APPENDIX A

EIS Guidelines and Table of Concordance

Government of Newfoundland and Labrador
Department of Environment and Conservation

Honourable Charlene Johnson
Minister

December 9, 2008

GUIDELINES

for

Environmental Impact Statement

Schefferville Area Iron Ore Mine

INTRODUCTION

Labrador Iron Mines Limited is required through the provincial environmental assessment process to prepare an Environmental Impact Statement (EIS) for the Schefferville Area Iron Ore Mine. The purpose of the EIS is to identify the potential environmental effects associated with the proposed undertaking, identify appropriate mitigative measures and predict the significance of the residual and unmitigable effects. The EIS will contain a review of all available pertinent information or data as provided by the proponent or requested by the Minister of Environment and Conservation. The contents of the EIS will be used by the Minister of Environment and Conservation, in consultation with Cabinet, to determine the acceptability of the proposed project based on its anticipated environmental effects, proposed mitigation and significance of residual environmental effects. The EIS will be as concise as possible while presenting the information necessary for making an informed decision.

As more specific information is provided and as additional baseline information is gathered, other concerns and potential effects may be required to be considered by the Minister as recommended by the Environmental Assessment Committee.

The proponent is required to hold public information sessions on the environmental assessment results in the town of Labrador City-Wabush

The purpose of the Guidelines is to assist the proponent in completing an EIS which conforms to legislative requirements and to address information requirements that will assist in making an informed decision on the undertaking. The contents of the EIS should be organized according to the following format and address the identified information requirements:

1. Executive Summary

The executive summary will contain the following information: identification of the proponent; a project overview; predicted environmental effects (both biophysical and socio-economic); mitigative measures; residual environmental effects; cumulative environmental effects; proposed monitoring programs and response plans and a summary of the fundamental conclusions of the EIS. The summary will allow reviewers to focus immediately on areas of concern.

The summary will be written in terms understandable to the general public.

2. Introduction

2.1 Name of Undertaking

The undertaking has been assigned the Name "Schefferville Area Iron Ore Mine." The proponent should identify the name which it proposes to use for the undertaking.

2.2 Identification of Proponent

Name the corporate body and state the mailing address.

Name the chief executive officer and state the official title, telephone number, fax number and e-mail address.

Name the principal contact person for purposes of environmental assessment and state the official title, telephone number, fax number and e-mail address.

2.3 Purpose of the Environmental Impact Statement

The purpose of the Environmental Impact Statement is to report on the results of the process by which the change in the present or future environment that would result from an undertaking is predicted and evaluated before the undertaking has begun or occurred.

3. The Proposed Undertaking

3.1 The Prospective Site and Study Area

A precise description of the boundary of the prospective site is to be presented, accompanied by maps of an appropriate scale showing the entire project with principle structures and appurtenant works;

The information on the boundary and extent of the project area is to be in digital form on computer discs in a format suitable for incorporation in a Geographic Information System (GIS). Maps should be at a 1:50,000 scale and possibly in ARC shape format. As a minimum, the information is to consist of sufficient number of geographic coordinates of point locations, line locations and/or spatial extent, as appropriate, of the features at the selected map scale and projection to either re-create the hard-copy versions provided as part of the EIS or to accurately display the features digitally. (Information already available on the National Topographic maps need not be provided.) The information must be organized and labeled such that each unique feature is distinguishable from all others. Appropriate descriptive parameters of each data set such as projection, UTM Zone, datum and data collection method (e.g., GPS, aerial survey, etc.) must also be included. The format should be in ASCII tabular format or in a spreadsheet or database format such as Lotus 1-2-3, Excel, dBase or similar software.

3.2 Rationale/Need/Purpose of the Project

The rationale for the project will describe its perceived benefits, both local and provincial. If the undertaking is in response to an established need, this should be clearly stated.

3.3 Alternative Means of Carrying Out the Project

A detailed discussion of technically and economically feasible alternative means of carrying out the project, and the environmental effects of such alternative means must be provided with supporting argument.

A detailed summary is required of the possible alternatives to the project and/or individual project components which were or could have been considered including but not limited to tailings disposal options If only one alternative is viable or possible, a statement will be made to this effect with supporting argument.

3.4 Relationship to Legislation, Permitting, Regulatory Agencies and Policies

The EIS will identify and discuss the project within the context of all existing relevant legislation and policies (municipal, provincial and federal). The proponent will provide a comprehensive list of permits and regulatory approvals required for the undertaking. The list will include the following details.

- activity requiring regulatory approval,
- name of permit and/or regulatory approval (e.g. authorization),
- legislation requiring compliance,
- regulatory agency.

3.5 General Project Description

The EIS will describe the scope of the project for which an assessment is being conducted.

The EIS will provide a written and graphic description (e.g. maps and drawings) of the physical features of the undertaking particularly as it is planned to progress through the construction and operation phases of its lifespan. The description should also address other phases of the project as can reasonably be foreseen, including modification, decommissioning and abandonment. Any assumptions which underlie the details of the project design shall be described, including effects avoidance opportunities inclusive of pollution prevention, and adherence to best management practices. Where specific codes of practice, guidelines and policies apply to items to be addressed, those documents shall be cited and included as appendices to the EIS, including mapping at an appropriate scale. Physical features include, but are not limited to:

- access road(s), and intersections, including those which may require upgrading, as well as service roads.
- lighting

- stream(s) or other water bodies to be dewatered
- residue ponds and/or clarification ponds
- stream crossings, including culverts, bridges and fording sites
- temporary stream diversions
- exact locations of mineral licenses and ore bodies to be mined in relation to Newfoundland and Labrador and Quebec provincial geographic boundaries
- borrow pits, major excavations, waste rock disposal locations and their rehabilitation
- temporary sewage and waste disposal facilities
- methods of handling waste and refuse at work and camp locations
- mine infrastructure, including ore crushing, screening and washing facilities, fuel tanks and utilities (including water supply and distribution, water treatment, rock fines and wash water discharges, electricity supply configuration and owner/operator arrangements, substations and/or on-site electricity transmission/distribution lines or alternative generation methods)
- railway infrastructure, including railcar loading station, ties, rails and ballast on rail bed
- ownership of new railway infrastructure, regulatory governing body and designation of common carrier status
- plant and storage facility for manufacturing and storing explosives
- support buildings, including but not limited to, administrative and engineering offices, warehouses, maintenance buildings and laboratory.
- effluent treatment plant components, as well as effluent discharge locations and configuration and including anticipated effluent plume(s)
- planned feasibility studies associated with the project, proposed mineral resources included within the feasibility studies and completion dates
- Clearance/condemnation work in areas underlying proposed waste piles, including in pit or on land disposal of fines and other infrastructure

3.6 Construction

The details, materials, methods, schedule, and location of all planned construction activities related to the physical features will be presented including estimates of magnitude or scale where applicable. This is to include but not be limited to, the following:

- general construction practices incorporating erosion and sedimentation control
- construction schedule, including proposed time frames for right-of-way clearing, slash disposal, construction adjacent to watercourses, utility placement, processing and storage facilities
- worker housing, providing a detailed overview of the housing for workers to be used during the construction and operation phases, including but not limited to location(s), capacity and facilities
- solid waste disposal and disposal of construction waste, as well as identified opportunities for waste recycling

- worker transportation, including details on the methods of transportation used to get workers to and from camps/worksites
- site preparation (i.e., grubbing/clearing of right-of-way, cut and/or fill operations, etc.)
- water body alteration: a 15 metre undisturbed buffer along the high water mark of all water bodies must be maintained. Identify any alterations that must be carried out in the water or within buffer areas, such as for water supply intakes, stream crossings, effluent discharges, storm drainage works or infilling and any stream activities
- design and information regarding the upgrading of any existing watercourse crossing associated with new or existing roads or railway
- location of blasting activities in relation to watercourses/waterbodies
- stream crossing structures: location of watercourse crossings for access and service roads, transmission lines, railroads, as well as any pipeline crossings, their proposed infrastructure (e.g., bridge, culvert), and their proposed specifications (e.g., clearance from watercourse, height, width, length, diameter, and construction materials); infill area or footprint together with design criteria and standards, length, width, cross section and estimated types and amount of fill material required. To avoid impacts on fish and fish habitat it is recommended that all watercourse crossings be designed and installed such that abutments are above the high water mark.
- proposed locations for any de-watering wells, pipelines, and discharge infrastructures
- electrical systems: location of substations, transmission
- estimate all significant emissions during construction, including but not limited to sources from generators, heaters, vents, storage tanks, stockpiles, vehicles, road surfaces, effluent treatment systems, and mobile sources.
- excavations
- blasting operations
- vehicle types, truck routes, hours of operation of vehicles
- transport, storage and use of hazardous materials
- establishment, operation and removal of construction camp and yard areas including their water, sewage and food handling provisions
- sources and estimated volumes of acceptable types of aggregate, ballast and pit-run material with identification of any currently known sources likely to be used
- disposal areas for excess/waste rock and overburden, including locations of any currently known or planned disposal sites
- disposal areas for organic soil, slash and grubbing , including locations of any currently known or planned disposal sites
- plans for harvested wood fibre associated with the project
- removal of temporary operations
- site rehabilitation and monitoring

With a goal of maximizing benefits for the province, the proponent shall present a strategy to ensure Full and Fair Opportunity and First Consideration for employment, contracting and procurement, education and training.

This strategy must identify corporate hiring objectives, quantitative and qualitative goals, special measures and policies; monitoring of compliance with objectives, goals, measures and policies; duration of contracts and/or employment and provide for a communication plan and any required re-evaluation process of objectives, goals, measures and policies. Included will be a Women's Employment Plan as a tool to aid the gender equity objective of the corporate hiring strategy.

In order to properly assess the socio-economic impacts in the province specific information on, but not limited to the 150 construction positions, contracting and procurement, and education and training will be provided, including a benefits statement with a concise description of the proportion of positions, contracting and procurement, and education and training opportunities which will be available to Newfoundland and Labrador residents, contractors, sub contractors and businesses in relation to the project totals.

Specific numbers by National Occupational Classification (NOC-2006), gender and employment equity considerations and period of employment will be provided.

Identify any measures to be implemented that may require contractors and sub-contractors to include employment equity considerations. Initiatives for the hiring of journeypersons, apprentices, engineering and technology students during construction and also those initiatives to increase opportunities for under-represented groups will be described. Provide an analysis of the availability of the skilled workforce necessary to complete the project and how any shortages in skilled trades may be addressed. The analysis is to include all positions associated with the project, listing the province in which they are located.

3.7 Operation and Maintenance

All aspects of the operation and maintenance of the proposed development will be presented in detail, including but not limited to information on the 75 operation and maintenance positions by National Occupational Classification (NOC-2006), gender and period of employment. Operation includes, but is not limited to, product excavation, product processing, product delivery, value-added secondary processing, product export and waste residue disposal. The analysis is to include all positions associated with the project, listing the province in which they are located.

With a goal of maximizing benefits for the province, the proponent shall present a strategy to ensure Full and Fair Opportunity and First Consideration for employment, contracting and procurement, education and training.

This description must identify corporate hiring objectives, quantitative and qualitative goals, special measures and policies; monitoring of compliance with objectives, goals, measures and policies; duration of contracts and/or employment and provide for a

communication plan and any required re-evaluation process of objectives, goals, measures and policies. Included will be a Women's Employment Plan as a tool to aid the gender equity objective of the corporate hiring strategy.

In order to properly assess the socio-economic impacts in the province specific information on, but not limited to the 75 operating positions, contracting and procurement, and education and training will be provided, including a benefits statement with a concise description of the proportion of positions, contracting and procurement, and education and training opportunities which will be available to Newfoundland and Labrador residents, contractors, sub contractors and businesses in relation to the project totals.

Information regarding the nature of any cross-border mobility for employees/contractors associated with the project will be provided.

Direct and indirect impacts the project may have on existing mining operations, railway operations, mineral exploration and/or mine development on mineral titles held by other parties in the area and right's of way will be provided. An analysis of the direct and indirect impacts the project may have on the operations or future viability of other mining projects in Labrador West including, but not limited to The Iron Ore Company of Canada, Wabush Mines and New Millennium Capital Corporation and the capacity of the QNS&L, Tshiuetin Rail Transportation and Wabush Mines Arnaud railways, will be required.

Estimate all significant emissions during operation, including but not limited to, sources from ore crushing screening and washing facilities, heaters, vents, storage tanks, stockpiles, ponds, basins, vehicles, road surfaces, cooling towers, effluent treatment systems, and mobile sources. Emissions from on-site thermal generation of supplied power must be incorporated if such a power source is being considered

The use of Best Available Control Technology (BACT) is required for all new emission sources. The EIS must identify the control technology to be applied at each emission source.

All sources of effluent must be identified and characterized, including handling methods, flow rates and treatment efficiencies for each component of the treatment system. Effluent includes, but is not limited to, process tailings and water, storm water, sewage, pit de-watering and surface runoff. Estimated annual quantities of each effluent must be provided. Cleaning methods and residue disposal options must also be described. In addition proposed sampling parameters and schedule must be provided for discharges.

Fully describe chemical storage facilities indicating how chemicals, reagents, catalysts and other potentially hazardous or toxic materials are to be handled, stored, segregated and contained. Identify chemicals by their Chemical Abstract Service Registry Number (CASRN) together with associated quantities, characteristics and toxicities.

Include in operational details water use for domestic and non-domestic purposes, including water used in the ore beneficiation process under consideration. Provide water withdrawal requirements throughout the year in consideration of hydrology of ponds and supporting watersheds and the ability of the basin to support daily demand and recharge throughout the year. Identify water level variations in ponds as a result of water extraction throughout the year. Include locations of the intake structure and proposed dams. If any conservation or technology measures are to be employed they should be identified. Identify the existing water quality from all sources, the required water quality for its desired use and any treatment processes required to meet its required water quality.

Identify the expected locations and number of de-watering wells, the volume of water to be pumped and the location/use of this water.

Include information on any food handling provisions during both construction and operation as well as disposal provisions for associated wastes.

Initiatives through such measures as training initiatives and skills upgrading for the hiring of journeypersons, apprentices and engineering and technology students during operation and maintenance, as well as initiatives to increase opportunities for under-represented groups in occupations in which they are under-represented will be described. Under-represented groups are to be identified through both census data demographic characteristics and labour force data for census subdivisions in the employment catchment area.

Identify the operational emergency response, safety and fire fighting facilities as well as preventative operating practices and support services. This will include on-site as well as regionally supplied training and preventative measures.

Maintenance includes, but is not limited to, routine ongoing maintenance of the mine and site infrastructure (including redeveloped railway) and machinery as well as periodic maintenance requiring plant closure or processing shut down. In addition to the employment information related to operation and maintenance it is important to include environmentally relevant information such as the location of maintenance support areas, material storage locations, and the likely maintenance and winter treatment.

Also documentation to demonstrate the Iron Ore Company of Canada/Quebec North Shore and Labrador Railway, Tshiuetin Rail Transportation and Wabush Mines Arnaud railway's agreement/acceptance of the railway line connection to existing railway line infrastructure and agreement/acceptance to provide transportation of Labrador Iron Mines iron ore and agreement of associated parties for access to port facilities in the Sept Isles region will be provided. This analysis is to consider the cumulative increased railway traffic from the proposed Bloom Lake Railway and the Elross Lake Mine.

3.8 Abandonment

The predicted lifespan of temporary facilities and the mine, processing facilities, and railway will be indicated. Details regarding decommissioning and abandonment will be presented. The maintenance and management of residue ponds left after closure will be described. Identify, at least in general terms, the issues requiring consideration in decommissioning based on current legislation for hazardous and other materials and structural requirements.

Rehabilitation, closure plans and financial assurances will be required by the Department of Natural Resources.

4. Environment

4.1 Existing Environment

The EIS will identify the study area and will describe the existing biophysical and socio-economic environment of the study area, and the resources within it, emphasizing Valued Ecosystem Components (VEC's) (as defined by Beanlands and Duinker, 1983). In addition, the EIS will describe environmental interrelationships and sensitivity to disturbance. The identification of known data gaps is imperative.

The timing and extent of any surveys for flora, fauna and ecologically sensitive areas must be provided.

