature reproductive structures (apothecia). On the second maple, 24 specimens of *D. plumbea* were counted, growing at heights ranging from 0.5 to 2.5 m. Specimens ranged from less than 1 cm to over 8 cm in diameter. All of the specimens over four centimetres in diameter possessed obvious apothecia. This tree was located in a forested area dominated by conifers, with scattered red maples present. The edge of an adjacent clearcut was approximately 40 m from this area.

The second patch of *D. plumbea* on the Project site occurs north of the Mooseland Road, along a small brook. This patch was growing on a very large mature red maple, which was located in an area which had been cleared within the past few years. Only this maple and a few other mature hardwoods and some small softwoods were present in this fringe of vegetation, which extended from the buffer zone left in place along the stream north of Mooseland Road. Three specimens of *D. plumbea*, all less than 5 cm in diameter, were clustered in a small patch approximately 0.75 m above ground. Only one of these specimens possessed mature apothecia.

A third known location of *D. plumbea* which is now outside the current Project boundary was revisited to check on its status. Two reproductive specimens of this lichen over seven centimetres in diameter were observed growing on a red maple between 0.5 and 2 m above the ground at this location.



- Coccocarpia palmicola
- Degelia plumbea
- Fuscoannaria ahlneri
- Fuscopannaria ahlneri
- Leptogium corticola
- Leptogium laceroides
- Moelleropsis nebulosa
- Pannaria conoplea
- Pannaria rubiginosa
- Sticta fuliginosa
- Building
- Existing Pit Extent
- Rivers and Streams
- Road
- Surface Contour Line (10 m)
- Project Site Boundary
- Site Boundary
- Swamp
- Lake

Figure 9.4
LOCATIONS OF RARE LICHENS ON PROJECT SITE
Touquoy Gold Project, DDV Gold Ltd.
Halifax County, Nova Scotia

CRA

Data projected to UTM (Zone 20T) NAD83

The boreal felt lichen was not observed on the site during any lichen surveys. A complete list of all lichen species observed on the Project site on February 15, 2007 is provided in Table 9.3. Some of these species have been given a draft status ranking by NSDNR locations of these lichens are depicted on Figure 9.4. None of these species have been listed under NSESA or COSEWIC. Some of these species, such as *D. plumbea*, *Lobaria pulmonaria*, *L. scrobiculata* and *Pannaria rubiginosa,* are considered indicative of relatively clean, non-polluted environments (Richardson, 1992).

TABLE 9.3: LICHEN SPECIES OBSERVED ON THE PROJECT SITE – FEBRUARY 2007

Species	Substrate	Draft NSDNR Status
Coccocarpia palmicola	Balsam Fir	Yellow
Collema subflaccidum	Red Maple	Green
Degelia plumbea	Red Maple	Yellow
Fuscopannaria ahlneri	Red Maple	Red
Heterodermia obscurata	Yellow Birch	N/A
Heterodermia speciosa	Red Maple	N/A
Imshaugia placorodia	American Larch	N/A
Leptogium corticola	Red Maple	Yellow
Leptogium cyanescens	Red Maple	Green
Leptogium laceroides	Red Maple	Yellow
Lobaria pulmonaria	Red Maple	Green
Lobaria quercizans	Red Maple	Green
Lobaria scrobiculata	Red Maple	Green
Moelleropsis nebulosa	Balsam Fir	Red
Nephroma bellum	Red Maple	Green
Pannaria conoplea	Red Maple	Yellow
Pannaria rubiginosa	Red Maple	Yellow
Parmelliella tryptophylla	Red Maple	Green
Peltigera aphthosa	Red Maple	Green
Pseudocyphellaria perpetua	Red Maple	Green
Sticta fuliginosa	Red Maple	Yellow

9.1.3 FAUNA

There were no wildlife management areas or ecological reserves noted in the Project study area. However, a variety of wildlife resources exist throughout the province and within the study area.

9.1.4 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 were conducted concurrently with vegetation, bird and wetland surveys conducted on the original Project site in 2004 and 2005, and on the revised Project site in September of 2006 (Figure 5.1). Field surveys such as these are 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)*, American red squirrel (*Tamiasciursus hudsonicus)*, varying or snowshoe hare (*Lepus americanus*), American black bear (*Ursus americanus)* and white-tailed deer (*Odocoileus virginianus)*, was observed during field studies on the original Project site in 2004 and 2005, and on the revised Project site in 2006. Raccoon (*Procyon lotor),* striped skunk (*Mephitis mephitis)* and bobcat (*Lynx rufus*) may also be present but were not observed. Evidence (tracks) of the endangered eastern moose (*Alces alces americana*) was observed within Wetland 4 (see discussion under Rare and Endangered Mammals section) in September 2006.

Small mammals likely to be present in the area include meadow vole (*Microtus pennsylvanicus*), red-backed vole (*Clethrionomys gapperi*), eastern chipmunk (*Tamias striatus*), and short-tailed shrew (*Blarina brevicaudata*). It is likely that bat species such as little brown bat) (*Myotis lucifugus*) and northern long-eared bat (*Myotis septentrionalis*) are present in the general area and may make use of habitat on the site. These species are local to the province, and although they may occur during summer foraging, are primarily of concern due to communal winter hibernating behaviour which concentrates the bats in few areas sensitive to disturbance. Bats are known to use old mine shafts as hibernating areas. Over 100 abandoned mine openings are mapped by NSDNR for the area within 500 m of the Moose River Gold Mines Provincial Park (Abandoned Mine Openings Database 97-035). Approximately 75% of these are less than six metres deep, but a couple of the shafts historically extended over 50 m deep. The Moose River openings have been extensively surveyed by NSDNR. These openings are currently either blocked or filled with water (pers. comm., E. Hennick; NSDNR) and as such would not provide suitable bat hibernating areas.

A discussion on rare bats in the vicinity is provided in the Rare and Endangered Mammals section below.

9.2 MAMMAL SPECIES OF SPECIAL STATUS

The ACCDC database and Nova Scotia's Significant Species Habitats database were reviewed to gain information regarding the presence of rare mammals and sensitive mammal habitat within the study area. The NSDNR Regional Biologist for the area was also consulted. Four NSDNR yellow-listed mammal species were encountered in the 100 km radius ACCDC database search (Appendix J). These were the mainland population of eastern moose (*Alces alces americana*), the long-tailed shrew (*Sorex dispar)*, and two bat species, the eastern pipistrelle (*Pipistrellus subflavus)* and the hoary bat (*Lasiurus cinereus)*. Each of these mammals and their habitat preferences are discussed below.

The mainland moose population has been designated as provincially protected and as Endangered under the NSESA. The mainland eastern moose population differs from the Cape Breton population, in that the mainland moose population is descended from the original Nova Scotian population of eastern moose (*Alces alces americana)*, while the Cape Breton population is derived from a herd of northwestern moose (*Alces alces andersonii)*) introduced to Cape Breton in the 1940s (Parker 2003).

Eastern moose are known to occur in the general area of the proposed mining area. Moose tracks were observed in a bog (Wetland 4) on the new study site in September and November 2006 by a CRA biologist. Moose calling exercises, conducted by CRA and representatives of the Confederation of Mainland Mi'kmaq, in Wetland 4 in November and December 2006 were unsuccessful, although the November survey did find additional moose tracks. The regional DNR biologist for the area has also stated that evidence of moose is observed in Moose River Gold Mines every year during annual deer pellet surveys (D. Archibald, NSDNR, pers. comm., 2006). NSDNR reports that within Halifax County, three areas of slightly elevated moose densities occur (D. Archibald, NSDNR, pers.com.) (Figure 9.5). One of these areas lies between Scraggy Lake and Tangier, encompassing the Tangier Grand Lake Wilderness Area. The second area is north of Sheet Harbour, while the third area is on the Chebucto Peninsula (Doug Archibald, NSDNR, pers. com.). Together these areas likely account for less than 75 individual moose (based on Parker 2003). The study site lies northwest of the Tangier Grand Lake Wilderness Area. Evidence of moose is observed in the vicinity of Moose River Gold Mines every year during the annual NSDNR deer pellet survey (D. Archibald, NSDNR pers. com.). Moose were also reported on several occasions in the

Expressway
Primary Highway
Water Areas
Moose Areas
Province of Nova Scotia
Other Provinces

Figure 9.5
AREAS OF CORE MOOSE POPULATION ON MAINLAND NOVA SCOTIA
Touquoy Gold Project
Halifax County, Nova Scotia

fall of 2006 from the community of Cooks Brook, to the west of Moose River Gold Mines. (D. Archibald, NSDNR pers. com.). However, moose numbers are very low and highly dispersed within this extended range.

Long-tailed or rock shrew (*Sorex dispar*) was also listed in the ACCDC 100 km search. This species has very specific habitat requirements, living only on talus slopes. There is no suitable habitat for long-tailed shrews on the study site.

Two at-risk bat species were listed in the ACCDC database within 100 km of the study site, hoary bat and eastern pipistrelle. The hoary bat is a migratory species that is only irregularly present in the province. The eastern pipistrelle, as well as the two non-listed bat species mentioned above, are primarily of concern during winter when individuals congregate in caves to hibernate. As previously explained, there are no known bat hibernacula in the vicinity of the Project.

The Environmental Screening conducted by the NSM found no records of rare or endangered mammals on the Project site (Appendix J).

9.2.1 BIRDS

In Nova Scotia, legislation protecting birds includes the Migratory Bird Convention Act and the Nova Scotia Wildlife Act. The MBCA protects migratory birds and their nests. Most bird species present in Nova Scotia are listed under the MBCA, however it does not include introduced species such as starlings and predators such as raptors. The Nova Scotia Wildlife Act specifically protects raptors: eagle, osprey, falcon, hawk and owls; and all bird and turtle nests and eggs. This act also regulates game or nuisance wildlife hunting.

To obtain information on bird species possibly present on the study site, desktop reviews were conducted, as well as a breeding bird survey on the site. The main desktop review consisted of a review of the Atlas of Breeding Birds of the Maritime Provinces (Erskine 1992) which provided information on bird species thought to be breeding in the Atlas square in which the study site is located. Table 9.4 lists the birds reported from the Atlas square in which the Project site is located, and their breeding status in that square. A total of 68 species were recorded from the square. Of these, 42 have been confirmed to breed in the area, while 9 are probable breeders and 17 are considered to be possibly breeding in the area. One of these species, the Common Loon (*Gavia immer*), is listed as sensitive in Nova Scotia. However, given the lack of any bodies of water on the study site, Common Loons are not expected to use any habitat on the study site. Table 9.4 shows the breeding status of birds listed in the Atlas of Breeding Birds of the Maritime Provinces (Erskine 1992) for the atlas square in which the Project site is located.