A qualitative and quantitative description of the present environment will include, but is not limited to:

- meteorological conditions, including weather patterns as they relate to processing operation and routine and periodic maintenance
- atmospheric conditions, including wind speeds and directions, precipitation amounts. Particular attention is to be paid to ambient dust levels in areas where construction activities may contribute to increased dust levels
- ambient air quality baseline assessment for common air contaminants prior to construction.
- ambient water quality baseline assessment for common water quality parameters prior to construction.
- site information on each stream or wetland crossing including: water depth, width, flow rate, substrate type, and potential obstructions to navigation. Hydrologic information on each body of water within the project footprint or within the predicted zone of influence.
- identification of wetland resources including location, size and class, classified using the Canadian Wetland Classification System, of any wetland within a predicted zone of influence and conduct of a wetland evaluation. The true ecosystem value of each wetland is to be examined using comprehensive valuation methodology that assesses component, functional and attribute values, including their wildlife habitat potential (including wildlife at risk), groundwater recharge role and potential, and their role in surface water flow regulation (storm

water retention and flood control). Field surveys and investigations required to supplement available data must be completed in an acceptable manner.

- flora, including typical species, species-at-risk, and potential habitat for flora species-at-risk. Flora species at risk include those species listed under the federal Species at Risk Act and the provincial Endangered Species Act as well as COSEWIC listed species. Current information can be obtained from appropriate sources and augmented by field surveys and investigations required to supplement available data. Available data, survey results and detailed mitigation measures that demonstrate a special emphasis on avoidance of environmental effects is to be included in the EIS.
- fauna (including migratory species), fauna species-at-risk, and potential habitat for fauna species-at-risk. Fauna species at risk include those species listed under the federal Species at Risk Act and the provincial Endangered Species Act as well as COSEWIC listed species. Fauna and avifauna in this context includes, but is not limited to, eagles, osprey, and woodland caribou. Current information can be obtained from appropriate sources and augmented by field surveys and investigations required to supplement available data. Available data, survey results and detailed mitigation measures that demonstrate a special emphasis on avoidance of environmental effects is to be included in the EIS.
- fish and fish habitat, which includes a description of fish species and any fisheries, commercial, recreational or aboriginal, which occur within the lakes, ponds and streams in the vicinity of the proposed project. As well as a description and quantification of fish habitat with the potential to be impacted by project operations, such as but not limited to, mining, storage, infrastructure, access roads, railway construction and in particular the existing flooded pits to be used for water extraction and residue disposal and the stream on James Property which has the potential to be dewatered due to mining activities
- identify the type, location, and magnitude/extent of existing, past and potential commercial, recreational and aboriginal fisheries within the proposed project area. Address the extent to which these fishing activities will be disrupted during both the construction and operation phases of the project

Discussion of the description of the existing environment will be developed for each alternative, drawing specific reference to the VECs. Detailed discussions will be developed for the following VECs:

- Socio-economic, demonstrating a goal of maximizing benefits for the province. The discussion will include corporate hiring objectives and policies, employment of under-represented groups, the effects the mine may have on existing industry and services and the ability of existing infrastructure to service the proposed construction and operation. The feasibility of the project will be included in this analysis.
- Fish and fish habitat
- Caribou species and habitat, including the applicability of the Endangered Species Act. In consideration of the predicted effects of the mine and associated infrastructure on woodland and/or migratory caribou, the potential impact of rail

traffic and blasting operations will be included. The potential effects on woodland caribou in Labrador as well as in Quebec will be described.

4.2 Data Gaps

Information gaps from a lack of previous research or practice will be described.

4.3 Future Environment

The predicted future condition of the environment described under 4.1 within the expected life span of the undertaking, if the undertaking were not approved, will be described. This information is required when attempting to distinguish project-related environmental effects from environmental change due to natural processes.

5. Environmental Effects

The EIS will describe the scope of the assessment being conducted for the undertaking.

The EIS will contain a comprehensive analysis of the predicted environmental effects of each project alternative for the VEC's. If the impacts are attributable to a particular phase of the project (construction, operation, maintenance or decommissioning) then they will be designated as such.

The EIS will also assess the effects of the environment on the mine. In particular the EIS must identify the vulnerability of the mine to climatic elements (including wind, weather and global climate change) and describe the provisions for minimizing any identified risk.

The EIS will characterize the disposal area for process tailings including the hydraulic conductivity of the base of the pit, and the potential to impact on groundwater and surrounding watersheds. Control technologies in consideration are also to be described.

Information will be included regarding methods to prevent suspended solids and other contaminants (originating from areas including but not limited to waste rock and overburden piles, tailings storage areas, crushing and washing areas) from migrating to nearby water bodies. The acid generating potential of waste rock will also be provided.

Identify the potential impacts of ammonia discharges from blasting operations and prepare an ammonia control strategy.

Predicted environmental effects (positive and negative, direct and indirect, short and long-term) will be defined quantitatively and qualitatively for each project alternative and for each valued ecosystem component. In this regard, the EIS will offer the study strategy, methodology and boundaries of the assessment which includes the following considerations:

- the VEC within the study boundaries and the methodology used to identify the VEC;
- definition of the spatial and temporal study boundaries for the interactions of the project, as proposed or subject to subsequent modification, with VECs and the methodology used to identify the study boundaries;
- the temporal boundaries (i.e., duration of specific project activities and potential effects) for construction and operation;
- the strategy for investigating the interactions between the project and each VEC and how that strategy will be used to coordinate individual studies undertaken;
- the strategy for assessing the project's contribution to cumulative effects on each VEC;
- the strategy for predicting and evaluating environmental effects, determining necessary mitigation, remediation and/or compensation, and for evaluating residual effects;
- definition of impact significance criteria against which to evaluate the potential impact of interactions;
- description of potential interactions;
- discussion of issues and concerns which relate to specific interactions;
- discussion of the existing knowledge on information related to the interactions;
- analysis of potential effects (significance, positive or negative, etc.);

In the latter regard, the proponent will offer a definition of significance for each category examined (e.g. biophysical or socio-economic).

Environmental effects will be defined and discussed in the following terms for the phases of the project (construction, operation, modification and decommissioning): nature, spatial extent, frequency, duration, magnitude (qualitative and quantitative), significance, and level of certainty.

The environmental effects of the project, including the environmental effects of malfunctions or accidental events that may occur in connection with the project will be discussed with respect to risk, severity and significance. Consequences of low probability, high impact events, including design failure, will also be described. In relation to accidents and malfunctions provide the following information to support an assessment of potential effects on the environment, including but not limited to species at risk and their habitat(s):

- discussion of accidents and malfunctions that could occur related to processing and transport activities, the probability of such events occurring, the fate of any hazardous materials that could be released as a result of such events, and the potential interactions with environmental features
- reference to the standards, codes and regulations applicable to governance of the project

Environmental effects from emissions estimates are required as part of the assessment. Preliminary dispersion modeling, incorporating baseline measurements as background

values for construction and operation, must be presented. The modeling must also account for combined effects of other significant air contaminant emission sources within the general project area. The proponent is advised that stack emission tests and accompanying dispersion models and/or ambient air monitoring may be required following commencement of mining and processing operations to demonstrate compliance with ambient air quality standards.

A discussion of environmental effects on freshwater quantity and quality is required as part of the assessment for all water bodies within the project footprint or influence zone of the project.

Environmental effects on the socio-economic environment are to be detailed and include, but will not be limited to, training needs, public health services in relation to potential demand as a result of the mine, adequacy of existing acute care services, potential need for an increase in community health support services.

Environmental effects on freshwater fish habitat, fish species and any existing or potential commercial, recreational or aboriginal fisheries that occur in the area of the proposed infrastructure, plant and mine location, water supply and residue disposal (i.e. tailings) location must be evaluated. As part of the evaluation any effects associated with water withdrawal must be examined, as must the potential effects on any downstream habitat.

5.1 Cumulative Environmental Effects

Consideration of any cumulative effects on valued ecosystem components that are likely to result from the project in combination with other projects or activities that have been or will be carried out (e.g., existing and proposed industrial activity in the area) will be discussed in the EIS. Other projects or activities that should be considered include the New Millennium proposal for the Elross Lake area and increased railway traffic as a result of the proposed Bloom Lake Railway.

Addressing cumulative environmental effects will involve considering:

- temporal and spatial boundaries;
- interactions among the project's environmental effects;
- interactions between the project's environmental effects and those of existing projects and activities;
- interactions between the project's environmental effects and those of planned projects and activities; and,
- mitigation measures employed toward a no-net-loss or net-gain outcome (e.g., recovery and restoration initiatives pertinent to a VEC that can offset predicted effects).

6. Environmental Protection

6.1 Mitigation

Mitigative measures that are technically and economically feasible, that have or will be taken, to avoid, minimize or eliminate the negative, and enhance the positive environmental effects, will be described and discussed with emphasis on pollution prevention, avoidance of environmental effect and best management practices. Mitigation includes the elimination, reduction or control of the adverse effects or the significant environmental effects of the project and may include restitution for any damage to the environment caused by such effects through replacement, restoration, compensation or any other means.

Mitigation will be evaluated based on the use of best available and economically achievable technologies (BATEAs) and best management practices (BMPs) to minimize adverse environmental effects.

Mitigative measures specific to the following must be addressed in particular:

- air quality including dust emissions from crushing operations, emissions from any on-site generation of power, aggregate and overburden stockpiles, unpaved roadways and cleared areas. Include dust control;
- water quality and quantity: outline siltation, erosion and run-off control features, storm drainage management procedures and measures, including specific reference to seasonal variation, that will be used in the following situations: (a) installation of watercourse structures; (b) construction of service roads; and (c) any in water works;
- blasting operations
- process effluent and sewage;
- flora species: discuss measures to be taken to minimize effects. Include any plans for landscaping and preservation of existing vegetation. Demonstrate how priority will be placed on the use of native species for revegetation efforts.
- fauna species: describe measures to be taken to minimize effects on terrestrial and aquatic fauna (including avifauna). Two caribou mitigation strategies must be proposed, one for woodland animals and one for migratory animals. The EIS should include a commitment to apply the mitigation plan developed for woodland caribou while a monitoring plan is undertaken to determine the identity of any caribou using the area. Include any plans for preservation of existing habitat and compensation for loss or degradation of aquatic and terrestrial habitat (i.e., habitat rehabilitation or replacement);
- fish and fish habitat: describe measures to be taken to minimize effects on freshwater fish and fish habitat, including, if necessary, compensation for losses that cannot be mitigated.

Proposed mitigative strategies integral to the phases of the project (construction, operation, maintenance and decommissioning) will be clearly identified and addressed. The effectiveness of the proposed mitigative measures will be discussed and evaluated.

Where possible and appropriate, compensation for losses that cannot be mitigated by any other means will be examined. Mitigation failure will be discussed with respect to risk and severity of consequence.

There must be full consideration for the precautionary principle which states, "where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation". The best available technology and best management practices must be considered. Consideration must be given for pollution prevention opportunities.

6.2 Emergency Response/Contingency Plan

An emergency response plan will be outlined that details measures to be taken to effectively respond to any foreseeable mishap that may occur as a result of the undertaking. In addition the outline will describe any partnering opportunities with area communities and other industry that may be affected by any emergency or be expected to respond to, and recover from, an emergency response.

6.3 Environmental Monitoring and Follow-up Programs

Environmental compliance, effectiveness and effects monitoring programs for construction, operation, maintenance and decommissioning phases of the project will be described. Compliance monitoring is conducted to ensure compliance with appropriate legislation and/or ensure commitments made in the EIS are fulfilled. Monitoring and follow-up programs must allow for testing of the accuracy of effects prediction and effectiveness of mitigation measures. Programs must support an adaptive management approach and demonstrate preparedness for a range of potential outcomes to be confirmed through follow-up.

Important ingredients of monitoring programs include:

- elements of the environment (i.e., air emissions, freshwater quantity and quality, habitat, etc.) that are to be monitored;
- where monitoring will occur;
- frequency and duration of monitoring;
- identification of resource agencies that will review program design and results;
- detailed statement of objectives;
- submission of results, and
- protocols for the interpretation of results and subsequent actions to be taken based on findings.

Details of a proposed environmental effects monitoring program for effluent discharge must be presented. It is expected that the effluent discharge environmental effects monitoring program will incorporate a commitment to full community disclosure.

Details of a proposed environmental effects monitoring program for fish habitat must be provided.

Details of a proposed caribou monitoring program must be provided.

A monitoring plan for employment, contracting and procurement, education and training will be required. This plan should include succession planning and opportunities for advancement and training upgrades.

Known or planned follow-up programs specifically related to detecting and monitoring cumulative environmental effects are to be described. Objectives, methodology, duration and reporting covered by the program evaluating effectiveness of avoidance and mitigation measures on long-term effects from the project are to be described. Programs may be proposed specifically for wildlife (including migratory birds) and their habitats, species-at-risk and their habitat, wetlands, air quality and water quality.

6.4 Rehabilitation

A plan of proposed rehabilitation measures for the activities associated with the project will be given with an explanation of how the measures will reduce or eliminate various negative effects during construction, operation, maintenance and decommissioning.

It is recommended that the use of native vegetation (seed) that is natural to the area be used in all revegetation efforts.

7. Residual Effects and Selection Criteria for Preferred Option

7.1 Residual Effects

All remaining effects after mitigation has been applied should be presented. The residual effects should be defined in terms of nature, spatial extent, frequency, duration, magnitude (qualitative and quantitative), significance and level of certainty. Those effects that cannot be mitigated or avoided will be clearly distinguished from those effects that will not be mitigated or avoided.

7.2 Effects Evaluation and Selection of Preferred Alternative

This section (as compared to Section 3.3 - Alternatives) is intended to provide a detailed discussion and comparison of the residual effects relative to the preferred option and viable alternatives (as applicable).

All selection criteria, including biophysical, socio-economic and technical, will be presented and discussed in sufficient detail to allow a comparative analysis with regard to costs, benefits and environmental risks associated with both the preferred and alternative options.

8. Public Participation

A proposed program of public information will be outlined. Open House Public Information Sessions will be held to present the proposal and to record public concerns. The proponent will hold public information sessions in the town of Labrador City-Wabush. Consideration should also be given to the holding of public information sessions in Schefferville, P.Q. Public concerns will be addressed in a separate section of the EIS. Protocol for these sessions will comply with Section 10 of the Newfoundland and Labrador Environmental Assessment Regulations, 2000. Public notification specifications are outlined in Appendix B.

8.1 Consultation with Aboriginal Groups and Communities

The EIS shall demonstrate the Proponent's understanding of the interests, values, concerns, contemporary and historic activities, Aboriginal traditional knowledge and important issues facing Aboriginal groups and indicate how these will be considered in planning and carrying out the Project.

To assist in ensuring the EIS provides the necessary information to address issues of potential concern, the Proponent shall consult with Aboriginal groups for the purpose of:

- Familiarizing Aboriginal groups with the Project and its potential environmental effects;
- Identifying any issues of concern regarding potential environmental effects of the Project; and
- Identifying what actions the Proponent is proposing to take to address each issue identified, as appropriate.

If the Proponent is not able or cannot address any particular issue(s), the EIS will include supporting information.

The results of these consultations are to be presented in a separate chapter of the EIS with individual sections for each of the affected Aboriginal groups. The Proponent must refer readers to the relevant sections of the EIS as appropriate.

9. Environmental Protection Plan

A site specific Environmental Protection Plan (EPP) for the proposed undertaking must be submitted to, and approved by, the Minister of Environment and Conservation before any construction on the project begins. For the purposes of the EIS, an outline of the EPP will be included. The EPP will be a "stand alone" document with all relevant maps and diagrams. Statements regarding the commitment to and philosophy of environmental protection planning and self-regulatory and compliance monitoring will be restricted to the EIS. The target audience for the EPP will be the resident engineer, site foreman/supervisor, proponent compliance staff and the provincial environmental inspector(s). Therefore the EPP will concentrate on addressing such issues as

construction/operation mitigation, permit application and approval planning, monitoring activities, contingency planning for accidental and unplanned events and contact lists. In addition, the EPP will contain a tabular breakdown of major construction and operational activities into sub-components, followed by permits required, field mitigation and contingency planning where appropriate. The objective is to present concise, comprehensive and easily accessed environmental protection information for field use by the target audience.

10. References Cited

Provide a bibliography of all citations in the EIS. Provide a bibliography of all project-related documents already generated by or for the undertaking.

11. Personnel

Brief descriptions of the expertise and qualifications of personnel involved in the completion of the EIS will be provided.

12. Copies of Reports

Copies of reports produced for any studies undertaken specifically in connection with this Environmental Impact Statement Report will be submitted.

APPENDIX A

Public Notices

Under the provisions of the Environmental Assessment Regulations 2003, Section 10, and where the approved Guidelines require public information session(s), the following specified public notification requirements must be met by the proponent prior to each meeting:

PUBLIC NOTICE

Public Information Session on the Proposed

Name of undertaking
Location of undertaking

shall be held at
Date and Time
Location

This session shall be conducted by the Proponent,
Proponent name and contact phone number,
as part of the environmental assessment for this Project.
The purpose of this session is to describe all aspects of the proposed Project, to describe the activities associated with it, and to provide an opportunity for all interested persons to request information or state their concerns.

ALL ARE WELCOME

Minimum information content of public advertisement - (Proponent to substitute appropriate information for italicized items):

Minimum newspaper ad size: 2 column widths.

Minimum posted ad size: 7" x 5"

Minimum newspaper ad coverage: Weekend preceding meeting and 3 consecutive days prior to meeting date; to be run in newspaper locally distributed within meeting area or newspaper with closest local distribution area.
Minimum posted ad coverage: Local Town or City Hall or Office, and local Post Office, within town or city where meeting is held, to be posted continually for 1 full week prior to meeting date.

Any deviation from these requirements for any reason must receive prior written approval of the Minister of Environment and Conservation.

Table of Concordance

EIS and Guidelines

Guideline Requirement		EIS Section
Section 1: Executive Summary		
1	Executive Summary	Executive Summary
2	Table of Concordance	Appendix A
Section 2: Introduction		
1	Name of Undertaking	Section 1.1
2	Identification of Proponent	Section 1.2
3	Purpose of the Environmental Impact Statement	Section 1.4
Section 3: The Proposed Undertaking		
1	The Prospective Site and Study Area	Section 2.1.1
2	Rationale/Need/Purpose of the Project	Section 2.1.3
3	Alternative Means of Carrying out the Project	Section 2.3
4	Relationship to Legislation, Permitting, Regulatory Agencies and Policies	Section 2.4
5	General Project Description: The EIS will provide a written and graphic description (e.g. maps and drawings) of the physical features of the undertaking particularly as it is planned to progress through the construction and operation phases of its lifespan. The description should also address other phases of the project as can reasonably be foreseen, including modification, decommissioning and abandonment. Any assumptions which underlie the details of the project design shall be described, including effects avoidance opportunities inclusive of pollution prevention, and adherence to best management practices. Where specific codes of practice, guidelines and policies apply to items to be addressed, those documents shall be cited and included as appendices to the EIS, including mapping at an appropriate scale.	Section 3.0
	(a) Access road(s), and intersections, including those which may require upgrading, as well as service roads.	Section 3.1.4
	(b) Lighting	Section 3.1.4.8
	(c) Stream(s) or other water bodies to be dewatered	Section 3.1.3
	(d) Residue ponds and/or clarification ponds	Section 3.1.4
	(e) Stream crossings, including culverts, bridges and fording sites	Section 7.1.3.3
	(f) Temporary stream diversions	N/A
	(g) Exact locations of mineral licenses and ore bodies to be mined in relation to Newfoundland and Labrador and Quebec provincial geographic boundaries	Section 3.1.1
	(h) Borrow pits, major excavations, waste rock disposal locations and their rehabilitation	Sections 3.1.2 and 3.1.7.5
	(i) Temporary sewage and waste disposal facilities	Section 3.1.7.1
	(j) Methods of handling waste and refuse at work and camp locations	Section 3.1.7.2

	Guideline Requirement	EIS Section
	(k) Mine infrastructure, including ore crushing, screening and washing facilities, fuel tanks and utilities (including water supply and distribution, water treatment, rock fines and wash water discharges, electricity supply configuration and owner/operator arrangements, substations and/or on-site electricity transmission/distribution lines or alternative generation methods)	Sections 3.1.3 and 3.1.4
	(l) Railway infrastructure, including railcar loading station, ties, rails and ballast on rail bed	Section 3.1.4.9
	(m) Ownership of new railway infrastructure, regulatory governing body and designation of common carrier status	Section 3.1.4.9 and 3.1.4.11
	(n) Plant and storage facility for manufacturing and storing explosives	Section 3.1.4.4
	(o) Support buildings, including but not limited to, administrative and engineering offices, warehouses, maintenance buildings and laboratory.	Section 3.1.4
	(p) Effluent treatment plant components, as well as effluent discharge locations and configuration and including anticipated effluent plume(s)	Section 3.3.5
	(q) Planned feasibility studies associated with the project, proposed mineral resources included within the feasibility studies and completion dates	Section 3.1.1
	(r) Clearance/condemnation work in areas underlying proposed waste piles, including in pit or on land disposal of fines and other infrastructure	Section 3.1.6
6	Construction	
6.1	The details, materials, methods, schedule, and location of all planned construction activities related to the physical features will be presented including estimates of magnitude or scale where applicable. This is to include, but not be limited to, the following	Section 3.2
	(a) General construction practices incorporating erosion and sedimentation control	Section 3.2
	(b) Construction schedule, including proposed time frames for right-of-way clearing, slash disposal, construction adjacent to watercourses, utility placement, processing and storage facilities	Section 3.2.1
	(c) Worker housing, providing a detailed overview of the housing for workers to be used during the construction and operation phases, including but not limited to location(s), capacity and facilities	Section 3.2.5
	(d) Solid waste disposal and disposal of construction waste, as well as identified opportunities for waste recycling	Section 3.1.7
	(e) Worker transportation, including details on the methods of transportation used to get workers to and from camps/worksites	Section 3.2.5
	(f) Site preparation (i.e., grubbing/clearing of right-of-way, cut and/or fill operations, etc.)	Section 3.2.2
	(g) Water body alteration: a 15 metre undisturbed buffer along the high water mark of all water bodies must be maintained. Identify any alterations that must be carried out in the water or within buffer areas, such as for water supply intakes, stream crossings, effluent discharges, storm drainage works or infilling and any stream activities	Section 3.3.5
	(h) Design and information regarding the upgrading of any existing watercourse crossing associated with new or existing roads or railway	Section 3.1.4.9

Guideline Requirement		EIS Section
	(i) Location of blasting activities in relation to watercourses/waterbodies	Section 7.1
	(j) Stream crossing structures: location of watercourse crossings for access and service roads, transmission lines, railroads, as well as any pipeline crossings, their proposed infrastructure (e.g., bridge, culvert), and their proposed specifications (e.g., clearance from watercourse, height, width, length, diameter, and construction materials); infill area or footprint together with design criteria and standards, length, width, cross section and estimated types and amount of fill material required. To avoid impacts on fish and fish habitat it is recommended that all watercourse crossings be designed and installed such that abutments are above the high water mark.	Section 7.1.3.3
	(k) Proposed locations for any de-watering wells, pipelines, and discharge infrastructures	Section 3.3.5
	(l) Electrical systems: location of substations, transmission	Sections 3.1.3 and 3.1.4
	(m) Estimate all significant emissions during construction, including but not limited to sources from generators, heaters, vents, storage tanks, stockpiles, ponds, basins, vehicles, road surfaces, effluent treatment systems, and mobile sources.	Section 3.2.6
	(n) Excavations	Section 3.1.2 and 3.3.1.1
	(o) Blasting operations	Section 3.3.1.3
	(p) Vehicle types, truck routes, hours of operation of vehicles	Sections 3.2.3 and 3.3.1.2
	(q) Transport, storage and use of hazardous materials	Section 3.1.7.3
	(r) Establishment, operation and removal of construction camp and yard areas including their water, sewage and food handling provisions	Section 3.2.3 and 3.2.5
	(s) Sources and estimated volumes of acceptable types of aggregate, ballast and pitrun material with identification of any currently known sources likely to be used	Section 3.2.2.4 and 3.2.3
	(t) Disposal areas for excess/waste rock and overburden, including locations of any currently known or planned disposal sites	Section 3.1.2.5 and 3.1.5.5
	(u) Disposal areas for organic soil, slash and grubbing, including locations of any currently known or planned disposal sites	Section 3.2.2.2
	(v) Plans for harvested wood fibre associated with the project	Section 3.2.2.1
	(w) Removal of temporary operations	Section 3.2.7
	(x) Site rehabilitation and monitoring	Sections 3.2.7 and 3.4
6.2	The proponent shall present a strategy to ensure Full and Fair Opportunity and First Consideration for employment, contracting and procurement, education and training.	Sections 2.2 and 3.2.10
6.3	Included will be a Women's Employment Plan as a tool to aid the gender equity objective of the corporate hiring strategy.	Sections 7.4.2, 2.2.3, 9.3 and Appendix D
6.4	Employment and benefits	Sections 3.2.10 and 7.3
	(a) Including local allocation	Section 7.3
	(b) Identify any measures to be implemented that may require contractors and sub-contractors to include employment equity considerations.	Section 7.3
	(c) Initiatives for the hiring of journeypersons, apprentices, engineering and technology students during construction	Section 7.3
	(d) Initiatives to increase opportunities for under-represented groups will be described	Section 7.3

Guideline Requirement		EIS Section
6.5	Provide an analysis of the availability of the skilled workforce necessary to complete the project and how any shortages in skilled trades may be addressed. Include all positions associated with the project, listing the province in which they are located.	Section 3.28, 3.2.10 and 4.3.3
7	Operation and Maintenance	
7.1	All aspects of the operation and maintenance of the proposed development will be presented in detail, including but not limited to information on the 75 operation and maintenance positions by National Occupational Classification (NOC-2006), gender and period of employment. Operation includes, but is not limited to, product excavation, product processing, product delivery, value-added secondary processing, product export and waste residue disposal. The analysis is to include all positions associated with the project, listing the province in which they are located.	Section 3.3.7
7.2	With a goal of maximizing benefits for the province, the proponent shall present a strategy to ensure Full and Fair Opportunity and First Consideration for employment, contracting and procurement, education and training. This description must identify corporate hiring objectives, quantitative and qualitative goals, special measures and policies; monitoring of compliance with objectives, goals, measures and policies; duration of contracts and/or employment and provide for a communication plan and any required re-evaluation process of objectives, goals, measures and policies. Included will be a Women's Employment Plan as a tool to aid the gender equity objective of the corporate hiring strategy.	Sections 2.2 and 3.2.10
7.3	In order to properly assess the socio-economic impacts in the province specific information on, but not limited to the 75 operating positions, contracting and procurement, and education and training will be provided, including a benefits statement with a concise description of the proportion of positions, contracting and procurement, and education and training opportunities which will be available to Newfoundland and Labrador residents, contractors, sub contractors and businesses in relation to the project totals. Information regarding the nature of any cross-border mobility for employees/contractors associated with the project will be provided	Section 7.3
7.4	Direct and indirect impacts the project may have on existing mining operations, railway operations, mineral exploration and/or mine development on mineral titles held by other parties in the area and right's of way will be provided. An analysis of the direct and indirect impacts the project may have on the operations or future viability of other mining projects in Labrador West including, but not limited to The Iron Ore Company of Canada, Wabush Mines and New Millennium Capital Corporation and the capacity of the QNS&L, Tshiuetin Rail Transportation and Wabush Mines Arnaud railways, will be required.	Sections 1.1 and 2.1.3
7.5	Estimate all significant emissions during operation, including but not limited to, sources from ore crushing screening and washing facilities, heaters, vents, storage tanks, stockpiles, ponds, basins, vehicles, road surfaces, cooling towers, effluent treatment systems, and mobile sources. Emissions from on-site thermal generation of supplied power must be incorporated if such a power source is being considered The use of Best Available Control Technology (BACT) is required for all new emission sources. The EIS must identify the control technology to be applied at each emission source.	Section 3.3.2

Guideline Requirement		EIS Section
7.6	All sources of effluent must be identified and characterized, including handling methods, flow rates and treatment efficiencies for each component of the treatment system. Effluent includes, but is not limited to, process tailings and water, storm water, sewage, pit de-watering and surface runoff. Estimated annual quantities of each effluent must be provided. Cleaning methods and residue disposal options must also be described. In addition proposed sampling parameters and schedule must be provided for discharges.	Sections 3.1.3.5, 3.2.4, 3.2.6, 3.3.3, and 3.3.5
7.7	Fully describe chemical storage facilities indicating how chemicals, reagents, catalysts and other potentially hazardous or toxic materials are to be handled, stored, segregated and contained. Identify chemicals by their Chemical Abstract Service Registry Number (CASRN) together with associated quantities, characteristics and toxicities.	Section 3.3.4
7.8	Include in operational details water use for domestic and non-domestic purposes, including water used in the ore beneficiation process under consideration. Provide water withdrawal requirements throughout the year in consideration of hydrology of ponds and supporting watersheds and the ability of the basin to support daily demand and recharge throughout the year. Identify water level variations in ponds as a result of water extraction throughout the year. Include locations of the intake structure and proposed dams. If any conservation or technology measures are to be employed they should be identified. Identify the existing water quality from all sources, the required water quality for its desired use and any treatment processes required to meet its required water quality.	Section 3.3.5
7.9	Identify the expected locations and number of de-watering wells, the volume of water to be pumped and the location/use of this water. Include information on any food handling provisions during both construction and operation as well as disposal provisions for associated wastes.	Section 3.3.5.6
7.10	Initiatives through such measures as training initiatives and skills upgrading for the hiring of journeypersons, apprentices and engineering and technology students during operation and maintenance, as well as initiatives to increase opportunities for under-represented groups in occupations in which they are under-represented will be described. Under-represented groups are to be identified through both census data demographic characteristics and labour force data for census subdivisions in the employment catchment area.	Sections 3.2.10 and 3.3.7
7.11	Identify the operational emergency response, safety and fire fighting facilities as well as preventative operating practices and support services. This will include on-site as well as regionally supplied training and preventative measures.	Section 8.2
7.12	Maintenance includes, but is not limited to, routine ongoing maintenance of the mine and site infrastructure (including redeveloped railway) and machinery as well as periodic maintenance requiring plant closure or processing shut down. In addition to the employment information related to operation and maintenance it is important to include environmentally relevant information such as the location of maintenance support areas, material storage locations, and the likely maintenance and winter treatment.	Section 3.1

Guideline Requirement		EIS Section
7.13	Demonstrate the Iron Ore Company of Canada/Quebec North Shore and Labrador Railway, Tshiuetin Rail Transportation and Wabush Mines Arnaud railway's agreement/acceptance of the railway line connection to existing railway line infrastructure and agreement/acceptance to provide transportation of Labrador Iron Mines iron ore and agreement of associated parties for access to port facilities in the Sept Isles region will be provided. This analysis is to consider the cumulative increased railway traffic from the proposed Bloom Lake Railway and the Elross Lake Mine.	Section 3.1.4.9
8	Abandonment	
8.1	The predicted lifespan of temporary facilities and the mine, processing facilities, and railway will be indicated. Details regarding decommissioning and abandonment will be presented. The maintenance and management of residue ponds left after closure will be described. Identify, at least in general terms, the issues requiring consideration in decommissioning based on current legislation for hazardous and other materials and structural requirements. Rehabilitation, closure plans and financial assurances will be required by the Department of Natural Resources.	Section 3.4
9	Worker's Accommodation Camp	
9.1	A written and graphic description of the proposed work camp(s) and any related appurtenances	Section 3.1.4.6 Figure 3.9
9.1	A detailed overview of the work camp(s) to be used during the construction and operation phases, including location, capacity, facilities, solid waste and sewage disposal of construction waste, as well as identified opportunities for waste recycling	Section 3.1.4.6
9.2	Methods of transportation used to get workers to and from camps;	Section 3.1.4.6 and 3.1.4.7
9.3	Water and food handling provisions	Section 3.1.4.6
Section 4: Environment		
1	Existing Environment	
1.1	The EIS will identify the study area and will describe the existing biophysical and socioeconomic environment of the study area, and the resources within it, emphasizing Valued Ecosystem Components (VEC's) (as defined by Beanlands and Duinker, 1983). In addition, the EIS will describe environmental interrelationships and sensitivity to disturbance. The identification of known data gaps is imperative.	Section 4.0
1.2	The timing and extent of any surveys for flora, fauna and ecologically sensitive areas must be provided. A qualitative and quantitative description of the present environment will include, but is not limited to:	Section 4.2
	(a) Meteorological conditions, including weather patterns as they relate to processing operation and routine and periodic maintenance	Section 4.1.1
	(b) Atmospheric conditions, including wind speeds and directions, precipitation amounts. Particular attention is to be paid to ambient dust levels in areas where construction activities may contribute to increased dust levels	Section 4.1.1
	(c) Ambient air quality baseline assessment for common air contaminants prior to construction.	Section 4.1.2.1
	(d) Ambient water quality baseline assessment for common water quality parameters prior to construction.	Section 4.1.5