TABLE 9.4: BREEDING STATUS OF BIRDS WITHIN THE PROJECT SITE (Erskine, 1992)

Common Name	Binomial	Atlas Status
Common Loon	*Gavia immer*	Possible
Canada Goose	*Branta canadensis*	Probable
American Black Duck	*Anas rubripes*	Probable
Ring-Necked Duck	*Aythya collaris*	Confirmed
Common Merganser	*Mergus merganser*	Confirmed
Sharp-Shinned Hawk	*Accipiter striatus*	Possible
Broad-Winged Hawk	*Buteo platypterus*	Probable
American Kestrel	*Falco sparverius*	Possible
Common Nighthawk	*Chordeiles minor*	Confirmed
Chimney Swift	*Chaetura pelagica*	Possible
Belted Kingfisher	*Ceryle alcyon*	Possible
Hairy Woodpecker	*Picoides villosus*	Confirmed
Northern Flicker	*Colaptes auratus*	Confirmed
Pileated Woodpecker	*Dryocopus pileatus*	Possible
Olive-sided Flycatcher	*Contopus borealis*	Possible
Eastern Wood-pewee	*Contopus virens*	Possible
Yellow-bellied Flycatcher	*Empidonax flaviventris*	Confirmed
Alder Flycatcher	*Empidonax alnorum*	Possible
Least Flycatcher	*Empidonax minimus*	Probable
Tree Swallow	*Tachycineta bicolor*	Confirmed
Barn Swallow	*Hirundo rustica*	Confirmed
Gray Jay	*Perisoreus Canadensis*	Confirmed
Blue Jay	*Cyanocitta cristata*	Possible
American Crow	*Corvus brachyrhynchos*	Confirmed
Common Raven	*Corvus corax*	Possible
Black-capped Chickadee	*Poecile atricapillus*	Confirmed
Boreal Chickadee	*Poecile hudsonicus*	Confirmed
Red-breasted Nuthatch	*Sitta Canadensis*	Confirmed
Winter Wren	*Troglodytes troglodytes*	Confirmed
Golden-crowned Kinglet	*Regulus satrapa*	Confirmed
Ruby-crowned Kinglet	*Regulus calendula*	Confirmed
Swainson's Thrush	*Catharus ustulatus*	Confirmed
Hermit Thrush	*Catharus guttatus*	Confirmed

TABLE 9.4: BREEDING STATUS OF BIRDS WITHIN THE PROJECT SITE (Erskine, 1992)

Common Name	Binomial	Atlas Status
American Robin	*Turdus migratorius*	Confirmed
Cedar Waxwing	*Bombycilla cedrorum*	Probable
Blue-headed Vireo	*Vireo solitarius*	Confirmed
Red-eyed Vireo	*Vireo olivaceus*	Probable
Tennessee Warbler	*Vermivora peregrine*	Possible
Nashville Warbler	*Vermivora ruficappilla*	Confirmed
Northern Parula Warbler	*Parula Americana*	Confirmed
Chestnut-sided Warbler	*Dendroica pensylvanica*	Confirmed
Magnolia Warbler	*Dendroica magnolia*	Confirmed
Black-throated Blue Warbler	*Dendroica caerulescens*	Possible
Yellow-Rumped Warbler	*Dendroica coronata*	Confirmed
Black-throated Green Warbler	*Dendroica virens*	Confirmed
Blackburnian Warbler	*Dendroica fusca*	Confirmed
Palm Warbler	*Dendroica palmarum*	Confirmed
Bay-breasted Warbler	*Dendroica castanea*	Confirmed
Black-and-white Warbler	*Mniotilta varia*	Confirmed
American Redstart	*Setophaga ruticilla*	Confirmed
Ovenbird	*Seiurus aurocapillus*	Confirmed
Mourning Warbler	*Oporinis philadelphia*	Confirmed
Common Yellowthroat	*Geothlypis trichas*	Confirmed
Canada Warbler	*Wilsonia canadensis*	Confirmed
Song Sparrow	*Melospiza melodia*	Confirmed
Lincoln's Sparrow	*Melospiza lincolnii*	Confirmed
Swamp Sparrow	*Melospiza georgiana*	Confirmed
White-throated Sparrow	*Zonotrichia albicollis*	Confirmed
Dark-eyed Junco	*Junco hyemalis*	Confirmed
Red-winged Blackbird	*Agelaius phoeniceus*	Possible
Rusty Blackbird	*Euphagus carolinus*	Confirmed
Common Grackle	*Quiscalus quiscula*	Confirmed
Pine Grosbeak	*Pinicola enucleator*	Probable
Purple Finch	*Carpodacus purpureus*	Possible
White Winged Crossbill	*Loxia leucoptera*	Probable
Pine Siskin	*Carduelis pinus*	Possible
American Goldfinch	*Carduelis tristis*	Possible
Evening Grosbeak	*Coccothraustes vespertinus*	Probable

A breeding bird survey was undertaken in June 2005 to provide a baseline on bird nesting uses of the property and to identify potential at-risk nesting birds. The area surveyed included all of the original Project footprint area found within the property. Surveys were conducted as listening posts (5 min point counts) at representative locations within major habitat types at the 2005 study area (Figure 5.1). Birds were identified by an experienced birder based on song and visual observations following the Environment Canada protocol. In addition, bird observations were recorded during the wetlands surveys conducted on the revised Project site in September 2006. A total of 398 birds representing 52 species were recorded during the breeding bird survey of the 2005 study area. A list of bird data recorded at each survey point is provided in Table 9.5. Breeding birds were present in all habitat types. Potential nesting habitat for species identified covered a full range of nesting types from typical tree and shrub nesting species to cavity and ground nesters. The earliest typical nesting period is identified as April (although one species may nest in winter and ravens may nest in March), while the latest is in September. The most abundant species in descending order of abundance were Magnolia Warbler (7.5% of total) and Common Grackle (7.3%). Only two of the 52 species, Osprey (*Pandion halieetus*) and Willow Flycatcher (*Empidonax trailli*), were not presumed to be attempting to breed on the study site, although suitable Osprey nesting habitat is present along the nearby Moose River. None of the bird species recorded during the breeding bird survey is considered to be rare in Nova Scotia or particularly sensitive to anthropogenic activities.

TABLE 9.5: BREEDING BIRD SPECIES DETECTED ON THE ORIGINAL PROJECT SITE DURING BREEDING BIRD SURVEY - JUNE 2005

NSDNR Status	Common Name	*Binomial*	Preferred Nesting Habitat	Nesting Period	Sampling Station											Total # of Individuals
					B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	
Green	Osprey	*Pandion haliaetus*	Coastal areas, near lakes	May-July											1	1
Green	Common Snipe	*Gallinago gallinago*	Shallow marshes, bogs	May-July	1											1
Green	Ruby-throated Hummingbird	*Archilochus colubris*	Gardens, orchards, forests	June-July								1				1
Green	Hairy Woodpecker	*Picoides villosus*	Cavities	Early May-early July										1		1
Green	Willow Flycatcher	*Empidonax trailli*	Shrubby areas	Summer			1 (not breeding)									1
Green	Black-and-white Warbler	*Mniotilta varia*	On ground, among tree roots	Early June-mid July									1			1
Green	Ovenbird	*Seiurus aurocapillus*	Ground	May-June										1		1
Green	Chipping Sparrow	*Spizella passerina*	Edges of woods	May-July								1				1
Green	Lincoln's Sparrow	*Melospiza lincolnii*	Shrubs and small trees, bogs, fields,	June-July							1					1
Green	Swamp Sparrow	*Melospiza georgiana*	Wetlands	Late May-mid July			1									1
Green	Rusty Blackbird	*Euphagus carolinus*	Cool spruce bogs, swamps, alder swales	May-June							1					1
Green	Pine Grosbeak	*Pinicola enucleator*	Conifers	May-June	1											1
Green	White-winged Crossbill	*Loxia leucoptera*	Conifers	Feb.-Sept							1					1
Green	Ruffed Grouse	*Bonasa umbellus*	Open, second-growth woodlands	Late April-July										2		2
Green	Common Raven	*Corvus corax*	Trees, cliffs, old buildings	Mar-June	1								1			2
Green	Yellow warbler	*Dendroica petechia*	Edges and disturbed areas	Late May- July		1						1				2
Green	Nashville Warbler	*Vermivora ruficapilla*	Open woods/shrubs	Late May-late July							2					2
Green	Bay-breasted Warbler	*Dendroica castanea*	Conifers	June-July										2		2
Green	Winter Wren	*Troglodytes troglodytes*	Damp conmiferous forests	Mid May-late June						1		1	1			3
Green	Swainson's Thrush	*Catharus ustulatus*	Trees	Late May-late July		1					1		1	1		4
Green	Cedar Waxwing	*Bombycilla cedrorum*	Open woods	Mid June-early Sept								4				4
Green	Red-winged Blackbird	*Agelaius phoeniceus*	Marshes with cattails	May-July								4				4
Green	Pine Siskin	*Carduelis pinus*	Conifers	Late April-early Aug	2							1		1		4
Green	Northern Flicker	*Colaptes auratus*	Cavities	Early May-early Aug		1		1		1			1		2	6
Green	Yellow-bellied Flycatcher	*Empidonax flaviventris*	Ground in conifer moss	Mid June-early Aug	1	1	1				1				2	6
Green	Barn Swallow	*Hirundo rustica*	Structures, cliffs	Late May-July			2					4				6
Green	Red-eyed Vireo	*Vireo olivaceus*	Forest	Early June-early Aug	1									5		6
Green	Palm Warbler	*Dendroica palmarum*	Shrub bogs	Mid May-late July	1			1		2			1		1	6
Green	American Crow	*Corvus brachyrhynchos*	Trees	April-July	2							5				7
Green	Northern Parula Warbler	*Parula americana*	Bearded lichen in conifers	Late May-early Aug	2	4						1				7
Green	Blue Jay	*Cyanocitta cristata*	Trees	Early May-mid July	1	2				1		4				8
Green	Boreal Chickadee	*Parus hudsonicus*	Nest cavities in rotted tree stumps	Early May- mid Aug	1	4			1	1	1				1	9
Green	American Redstart	*Setophaga ruticilla*	Small trees	Late May-late July		1	2			1					5	9
Green	Common Yellowthroat	*Geothlypis trichas*	Brushy areas	Late May - late July			2	3			2	1	1			9
Green	Song Sparrow	*Melospiza melodia*	Shrubbery	May-Aug	1	2						6				9
Green	European Starling	*Sturnus vulgaris*	Cavities in trees, structures	Late April-July								10				10
Green	Blue-headed Vireo	*Vireo solitarius*	Forest	Late May-late July	2					1	3		2		2	10
Green	Yellow-Rumped Warbler	*Dendroica coronata*	Coniferous forest	Early May-early June	5						1			2	2	10
Green	White-Throated Sparrow	*zonotrichia albicolis*	Ground at forest edge	Mid-May -mid Aug	1	1		1		2	1		2		2	10
Green	Black-capped Chickadee	*Parus atricapillus*	Nest cavities in rotted tree stumps	Early May- mid Aug	3	3						4		2		12
Green	Dark-eyed Junco	*Junco hyemalis*	Forest edge	Early May-late Aug	3	4				1		1	1		2	12
Green	American Goldfinch	*Carduelis tristis*	Deciduous trees, often in orchards	Late June-mid Sept	2	2	1				1	6				12
Green	Mourning Dove	*Zenaida macroura*	Open areas, nest in trees	Early April-mid Sept	1	2						12				14
Green	American Robin	*Turdus migratorius*	Disturbed woods, farmlands and settlements	Late April-mid Sept	2	1	3					8				14
Green	Ruby-crowned Kinglet	*Regulus calendula*	Conifers	Mid May-Early July	2	2			4	2	3		1		1	15
Green	Hermit Thrush	*Catharus guttatus*	On ground in wooded areas	May-Late Aug	2					1	6		1	2	4	16