Guideline Requirement		EIS Section
	(e) Site information on each stream or wetland crossing including: water depth, width, flow rate, substrate type, and potential obstructions to navigation. Hydrologic information on each body of water within the project footprint or within the predicted zone of influence.	Section 4.1.4
	(f) Identification of wetland resources including location, size and class, classified using the Canadian Wetland Classification System, of any wetland within a predicted zone of influence and conduct of a wetland evaluation. The true ecosystem value of each wetland is to be examined using comprehensive valuation methodology that assesses component, functional and attribute values, including their wildlife habitat potential (including wildlife at risk), groundwater recharge role and potential, and their role in surface water flow regulation (storm water retention and flood control). Field surveys and investigations required to supplement available data must be completed in an acceptable manner.	Section 4.2.1.4
	(g) Flora, including typical species, species-at-risk, and potential habitat for flora species-at-risk. Flora species at risk include those species listed under the federal Species at Risk Act and the provincial Endangered Species Act as well as COSEWIC listed species. Current information can be obtained from appropriate sources and augmented by field surveys and investigations required to supplement available data. Available data, survey results and detailed mitigation measures that demonstrate a special emphasis on avoidance of environmental effects is to be included in the EIS.	Section 4.2.1
	(h) Fauna (including migratory species), fauna species-at-risk, and potential habitat for fauna species-at-risk. Fauna species at risk include those species listed under the federal Species at Risk Act and the provincial Endangered Species Act as well as COSEWIC listed species. Fauna and avifauna in this context includes, but is not limited to, eagles, osprey, and woodland caribou. Current information can be obtained from appropriate sources and augmented by field surveys and investigations required to supplement available data. Available data, survey results and detailed mitigation measures that demonstrate a special emphasis on avoidance of environmental effects is to be included in the EIS.	Sections 4.2.2 and 4.2.3
	(i) Fish and fish habitat, which includes a description of fish species and any fisheries, commercial, recreational or aboriginal, which occur within the lakes, ponds and streams in the vicinity of the proposed project. As well as a description and quantification of fish habitat with the potential to be impacted by project operations, such as but not limited to, mining, storage, infrastructure, access roads, railway construction and in particular the existing flooded pits to be used for water extraction and residue disposal and the stream on James Property which has the potential to be dewatered due to mining activities	Section 4.2.4
	(j) Identify the type, location, and magnitude/extent of existing, past and potential commercial, recreational and aboriginal fisheries within the proposed project area. Address the extent to which these fishing activities will be disrupted during both the construction and operation phases of the project	Section 4.2.4.4
1.3	Discussion of the description of the existing environment will be developed for each alternative, drawing specific reference to the VECs. Detailed discussions will be developed for the following VECs:	Section 4.0
	(a) Socio-economic, demonstrating a goal of maximizing benefits for the province. The discussion will include corporate hiring objectives and policies, employment of under-represented groups, the effects the mine may have on existing industry and services and the ability of existing infrastructure to service the proposed construction and operation. The feasibility of the project will be included in this analysis.	Section 4.3
	(b) Fish and fish habitat	Section 4.2.4

Guideline Requirement		EIS Section
	(c) Caribou species and habitat, including the applicability of the Endangered Species Act. In consideration of the predicted effects of the mine and associated infrastructure on woodland and/or migratory caribou, the potential impact of rail traffic and blasting operations will be included. The potential effects on woodland caribou in Newfoundland and Labrador as well as in Quebec will be described.	Section 4.2.2.1
2	Data Gaps	Section 4.4
3	Future Environment	Section 4.5
Section 5: Environmental Effects		
1	Comprehensive analysis of the predicted environmental effects of each project alternative for the VEC's.	Section 2.3
2	The effects of the environment on the mine. In particular the EIS must identify the vulnerability of the mine to climatic elements and describe the provisions for minimizing any identified risk.	Section 7.7.3
3	Characterize the disposal area for process tailings including the hydraulic conductivity of the base of the pit, and the potential to impact on groundwater and surrounding watersheds. Control technologies in consideration are also to be described.	Section 4.1.4
4	Information will be included regarding methods to prevent suspended solids and other contaminants (originating from areas including but not limited to waste rock and overburden piles, tailings storage areas, crushing and washing areas) from migrating to nearby water bodies. The acid generating potential of waste rock will also be provided.	Sections 4.1.3.6, 4.1.4, and 7.1
5	Identify the potential impacts of ammonia discharges from blasting operations and prepare an ammonia control strategy.	Sections 7.1, 8.1.1
6	Boundaries of the assessment which includes the following considerations:	See below
6.1	VEC within the study boundaries and the methodology used to identify the VEC	Section 5.4
6.2	Definition of the spatial and temporal study boundaries for the interactions of the project, as proposed or subject to subsequent modification, with VECs and the methodology used to identify the study boundaries	Sections 4.2.2, 4.2.4.2, 7.1.1, 7.2.1, 7.4, and 7.5
6.3	The temporal boundaries for construction and operation	Section 3.2.1
6.4	The strategy for investigating the interactions between the project and each VEC and how that strategy will be used to coordinate individual studies undertaken	Appendix S Environmental Assessment Methods Sections 7.1.3, 7.1.5.1, 7.2.2, 7.2.4, 7.4.1, 7.4.2, 7.4.1, and 6.5.2
6.5	The strategy for assessing the project's contribution to cumulative effects on each VEC	
6.6	The strategy for predicting and evaluating environmental effects, determining necessary mitigation, remediation and/or compensation, and for evaluating residual effects	
6.7	Definition of impact significance criteria against which to evaluate the potential impact of interactions	
6.8	Description of potential interactions	
6.9	Discussion of issues and concerns which relate to specific interactions	Appendix R
6.10	Discussion of the existing knowledge on information related to the interactions	Sections 7.1.4, 7.2.6.4, 7.4, and 7.5
6.11	Analysis of potential effects (significance, positive or negative, etc.)	Sections 7.1.5.2, 7.1.5, 7.4.2 and 7.5.2

	Guideline Requirement	EIS Section
7	Definition of significance for each category examined	Sections 7.1.5.1, 7.2.4, 7.4, and 7.5
8	Environmental effects will be defined and discussed in the following terms for the phases of the project (construction, operation, modification and decommissioning): nature, spatial extent, frequency, duration, magnitude (qualitative and quantitative), significance, and level of certainty.	Sections 7.1, 7.2, 7.4, and 7.5
9	The environmental effects of the project, including the environmental effects of malfunctions or accidental events that may occur in connection with the project will be discussed with respect to risk, severity and significance. Consequences of low probability, high impact events, including design failure, will also be described. In relation to accidents and malfunctions provide the following information to support an assessment of potential effects on the environment, including but not limited to species at risk and their habitat	Section 7.6
9.1	Discussion of accidents and malfunctions that could occur related to processing and transport activities, the probability of such events occurring, the fate of any hazardous materials that could be released as a result of such events, and the potential interactions with environmental features	Section 7.6
9.2	Reference to the standards, codes and regulations applicable to governance of the project	Section 1.3.2, 2.4, and 3.1.6
10	Environmental effects from emissions estimates are required as part of the assessment. Preliminary dispersion modeling, incorporating baseline measurements as background values for construction and operation, must be presented. The modeling must also account for combined effects of other significant air contaminant emission sources within the general project area. The proponent is advised that stack emission tests and accompanying dispersion models and/or ambient air monitoring may be required following commencement of mining and processing operations to demonstrate compliance with ambient air quality standards.	Section 4.1.2.5
11	A discussion of environmental effects on freshwater quantity and quality is required as part of the assessment for all water bodies within the project footprint or influence zone of the project.	Section 7.1 and 7.3
12	Environmental effects on the socio-economic environment are to be detailed and include, but will not be limited to, training needs, public health services in relation to potential demand as a result of the mine, adequacy of existing acute care services, potential need for an increase in community health support services.	Sections 7.4 and 7.5
13	Environmental effects on freshwater fish habitat, fish species and any existing or potential commercial, recreational or aboriginal fisheries that occur in the area of the proposed infrastructure, plant and mine location, water supply and residue disposal (i.e. tailings) location must be evaluated. As part of the evaluation any effects associated with water withdrawal must be examined, as must the potential effects on any downstream habitat.	Section 7.1
14	Cumulative Environmental Effects	See below
14.1	Consideration of any cumulative effects on valued ecosystem components that are likely to result from the project in combination with other projects or activities that have been or will be carried out (e.g., existing and proposed industrial activity in the area) will be discussed in the EIS.	Sections 7.1.6, 7.2.7, 7.4.3 and 7.5
14.2	Temporal and spatial boundaries;	
14.3	interactions among the project's environmental effects;	

Guideline Requirement		EIS Section
14.4	interactions between the project's environmental effects and those of existing projects and activities;	
14.5	interactions between the project's environmental effects and those of planned projects and activities; and,	
14.6	mitigation measures employed toward a no-net-loss or net-gain outcome (e.g., recovery and restoration initiatives pertinent to a VEC that can offset predicted effects).	Section 8.1
Section 6: Environmental Protection		
1	Mitigation	See below
1.1	Mitigative measures that are technically and economically feasible, that have or will be taken, to avoid, minimize or eliminate the negative, and enhance the positive environmental effects, will be described and discussed with emphasis on pollution prevention, avoidance of environmental effect and best management practices. Mitigative measures specific to the following must be addressed in particular:	Section 8.1
1.2	Air quality including dust emissions from crushing operations, emissions from any on-site generation of power, aggregate and overburden stockpiles, unpaved roadways and cleared areas. Include dust control;	Section 8.1.6
1.3	Water quality and quantity: outline siltation, erosion and run-off control features, storm drainage management procedures and measures, including specific reference to seasonal variation, that will be used in the following situations: (a) installation of watercourse structures; (b) construction of service roads; and (c) any in water works;	Sections 8.1.2, 8.1.3, 8.1.4, and 8.1.5
1.4	Blasting operations	Section 8.1.1
1.5	Process effluent and sewage;	Section 8.1.3 and 8.1.5
1.6	Flora species: discuss measures to be taken to minimize effects. Include any plans for landscaping and preservation of existing vegetation. Demonstrate how priority will be placed on the use of native species for revegetation efforts.	Sections 4.2.1, 8.4.10 and 8.5
	(a) Fauna species: describe measures to be taken to minimize effects on terrestrial and aquatic fauna (including avifauna). Two caribou mitigation strategies must be proposed, one for woodland animals and one for migratory animals. The EIS should include a commitment to apply the mitigation plan developed for woodland caribou while a monitoring plan is undertaken to determine the identity of any caribou using the area. Include any plans for preservation of existing habitat and compensation for loss or degradation of aquatic and terrestrial habitat (i.e., habitat rehabilitation or replacement);	Sections 8.3.3 and 7.2.5
	(b) Fish and fish habitat: describe measures to be taken to minimize effects on freshwater fish and fish habitat, including, if necessary, compensation for losses that cannot be mitigated.	Section 7.1.5
2	Emergency Response/Contingency Plan	Section 8.2
3	Environmental Monitoring and Follow-up Programs	Section 8.3
3.1	Environmental compliance, effectiveness and effects monitoring programs for construction, operation, maintenance and decommissioning phases of the project will be described. Compliance monitoring is conducted to ensure compliance with appropriate legislation and/or ensure commitments made in the EIS are fulfilled. Monitoring and follow-up programs must allow for testing of the accuracy of effects prediction and effectiveness of mitigation measures. Programs must support an adaptive management approach and demonstrate preparedness for a range of potential outcomes to be confirmed through follow-up. Important ingredients of monitoring programs include:	Section 8.3

Guideline Requirement		EIS Section
	(a) Elements of the environment (i.e., air emissions, freshwater quantity and quality, habitat, etc.) that are to be monitored;	
	(b) Where monitoring will occur;	
	(c) Frequency and duration of monitoring;	
	(d) Identification of resource agencies that will review program design and results;	
	(e) Detailed statement of objectives;	
	(f) Submission of results; and	
	(g) Protocols for the interpretation of results and subsequent actions to be taken based on findings.	
3.2	Details of a proposed environmental effects monitoring program for effluent discharge must be presented. It is expected that the effluent discharge environmental effects monitoring program will incorporate a commitment to full community disclosure.	Section 8.3.2
3.3	Details of a proposed environmental effects monitoring program for fish habitat must be provided.	Section 8.3.2
3.4	Details of a proposed caribou monitoring program must be provided.	Section 8.3.3
3.5	A monitoring plan for employment, contracting and procurement, education and training will be required. This plan should include succession planning and opportunities for advancement and training upgrades.	Sections 8.3.5 and 8.3.6
3.6	Known or planned follow-up programs specifically related to detecting and monitoring cumulative environmental effects are to be described. Objectives, methodology, duration and reporting covered by the program evaluating effectiveness of avoidance and mitigation measures on long-term effects from the project are to be described. Programs may be proposed specifically for wildlife (including migratory birds) and their habitats, species-at-risk and their habitat, wetlands, air quality and water quality.	Sections 8.3
4	Rehabilitation	Section 8.4
Section 7: Residual Effects and Selection Criteria for Preferred Option		
1	Residual Effects	Sections 2.3, 7.1, 7.2, 7.4 and 7.5
2	Effects Evaluation and Selection of Preferred Alternative	
Section 8: Public Participation		
1	Consultation with Aboriginal Groups and Communities	Sections 5.0 and 6.0
1.1	The EIS shall demonstrate the Proponent's understanding of the interests, values, concerns, contemporary and historic activities, Aboriginal traditional knowledge and important issues facing Aboriginal groups and indicate how these will be considered in planning and carrying out the Project.	Section 5.1.6
1.2	To assist in ensuring the EIS provides the necessary information to address issues of potential concern, the Proponent shall consult with Aboriginal groups for the purpose of:	Section 5.2 and 6.0
	(a) Familiarizing Aboriginal groups with the Project and its potential environmental effects;	Section 5.2 and 6.0
	(b) Identifying any issues of concern regarding potential environmental effects of the Project; and	Section 5.1.6

Guideline Requirement		EIS Section
	(c) Identifying what actions the Proponent is proposing to take to address each issue identified, as appropriate.	Section 8.0
Section 9: Environmental Protection Plan		
1	An outline of the EPP will be included	Section 8.5
Section 10: Reference Cited		
1	Provide a bibliography of all citations in the EIS	Section 10
2	Provide a bibliography of all project-related documents already generated by or for the undertaking.	Appendix C
Section 11: Personnel		
1	Brief descriptions of the expertise and qualifications of personnel involved in the completion of the EIS will be provided.	Appendix B
Section 12: Copies of Reports		
1	Copies of report produced for any studies undertaken specifically in connection with this Environmental Impact Statement Report will be submitted.	Appendices

APPENDIX B

EIS Study Team

EIS Study Team

Key Personnel

Labrador Iron Mines Limited

John F. Kearney, Chairman & CEO

Mr. Kearney has 30 years experience in the mining industry. He is currently the Chairman of Canadian Zinc Corporation, Conquest Resources Limited, Scandinavian Minerals Limited, Sulliden Exploration Inc. and Anglesey Mining plc. In addition, Mr. Kearney is currently a director of Avnel Gold Mining Limited and Minco plc. Previously, he was Chairman, President and Chief Executive Officer of Northgate Exploration Limited; Campbell Resources Inc. and Sonora Gold Corp. He also currently serves as a director of the Mining Association of Canada. Mr. Kearney holds degrees in law and economics from University College Dublin and an M.B.A. degree from Trinity College Dublin. He qualified as a solicitor in Ireland and as a chartered secretary with the Institute of Chartered Secretaries and Administrators in London. Mr. Kearney is also a member of the Canadian Institute of Mining and Metallurgy, the Prospectors and Developers Association of Canada and the Law Society of Ireland.

Bill Hooley, Director, President & COO

Mr. Hooley is currently Executive Director of Anglesey Mining plc. Previously, he was the Managing Director of Micon International Ltd from 2000 to 2005. In addition, he held various management and executive posts with mining and service companies in the UK and Australia from 1975 to 1999. Mr. Hooley is a professionally qualified mining engineer and has 39 years of experience in the world-wide mineral industry. He holds a degree in mining engineering from the Royal School of Mines, Imperial College London. Mr. Hooley is also a Fellow of the Australasian Institute of Mining and Metallurgy.

Terence McKillen, Director & Vice-President

Mr. McKillen is a professional geologist and has 39 years of experience in the mining industry. He holds degrees in geology from the University of Dublin (Trinity College) and a Masters degree in mining geology and mineral exploration from the University of Leicester. He is a registered Professional Geoscientist in the Provinces of Ontario and Newfoundland and Labrador. Mr. McKillen is currently Director, President and CEO of Conquest Resources Limited and Director of Exploration and Business Development for Minco plc. He was formerly Vice-President Exploration of Northgate Exploration Limited and Vice President Exploration and Development of Campbell Resources Inc. He was Director, President and CEO of Rift Resources Ltd., and Director of EXP Resources Inc.

Mathew Coon Come, Director

Dr. Mathew Coon Come is a Board Member of the Grand Counsel of the Crees (Eeyou Istchee) and the Cree Regional Authority. He was National Chief of the Assembly of First Nations from 2000 to 2003 and previously was Grand Chief of the Grand Counsel of the Crees in Québec for 12 years from 1987 to 1999. Earlier he served two terms as Chief of the Mistassini First 66 Nation. Mr. Coon Come is a Founding Member of the Board of

Compensation of the Cree Nation and has been a director of Creeco; AirCreebec, Cree Regional Intercompany Enterprise Company and Cree Construction Company and Chairman of Cree Housing Corporation and James Bay Native Development Corporation. He was a founding director of the First Nations Bank of Canada. In 1998 he was awarded the Goldman Prize (Environmental Award) in recognition of his leadership in northern Québec. He was awarded Honorary Doctorate of Laws degrees by Trent University in 1998 and by the University of Toronto in 2000.

Don Hindy, P.Eng

Don Hindy is a professional engineer and manager with over 30 years of experience in the Canadian mining industry, including oil sands, iron ore, base metals and coal. A longtime former resident of Schefferville, Mr. Hindy worked for the Iron Ore Company for over 16 years, during which occupied various mine operations and engineering positions including Supervisor of Mine Engineering, Mine Operations General Foreman, Mine Foreman, Supervising Engineer of Mine Planning, Supervising Engineer of Mines, Dewatering Engineer, Ore Grading Engineer, Pit Engineer and Surveyor. During this period, Mr. Hindy was personally involved in deposit assessment and overall surface mine design for many of the iron ore mines in the Schefferville area of the Labrador Trough.

He has extensive experience in engineering and operational positions, covering most aspects of mining, from project planning through project start up and full production operations. Senior management positions occupied include Manager of Mine Operations, Manager of Mine Maintenance and Manager of Mine Engineering/Chief Mine Engineer. Recently retired from his position as Mines Health and Safety Program Coordinator and designated Director of Mines for the Province of Alberta, Mr. Hindy was responsible for the application and enforcement of mine-related safety regulations in Alberta. In addition, as the Director of Mines, he represented the Province of Alberta on a Committee of Provincial Chief Mine Inspectors and on the Western Regional Mine Rescue Committee and fulfilled the role of Chair of the Board of Examiners - Mining, under the Alberta Occupational Health Regulation.

Linda Wrong, P.Geo., Vice-President Environment & Permitting

Linda Wrong is a professional geoscientist with an Honours B.Sc. (Geol.) from the University of Toronto. Linda is a former senior exploration geologist with over 20 years experience in remote and northern locations and specific experience over the last five years in Labrador, including work relating to the Company's project. Complementing her direct experience in the mining industry, she has over 15 years experience in the fields of environmental assessment, environmental baseline program development, community consultation, hydrogeology, environmental management system design and implementation and contaminated site assessment and management with major international consulting firms and mining companies, most recently as Mining Technical Program Lead, North America, with Earth Tech Canada and Manager Environmental Baseline and Engineering Liaison with Aurora Energy Resources Inc.

Marc Duclos, Vice-President Transportation Services

Mr. Marc Duclos, MBA, brings over 30 years experience in rail, port, and truck transportation management to Labrador Iron Mines. Amongst his extensive experience, Mr. Duclos was previously General Manager for the Sept-Iles operations of the Iron Ore Company of Canada and, as such, was responsible for the overall operations of the 600 km Sept-Iles to Schefferville railroad and the Sept-Iles port terminal. Marc was also previously employed by both Canadian National Railway and Via Rail. In addition to Marc's invaluable and extensive site-specific experience, he also brings a strong background in regulatory knowledge, project management, planning and successful project execution to the Labrador Iron Mines Project team.

Erick Chavez, Senior Geologist

Mr. Chavez is a professional geologist with 14 years international exploration experience. He is a graduate of Universidad Nacional de San Agustin de Arequipa, Peru and holds a M.Sc. degree from the University of Toronto. He has been Senior Exploration geologist with Conquest Resources Limited since 2003. Prior to 2000, Mr. Chavez was an exploration geologist with Cominco (Peru) SRL.

Joseph Lanzon, Government & Corporate Affairs

Mr. Lanzon has extensive experience in governmental affairs and in facilitating the development of community partnerships in the natural resource sector. Mr. Lanzon is Senior Advocate, Homeland Security for Canadian Advanced Technology Alliance. He has held management positions at CGI and General Electric with mandates for business development and government affairs. Mr. Lanzon has worked for the Federal Government of Canada, the NWT Government, the House of Commons and the Senate of Canada and has held senior positions as advisor and executive assistant. He has extensive knowledge of the workings of government at all levels.

Joanne Robinson, Senior Mine Engineer

Ms. Robinson is a professional engineer (P.Eng.) and a graduate of Queen's University (B.Sc. Mining Engineering) with 11 years experience in the Canadian mining industry. She has most recently been Senior Mine Engineer with the Ledcor Group in charge of an open pit metallurgical coal mine. Prior to 2006, Joanne held progressively senior engineering positions with Quintette Operation Corp., Trow Associates Inc., Huckleberry Mines Ltd. and Century Mining Corp.

Jacques Whitford Ltd.

Colleen Leeder, M.Sc.

Colleen Leeder is a Principal with Jacques Whitford in St. John's, NL, where she is the Environmental Planning and Permitting Group Leader, and Practice Director for Environmental Assessment. She has over 20 years experience in federal and provincial environmental assessment procedures and policies, including cumulative environmental effects assessment. Ms. Leeder was the EIS Manager for the Voisey's Bay Mine/Mill EIS, and the Liquefied Natural Gas Receiving, Storage and Processing Facility in Saint

John, New Brunswick. Both of these projects were subject to federal and respective provincial environmental assessment legislation. Ms. Leeder was also part of the environmental assessment team that prepared the Development Application and Comprehensive Study for Husky Energy's White Rose oilfield development, providing direction on environmental assessment methods, and support to Husky Energy. Prior to joining Jacques Whitford in 1995, she worked with the Environmental Assessment Division of the Newfoundland and Labrador Department of Environment and Labour. As Section Head, Ms. Leeder was responsible for the administration of the environmental assessment process and supervised the assessment of numerous developments.

Bruce Bennett, B.Sc. Hons.

Bruce Bennett is a Principal and senior scientist with Jacques Whitford St. John's office, who has a solid background in environmental assessments – including site inspections, feasibility studies, land and resource use reviews, baseline surveys, regulatory (and permitting) reviews and environmental protection planning. He was involved in provincial and federal environmental assessments of Hope Brook Gold mine/mill, Voisey's Bay mine/mill, IOC's Luce Pit Development, IOC's Tailings Management Plan, Nugget Pond Gold mine/mill, and Duck Pond Copper-Zinc Mine. Mr. Bennett has completed the one-day CEAA Training Course that is provided by the federal office. Since the enactment of CEAA, several of the assessments have been screening, comprehensive study and panel level assessments. Beyond Mr. Bennett's assessment experience for mining clients, he has been involved in baseline studies for: Voisey's Bay Mine/Mill Project, Voisey's Bay (Proposed) Smelter, Voisey's Bay Pilot Hydrometallugical Facility, Voisey's Bay (Proposed) Long Harbour Commercial Nickel Processing Facility, Hope Brook Gold Mine, Cape Ray (Proposed) Mine; Tally Pond (Proposed) Mine and Duck Pond Copper-Zinc Project.

As part of the assessment process, or complementary to the process, Mr. Bennett has developed environmental protection plans (EPPs) for Pine Cove Gold Mine, Nugget Pond Gold Mine, Hammerdown Gold Mine, Beaver Brook Antimony Mine, IOC Luce Pit and Duck Pond Copper-Zinc Mine.

Among the mine projects that have progressed to an operational stage, Mr. Bennett has assisted in the permitting stage and performed or managed EEM studies for: Voisey's Bay Mine, Hope Brook Gold Mine, Nugget Pond Gold Mine, Hammerdown Gold Mine, Wabush Mines, Iron Ore Company of Canada Carol Project, ASARCO Mine at Buchans, Rambler Mines, Ming Mines and Beaver Brook Antimony Mine.

With the recent formalization of EEM requirements under the Metal Mines Effluent Regulations (MMER) in June 2002, Mr. Bennett has participated in two working sessions with Environment Canada aimed at familiarizing the mining sector with the MMER requirements. Mr. Bennett has provided strategic advice regarding the implementation of MMER and regulatory liaison on behalf of, or for, mining clients such as Aur Resources, Iron Ore Company of Canada, Richmont Mines, Anaconda Gold Corp, Crew Gold Corp. and Voisey's Bay Nickel Company Limited. He participated in the design of the Voisey's Bay Mine/Mill Cycle 1 Marine EEM and later he managed the implementation of that program as well as the Cycle 1 for Nugget Pond Gold Mine. He

has managed programs to design and implement Cycle 1 EEM for Duck Pond Project and Cycle 2 for Voisey's Bay and Nugget Pond mines. Mr. Bennett has worked with the Jacques Whitford team that developed the decommissioning plans for Duck Pond Mine and Pine Cove Gold Mine.

Mark Shrimpton, M.A.

Mark Shrimpton (Principal, Jacques Whitford) has over 25 years experience in socio-economic consultant research, assessing, planning and managing the impacts of resource industry activities. This has included work for the mining, petroleum and hydro-power industries, and for governments, international agencies and communities.

In Canada, Mark has played a lead role in preparing: socio-economic impact assessments of the Voisey's Bay mine/mill and processing plant, LabMag iron ore mine, Lower Churchill hydro project, and the Hibernia, Terra Nova, White Rose, Hebron, Newfoundland Transshipment Terminal and Newfoundland LNG petroleum projects; industrial benefits, human resources and diversity plans for the White Rose project; infrastructure and labour requirements studies for various mining, petroleum and hydro projects; and, studies monitoring the socio-economic effects of resource development activity. He has also worked in the US, Iceland, the Faroe Islands, France, Switzerland, the Falkland Islands and Australia, including managing the preparation of socio-economic impact assessments of the smelter and hydro projects in Iceland. Mark has also completed various studies of the effects of remote mines, including research into operations in Canada, US and Australia. The clients for this work have included: Labour Canada; Energy, Mines and Resources Canada; Health and Welfare Canada; the Centre for Resource Studies, Queen's University; the Government of the Yukon; the Australian Mines and Metals Association; and, the UN International Labour Office. These studies involved site visits to remote mines and adjacent communities across Canada and in Western Australia, South Australia and Queensland.

Mark has published widely and made presentations on his research at conferences in Canada, the US, the UK, France, Norway, Lithuania, Russia, Malaysia and Australia. In addition to his consulting work, he is an Adjunct Professor of Geography and Associate of the Centre for International Business Studies at Memorial University.

Michael C. Murphy, PhD, P.Eng.

Dr. Mike Murphy is a Principal of Jacques Whitford AXYS Ltd. and the Senior Service Director for the Atmospheric Environment Group company-wide, working out of the Fredericton, New Brunswick office. He graduated from the University of Waterloo in 1987 with a Ph.D. in Chemical Engineering, specializing in energy analyses, fluid modelling and boiling heat transfer. With more than 23 years of experience in Canada, USA and international, Dr. Murphy has managed air quality and engineering studies on: emissions inventories of air pollutants and greenhouse gases, source emissions testing, dispersion modelling, dispersion and deposition modelling for human health and ecological risk assessments, ambient air quality, noise, odour, climate analysis, greenhouse gas management, flow profiling, indoor air quality and environmental assessments.

Dr. Murphy has worked on large environmental assessment (EA) projects including the NB Power Coleson Cove Refurbishment and the largest natural gas treatment plant in the world in Qatar, in the Middle East. He has conducted air quality studies for the shipping industry in Atlantic Canada (Saint John Port Authority), N.B. Power, Irving Oil Limited and in British Columbia (Vancouver Port Authority).

Dr. Murphy participated in the full EA for the LNG facility proposed for New Brunswick, and a similar one in Kitimat, B.C., including dispersion modelling, air quality assessments and public consultation on all air quality aspects. He acted as senior reviewer on the air quality and human health and ecological risk assessment for a pulp mill in Crofton, B.C. Recently, he has conducted a comprehensive review of the Draft Air Pollution Rules (2005) for the Government of Trinidad and Tobago and is assisting with policy development to protect the environment in light of continued industrial expansion. He is a member of the Environment Committee for the Road Builders Association of New Brunswick. Dr. Murphy maintains close ties with the University of New Brunswick and has given courses on air pollution, process safety, and mass and energy balances.

Benjamin Coulson, M.A.Sc., P.Eng.

Benjamin Coulson joined Jacques Whitford in 2005 as the Atmospheric Environment Group Leader and a Senior Engineer specializing in air quality, climate change, noise and acoustics issues. He has conducted dozens of environmental impact studies and regulatory compliance projects for a variety of industry sectors, including: institutions; power generation; manufacturing; medical research and health care; and transportation. His air quality experience includes numerical and physical dispersion modeling, regional airshed and photochemical modeling, emission inventory development, field measurement, and public and agency consultations. Ben has given lectures and presentations on a variety of air quality issues, including the development and teaching of training courses on air quality theory and dispersion modeling.

Benjamin Burkholder, B.Sc.

Benjamin Burkholder is an Air Quality Specialist with Jacques Whitford Limited. He has over six years experience conducting boundary layer meteorological and air quality dispersion modelling, ambient air quality monitoring and assessment, and emissions inventories. He has provided air quality emissions/modelling support for numerous environmental impact and risk assessment projects. Mr. Burkholder specializes in High Performance Computing (HPC) technology and has substantial experience running advanced dispersion, meteorological, and photochemical models on such platforms. He has worked on emissions and dispersion modelling assessments for a wide range of industries including the oil and gas, mining, power generation utility, pipeline utility and forest products sectors. Prior to joining Jacques Whitford, Mr. Burkholder worked as an Air Quality Scientist with the University of British Columbia and the British Columbia Ministry of Environment.

Jim Knight, P.Eng.,

Mr. Knight is Jacques Whitford's Senior Climate Specialist. As a former air quality and energy regulator, Mr. Knight has designed and implemented national and provincial emissions inventory, ambient air quality and acid rain programs. He has managed databases and progress tracking mechanisms and developed air quality, energy and energy efficiency legislation. He has lead public consultations on diverse issues including a national acid rain program, permitting of a coal-fired power plant, mining operations, the Petitcodiac Causeway and others. He recommended environmental priorities for a municipality (*A View of the City* (Saint John)), created Air Resource Management Areas (ARMA) across New Brunswick and drafted the Climate Change Action Plan for New Brunswick. He represented New Brunswick nationally and internationally on air quality, acid rain, ozone depleting substances and climate change matters. While at NB Executive Council, in 2001, he was a key Policy Analyst in the completion of a government-wide, department by department, program review. He co-authored the New Brunswick Energy Policy (1990; 2001) and worked directly with legal drafters on significant energy and environmental legislation (Clean Air Act, Electricity Act). He developed policy support documentation for the creation of Efficiency New Brunswick and the Renewable Portfolio Standard Regulation. He is an engineer, meteorologist, and a trained GHG Emissions Validation and Verification auditor with experience with the federal and provincial governments and with an electric utility.