NSDNR Status	Common Name	*Binomial*	Preferred Nesting Habitat	Nesting Period	Sampling Station											Total # of Individuals
					B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	
Green	Black-throated Green Warbler	*Dendroica virens*	Mixed or coniferous forest	Early June-mid July	2			1		2	1			12		18
Green	Purple Finch	*Carpodacus purpureus*	Conifers	early June-mid Aug		2						1	15			18
Green	Alder Flycatcher	*Empidonax alnorum*	Thickets, near ground	Mid-June-mid Aug	1	2	8					3	3		2	19
Green	Golden-crowned Kinglet	*Regulus satrapa*	Coniferous forest	Early May-mid July	4	5			2	3	5					19
Green	Common Grackle	*Quiscalus quiscula*	Trees , bushes, buildings in open areas	Late April-July	4		3					20		2		29
Green	Magnolia Warbler	*Dendroica magnolia*	Conifers	Early June-late July	4	4	3	1	3	3	4	1	1	3	3	30
Total Number of Species					27	20	10	6	4	14	17	23	15	13	14	52
Total number of individuals					53	45	27	8	10	22	35	100	33	36	30	398

Two additional species were encountered during the 2006 wetland surveys, these were Pileated Woodpecker (*Dryocopus pileatus*) and Spruce Grouse (*Dendragapus canadensis*). Both are likely to breed in the habitat types present on site, and neither is listed as sensitive or at-risk in Nova Scotia. A Barred Owl (*Strix varia*) was also heard during a groundwater upwelling survey of the Moose River, near the location of the current Provincial Park, on Sept 13, 2006. In addition, the person who conducted the breeding bird survey is familiar with the area and has confirmed the presence of four owl species in the Moose River Gold Mines area in recent years (F. Lavender, pers. com 2007). The owl species are the Northern Saw-whet Owl (*Aegolius acadicus*), Great Horned Owl (*Bubo virginianus*), Barred Owl, and Long-Eared Owl (*Asio otus*). The Long-Eared Owl is yellow-listed in Nova Scotia and may use the Project site as suitable breeding habitat does exist (Fulton Lavender, pers com.)

Additional bird surveys are planned for 2007 to ensure the adjusted Project site is assessed sufficiently.

9.2.2 BIRD SPECIES 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 (Appendix J) and a resulting habitat modelling 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.

A review of the ACCDC database of rare species records revealed fourteen listed species in the region (Appendix J). Three red-listed and eleven yellow-listed bird species were listed within 100 km by the ACCDC search. Each species' habitat preference was determined based on Erksine (1992), and the likelihood of their presence on site was determined based on the habitat types present on site. The results of the rare bird habitat modeling are presented in Table 9.6. None of the three red-listed species, Peregrine Falcon (*Falco peregrinus*), Piping Plover (*Charadrius melodus*), and Roseate Tern (*Sterna dougallii*), is expected to be present on site or to use the site due to the lack of suitable habitat (Table 9.6).

TABLE 9.6. RARE BIRD HABITAT MODELLING EXERCISE

NSDNR Status	Common Name	Binomial	Habitat Preference	Potential Presence on Site
RED	Roseate Tern	*Sterna dougallii*	Coast	Low
RED	Peregrine Falcon	*Falco peregrinus*	Rocky cliffs	Low
RED	Piping Plover	*Charadrius melodus*	Sandy Beaches	Low
YELLOW	Common Tern	*Sterna hirundo*	Coast	Low
YELLOW	Arctic Tern	*Sterna paradisea*	Coast	Low
YELLOW	Barrow's Goldeneye	*Bucephala islandica*	Small clear lakes and ponds	Low
YELLOW	Northern Goshawk	*Accipiter gentiles*	Mature woods	High
YELLOW	Semipalmated Sandpiper	*Calidris pusilla*	Beaches, mudflats, shallow estuaries, and inlets.	Low
YELLOW	Eastern Meadowlark	*Sturnella magna*	Grassy fields, pastures, cultivated areas	Low
YELLOW	Razorbill	*Alca torda*	Coastal islands	Low
YELLOW	Eastern Bluebird	*Sialia sialis*	Areas with scattered trees and short ground cover.	Low
YELLOW	Vesper Sparrow	*Poecetes gramineus*	Areas with short grass or low shrubs	Low
YELLOW	Sharp-tailed Sparrow	*Ammodramus caudacutus*	Breed in meadows adjacent to salt marshes	Low
YELLOW	Bobolink	*Dolichonyx oryzivorus*	Grasslands	Low

Only one of the yellow-listed species listed in the ACCDC request is expected to make use of any habitat types on the study site. Goshawks prefer heavily wooded areas, and prefer to breed in mature mixed woods. They will also breed in mature hardwoods, or if that is not available, mature softwoods. Goshawks are relatively common in the Moose River area, and have bred there in previous years and are likely still breeding in the general area. (F. Lavender, pers. comm. 2007).

Arctic Terns, Common Terns, and Razorbills are coastal species, and so should not be present on site. Sharp-tailed Sparrows breed in meadows adjacent to salt marshes, which are not present onsite. Vesper Sparrows are characteristic of areas with short grass or low shrubs, such as sandy pastures, blueberry fields, and clearings. This bird shows a preference for open pastures or fields where the grass is short and sparse as a result of poor soil (Birds of Nova Scotia and website Tufts Birds of Nova Scotia online at http://museum.gov.ns.ca/muh/nature/nsbirds/bons.htm). Such habitat does not exist for them on the study site. Eastern Meadowlarks and Bobolinks are grassland/meadow species and would not be expected to be present on the study site. Neither the Semipalmated Sandpiper nor Barrow's Goldeneye is known to breed in Nova Scotia. These species tend to live near large bodies of water and thus would not be expected to use the habitat found on the study site.

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 site in any given year (F. Lavender, pers comm. 2006)

None of the birds listed in the ACCDC search was observed during the breeding bird survey and the area is not considered to be critical habitat for any of the birds listed in the ACCDC search, although two listed species observed on the site in recent years, Northern Goshawk and Long-Eared Owl, may use habitat present on the Project site.

The environmental screening conducted by the NSM found no records of rare or endangered birds on the Project site (Appendix J).

9.2.3 HERPETILES

A herpetile (reptile and amphibian) survey was conducted in 2004. Information regarding amphibians and reptiles and their habitat within the study area was also obtained during the 2004 and 2005 surveys conducted on the original Project site and the 2006 plant and wetland surveys conducted on the adjusted Project site (Figure 5.1). No rare or endangered herpetiles were observed on the Project site.

9.2.3.1 HERPETILE SPECIES OF SPECIAL STATUS

A review of the ACCDC database of rare species records revealed one currently at-risk herptile species in the region, the wood turtle, (*Glyptemys insculpta*). The environmental screening conducted by the NSM also suggested that wood turtles may be present in the general area.

Wood turtles have been reported historically from the area of Moose River Gold Mines and are listed on the ACCDC database, however, the most recent record within 30 km of the site is almost 40 years old. 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. No evidence of wood turtles or suitable breeding or hibernating habitat was observed in any of the 2005 or 2006 field surveys.

The ACCDC database search also reported several records of four-toed salamanders within 100 km of Moose River Gold Mines. Four-toed salamanders are a very cryptic species and are generally only easily detected during the breeding seasons, when females deposit their eggs in sphagnum mounds near small pools in swampy areas. This species was 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. No suitable spawning habitat for four-toed salamanders was detected during the 2004 herpetile survey.

In summary, no suitable habitat for any at-risk reptile or amphibian species was encountered during the 2004 herpetile survey or during any subsequent habitat surveys in 2005 on the original Project site or on the revised Project site in 2006.

9.2.4 ODONATES

The ACCDC request noted three red-listed and seven yellow-listed species of rare or sensitive dragonflies and damselflies in the general area; however, their potential presence on the mine site is non-existent given the lack of suitable wetland habitat. Wetlands present on the site are bogs which would not provide suitable breeding habitat for most odonates.

9.3 POTENTIAL EFFECTS, PROPOSED MITIGATION, AND FOLLOW-UP MONITORING

9.3.1 FLORA

9.3.1.1 VASCULAR PLANTS

Historical and ongoing forestry have already had significant effects on the vascular flora of the study site. Road and dwelling construction activities have also had significant impacts. Loss of habitat is the main potential adverse impact of the mine construction on plant species in the area. Potential impacts to plant species include removal of plants or alteration of their habitat.

There are no known threats to rare or endangered vascular plant species on the Project site, as none have been observed to date. To augment the desktop review and prior studies, DDVG proposes additional spring field surveys to be completed prior to site disturbance. This work will consist of surveys completed by professional biologists for rare or sensitive species on the revised Project site in spring of 2007.

Reclamation of land disturbed from past or ongoing surface mining is an essential component of mitigating impacts to flora. Where reclamation is not complete and a landscape remains disturbed, terrestrial habitat (for both flora and fauna) is impacted in the long term. This long term impact can be successfully mitigated via reclamation of the site. Topsoil from the site will be stockpiled during the construction period for use in reclamation. The existing scrub plant material and debris will also be re-used in the reclamation as a growing medium placed as the final layer on top of the contoured lands. Excess organic material will be disposed of in appropriate locations.