At Jacques Whitford, Jim has worked with municipalities, institutions, commercial operations and heavy industries to establish and verify their GHG emissions inventories / intensities, identify potential emission reduction opportunities and quantified carbon offset credits, while assisting clients to prepare for proposed GHG and air pollutant regulations. He has worked with industries to address Climate Change and GHG Management Plans in Environmental Assessments on large construction projects (fossil and hydro-electric generation, LNG, pipelines, oil sands). He has assisted the Government of Trinidad and Tobago to develop new air quality standards and emissions regulations. He is responsible for the development and staffing of Jacques Whitford's Climate Services Line.

AECOM

Gary Epp Ph.D. (Project Manager)

Dr. Epp is the Technical Practice Group Leader for AECOM's Ecological Services Practice Group with the responsibility of coordinating global ecological services. He is also the Manager of Ecological Services for AECOM Kitchener and a senior ecologist, with the overall responsibility for providing comprehensive and integrated ecological assessment services to our clients. As head of the Ecological Services Group, Dr. Epp is directly responsible for the management and coordination of a wide range of ecological assessment assignments including natural heritage studies, environmental impact studies, watershed management plans, wetland evaluations & assessments, re-vegetation plans, aquatic & terrestrial habitat studies, natural resources screening, and bio-monitoring studies. Dr. Epp's experience has frequently involved an integrated approach where ecological studies have been strategically coordinated with a variety of

other scientific, engineering and planning disciplines. Dr. Epp has extensive experience negotiating with a wide range of review agencies, naturalist groups, and the public. Dr. Epp is recognized as an expert in ecological assessment before the Ontario Municipal and Environmental Assessment Boards.

Derek Parks, B.Sc. (HON), M.Sc. (Fish habitat, water quality, sediment, wildlife, field work, report preparation and logistical support)

Mr. Derek Parks is currently employed as a senior aquatic specialist within AECOM, with more than ten years of experience and whose specialties and interests include fisheries and fish habitat, water-quality, environmental effects monitoring, bioengineering and habitat assessment and enhancement. These skills provide Mr. Parks the ability to complete permitting approvals from various government agencies. He also has experience in the use of GIS to evaluate a range of fisheries issues. His previous employment includes AMEC Earth and Environmental, the Ontario Ministry of Natural Resources, the Township of Goulbourn and Niblett and Associates. He is also certified by MNR in the use of electrofishers and the Southern Ontario Rapid Stream Assessment Protocol and has extensive experience with a wide range of environmental studies. With a strong technical and academic background in fisheries resources, Mr Parks has applied this knowledge to plan, design and monitor a variety of projects to meet the needs of the client. He acted as a liaison for the client between regulatory agencies such as; Department of Fisheries and Ocean, Ontario Ministry of Natural Resources, and several Conservation Authorities, to provide the required information to be submitted to the appropriate agency. Once approvals have been granted, Mr. Parks has carried out over 15 monitoring programs to confirm work proposed and compensation and mitigation measures used were successful in protecting fish and fish habitat.

Jillian deMan (B.Sc.). (Vegetation field work, laboratory plant identification and report preparation) is a terrestrial ecologist with AECOM's Environmental Division based out of Kitchener, Ontario. With the company for over 12 years, her expertise has a wide range of scope within the environmental, engineering and waste management fields enabling her to be involved with numerous projects across Canada that incorporate natural heritage issues/planning and restoration. Consequently gaining familiarity with the Mixed wood Plains, Boreal Shield, Taiga Shield, Atlantic Maritime and Hudson Plains ecozones of Canada. Her technical skills include; wetland boundary delineation, evaluation, monitoring and restoration, soils identification, air-photo interpretation, multi-scale floral inventories, amphibian surveys, woodland evaluations and biomass fish sampling through seine net, minnow trap or electrofishing methods. These skills facilitate in the preparation of comprehensive Environmental Baseline studies.

James Holdsworth (Avifauna field work and report preparation)

James Holdsworth has over 33 years of field based experience with special emphasis on population dynamics in South Western Ontario. He possesses a wide variety of skills and specializes in point-counts, breeding and migratory bird surveys, and butterfly, dragonfly, mammal, reptile and amphibian surveys. Mr. Holdswroth has also co-authored " Checklist of the Birds of Oxford County " published in spring 2007, serves as sub-regional editor, Oxford County, for American Birds, Field Notes and North American

Birds magazines, has participated in both Ontario Breeding Bird Atlas projects, providing survey data on the breeding birds of Oxford County and is currently compiling and editing "The Birds of Oxford County", a definitive work on the history, abundance and diversity of the birds in the county of Oxford. He has worked on numerous projects including a sub-watershed study of the Greensville area, for the City of Hamilton, which included a migrant and breeding bird study, as well as inventories of butterflies, dragonflies, mammals, reptiles and amphibians in the Alvar communities. The design and implementation of a breeding and migratory bird survey for a proposed CPR rail extension in PIttock Lake, near Woodstock and served as a consulting breeding bird surveyor for the Red Hill Expressway project within the City of Hamilton.

David Praskey, B.Sc. (Fish habitat, water quality and sediment field work and data summarization)

Mr. Praskey is an aquatic ecologist with AECOM's Ecological Services group in Kitchener, Ontario. He has over six years experience in the aquatic biology field including lake and stream fisheries and habitat assessments, Lake Ontario wetland fish sampling, aquatic habitat mapping, Ontario Benthos Biomonitoring Network sampling, BC stream classification, and aquatic biological toxicity testing. Mr. Praskey's fish sampling experience includes index trapnetting and gillnetting, backpack and boat electrofishing, as well as seine and fyke netting. He also has more than 20 years of safe boating experience and has operated various sized boats for several professional and volunteer projects. He also has experience preparing project and client reports.

Intermesh Enterprises

Paul Thibaudeau, Ph.D

Paul Thibaudeau is an anthropologist (PhD Anthropology, University of Toronto), consultant (Intermesh Enterprises) and adjunct research professor (Department of Sociology/Anthropology and the School of Industrial Design at Carleton University) with a background in native ethno-history, archaeology and contemporary political affairs as well as experience in researching product design. He has provided consultation to both the private and public sector on different aboriginal and socio-economic issues including self-government, land claim resolution, litigation and history of residential school abuse and Aboriginal literacy and essential skills development. Paul also teaches courses on product design and anthropology and provides lectures and graduate advisement in the Master's of Design program.

SNC-Lavalin

Claude Beaulé

Mr. Claude Beaulé is an Engineering Project Manager and Team Leader. He's driven towards results with more than 20 years of relevant experience. His more important career accomplishments were in industrial process and utilities engineering: power plants – steam – natural gas – pumping and heat transfer.

His communication skills and leadership motivation abilities were key benefits in multidisciplinary team work.

Daniel Dufort

Mr. Daniel Dufort is a Project Manager in the Mining and Metallurgy Division of SNC-Lavalin, based in Montreal. Prior to his current appointment, he held Senior Executive positions in the mining industry and possesses more than 25 years of experience in production, operations, sales, marketing and project management. He has earned a solid reputation as an experience hands-on professional who can quickly motivate and rally a team around a common vision and business goals. Driven by continuous improvements, he focused on delivering strong results.

Stéphane Rivard

Mr. Stéphane Rivard has 14 years of experience as an engineer in the mining and metallurgy sector. He has extensive experience in copper; from chalcopyrite flotation to copper metal smelting, as well as in hydrometallurgy and production of copper rods. He also has over 7-year experience with zinc flotation (sphalerite). He has been involved in three plant start-ups, specifically the concentrator at the Bouchard-Hébert mine, the concentrator at the Horne smelter for the Gallen mine and the slag milling circuit for Fondicion Altonorte in Chile. He is a Six-Sigma Black Belt and took DFSS training with the Bismuth input/output management team including business modeling for Altonorte, Antamina, Gaspé, Horne and Kidd Creek (regarding minor elements in concentrates, smelters and refineries). More recently he has been involved either as Process Lead and Process Manager for several studies for SNC such as Mine Raglan Phase 2, Canadian Royalties Bankable Feasibility Study on their nickel project in Nunavik, Guelb El-Aouj (BFS) iron ore project in Mauritania and Silvermet's zinc fuming BFS in Turkey. Since 1994, Mr. Rivard has risen from Production Metallurgist to Senior Metallurgist, Head Metallurgist and Black Belt. More recently, he was an Engineer part of the production management team with a copper rod producer.

Jean Routhier

Mr. Jean Routhier has over 24 years of experience in the following process industries: petrochemical, mining, aluminum and pulp and paper. He has worked on multidisciplinary projects having undertaken numerous assignments in design, engineering, procurement, project controls, project management, construction management, commissioning and start-up. He has been involved in major capital projects in Canada, USA and overseas, including EPC projects.

Michaela Ilie

Mrs. Michaela Ilie has over 10 years of experience at increasing levels of responsibility in the Health, Safety and Environment field for industrial firms.

Her experience has mainly been gained in managing corporate Health, Safety and Environment programs and the development of HSE programs in both the operations and construction phases of projects. She is familiar with leading systems and procedures used in implementing and monitoring HSE, including behavioural based safety program (STOP), OSHA, OHSAS, ISO 14001, and in carrying out Job Safety Analysis, Process Safety Analysis, HAZOP and FMEA.

Her core skills include her experience in the implementation of management systems, environmental permitting, strategic planning, providing supporting to higher management and teamwork supervision in unionized environments. In continuously undertaking more challenging mandates, she has proven her capability to provide multi-unit support, to multi-task and to work independently in a fast-paced environment.

Jean-Sébastien Tremblay

Mr. Jean-Sébastien Tremblay, M. Eng., is a mining engineer with 8 years of experience in the mining and metallurgy field. He worked as much on the building sites, the existing mining installations and with the design of the future mines. In the 3 last years, it contributed to the development of a database making it possible to accelerate the calculation of the costs of operation relative to a plan of mining. He can measure the improvement of this tool for 3 different projects. He also integrated the design of the infrastructures relating to the supply of fuels and water for the periods of construction and operation for a mine and a mill. Moreover, Mr. Tremblay is familiar with the Whittle software of GEMCOM allowing optimizing the methods of mining. He also has acts as controller of project within the framework of a feasibility study adding up nearly 20000 hours.

WESA

Byron O'Connor, P.Eng.

Byron O'Connor is a Principal with WESA Inc. and licensed professional engineer in the Provinces of Ontario, New Brunswick, the Northwest Territories and Nunavut, and Newfoundland and Labrador. He has degrees in geology and geological engineering from the University of New Brunswick. He has worked in the mineral exploration and environmental fields since 1987. He has conducted environmental work at mine sites, industrial facilities and other sites throughout Ontario, across the Arctic, in Quebec, Alberta, Northwest Territories, New Brunswick, Labrador, Missouri, Delaware, Jamaica, Turks and Caicos, and St Lucia.

APPENDIX C

List of Documents

Other Related Documentation

Bauer, A. The Status of Rock Mechanic in Blasting, Drilling Considerations.

Bish Canada 2002. Assessment Report for an Investment Proposal for the Hollinger Iron

Ore Development Project. A report prepared for Soquem Inc.

Blais, R.A. & Stubbins, J.B. 1962. Role of mine geology in the exploration of iron deposits of the knob lake range, Canada. Transactions.

Bradbury, J., & St-Martin.2008. Winding Down in a Quebec Mining Town: a Case Study of Schefferville. Canadian Geographer, 27 (2), pp. 128-144.

Brouillette, Benoit. 1969. Le mineral de fer du Venezuela et du Labrador, Actualite Economique, 45 (1), p. 105.

Brown, D.D. 1981. The St. Lawrence Seaway tolls and the Quebec-Labrador iron ore industry. Mineral Policy Sector Internal report, Ottawa Energy, Mines and Resources Canada, Minerals, vi. 11p.

Burger, J. 1981. The Labrador Trough- Roads of Iron. E&MJ-Engineering and Mining Journal. 182, 11, pps.133-133.

CABO Drilling Corporation.2008. Health, Safety, and Environmental Policies and Procedures.

Centre de Recherches Minerales. 1996. Memorandum Technique. Preparation d'un Echantillon de Minerai de Fer de Schefferville. A report prepared for Fonteneau Resources Ltd. Report No. 7224M016.

Chavez, E. 2006. Feasibility Study for the Labrador Iron Ore Project, Province of NL, Canada. Vol 1. For Labrador Iron Mines Limited.

Chavez, E., & McKillen, T.N. 2007. Labrador Iron Mines Limited, Scoping study for the Labrador Iron Ore project, Province of NL, Canada. Energold Minerals Inc.

Clark-Jones, Melissa, McDonald, J.A. 2003. Globalization and the single industry town: an annotated bibliography. Journal of eastern townships, Issue 22.

Coates, D.F., Gyenge, M., Stubbins, J.B. Slope stability studies at Knob lake.

Coutes, D.F., McRorie, K.L. & Stubbins, J.B. 1963. Analyses of pit slides in some incompetent rocks. Transactions, Society of mining engineers.

Des Roches, M. & Therriault, Y. 2005 A Demographic and Health Profile, North Shore population. North Shore Local Health and Social Services Network Development Agency, 14p.

Dufort, D., & Kroon, A.S. 2007. Labrador Iron Mines Limited Technical Report of an Iron Project in Northwest Labrador Province of NL. Mining and Metallurgy. SNC-Lavalin.

Durrell, W. 1954. Quebec-Labrador Iron Ore Potential Dwarfs Mesabi Range. Journal of metals, 6 (4), pp.452-454.

Earth Tech Canada Inc. doing business as AECOM (2008). *Labrador Iron Mines Baseline Terrestrial Report- James, Redmond & Silver Yards*.

Earth Tech. 2008 (received).Iron Mountain Project. Schefferville Socio-Economic Background Information.

Earth Tech Canada Inc. 2006. Labrador Iron Mines Limited Environmental and Engineering Baseline Work Plan.

Elalfy, SE., Atkinson, T. 1993. The Carol Lake Mine of the Iron Ore Company of Canada. Transactions of the Institution of Mining and Metallurgy. Section A, Mining Industry, 102, A1-A14.

Fahraeus-Van Ree, G., & Payne, J.F. 2005. Endocrine disruption in the pituitary of white sucker (catostomus commersoni) caged in a lake contaminated with iron-ore mine tailings. Hydrobiologia 532, 221-224.

Fenwick, F.R. (2001). Sorrow in Sheshatshiu: the Innu of Labrador, 25 (5), p.38.

Garg, O.P. 1982. Recently developed blasting techniques in frozen iron ore at Schefferville, QC. Engineering Applications in Permafrost Areas. 4TH Canadian Permafrost Conference.

Garg, O.P. Successful Implementation of steeper slope angles in Labrador, Canada, Chapter 30, Third Stability in Surface Mining.

Garg, O.P.& Devon, J.W. 1978. Practical Applications of recently improved pit slope design procedures at Schefferville. Open Pit operations. CIM Bulletin.

Garg, O., & Kalis, T. Slope Stability Studies in the Schefferville Area.

Gauthier, G. 2004.Memorandum on Sawyer Lake Hematite Deposit, Labrador. Prepared for Energold Minerals Inc.

Gilders, R., & Cheung, L. 2007. Labrador Iron Mines Metallurgical Testing. Reference number: PET-J1577. Research and Productivity Council. Prepared for Labrador Iron Mines Ltd.

Gross, G.A. 1965. Geology of Iron deposits in Canada, Vol. 1. General Geology and Evaluation of Iron Deposits. Geological Survey of Canada, Economic Geology Report 22, p 181.

Hatch Mott MacDonald. 2006. Transportation and Tunnels. Assessment of Rail Infrastructure Conditions of the Menihek Subdivision of Tshiuetin Rain Transportation Inc. for Labrador Iron Ore Mines Limited, Rail Systems.

Hatch, W.R. 1989. Wet Spiral Classification of Iron Ores for LaFosse Platinun Group Inc.

Hatch, W.R. 1989. Wet Spiral Classification of Iron Ores. Report for LaFosse Platinum Group Inc.

Indian and Northern Affairs Canada, 2006a. http://www.ainc-inac.gc.ca/qc/gui/Map/naskapis_e.html

Indian and Northern Affairs Canada, 2006b. www.ainc-inac.gc.ca/qc/gui/matimekush_e.html

Iron Ore Company of Canada. 1979. Development Project Report on the James Mine Area. IOCC Engineering Department, Report No. 1975-11.

Iron Ore Company of Canada. 1983. Reserves and Stripping Estimates for Barney #2, North Ferriman, Ferriman #4, South Ferriman, Burnt Creek, Fleming #7, Retty, Knox, Fleming #9, Sawmill #1, Barney #1, Houston #2, Star Creek #1, Lance Ridge #1, Knob Lake #1, Redmond #5, Redmond #2, Wishart, & Timmins iron deposits. IOCC Engineering Department, Report. Kilborn Inc. 1995. Iron Ore Project Development Plan. Prepared for Hollinger North Shore Exploration Inc. Kilborn Report No. 3941-15.

Janssen, A.T. Long range production planning of direct shipping ore from several deposits.

Kearney, J. 2006. L.I.M. Limited. Labrador Iron Mountain Iron Ore Project Overview Report.

King, M.S., & Garg, O.P. (1983). Compressive strengths and dynamic elastic properties of frozen and unfrozen iron ore from northern Québec. Laboratory Testing of frozen Soils. 4TH Canadian Permafrost Conference.

Klein, C. 1966. Mineralogy and Petrology of Metamorphosed Wabush Iron Formation Southwestern Labrador. Journal of Petrology, 7 (2), 1966, p.246.

Kosovac, M., & Kundu, S. 1978. Iron Ore Co. of Canada's Computerized Analysis Method Speeds mine Planning and Pit Design. Society of Mining Engineers.

Labrador Iron Mines Limited Schefferville Project. 2008. Registration Pursuant to Section 3 of the Newfoundland and Labrador Regulation 54/03. Environmental Assessment Regulations, 2003, Under the Environmental Protection Act for the Proposed Labrador Iron Mines Limited, Schefferville Project.

Labrador Iron Mines Limited. 2005. Scoping Study for the Labrador Iron Mountain Project, Schefferville Area, Labrador.

Labrador Iron Mines, 2005. Iron Mountain Iron Ore Project review of First Nations Communities in the

Quebec-Labrador Peninsula

McKillen, T.N. 2005. Labrador Iron Mines PLC. Labrador Iron Ore Project. Summary Report.

Met-Chem Canada Inc. 2006. Labrador Iron Mines Limited High Level Review of Transportation Options.

Meyer, T. 2005. Baffinland Iron Mines Corporation, Research Report by First Associates

Inc. Midland Standard, Inc. 1990. Technical Review of La Fosse Platinum Group Inc. Iron Ore and Manganese Ore Project, Volume 1. A report prepared for Kidder Peabody & Co. Inc. MSI Report No. 40-01-138.

Midland Standard, Inc. 1990. Development Project Report on the James Mine Area. Technical Review of La Fosse Platinum Group, Incorporated Iron Ore and Manganese Ore Project for Kidder Peabody & Co., Inc. Iron Ore Company of Canada Engineering Department Development Section, Report No. 1975-11.

Naskapi Nation, 2006. http://www.naskapi.ca/en/our_organisations/corporate.htm

Neal, H.E. 2000. Explor. Mining Geol., Vol. 9, No. 2, pp. 113-121.

Neil, C., Tykkylainen, M., Bradbury, J. 1992. Coping with Closure: An International Comparison of mine town experiences. Routledge.

Nichols, L. 1968. Field techniques for the economic and geotechnical evaluation of mining property for opencast mine design, Knob lake, Québec. Journal of Engineering Geology, Vol.1. pp. 169-180.

Quebec Secretariat aux affaires Autochones, 2006. http://www.versuntraite.com/innus/matimekosh_en.htm

Retty, J., Moss, A (1951). Iron Ore Deposits of New Quebec and Labrador. Geological Society of America Bulletin, 62 (12), pp.1471-1472.

Risto, R.W., Neal, H.E. & Kociumbas, M.W. 2005. Technical Review and Mineral Resource Estimate for the Bloom Lake Iron Deposit, Quebec. A report prepared for Consolidated Thompson- Lundmark Gold Mines Limited by Watts, Griffis & McOuat Limited.

Risto, R.W. &, Neal, H.E. 2004. Amended Technical Report on the Howells River Iron Ore Project, Labrador . A report prepared for New Millennium Capital Corp. by Watts, Griffis & McOuat Limited.

RSM Mining Services Inc. 2007. Environment Health and Safety Program Manual.

Scales, M. 2007. IOC begins $60-million expansion. Canadian Mining Journal, 128 (7), p 20.

Scott, F. 2000. Overview Report on Hollinger Knob Lake Iron Deposits

Scott, F. 1990. Environment Preview Report for Temporary Access Road to Dyke Lake Area, Labrador. A report prepared for Fonteneau Resources Limited.

Scott, F. 2000. Overview Report on Hollinger Knob Lake Iron Deposits.

Scott, F. 2004. Report on Resources at Sawyer Lake Deposit, Labrador. A report prepared for Fonteneau Resources Limited.

Snelgrove, A. 1953. The Role of Geologists in the Development of the Labrador- Quebec Iron Ore Districts- Discussion. Transactions of the American Institute of mining and metallurgical engineers. 196 (11), pp. 1129-1130.

Stubbins, J. Dewatering and Flood Control. Auxiliary Operations, Chapter 11.4.

Stubbin, J.B. & Munro, P. 1965. Open pit mine dewatering-Knob Lake. Transactions, Vol LXVIII, pp.229-237.

Studeignesellshaft Fur Eisenerzaufbereitung. 1985. Report on the Use of Schefferville Iron Ore in the Standard Sinter Mixture. Prepared for Hollinger north Shore Exploration Company Ltd.

Swierkot, G., & Taciuk, W. 1970. Problems Associated with Flow of Bulk Solids at Iron Ore Company of Canada, Labrador City. Canadian Mining and Metallurgical Bulletin, 83 (695), 1970, p.304.

Toth, P. 2005. Production and Market Strategies in a Changing Iron Ore World. AJM Global Iron Ore and Steel Forecasting Conference, Perth, W.A.

Toth, P. 2005. Iron Ore Market Update. Presentation to Analysts by BHP Billiton.

Valliant, W. 2004. Memorandum on the Sawyer Lake Deposit. Prepared for Energold Minerals Inc. Studiengesellschaft fur Eisenerzaufbereitung 1989. Report on the use of Schefferville Iron Ore in the Standard Sinter Mixture ’85 of the Studiengesellschaft Fur Eisenerzaufbereitung. Report prepared for Hollinger North Shore Exploration Company.

Wardel, R.J. 1979. Geology of the Eastern Margin of the Labrador Trough, Mineral Development Division, Department of Mines and Energy, Government of Newfoundland and Labrador, Report 78-9.

Williams, G.E., & Schmidt, P.W (2004). Paleomagneticm of the 1.88-Ga Sokoman Formation in the Schefferville-Knob Lake area, Quebec, Canada, and implications for the genesis of iron oxide deposits in the central New Quebec Orogen. Precambrian Research, 128, pp. 167-188.

Zajac, I.S. 1974. The stratigraphy and mineralogy of the Sokoman Formation in the

Knob Lake area, Quebec and Newfoundland, Geological Survey of Canada, Bulletin 220.

APPENDIX D

Newfoundland and Labrador Benefits Policy and Women’s Employment Plan

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Schefferville Area Iron Ore Mine
(Western Labrador)

Newfoundland and Labrador Benefits Plan

August 21 2009

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1.0 INTRODUCTION

Labrador Iron Mines Limited ("LIM") understands the importance of the Schefferville Area Iron Ore Mine Project in Western Labrador (the "Project") to the people of the Province of Newfoundland and Labrador (the "Province"). LIM is committed to the maximization of associated benefits – including employment, procurement, education, training and economic development - to the Province and, in particular to Labrador, and is committed to providing full and fair opportunity and giving first consideration to residents and businesses of the Province to participate in, and benefit from, the Project.

LIM has accordingly established a **Labrador Iron Mines Limited Newfoundland and Labrador Benefits Policy** (Benefits Policy) that will apply to LIM and to all Project contractors and subcontractors and has developed this Newfoundland and Labrador Benefits Plan to implement the Benefits Policy.

LIM has entered into an Impact Benefits Agreement with Innu Nation of Labrador under which LIM has agreed to commitments and undertakings with regard to business opportunities, employment and other matters.

LIM has committed to project employment targets and goods and services procurement targets within the Newfoundland and Labrador Benefits Plan. The targets represent minimum levels of participation by residents of the Province in Project employment and for business opportunities for Newfoundland and Labrador companies in Project activity and LIM commits to achieve or exceed these targets.

Regardless of any other provision or statement set out in this Newfoundland and Labrador Benefits Plan, LIM shall, in all cases, meet or exceed all specific targets provided for in this Newfoundland and Labrador Benefits Plan relating to employment and procurement of goods and services.

This Newfoundland and Labrador Benefits Plan presents the **Benefits Policy** in Section 2.0 and describes the **processes and procedures** that will be used in implementing the Benefits Policy in Section 3.0, outlines specific initiatives with respect to opportunities for **employment** in Section 4.0 and with respect to the **procurement of goods and services** in Section 5.0.

The Project has been planned with the objective of maintaining a small footprint to minimise environmental and social impacts. To achieve this, the Project has been deliberately designed with the following specific characteristics:

- Small size of the operation.
- Phased development: LIM holds eight different properties in the area at varying stages of exploration and evaluation. The James and Redmond properties, which comprise the first phase of what it is hoped will become a multi–phase long term development, are located in an area of existing historical mining impacts with extensive existing infrastructure (access roads, existing water crossings, rail, etc). This existing infrastructure reduces the need for extensive new construction typically associated with new mine development. By using a phased development approach, starting with the James and Redmond properties, LIM hopes to facilitate the

adjustment by the community and regional support systems to the reintroduction of sustainable mining in the Schefferville Area of Western Labrador.

- Commute Operation: It is not intended that there will be a Project mining community where employees and their families will live. Instead, most workers will alternate between periods working at the site, living in LIM-provided accommodations in Labrador, and periods at home with their families.
- Staffed by contractors: The development and operation of the James and Redmond mines will be conducted using mining contractors that have knowledge and experience in the region. Labrador West has a long history of mining and related expertise and many experienced contractors are available.
- Mobile and semi-mobile equipment: There will be no permanent buildings on the mine sites. Equipment and structures will be mobile and semi-mobile, allowing these to be moved to where they are needed, reducing transportation-related impacts and facilitating progressive rehabilitation.
- Seasonal: During the five years of planned operations in the First Phase, mining operations will be carried out on a seasonal basis, from mid-April to mid-November each year. Project construction will be very short-term (approximately 8 weeks) and is planned to occur during the ice-free period.

In the foregoing respects, the Project differs in scale and character from the historical mining activities in Western Labrador, and is very different from most other mines currently operating in the Province of Newfoundland and Labrador.

LIM's commitment to delivering economic benefits to Newfoundland and Labrador is set out in this Newfoundland and Labrador Benefits Plan under which LIM has committed to several strategies summarised as follows:

Employment and Training:

LIM will implement an employment strategy that ensures residents of the Province are given full and fair opportunity and first consideration for employment. LIM will also implement training programs that allow for employment of residents within all levels of the Project.

Procurement Policies and Procedures:

LIM will establish and implement procurement policies and procedures to ensure opportunities for provincial benefits. Provincial suppliers will be provided full and fair opportunity and first consideration to participate on a competitive basis for the supply of goods and commercial services.

Construction Facilities:

LIM recognizes the existence of significant construction, fabrication and assembly infrastructure within the Province and will maximise its use whenever possible. This includes requiring that potential contractors bid work on the basis of using competitive qualified provincial suppliers of construction, fabrication and assembly services, where available on a full and fair opportunity and first consideration basis.

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Engineering:

LIM will ensure that management, engineering, procurement and service activities are to the greatest extent possible carried out in the Province. This work will be undertaken by, or have significant participation of, provincial suppliers on a full and fair opportunity and first consideration basis.

Supplier Development:

LIM recognizes that the availability of competent and competitive suppliers in the Province is a key element in the long term success of the Project and will implement procedures and practices that will enhance supplier capability on the basis of full and fair opportunity and first consideration to participate.

Labrador Offices:

LIM will establish and maintain two offices in the Province to serve as information centres and facilitate communication and will staff these offices with appropriate skilled residents appropriate to the nature of the Project and, so far as possible, provide management to the Project from these offices.

This Newfoundland and Labrador Benefits Plan reflects the distinctive nature of the Project and the specific opportunities and some constraints that the Project creates for the provision and delivery of benefits, including employment, education, training, business opportunities and economic development, to the Province of Newfoundland and Labrador.

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2.0 LABRADOR IRON MINES – NEWFOUNDLAND AND LABRADOR BENEFITS POLICY

Labrador Iron Mines understands the importance of the Project to the Province of Newfoundland and Labrador and in line with the principles and targets described in this Policy will provide full and fair opportunity and first consideration for the people, businesses and companies of the Province to secure employment and to participate in and benefit from the business opportunities associated with the Project.

Specifically, LIM is committed to:

- the delivery of associated benefits, including employment, education, training and business and economic development to the Province and in particular to Labrador on a full and fair opportunity and first consideration basis;
- the encouragement and assistance of residents of the Province, and in particular of Labrador, to receive the education and training necessary to maximize their opportunities for employment, retention and advancement on the Project;
- the procurement of goods and services from within the Province and, in particular from Labrador, and provincial suppliers will be provided full and fair opportunity and first consideration for the supply of goods and commercial services to the Project on a competitive basis;
- the implementation of policies and practices in connection with the procurement of goods and services for the project that enhance economic and business opportunities in Labrador, including the identification and support of industry businesses that would generate long-term economic benefits to Labrador;
- the provision of timely Project-related information to encourage the participation of all potential employees, businesses and contractors in the economic opportunities of the Project;
- and in all cases, LIM will attain or exceed minimum project employment targets and goods and services procurement targets as set out in this Newfoundland and Labrador Benefits Plan.

In addition LIM will also comply with the undertakings, commitments and obligations of the Impact and Benefits Agreement (IBA) entered into with the Innu Nation of Labrador, and with the provisions of LIM's Women's Employment Plan.

The IBA is a life of mine agreement that establishes the processes and sharing of benefits that will ensure an ongoing positive relationship between LIM and the Innu Nation, through which the Innu Nation and their members will benefit through employment, training, business opportunities and financial participation in the Project.

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The Women's Employment Plan details LIM's approach to employment equity, identifies occupations in which women are under-represented, uses this to establish appropriate initiatives and targets and describes a process for achieving these targets, monitor success in meeting these targets, and reviewing and revising equity initiatives where appropriate.

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3.0 BENEFITS PROCEDURE - TO BE USED IN IMPLEMENTING THE BENEFITS POLICY

The provisions of this Newfoundland and Labrador Benefits Plan apply to LIM itself, and all contractors and subcontractors undertaking Project construction or operations work. The Newfoundland and Labrador Benefits Plan will be implemented and administered by LIM with the support of the selected contractors.

In implementing the Newfoundland and Labrador Benefits Plan, LIM will:

- Ensure that all contractors and subcontractors working on the Project abide by this Newfoundland and Labrador Benefits Plan.

- Communicate all material (greater than $100,000) Project labour, contracts, goods and services requirements on its website and in newspapers in the Province, and especially in Labrador, and require its contractors and subcontractors to comply with this Policy.

- Ensure that full and fair opportunity and first consideration principles and procedures for Newfoundland and Labrador residents and businesses are applied to any Project labour, contracts, and goods and services requirements with a dollar value of less than $100,000.

- Meet targets for Project employment and for goods and services procurement, for both Project construction and operations. The targets represent minimum levels of participation by residents of the Province in Project employment and for business opportunities for Newfoundland and Labrador companies in Project activity and LIM commits to achieve or exceed these targets. Residents of Newfoundland and Labrador, at point of hire, will be determined according to the principles established in The Elections Act, SNL 1992, CE-3.1 as being “ordinarily resident.”