A good example of the rate of natural reclamation possible in the Moose River Gold Mines area is already present on the Project site. The proposed mine pit now exists as a small 0.45 ha test pit which was excavated in 1989. No reclamation or revegetation of this site was conducted. An area of 1.32 ha around the pit was devoid of vegetation in 1992, three years after the pit excavation. No data is available on how large an area was cleared in 1989 for the test pit excavation, although the presence of mature trees around the perimeter of the cleared area in 1992 suggests the boundaries of the vegetated area in 1989 and 1992 were essentially the same. By 2003, the area devoid of vegetation had been reduced to 0.22 ha, solely due to natural colonization and revegetation processes (Figure 9.6). Thus over 83% of the cleared area present in 1992 had been recolonized by natural processes alone in just over a decade. Thus, natural revegetation processes combined with an active reclamation plan which includes redistribution of native topsoil and organic materials, should result in the reclamation period being significantly shorter.

There are no mitigation activities planned for rare or endangered vascular plant species as none have been observed on the site to date. Additional surveys will be conducted in spring of 2007, and if rare or endangered species are encountered, suitable mitigation plans will be developed in consultation with NSDNR.

Boundary of Cleared Area

Figure 9.6
NATURAL REVEGETATION OF EXISTING PIT 1992-2003
Touquoy Gold Project, DDV Gold Ltd.
Halifax County, Nova Scotia

Data projected to UTM (Zone 20T) NAD83

9.3.1.2 LICHENS

Loss of habitat is the main potential adverse impact of the proposed Project on listed lichen species in the area. The group of lichens known as cyanolichens, which contain a cyanobacterium as the photosynthesizing component, can be particularly abundant in mature or coastal forests such as those present along the Atlantic coast of Nova Scotia (Nash 1986). Many of these cyanolichens are epiphytic, and forestry practices which result in loss of mature trees and the accompanying changes in environmental conditions are a main cause of habitat destruction (Maas and Yetman 2002). Lichen abundance also tends to be greater in mature and old-growth forests than in regrowth or immature forests. A significant portion of the forested land on the Project site has been clear-cut in recent years, and is therefore, poor-quality cyanolichen habitat.

The area in which the larger patch of the rare lichen *D. plumbea* was found is not planned for any Project development, and therefore will not be cleared (Figures 2.3 and 9.4). Although lichens are considered to be sensitive to changes in microclimate, such as that resulting from removal of adjacent trees, this patch is located less than 40 m from a large clear-cut which occurred sometime after 2003. This population appears to be still doing well, judging by the number of specimens, the considerable number of small (presumably young) specimens, and the reproductive status of all large specimens. As no development is planned for this area of the Project site, the proponent will ensure that this area of forest is left undisturbed. The patch of *D. plumbea* north of Mooseland Road is located on a rather isolated tree in the centre of a recent clear-cut (Figures 9.2 and 9.4). While it is not possible to leave a buffer zone of forest in place around this patch (as there is no existing forest), the proponent will ensure that this tree is not disturbed. The buffer zone along the stream will also remain intact, except for a small section where the reclaim pipeline from the tailings dam will pass through the area. Thus, significant adverse effects on habitat of *D. plumbea* is not anticipated to occur. Forested areas currently existing around *D. plumbea* locations will not be disturbed.

Potential adverse effects on listed lichens may result from air pollution. Lichens rely primarily on air and rain-borne nutrients and thus, are susceptible to air pollution, particularly acidifying or fertilizing sulfur and nitrogen-based pollutants. Unlike vascular plants, lichens do not have a cuticle layer to protect them (Richardson, 1988) and many have been shown to accumulate pollutants, including tiny particulates (Richardson 1992). The utility of lichens as early warning indicators of air pollution is a well-established fact, with countries such as the United States, Switzerland and the Netherlands all currently having established permanent lichen monitoring programs.

The potential air contaminants from the proposed gold ore processing operation include sulphur dioxide, ammonia, and particulate matter. Sulphur dioxide and ammonia will be produced from the electrowinning and smelting phases of the Project. Particulates will be produced in small amounts primarily from construction, blasting, crushing, drilling activities and from the waste rock piles, although some metals will also be released from the smelting phase.

Sulphur dioxide is a typical by-product of coal and fuel oil combustion, ore reduction, paper manufacture, other industrial processes and vehicle exhaust. This soluble gas combines with water to form acid rain when it is emitted high into the atmosphere, where it is oxidized and falls as sulphuric acid. The main impact of acid rain on lichens is to acidify their environment, causing leaching of important nutrients or changes in the buffering capacity of bark and soil (Richardson 1992). Thus, sensitive lichens may thrive on substrates with a high pH which can buffer acid rain, such as the bark of certain deciduous trees or limestone outcrops.

Because of the high reactivity of sulphur dioxide, it also has the potential to disrupt metabolic process in lichens, including photosynthesis, respiration and nitrogen fixation (Richardson 1992), causing negative impacts on growth. Lichens are sensitive to sulphur dioxide because they have no protective cuticle or stomata (Richardson 1988), as vascular plants do, and thus, sulphur dioxide can absorbed directly into lichen thalli through moist cell walls. Lichen species vary in their sensitivity to sulphur dioxide. Many field studies have demonstrated that the more sensitive lichen species can be damaged or killed by annual average ambient levels of sulfur dioxide as low as 8-30 $\mu g/m^3$ (0.003-0.012 ppm) and very few lichens can tolerate levels exceeding 125 $\mu g/m^3$ (0.048 ppm) (Johnson 1979, deWit 1976, Hawksworth and Rose 1970, LeBlanc *et al*. 1972, all cited in Blett *et al.* 2003). A combination of acid rain and habitat destruction is considered responsible for the loss of the boreal felt lichen (*Erioderma pedicellatum*) from Europe, New Brunswick, and most of Nova Scotia (Maas and Yetman 2002).

Low concentrations of sulphur dioxide will be produced intermittently during the electrowinning and smelting process. These gases will be removed from the processing facility by the use of extraction fans and emitted through a stack. The ambient air quality sulphur dioxide guideline for Nova Scotia is a maximum acceptable annual concentration of sulphur dioxide of 60 $\mu g/m^3$. Wind direction in the Moose River Gold Mines areas is generally westerly to northerly in January through April, southerly in

May through October, and again more westerly to northerly in November and December, with an average annual wind speed of 16.5 km/h. Thus local winds will aid in dispersal of sulphur dioxide to near background levels. In addition, fugitive gases escaping from the processing facility and emission from the stacks will consist of warm air, which will rise in the atmosphere to be dispersed instead of remaining at ground level. Dispersion modeling of emissions will be conducted for the proposed Project for purposes of impingement monitoring and results will be submitted in the Industrial Approval document. Results will be used to determine appropriate air quality sampling locations for sulphur dioxide. If feasible, baseline measurements of sulphur dioxide content in sensitive lichen species (possibly *Lobaria pulmonaria* or *L. scrobiculata*) on site may be collected and used to monitor for changes in levels once the Project begins producing emissions. Release of sulphur dioxide from the Project is not expected to have significant adverse effects on rare lichens.

As mentioned earlier, lichens are also sensitive to nitrogen–based pollutants. Ammonia has been shown to have negative impacts on lichens growing in nutrient-poor areas of Europe (Sochting 1987, 1990, cited in Richardson 1992) or when ammonia levels are very high, such as due to agricultural inputs. Low concentrations of ammonia will be produced during the electrowinning and smelting processes. This gas will be removed from the processing facility by the use of extraction fans and emitted through a stack. Once released to the atmosphere, ammonia is expected to be rapidly diluted to background levels, due to both thermal and wind-driven dispersion. As the Project site in not in a nutrient-poor area, and emitted ammonia levels are not predicted to be high, the release of ammonia from the Project is not expected to have significant adverse effects on rare lichens. As mentioned earlier, dispersion modeling of emissions will be conducted for the proposed Project and results will be submitted in the Industrial Approval document. Results will be used to determine appropriate air quality sampling locations. Ammonia emissions are not expected to have significant adverse effects on rare lichens.

Particulates can have negative effects on lichens due to the fact that lichens are known to accumulate metals by trapping insoluble particulates containing metals. Lichens can also take up dissolved metal ions through ion exchange. 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 be excellent monitors of metal contamination around a wide range of industrial sites (Richardson 1992), with spatial patterns in lichen thallus metal levels closely matching patterns of particulate fallout. Emissions from the proposed Project must meet MMER requirements for particulate air emissions, thus air quality monitoring will be conducted on site and measures enacted to ensure these guidelines are met. The dense forest surrounding the site and the relatively high humidity in this coastal forest will also help to minimize penetration of airborne particulates into forested areas. In addition, keeping waste piles dampened during dry periods will minimize particle resuspension from waste piles. Dispersion modeling of particulates from the Project will be conducted, and the results submitted in the Industrial Approval document. These data will be used to select appropriate air quality sampling locations. Release of airborne particulates from the Project is not predicted to have significant adverse effects on rare lichens.

In summary, significant adverse impacts on rare lichens due to air pollution are not predicted, given satisfactory results of the dispersion modeling to be conducted for the Industrial Approval document.

9.3.1.3 FAUNA

Similarly to flora, impacts to fauna have occurred historically from local activities which removed terrestrial habitat. These activities have included forestry, tourism, housing and recreational activities. Potential impacts to fauna include direct mortality or disruptions with potential to affect individuals or populations through alteration or loss of habitat (Project footprint), and disturbance of reproductive or feeding activities (generally due to noise or site activity), and increased mortality (vehicle collision) due to increased traffic or disruption of migration patterns and habitat fragmentation.

The potential for an adverse impact to fauna also exists due to the fact that potentially hazardous substances will be used during the gold-mining process. Sodium cyanide (NaCN) will be used to leach gold from the ore. Cyanide compounds are readily absorbed through inhalation, ingestion, and skin contact, and are readily spread thorough the body via the circulatory system (Eisler *et al.* 1999). At high concentrations, sodium cyanide is a fast-acting respiratory poison. Cyanide compounds have been known to cause large mortality events in wildlife, particularly birds and fish (Eisler *et al.* 1999). These events have generally occurred at gold mines using the heap leaching method (Henny *et al*. 1994), or in situations where tailings are not treated to destroy residual cyanide and where tailings dam failure or accidental discharge events were to blame (Albersworth *et al*. 1989).

To minimize exposure of wildlife to cyanide, the Project design does not utilize the heap-leaching technique, but instead will use six or so large enclosed leaching tanks. Thus, the relatively dilute sodium cyanide leaching solution will be safely enclosed and inaccessible to wildlife at all times. The use of this conventional enclosed leach tank system at the Touquoy Gold Project, plus the inclusion of the INCO SO2/air cyanide destruction step and the water treatment plant for removal of arsenic, ensures that wildlife is not exposed to toxic levels of either of these substances. CN_{WAD} concentration in water in the tailings pond will be <10 ppm. The International Cyanide Management Code (2005) recommends enacting measures to restrict access by wildlife and livestock for open waters in tailings management facilities when levels of CN_{WAD} exceed 50 mg/L. As CN_{WAD} content in the tailings management facility will not exceed 10 ppm, these measures are not necessary. However, as a safety precaution for both humans and wildlife, the tailings and polishing ponds will be fenced.

Potential impacts are also possible due to the fact that ore containing gold tends to contain relatively high levels of arsenic as arsenopyrite, a naturally-occurring mineral. Soil arsenic levels are usually elevated in mineralized zones containing gold, silver, and sulfides of lead and zinc (Dudas 1984). Arsenic may be absorbed by ingestion, inhalation, or through permeation of skin or mucous membranes. In general, inorganic arsenic compounds are more toxic than organic compounds (Eisler 1988). Episodes of arsenic poisoning are either acute or subacute; chronic cases of arsenosis are seldom encountered in any species except humans (Eisler 1988). The probability of chronic arsenic poisoning in animals from continuous ingestion of small doses is rare, because detoxification and excretion are rapid (Woolson 1975, cited in Eisler 1988)). The toxicity of arsenical compounds to wildlife depends on many factors, including the nature of the compound in question, the dose, the exposure route, and the species (Eisler 1988).

The arsenic content of the solid tailings within the tailings dam will be about 0.1%, or 1000 ppm. This arsenic will remain sequestered within the solid tailings and will not be present in significant amounts in the waters of the tailings management facility. Thus it will be relatively inaccessible to wildlife.

In addition, while the ponds may initially seem attractive to wildlife, they are poor substitutes in terms of habitat when compared to natural water bodies in the area, such as Scraggy Lake to the south and Square Lake to the north. The tailings and polishing ponds will be quite deep, and will have steeply sloping sides and thus will not provide easy access or egress for most wildlife. The lack of shallow areas will also prevent aquatic and emergent plant species from becoming established, limiting habitat, breeding areas, and food availability to amphibians and reptiles and to mammals such as beaver, muskrat , and moose.

9.4 MAMMALS

No critical areas for mammals such as deer wintering areas are known to exist in the study area. Although the endangered mainland moose is present in the area, the Project site is not considered to be critical habitat for moose. Deer are known to winter along the shores of Scraggy Lake, to the south. The field survey and a review of existing records did not reveal the presence of any rare mammal species in the immediate vicinity of the study area, with the exception of the mainland moose, discussed above. The habitats present in the study area are commonly encountered throughout the province and are unlikely to provide habitat for rare small mammal species.

Potential impacts to mammals could include direct mortality or disruptions with potential to affect populations such as loss of habitat, habitat fragmentation or significant disruption of migration or reproduction. Habitat loss may occur, if present, through site development and clearing activities. Habitat fragmentation in the local Project area is not expected to add significantly to existing habitat fragmentation in the local area. The area of the proposed mining and processing is currently intersected by an existing paved road, forestry roads and ATV trails. Similar habitat is extensive, surrounding the site to the extent of several hundred thousand hectares.

Disruption of mammal reproduction is not expected to be significant at the property. Noise associated with site activities may disrupt individual mammals within several hundred metres of the active area; however, similar habitat is available throughout the adjacent area and impacts at the population level or to "at risk" species are not expected.

Potential impacts to mammals may occur from exposure to sodium cyanide and arsenic on the mine site. Bats appear to be the most frequent mammal affected by cyanide poisoning from tailings ponds (O'Shea *et al.* 2000). It is also likely that most bat deaths are unreported, as bats are small and easy to overlook, and may fly away from the vicinity of the pit before the effects of the cyanide occur. Bats experimentally dosed with sodium cyanide experienced delayed mortality relative to birds and mice (Clark *et al.* 1991, cited in O'Shea *et. al* 2000). It has been suggested that animals, including bats, which drink weak cyanide solutions may be affected later, once their stomach acids have liberated additional cyanide (Eisler *et al*. 1999). It is for this reason that the International Cyanide Code recommends measuring CN_{WAD} cyanide levels, rather than free or total cyanide. Mortality of red bats (*Lasiurus borealis*), a species not present in Nova Scotia, has been reported from tailings ponds where the concentration of cyanide was reportedly 20 ppm (Clark 1991, cited in O'Shea *et. al* 2000).

Mortality of bats in non-arid regions appears to be concentrated in late summer and fall, possibly due to migrating bats (O'Shea *et al.* 2000). There are no bat hibernacula known from the area which might attract migrating bats in spring and fall. There are over 100 abandoned mine openings within 500 m of the Moose River Gold Mines Provincial Park (Abandoned Mine Openings Database 97-035), however 75% of these are less than six metres deep, and all openings are currently either blocked or filled with water (pers. comm., E. Hennick; NSDNR), and thus are not suitable bat hibernating areas for bats.

The toxicity of arsenical compounds to wildlife depends on many factors, including the nature of the compound in question, the dose, the exposure route, and the species (Eisler 1988). There are few reports of mammals being poisoned by arsenic. Most of these involve livestock accidentally overdosed with delousing or anti-parasite solutions. White-tailed deer (*Odocoilesus virginianus*) have been known to die after licking salty arsenic compounds off tree trunks, when arsenic solutions were used to debark trees (Matthew and Porter, 1989). Snowshoe hares (*Lepas sp.*) have also been known to die after consuming vegetation heavily contaminated with a methylated arsenic compound as a result of careless silviculture practices (Hood 1985, cited in Eisler 1988). Single oral doses of arsenical compounds fatal to 50% of sensitive species tested ranged from 2.5 to 33 mg/kg body weight in mammals (Eisler 1988).

The use of the enclosed leaching system will prevent exposure of mammals to the dilute sodium cyanide solution during the leaching process. The inclusion of the cyanide destruction circuit and a water treatment plant for arsenic removal will minimize cyanide and arsenic levels in the TMF and minimize exposure of mammals to these compounds. Fortunately, chronic effects are not considered to be a problem with cyanide, as it does not bioaccummulate in food webs, nor is it mutagenic or carcinogenic. The rapid detoxification of cyanide by animals allows them to ingest relatively high sublethal doses over extended periods without harm (Eisler *et al.* 1986). The precipitation of arsenic from solution in the water treatment plant will result in arsenic being elevated in the sediments of the tailings management facility, not the water column. As such it will be relatively inaccessible to most mammals. To further minimize exposure of mammals to contaminants, the tailings management facility will be fenced to prevent access by large mammals, humans included. In addition, mammals, particularly bats, are not expected to use the tailings management facility to a significant extent for drinking water, as most reports of mammal mortalities have come from gold mining operations in arid regions (*ie.* western USA) where access to drinking water is limited, and tailings ponds are thus heavily used by wildlife. As fresh water is plentiful in the Moose River Gold mines area, wildlife is not expected to rely on the tailings management facility as a significant source of water.

In summary, significant adverse effects to mammals due to exposure to contaminants are not expected.

It has been suggested that increased traffic due to the Project may impact wildlife in the Tangier Grand Lake Wilderness Area. The most recent traffic statistics for the area (2003) indicate that the average annual daily traffic volume for a location on the Moose River Road 0.5 km south of Route 224 is 330 vehicles per day (Lester Hanley, Traffic Counts, pers. comm. 2007). At the southern-most end of the Mooseland Road, a site 0.5 km north of the junction with Highway 7 an average annual daily traffic volume of 150 vehicles in 2003 was recorded, most of which traffic passes the Tangier Grand Lake Wilderness Area (Lester Hanley, Traffic Counts, pers. comm. 2007). There is no information available on the composition of this traffic (i.e. the proportion of small vehicles and large trucks).

An estimated 200 employees are expected to travel to and from the site each day during the construction period. As most will carpool (3-4 employees per car), an estimated 65 cars will travel to the site each day, for a maximum of 5 days per week during the construction period. In terms of small vehicle traffic conveying mine employees during normal operation, an estimated 20 to 30 cars (based on two people per car) will travel to and from the mine site every 8 to 12 hours. Most of these cars are expected to come from the north, and will not pass the Tangier Grand Lake Wilderness Area. Thus, the Project is not expected to significantly increase the amount of small vehicle traffic passing the Tangier Grand Lake Wilderness Area and, in addition, is not likely to increase the chances of moose being struck by vehicles.

During the construction period, an estimated 1000 loads of materials and equipment are predicted to be delivered to the site. Over a 250 day construction period, this averages 4 loads per day. With an additional 400 loads due to normal operations during the construction period, another 400 loads will be delivered, averaging 1.6 loads per day. Thus 5-6 loads per day are expected during the construction period and 1-2 per day during normal operations once construction is completed.

The very nature of gold mining ensures that there will be little trucking of product from the site when compared to other types of mining operations, such as coal or gypsum mining. It is expected that most of the supply and shipment trucks travel along

Highway 7 from Halifax, turn north at Tangier and along the Mooseland Road to the Project site. These vehicles will travel adjacent to the eastern edge of the Tangier Grand Lake Wilderness Area. This should not be a concern, as the traffic loads resulting from the Project should only cause a slight increase in traffic volume. In addition, the area in which the Project site is located is heavily logged, and heavy logging trucks frequently pass the Tangier Grand Lake Wilderness Area. Thus, disturbance due to Project trucking is not likely to have a significant or cumulative adverse effect on wildlife, in the Tangier Grand Lake Wilderness Area, as the wildlife present is already acclimated to low levels of trucking noise. Traffic may access the site by traveling north along Highway 102 from Halifax, then eastwards from Enfield along Highway 224 then south from Middle Musquodoboit to the site.

Thus, the predicted slight increase in Project-related traffic is unlikely to cause adverse effects on wildlife, particularly moose, in the Tangier Grand Lake Wilderness Area.

Species of Special Status

Section 9 (1) of the *Endangered Species Act* specifies that the Minister appoints a Species-at-Risk Working Group. Section 10 (d) and (e) specifies that part of the Group's duties is to make recommendation to the Minister regarding the content and implementation of recovery plans; and provide advice respecting the conservation and management of species at risk, and their habitat, in the Province. Section 15 (4)(g) and (h) state the recovery plan is to identify habitat of the endangered or threatened species; and identify areas to be considered for designation as core habitat. Section 15(10) states the Minister may appoint a management team and shall within three years of the listing of a vulnerable species, prepare a management plan for the species. Section 15(12) states the Minister shall ensure the implementation of the portions of the recovery or management plan which are provincial responsibilities and which in the Minister's discretion are considered feasible. The mainland population of the eastern moose (*Alces alces americana*) has been listed as endangered under the Provincial Endangered Species Act as of 2003. A Moose Management Plan has not yet been released in the required legislated timeframe and it is not the responsibility of DDVG to undertake this task. However, conservation measures will be taken by DDVG to protect moose from Project infrastructure and activities.

DDVG values the input of the Confederacy of Mainland Mi'kmaq in the Touquoy Project to date via the Mi'kmaq Knowledge Study and moose presence study. DDVG has indicated to CMM a desire to continue this excellent working relationship for additional work relative to mainland moose. DDVG and CMM intend to have additional discussions to formalize this work recognizing the existing and future legislation in Nova Scotia relative to Moose.

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 less well defined in areas in Nova Scotia where snow depths are often not excessive; however suitable wintering areas do contribute to moose survival. Moose are expected to winter in the general area, however the core concentration of moose is not in the 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 present on the study site. 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 Project having a very low potential to affect calving of moose.

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 used in the late spring and summer when moose feed heavily on herbaceous vegetation. Buffer zones of at least 30m wide will be left intact along these rivers to provide foraging areas and migration corridors.

Potential impacts to moose may include direct mortality (vehicles), alteration or loss of habitat, disturbance of reproductive or feeding activities (generally due to noise or site activity), increased predation (natural predators, vehicle collision or hunting/trapping) due to improved access and traffic or disruption of migration patterns and habitat fragmentation. Accidental events could result in similar impacts. Vehicle use on-site could result in accidental mortality of moose. As few moose are in the area, it is unlikely that encounters will occur, however, the importance of individual moose within this herd is recognized. As collisions can be avoided by ensuring on-site vehicle speeds are under 50 km/hour, speed limits below this level will be enforced year round.

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.

The Project is not expected to increase access to the area by the general public and thus is not expected to increase illegal hunting in the area. The increased presence of DDVG personnel in the area may actually discourage poaching and may result in a positive effect as a sanctuary for moose. The Project is unlikely to affect predation levels for moose. Predation on moose in Nova Scotia is limited. The vulnerable period is the first six weeks of a calf's life and predators are expected to be restricted to bear and possibly coyotes. 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.

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. The habitat will undergo restoration and will include terrestrial corridors as part of reclamation.

Direct impacts to moose will be mitigated by measures such as:

- DDVG will limit access for moose to the pit areas using berms and fencing and consult with the appropriate government department on the success of this;
- Mine vehicles will have a 50 km/hour speed limit;
- During calving season, pre-blast visual assessments will be undertaken by DDVG personnel to determine if moose are present in the area and in discussion with NSDNR;
- A no wildlife harassment policy enacted on site;
- Avoidance of active wintering/calving areas if any are identified, *i.e.* disturbance will not occur in these areas during active wintering and or calving periods;
- Staff will not be permitted to use ATVs on-site other than use required for mining related activities;
- Maintenance of wildlife sighting records including moose at the Touquoy Gold Project site;

- The primary moose travel corridors are expected to occur along the river valleys which will not be disturbed;
- Collaborative monitoring strategies for moose will be developed in consultation with NSDNR;
- Discussion with NSDNR and researchers on appropriate habitat restoration;
- Maintaining vegetative buffers that will provide moose browse and shelter whenever possible; and,
- Ongoing communication with NSDNR.

Loss of portions of habitat will be mitigated by collaborative monitoring strategies for moose and will be developed in consultation with NSDNR, and discussion with NSDNR and researchers on appropriate habitat restoration. Such restoration may include:

- Maintaining vegetative buffers that will provide moose browse and shelter whenever possible; and
- 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.

In order to mitigate increased access by general public/predators:

- Public access will not be permitted in the active mine/processing area unless accompanied by mine site staff;
- Should additional access roads and corridors be constructed outside the active area, the routes selected will take potential moose habitat into consideration;
- DDVG will consult with NSDNR during the Project, and development of the Land Management Plan and Reclamation Plan.

9.5 BIRDS

No designated protected areas for migratory birds occur within the study area. No areas of high concentrations of migratory birds were observed such as breeding areas, colonies, spring/fall staging area or wintering areas. 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, however, these habitat types are well represented outside of the proposed area of disturbance. Potential impacts to migratory birds could include direct mortality or disruptions with potential to affect populations such as loss of habitat, habitat fragmentation or significant disruption of migration or reproduction.

Habitat loss may occur, if present, through site development/clearing activities. Habitat fragmentation in the local Project area is not expected to add significantly to existing habitat fragmentation in the local area. The area of the proposed extraction and processing area is currently intersected by an existing paved road and by forestry roads and ATV trails. Similar habitat is extensive surrounding the site to the extent of several hundred thousand hectares.

Disruption of migrating birds is not expected due to the low profile structures, limited lighting and localized activity at the site. Disruption of bird reproduction is not expected to be significant at the property. Noise associated with site activities may disrupt individual birds nesting within several hundred metres of the active area, however similar habitat is available throughout the adjacent area and impacts at the population level or to "at risk" species are not expected.

None of the bird species recorded during the breeding bird surveys listed under the NS *Endangered Species Act*, is considered to be rare in Nova Scotia, or particularly sensitive to anthropogenic activities. 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.

Mitigation measures associated with habitat losses are not expected to be required. Areas of habitat (breeding colonies, staging areas and areas of wintering concentrations) or other important habitat (supporting high abundance, high diversity, priority or at risk species) are not expected to occur within the proposed extraction/processing area. Mitigation for avoiding disruption to breeding birds is discussed above. This should successfully mitigate the possible impacts to the two known yellow-listed birds (Northern Goshawk and Long-Eared Owl) species possibly using the Project site.

The use of sodium cyanide and arsenic on site poses a potential adverse impact on birds. The use of the enclosed leaching method eliminates exposure of birds to sodium cyanide solution during the leaching process, while the water treatment facility will reduce arsenic levels in waste water. 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. A cyanide concentration of 50 mg/L of CN_{WAD} (equivalent to 50 ppm) is considered to be the exposure level below which bird mortalities approach zero (International Cyanide Management Code 2005). The cyanide destruction step of the mining process is expected to result in a CN_{WAD} concentration in the tailings pond of <10 ppm, well below the maximum recommended concentration.

Chronic effects are not considered to be a problem with cyanide, as it does not bioaccumulate in food webs, nor is it mutagenic or carcinogenic. In addition, the rapid detoxification by animals allows them to ingest high sublethal doses over extended periods without harm (Eisler *et al*. 1986). Similarly to cyanide, arsenic also does not bioaccumulate in food webs (Eisler 1988). The water treatment plant has been designed to eliminate most of the arsenic from the tailings water by the addition of ferric sulphate to precipitate arsenic from solution. Arsenic content of the solid tailings within the tailings dam will be about 0.1%, or 1000 ppm. The arsenic will remain within the solid tailings and will not be elevated in the water column.

In addition, while the ponds may initially seem attractive to waterfowl, they are poor substitutes in terms of habitat when compared to natural water bodies in the area, such as Scraggy Lake to the south and Square Lake to the north. The behaviour of individual bird species influences their risk of cyanide poisoning. In particular, wading and dabbling species of birds appear to be the most susceptible (Northern Territory Department of Mines and Energy, 1998) The tailings and polishing ponds will be quite deep, and will have steeply sloping sides and thus will not provide any shallow foraging areas for wading and dabbling species. The lack of shallow areas will also prevent aquatic and emergent plant species and benthic macroinvertebrate communities from becoming established, further decreasing food availability to birds. Cyanide tailings ponds are also limited with respect to plankton communities because, as cited in Simovic and Snodgrass (1985), they often have very high ph (>10), low nutrient levels, and large quiescent zones. Thus, the tailings pond will have few characteristics attractive to birds. The Project site is not considered to be an important stopover point for migrating birds and thus, is not expected to attract large numbers of migratory waterfowl.

Thus, the tailings management facility is not expected to have a significant adverse impact on migratory or breeding birds.

9.6 HERPETILES

The main impact to amphibians and reptiles will be habitat loss. Amphibians in particular will lose habitat due to the removal of four wetlands on the study site. However, none of these wetlands contained suitable breeding habitat for amphibians, due to the lack of pools of standing water. No rare or endangered reptiles or amphibians are known to occur on the study site.

There is little information available regarding the effects of sodium cyanide and arsenic on herpetiles. Poorly-managed gold mining in South America has produced some poisoning of rain forest rivers with cyanide and arsenic, which has resulted in increased amphibian mortality and morbidity. The present Project will not result in contamination of rivers in the area, due to the cyanide destruction circuit and arsenic-removing water treatment plant included in the Project design, and to the proponent's adherence to the strict requirements of the Cyanide Management Code.

No critical reptile or amphibian habitat will be impacted by the Project construction or operation. Reclamation of the land by reintroducing terrestrial habitat will successfully mitigate this potential long term impact. Noise and dust control and maintaining limits of work will also reduce impacts to herpetiles. There are no potential impacts to rare or endangered reptile or amphibian species anticipated with this Project. Loss of some non-critical habit due to removal of wetlands will be mitigated by the creation of compensatory wetlands.

9.7 SUMMARY

In summary, assuming that the proposed wetland compensation and mine site reclamation mitigation measures are applied, and that appropriate reagent management and emissions guidelines are met, the Touquoy Gold Project is not likely to have significant adverse effects on terrestrial resources in the area.

10.0 WETLANDS

10.1 EXISTING ENVIRONMENT

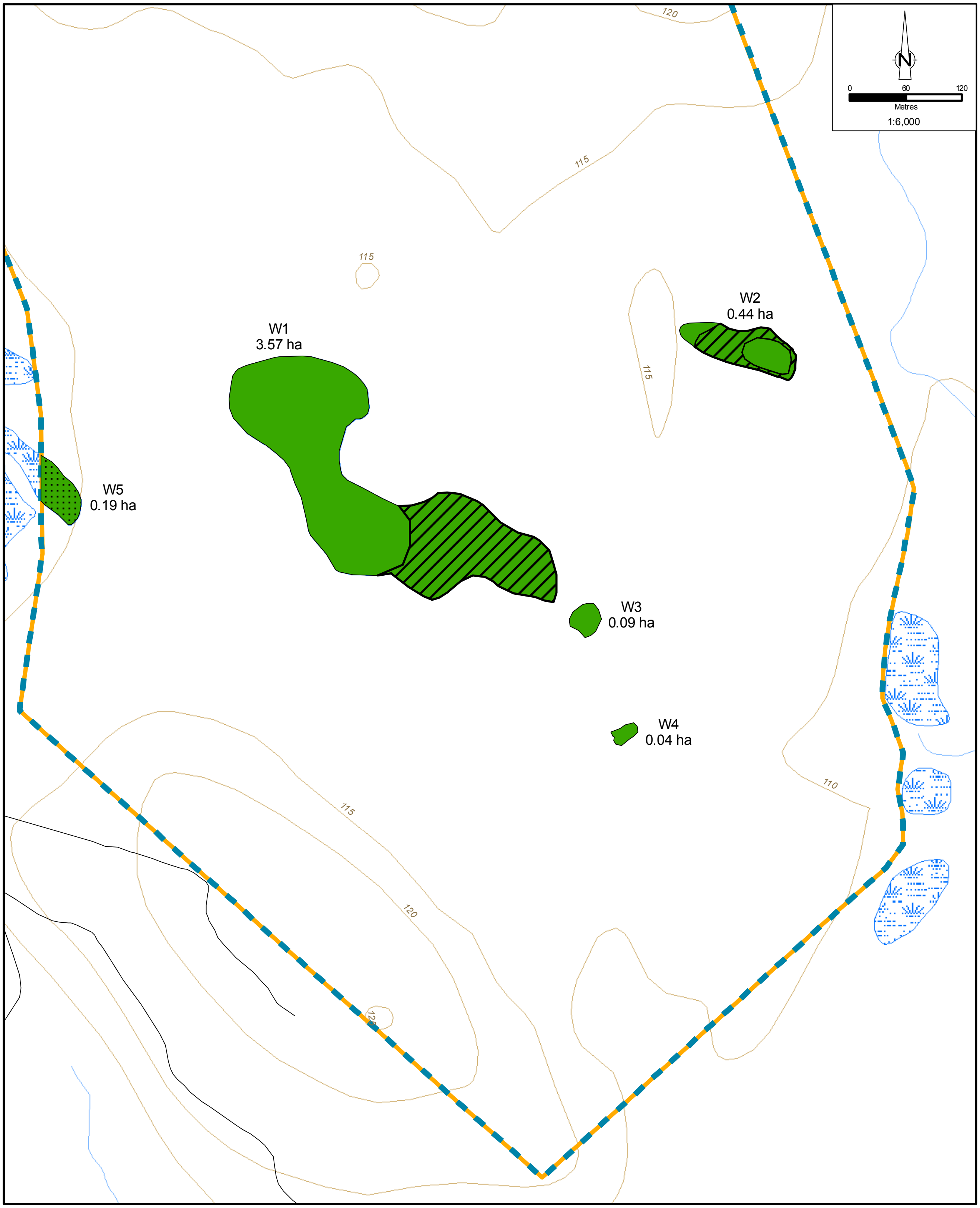
Wetlands are protected under the provincial *Environment Act* and an approval is required for alteration. Information regarding wetlands within the study area was derived from several sources, including the NSDNR Wetlands Database, 1:10,000 scale topographic mapping, 1:10,000 scale colour air photos, and field surveys. The Project boundaries have been adjusted to minimize impacts to Moose River and associated wetlands, and to other wetlands in the area. The southern perimeter of the Project site was adjusted to avoid a wetland complex located to the east.

The NSDNR Wetlands Database lists four wetlands on the adjusted Project site. Air photo interpretation and field surveys revealed another two small wetlands on the site. These wetlands are depicted in Figure 10.1. Five wetlands were assessed in September 2006. These wetlands will be revisited in spring of 2007 and additional information on species of flora and fauna present, as well as information on the depths and levels of humification of peat will be obtained. As per the NSEL regulations, a Wetland Report has been prepared for each wetland, and is provided in Appendix K. A brief description of each wetland is given below. The sixth, a small wetland north of the tributary to Moose River which runs north-south on the project site, will not be disturbed by the Project and thus was not evaluated.

Due to the field surveys being conducted in late summer, breeding bird surveys were not possible for the wetlands. Breeding bird surveys will be conducted in spring of 2007. Additional mammal and herpetile surveys will be conducted concurrently.

Wetland 1

Wetland 1 (Figure 10.1) encompasses 3.57 ha and consists of low shrub bog which grades into treed bog at the southeastern end. It is centered on 506067 E, 4980678 N. This wetland is characterized by a low layer of ericaceous shrubs (< 0.5m) consisting of *Chamaedaphne calyculata, Kalmia angustifolia, K. polifolia, Ledum groenlandicum*, *Gaylassacia baccata*, and *Rhododendron canadense*. Low-growing ericaceous plants such as *Vaccinium oxycoccos* and *Emptrum nigrum* are also present. Ground vegetation consists of *Cladonia spp.*, *Sphagnum* spp., *Vaccinium oxycoccos, Coptis trifolia,* cottongrass (*Eriophorum virginicum),* and *Solidago uliginosa*, with a considerable patch of northern pitcher plant (*Sarracenia purpurea)* located in the northeast corner of the wetland. A few scattered



Building
Road
Rivers and Streams
Surface Contour Line (10 m)
Shrub Bog
Treed Bog
Tall Shrub Swamp
Lake
Other Wetlands

Figure 10.1
WETLANDS LOCATED ON PROJECT SITE
Touquoy Gold Project, DDV Gold Ltd.
Halifax County, Nova Scotia

Data projected to UTM (Zone 20T) NAD83

larch *(Larix laracina*) and black spruce (*Picea mariana*) trees are also present in the more open portion of the bog. These species, along with red maple, became more abundant in the southeastern corner of the wetland. A Blue Jay (*Cyanocitta cristata*) and a Common Crow (*Corvus brachyrhynchos*), and evidence of white-tailed deer (*Odocoileus virginianus*) and varying hare (*Lepus americanus*) were observed in this wetland during the Sept 2006 field survey.

No amphibians or reptiles were observed during the field survey.

This wetland will be revisited in spring of 2007 and additional information on species of flora and fauna present, as well as information on the depths and levels of humification of peat will be obtained.

Wetland 2

Wetland 2 (Figure 10.1) is a wetland complex consisting of coniferous treed bog and two areas of low shrub bog. This wetland complex has a total area of 0.44 ha and is centered on 506474 E, 4980867 N.

The treed bog supports a plant community dominated by black spruce and larch, with a few scattered Red maples, *Acer rubrum*. Shrubs consist of *Viburnum nudum* and *Ilex verticillata*, while ground vegetation consists of *Cornus canadensis* and *Rubus hispidus, Viola* spp.

The low shrub bog is dominated by leatherleaf, lambkill, and Labrador tea, while the ground vegetation consists of sphagnum, *Vaccinium oxycoccos*, cottongrass, *Smilacina trifolia*, and round-leaved sundew, *Drosera rotundifolia*.

No birds, amphibians or reptiles were observed during the field survey.

This wetland will be revisited in spring of 2007 and additional information on species of flora and fauna present, as well as information on the depths and levels of humification of peat will be obtained.

Wetland 3

Wetland 3 (Figure 10.1) is a very small wetland dominated by low shrub bog. This wetland is 0.09 ha in area and is centered on 506334 E, 4980582 N. This bog supports a plant community dominated by bog shrubs such as leatherleaf, lambkill, labrador tea, *K.*

polifolia, and stunted black spruce. Some *Viburnum nudum* is also present around the margins of the bog. A few tree-height black spruce are also present. Ground vegetation consists of *Cladonia* spp., *sphagnum* spp. and *Empetrum nigrum*, with some *Carex stricta* and goldthread as well. Evidence of varying hare *(Lepus americanas)* was observed in this wetland.

No birds, amphibians or reptiles were observed during the field survey.

This wetland will be revisited in spring of 2007 and additional information on species of flora and fauna present, as well as information on the depths and levels of humification of peat will be obtained.

Wetland 4

Wetland 4 (Figure 10.1) is a tiny wetland dominated by low shrub bog. This wetland is 0.04 ha in area and is centered on 506366 E, 4980452 N. This wetland is dominated by leatherleaf and lambkill, with some Labrador Tea, and a few stunted larch and black spruce. Ground vegetation consists of *Vaccinium oxycoccos*, *Empetrum nigrum*, and cottongrass, and an unknown orchid (likely *Liparis loesli*, identification to be confirmed during spring surveys). *Cornus canadensis* and goldthread are also present. This wetland also contains open mucky areas which were considerably wetter at the time of the survey than all other wetlands on the study site. Ephemeral pools are likely present during wetter periods, and likely provide habitat for *Utricularia* species. Evidence of white tailed deer and varying hare was observed in this wetland. A few old moose tracks were also observed in this bog.

No birds, amphibians or reptiles were observed during the field survey.

This wetland will be revisited in spring of 2007 and additional information on species of flora and fauna present, as well as information on the depths and levels of humification of peat will be obtained.

Wetland 5

Wetland 5 (Figure 10.1) is a 6.0 ha wetland consisting of open water surrounded by shrub bog and with areas of tall shrub swamp around the perimeter. It is centered on 4980726 N, 0505651 E.

The open water portion of this wetland is home to submerged and emergent aquatic species such as pipewort (*Eriocaulon aquaticum*) and pondweeds (*Potamogeton spp*. (confirmed not to be the listed pondweed species). The bog portion surrounding the open water contains shrub species such as pale laurel (*Kalmia polifola*), Labrador tea (*Ledum grouenlandicum*), speckled alder (*Alnus rugosa*), and meadowsweet (*Sprirea alba*), with rhodora (Rhododendron canadense) and leatherleaf (*Chamaedaphne calyculata*) in wetter areas. There are also a few black spruce (*Picea mariana*) and tamarack (*Larix laracina*) scattered throughout and around the perimeter. There are scattered pockets of sphagnum development containing typical species such as northern pitcher plant (*Sarracenia purpurea*) and round-leaved sundew (*Drosera rotundifolia*). Surrounding the bog, there are areas of tall shrub swamp containing larch, speckled alder, meadowsweet, red maple, and Labrador tea.

Only a small portion (0.19 ha) of the tall shrub swamp area will be impacted by the proposed Project, the edge of the eastern lobe (Figure 10.1). The tree layer in this region consists of scattered larch (*Larix laracina*) and a few Ash *(Sorbus americana).* Shrubs such as speckled alder (*Alnus rugosa*), meadowsweet (*Spiraea alba)*, possum-haw viburnum (*Viburnum nudum)*, immature red maple (*Acer rubrum*), and Labrador tea (*Ledum groenlandicum*). Ground vegetation consists of sphagnum mosses (*Sphagnum* spp.), dewberry (*Rubus hispidus*), dwarf dogwood (*Cornus canadensis*), and scattered sedges (*Carex trisperma* and *C. imtumescens*).

During the field survey for Wetland 5 on September 13 2006, three bird species were observed in vicinity of the wetland. These were Spruce Grouse, Pileated Woodpecker and Common Crow. None of these birds are expected to breed in tall shrub swamp.

Evidence of black bear (*Ursus americana*), red squirrel (*Tamiasciurius hudsonicus*) and eastern chipmunk (*Tamias striatus*) was noted in the vicinity of Wetland 5 during the September 13 2006 wetland survey.

No amphibians or reptiles were observed during the field survey.

This wetland will be revisited in spring of 2007 and additional information on species of flora and fauna present, as well as information on the depths and levels of humification of peat will be obtained.

10.2 POTENTIAL EFFECTS, PROPOSED MITIGATION, AND FOLLOW-UP MONITORING

Wetlands are known as productive natural areas which bridge the gap between terrestrial and aquatic environments. As productive natural areas, wetlands provide habitat for diverse and abundant animal and plant communities. However, as they are not often recognized for their ecological value, wetlands are often threatened by development. As a result, wetland habitat is of concern to provincial regulators. Any alteration to a wetland in Nova Scotia requires a Wetland Alteration Approval permit.

The development of the Touquoy Gold Project will result in the removal of the four wetlands and a small portion of a fifth wetland located within the proposed Project area (Wetlands 1, 2, 3, 4, and 5). This will result in the loss of 4.33 ha of wetlands on the Project site. An application for a Wetland Alteration Approval permit will be submitted to the NSEL for all five wetlands to be impacted by this Project. A total of 4.13 ha of wetland habitat will be removed from the area by the construction of the Touquoy Gold Project. This will result in loss of habitat to both plant and animal species dependent on wetland, in this case bog, habitat. The wetland reports prepared for the Wetland Alteration Approval (Appendix K) demonstrate that no significant habitat loss for wildlife and plant species in the area would occur with the removal of Wetlands 1, 2, 3, and 4 and the removal of a small portion of Wetland 5.

DDVG 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. DDVG 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. DDVG 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. DDVG is considering creating wetland habitat onsite once mine operations are completed by ensuring that the flooded pit has sufficiently shallow edges to support a large marsh-type wetland. If this is not possible, DDVG will consider a wetland enhancement or creation project outside of the local watershed. Contribution to wetland education and/or protection programs may also be considered.

10.3 SUMMARY

In summary, assuming that the proposed compensation and mine site reclamation mitigation measures are applied, and that existing site drainage conditions are maintained, the Touquoy Gold Project is not likely to have significant adverse effects on wetland functional attributes in the area.

1I.0 ARCHAEOLOGICAL AND CULTURAL RESOURCES

11.1 EXISTING ENVIRONMENT

An archaeological screening was conducted by the Cultural Resource Management Group (CRM) to evaluate the archaeological potential within the proposed development limits. The results of the study indicated that there is a low archaeological potential ascribed to the area. The report is located in Appendix L.

The site area also has some potential for heritage resources based on late 1800s and early 1900s gold mining history. Due care will be taken during the development and mining operation to ensure that discovery of any objects of historical or archaeological relevance is immediately notified to the Nova Scotia Museum and/or The Confederacy of Mainland Mi'kmaq.

Mi'kmaq Land and Resource Use

There are no Mi'kmaq communities within the site boundaries. The closest reserve is Beaver Lake at a distance of approximately 15 km away to the southeast. A Mi'kmaq Knowledge Study has been prepared and is provided in Appendix M.

11.2 POTENTIAL EFFECTS, PROPOSED MITIGATION, AND FOLLOW-UP MONITORING

On the basis of the archaeological screening program, which combined archival research and limited field reconnaissance, the entire Moose River Gold Mines study area, as defined in this report, is ascribed low archaeological potential. At Moose River Gold Mines, the surviving mine features, standing buildings and the buried remains of buildings that are no longer standing, are not old enough to be considered archaeological features. They are, however, of considerable historical interest, as demonstrated by the existence of the Moose River Mines Museum.

Based on those conclusions, CRM Group offered the following management recommendations for the study area:

1. Given the low archaeological potential ascribed to the study area, it is recommended that the entire area be cleared of any further archaeological investigation prior to development.

2. In the event that archaeological deposits or human remains are encountered during construction, all work in the associated area(s) should be halted and immediate contact should be made with the Nova Scotia Museum (David Christianson: 424-6461).

3. Given the historical significance of Moose River Gold Mines, it is recommended that DDVG work with the provincial Heritage Division to develop a strategy for the documentation of the community before it is impacted by mine development.

11.3 SUMMARY

In summary, assuming that the proposed mitigation measures are applied, the Touquoy Gold Project is not likely to have significant adverse effects on archeological and historical features in the area.

12.0 POPULATION AND ECONOMY

12.1 EXISTING ENVIRONMENT

The Project site encompasses most of the present settlement of Moose River Gold Mines, a former gold mining community with a peak population of up to 5000 during its most productive period in the late 1800s.

Census figures subsequent to the last underground mining activity in 1936 are as follows:

1941	108
1951	82
1956	63
1961	61
1981	22

The permanent population of Moose River Gold Mines in 2003 when DDVG commenced its involvement in the Project was 21 and by October 2006 had reduced to eight. There are presently 27 houses, plus outbuildings, remaining, and excepting accommodation for DDVG personnel, five of these are permanently occupied, eight are used for occasional recreational purposes, and fourteen are permanently vacant. In addition to the houses there is a small museum, which was the former schoolhouse and today operates in the summer months under the auspices of the Musquodoboit Valley Tourism Association, and a United Church building. The last church service, a funeral, was conducted in 1997.

Including lands owned by the Crown and Neenah Paper Inc there are 65 individual parcels of land (PID's) within the Project's footprint, and these are owned or identified with 40 individual parties. These include one property owned by DDVG. Option agreements to purchase these properties have now been negotiated with most of these parties and a small minority of properties with unclear titles have been returned to the Registrar General of Land Titles for determination.

Of particular note are two properties held by the Crown (NSDNR) which comprise the Moose River Provincial Park, an area of 4.3ha. Legislation provides for exploration and mining within this Park. It is located such that a substantial area of the Park will be encompassed within the open-pit. Fruitful discussions have been held with the Parks Division of the NSDNR and with the Musquodoboit Valley Tourism Association in relation to a suggestion by DDVG to re-locate the Park nearby, with possible incorporation of the existing museum into a simple but functional interpretation centre. As common in many modern gold mining operations worldwide, this facility could celebrate the gold mining history of the site (the 1936 cave-in at Moose River Gold Mines being of specific interest) and demonstrate modern gold mining and processing technology. This facility, accessible by simple excursion from Halifax, could be expected to enhance the local tourism potential. DDVG is open to other suggestions from the wider community as to re-location of the Park and improvements to the museum and its interpretive value.

12.2 POTENTIAL EFFECTS, PROPOSED MITIGATION AND FOLLOW UP

The Proponent proposes to purchase/option properties within the site boundary, demolish or remove the existing buildings, and mine within the Moose River Provincial Park (as permitted by legislation). These activities will adversely impact the current settlement within Moose River Gold Mines.

As discussed previously, there are 27 houses, plus outbuildings, presently remaining within this settlement. Discussions to date with the owners of properties that are permanently occupied (five at present) and owners of those properties used for occasional recreational purposes (currently eight) have generally shown support for the Project and the benefits of relocation; however, discussions on options to purchase are still underway with some non-resident land owners. It is understood that approval by NSEL under the Environmental Assessment Regulations pursuant to the *Environment Act* does not influence the rights of the property owners to negotiate with DDVG.

Within the scope of this Project, there is potential to relocate the Moose River Provincial Park to a nearby location. While Section 20 of Nova Scotia's *Provincial Parks Regulations* allows mineral exploration and mining development within the Moose River Provincial Park, discussions are underway to relocate the Park to a nearby location with the goal of improved access and recreation potential.

In addition, the existing Moose River Mines Museum may be incorporated into a permanent interpretation centre. This new centre may provide explanation of the new mine in operation, and display artifacts and information panels on past mining in the area. DDVG's mining plan does not require that the Museum be moved; however, the local benefit of enhancing the heritage of the area has been communicated by the stakeholders and is understood by DDVG.

With respect to the potential adverse impacts on the Provincial Park and the Museum, discussions are ongoing with the Parks Division of NSDNR and the Musquodoboit Valley Tourism Association regarding these mitigative measures. It is believed that adverse impacts can be mitigated by working with the community, heritage/tourism groups and other stakeholders. DDVG has shown commitment to working with stakeholders and the regulators on these issues.

12.3 SUMMARY

In summary, the residents and landowners will obtain fair compensation for their homes and there is a potential positive effect on tourism, therefore no significant adverse effects are anticipated to result from development of the Touquoy Project.

13.0 TRANSPORTATION

The Touquoy Gold Project will use existing roads and transportation infrastructure with the previously described changes. The traffic loads and vehicle types resulting from the Project are similar to those of existing conditions and are therefore not a project impact.

Bussing arrangements to surrounding collection points could be organized to reduce traffic flow on the Mooseland Road if issues arise. Wherever possible, DDVG has a preference to train and employ local people for this Project.

14.0 EFFECTS OF ENVIRONMENT ON THE PROJECT

The definition of an environmental effect includes changes to the Project that may be caused by the environment. In the case of a open pit mining operation, potential effects of the environment on the Project include meteorological conditions, specifically precipitation. Precipitation and runoff may cause temporary delays in mine construction, operation, and rehabilitation activities.

On a national basis, Canada shows a warming and cooling pattern with a higher overall warming trend of approximately 1.1 ºC since 1895. The Atlantic Region, however, shows a warming trend from 1895 which peaked in the mid-1950s followed by a cooling trend in the 1990s. The overall warming trend of 0.4 ºC in Atlantic Canada since 1895 is not statistically significant. With respect to precipitation, the Atlantic Region shows an overall increasing trend in precipitation since 1948, with an increasing trend in the number of daily precipitation events above 20 mm and a very slightly increasing trend in the number of daily snowfall events above 15 cm (Lewis 1997). There are a number of planning, design and construction strategies intended to minimize the potential effects of the environment on the Project so that the risk of damage to the Project or interruption of service can be reduced to acceptable levels. Mitigation measures include, but are not limited to, designing and installing erosion and sediment control structures to accommodate appropriate levels of precipitation, and consideration of weather conditions when scheduling activities, including scheduling of activities to accommodate weather interruptions. Apart from some processing functions Project activities will be taking place out-of-doors and thus weather has been and will be factored into all Project activities.

Heavy snowfalls and significant snow accumulation may have short term impact on the mine's ability to remain open. In summary, meteorological conditions, including climate change, are not anticipated to significantly affect the operation of the mine over its proposed lifetime.

15.0 FUNDING

No federal funding or federal land is sought for this Project. The undertaking is 100% privately funded by the proponent, DDVG.

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