- Include a copy of this Newfoundland and Labrador Benefits Plan in all Project calls for expressions of interest, requests for proposals or contracts, and require that its contractors do the same.

- Require that prospective contractors indicate in bids how they would address the requirements of this Newfoundland and Labrador Plan.

- Monitor Project employment and the supply of goods and services and, on a monthly basis for construction and initial operations and on a frequency to be agreed with the Government of Newfoundland and Labrador for subsequent operations, prepare concise reports assessing actual outcomes relative to the Benefits targets.

- Provide copies of the above-noted employment and business reports to the Department of Human Resources, Labour and Employment and to the Department of Natural Resources on this agreed basis and be available to discuss these reports, including LIM’s level of success in meeting targets, and appropriate responses.

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- Review and, as necessary, revise LIM's benefits procedures and initiatives to ensure that LIM's commitments under this Benefits Plan including the attainment of minimum targets, have been achieved.

Information Centres and Communication:

In support of its commitment to the maximization of benefits to Newfoundland and Labrador, LIM will establish and maintain offices in Labrador West and Happy Valley-Goose Bay to serve as centers of information about the Project and about requirements for labour and requirements for goods and services and also to provide local administration and procurement services to LIM.

LIM will provide Project employment and business opportunity information and computer and internet facilities and personnel at its offices in Happy Valley Goose Bay and Labrador West to assist provincial suppliers and/or residents of the Province to access applicable information and will also post information on its website and make applicable information available by mail to potential employees, provincial suppliers and residents of the Province at their request.

LIM will establish an Information Centre in Happy Valley – Goose Bay to make available to the general public of the Province information concerning the status of and major developments relating to the Project. The Information Centre will also provide information relating to employment and supplier participation opportunities for the Project and will also serve as a receiving point for resumes and pre-qualification documentation. The Goose Bay office will also coordinate LIM's partnership with the Innu of Labrador and will focus on business, training and employment opportunities for Aboriginal participation in the Project.

LIM will also establish and maintain an office in Labrador City / Wabush which, to the greatest extent possible, will provide management services to the Project, and will staff such office with residents having skills appropriate to the stage of development, construction and operation activities taking place at the Project. The primary function of the Labrador City office will be to focus on procurement activities and on personnel, and on human resource management including, training and coordinating the fly-in-fly-out transportation arrangements and contractor's procurement activities.

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4.0 EMPLOYMENT

In order to recruit, develop and maintain the highest levels of commercial, technical, environmental and personnel management at all times, it is LIM's general policy to employ people of the highest possible calibre available for each position, consistent with sound economic and management principles.

LIM will provide full and fair opportunity and first consideration to residents of the Province of Newfoundland and Labrador for Project related employment, recognizing its legal obligations under the Canadian Charter of Rights and Freedoms and applicable laws, including those relating to accommodation of Aboriginal First Nations, and complying with its commitments under the Impacts Benefits Agreement signed with the Innu Nation of Labrador.

It is estimated that the Project will employ approximately 40 people during the Construction Phase and approximately 109 people during the Operations Phase. Overall, LIM has committed to achieving a minimum of 78 percent of Construction, 78 percent of Operations Phase employment and corresponding person-days accruing to residents of Newfoundland and Labrador.

Regardless of any other provision or statement set out in this Newfoundland and Labrador Benefits Plan, LIM shall, in all cases, meet or exceed all specific targets provided for in this Newfoundland and Labrador Benefits Plan relating to employment.

Consistent with its legal and corporate social responsibilities it is expected that LIM and its contractors will offer employment to Aboriginal First Nations throughout all phases of the Project. LIM has entered into an Impacts Benefits Agreement with the Innu Nation of Labrador that amongst other matters includes commitments for Aboriginal employment.

LIM has also entered into Memoranda of Understanding with other adjacent First Nations who claim traditional and aboriginal rights in the area and who may be impacted by the Project. The other First Nations, based in Quebec, are the Innu Nation of Matimekush, located immediately adjacent to the Project area in or around the town of Schefferville, and the Naskapi Nation located at Kawawachikamach about fifteen kilometers from the Project area. LIM has also entered into negotiations with the Innu Nation of Uashat, who also claim traditional Aboriginal rights in the Project area. LIM expects to convert these MOUs to formal co-operation agreements in the near future and these agreements will address employment opportunities for those Aboriginal First Nations.

It is expected that during both the Construction Phase and Operations Phase approximately 25 percent of total employees will be Aboriginal First Nations comprising all of the various Aboriginal groups noted above including the Innu Nation of Labrador. Success in achieving this will be dependent on progress in implementing the employment related provisions of the IBA Agreement with the Innu Nation of Labrador.

It is expected that the great majority of both construction and operations workers will commute to and from the mine site using a 'fly-in' rotation, alternating between periods of work, during which they will live in LIM provided camp accommodation in Labrador and periods living in their home communities.

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During the Construction Phase ahead of Operations some commute workers will be temporarily housed in LIM provided accommodation while a new trailer camp with accommodation for up to sixty operations personnel is erected in or near to the Silver Yards area in Labrador, and which will be in service ahead of mine Operations.

In the Operational phase of the Project the commute schedule will generally see most workers following a standard rotation of four weeks on and two weeks off. The commute system will be designed based on the residential locations of the labour force, and is expected to include the provision of air transportation to and from Labrador City – Wabush and Happy Valley - Goose Bay and from the island of Newfoundland, if so required, and the use of the railway from Labrador City. LIM expects to employ workers from the adjacent communities of Matimekush and Kawawachikamach on a daily commute basis.

LIM intends to follow an adjacency policy in selecting commute employees. First priority in the employment of these commute workers will be given to qualified residents of Western and Central Labrador. Second priority will be given to qualified residents of other parts of Labrador, and third priority to qualified workers from elsewhere in the Province of Newfoundland and Labrador.

In keeping with LIM's commitment to providing full and fair opportunity and giving first consideration for employment to residents of the Province, LIM will:

- communicate information on the Project job opportunities and labour requirements in a timely manner;
- develop and implement a human resources plan and appropriate training programs;
- develop and implement policies and procedures to encourage the participation of Aboriginal First Nations and disadvantaged individuals and groups;
- develop an employment equity policy and implementation plan that addresses recruitment, training and advancement of women.

In order to encourage and facilitate the training and skill development of Labradorians and Newfoundlanders, LIM will:

- Implement human resources initiatives (e.g. mentoring, succession planning, orientation and cultural diversity programs and work schedules) that will facilitate the hiring, retention and promotion of Labrador and Newfoundland resident employees, including the Innu of Labrador.
- Ensure that Project human resources initiatives address any labour market under-representation of Labradorians and Newfoundlanders, including the Innu of Labrador and women, in engineering, design, management, skilled trades and other occupations.
- Implement the employment-related provisions of its IBA with the Innu Nation of Labrador. LIM will work with the Innu Nation to develop pre-employment and training programs that meet both the specific needs and the culture of the Innu of Labrador. LIM will also work with the Innu schools to develop specific Aboriginal employment programs.

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- Maintain an ongoing liaison and communication with the Labrador Regional Economic Development Zone Boards and the Department of Human Resources, Labour and Employment, and the Innu Nation, so that they are informed about Project employment requirements, opportunities and plans.

- Work with the above institutions and agencies to help them develop and implement training initiatives that will facilitate the availability of qualified Labradorians and Newfoundlanders, including the Innu of Labrador, to work on the Project.

- Develop and implement training initiatives for all phases of the Project in co-operation with the Government of Newfoundland and Labrador, provincial suppliers and educational and training institutions in the Province. These initiatives will include pre-employment and employment training programs utilizing in house expertise and external training organizations. LIM will make maximum use of existing provincial education facilities in Labrador City and Happy Valley Goose Bay and establish specific programs for training at the mine site.

- LIM will work with the College of North Atlantic to develop technical courses specific to LIM and initially will focus training programs on an Environmental Monitoring program and a Health and Safety Training program.

- Work together with Labrador schools and colleges to establish scholarships in mining and geology-related subjects with eligibility for Labrador residents.

LIM has adopted a Women's Employment Plan.

- The Women's Employment Plan details LIM's approach to employment equity, identifies occupations in which women are under-represented, uses this to establish appropriate initiatives and targets and describes a process for achieving these targets, monitor success in meeting these targets, and reviewing and revising equity initiatives where appropriate.

The Women's Employment Plan describes:

- the LIM women's employment planning process, including: the responsibilities of LIM and its main contractors; the process for identifying and implementing targets and initiatives; and, the process for monitoring and reporting the implementation of those initiatives and success in achieving targets;

- the types of information and communications; employee recruitment and selection; employee development; working environments and community outreach initiatives that LIM and its contractors will use to achieve employment equity for women;

- specific LIM initiatives such as an anti-harassment program; community sensitivity program and a review of childcare services available; and

- LIM will maintain an ongoing liaison and communication with the Women's Policy Office, the Department of Natural Resources Women's Policy Group and the Women in Resource

Development Committee (WRDC), so that they are informed about Project employment requirements, opportunities and plans.

4.1 Construction Phase Employment

Project construction will be of limited duration (approximately eight weeks) and will overlap with the initial year of operations. It is estimated that the Project will employ approximately 40 people during the Construction Phase from several occupational categories, including direct and indirect building and technical trades, engineering, procurement and construction management (Table 4.1). It is intended that most of these positions will be supplied by the main contractors or subcontractors.

Overall, LIM has a target commitment of having a minimum of 78 percent of construction phase employment and corresponding person-days accruing to Newfoundland and Labrador residents, most of it to Labrador. Specific targets with respect to women's employment are outlined in the Women's Employment Plan.

LIM will require its contractors and subcontractors to abide by the provisions of this Newfoundland and Labrador Benefits Plan with regard to maximizing employment of construction personnel from within the Province.

There is an adequate supply of labour in the Province to meet most project construction demands. However it is recognized that there are specific skill shortages throughout the construction industry and, with the limited size of the mining industry in the Province and the short duration of the Construction Phase of the Project, it is anticipated that a number of Project specific specialized positions may not be able to be filled by residents of the Province. Not withstanding this, the 78 percent minimum Newfoundland and Labrador resident employment commitment will apply.

The Project Construction labour force is described in Table 4.1. It should be noted that, with the exception of the General Site Management, the positions that will be required throughout the Construction Phase will involve short periods of work (i.e. between about two days and four weeks) on site.

Given the small numbers of trades-persons involved, it may be difficult to employ apprentices for some trades, in the journeyperson to apprentice ratios determined in accordance with the provincial general conditions concerning apprenticeship. However, LIM will strive to maintain the journeyperson to apprentice ratios where possible.

The labour demand for the Construction Phase of the Project is not expected to affect labour supply in the Province. Potential labour demands from other major projects could affected skilled construction labour supply.

The labour market in Canada for skilled trades is facing shortages and there is competition for labour across the country, given the compounding effects of an aging population, declining birth rates and a general lack of interest in skilled trade occupations. All existing and new major industrial projects are expected to experience skilled labour shortages. It is expected that there will be a shortage of civil engineers, electricians, plumbers, iron workers, welders, concrete finishers, carpenters and engineers in particular. The skilled labour market in Canada and particularly in Newfoundland and Labrador is dynamic and labour supply and demand present difficulties across the country. Emigration of skilled

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workers from Newfoundland, especially to Alberta, has been noticed in recent years but this has declined in the current year.

It is planned that Construction Phase of the Project will be completed by mid-2010. As such, it is expected that construction of the Project will be completed in advance of the anticipated construction labour requirements of other major proposed Labrador projects, such as the Lower Churchill Hydroelectric Generation Project (peak employment 1,700, construction period 2010 to 2018) and Aurora Energy project (peak employment 700, construction period 2011 to 2014). Additional projects planned for development in Western Labrador include the Elross Lake DSO iron ore project and Consolidated Thompson's Bloom Lake railway. Given its short construction duration LIM's Project will therefore not be in competition for labour with these other Labrador construction projects.

The Project will provide some Labrador residents, including some workers in Labrador West who have recently become unemployed, with an opportunity to further develop their skills and employment experience, thereby assisting in the development of the labour force for subsequent construction projects in the Province.

Table 4.1 Construction Phase Employment

POSITION	NUMBER	NOC
Site Manager	1	
Clerk	1	
Lead Foreman	1	0721
Surveyor	1	2254
Equipment Operator – heavy	4	7421
Equipment Operator – light	3	7421
Truck Drivers	3	7411
Labourers-specialized	2	7611
Labourers	6	7612
Carpenter	2	7215
Welders	2	7265
Electricians	1	7241
Electrical Helper	1	7611
Crane Operator	1	7371
Boilermakers	1	7262
Ironworkers - steel reinforcement	1	7264
Ironworkers - steel reinforcement-helper	1	7611
Cement Finisher	2	7282
Structural Steel Workers	2	7263
Structural Steel Worker – apprentice	1	7611
Pipe Fitters	2	7252
Pipe Fitter-helper	1	7611
TOTAL - CONSTRUCTION	**40**	

4.2 Operations Phase Employment

It is expected that during mine operations the Project will provide employment for a total of approximately 109 personnel (100 on mine operations + 9 spur line operations), including allowance for the commute roster (Table 4.2).

LIM will provide full and fair opportunity and first consideration to residents of the province of Newfoundland and Labrador for operations related employment. LIM is committed to a minimum of 78

percent of employment and corresponding person-days accruing to residents of Newfoundland and Labrador, together with approximately 25 percent Aboriginal First Nation employment participation.

Operations will generate an important level of longer-term (estimated five-year duration) seasonal (approximately seven months per year) employment benefits to Labrador and the Province as a whole. Table 4.2 includes the total workforce including those personnel away from the site, on rostered time-off, at any time. It is expected that most workers will generally be employed on a four weeks on and two week off schedule. With the exception of the owner management positions, which will be full-time office positions, these personnel will be employed on a full-time seasonal basis.

Given the small numbers of trades-persons involved, it may be difficult to employ apprentices for some trades, in the journeyperson to apprentice ratios determined in accordance with the provincial general conditions concerning apprenticeship. However, LIM will strive to maintain the journeyperson to apprentice ratios where possible.

In addition to direct project employees there will be significant indirect employment created in both Labrador West and in Happy Valley-Goose Bay as a result of the supply of goods and services. Using a conservative economic multiplier of 2, it is estimated that at least an additional 100 operations phase jobs would be created across both Labrador communities.

LIM will use every effort to provide ongoing training and development for its employees and will:

- maintain a safe work environment that provides employees with the opportunity to achieve their career goals, and the training and support they need to meet personal objectives;
- provide competitive wages and benefits and a progressive work environment;
- create a welcoming and respectful work place, and adopt policies and initiatives that incorporate the Company's commitment to support training and development;
- work with Government, education institutions, women's organizations and industry associations to advance gender diversity on the Project;
- develop a human resources plan in support of its commitment to women's employment which will include targets and initiatives with respect to women as specified in the Women's Employment Plan.

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Table 4.2 Operation Phase Employment

Positions	Number	NOC Code
Mine Operations		
Mine Operation Foreman	1	8221
Foreman	3	8221
Drill Operator	3	7372
Blaster	2	7372
Blaster Helper	1	8411
Loader Operator	3	7421
Haulage Truck Operator	9	7411
Dozer Operator	3	7421
Grader Operator	3	7421
Sampler	3	8614
Subtotal	31	
Mine Engineering		
Mine Engineer	2	2143
Mine Technician	1	2212
Surveyor	2	2254
Draftsman CAD	1	2253
Subtotal	6	
Beneficiation Operation		
Plant Manager	1	0721
Process Technician	1	2243
Chemical Technician (Lab)	3	2211
Labourer	1	7612
Administrative Assistant	1	1441
Warehouse Person	3	1472
Maintenance Foreman	1	7211
Utility Crew (pipeline, pumps, etc.)	1	
Primary Crusher Operator	6	9411
Secondary Crusher Operator	3	9411
Secondary Crusher Helper	2	9611
Belt Filter & Load-out Operator	6	9411
Mechanic	2	7312
Mechanic Helper	1	7612
Safety/First Aid personnel	3	
Electrician/Instrumentation	2	7241
Locomotive Engineers	3	7361
Brakemen	3	7362
Yard Workers	3	7432
Subtotal	46	
Owner Management		
General Manager	1	0721
Geologist	3	2113
Environmental Technician	1	
Clerk	1	
Mine Engineer	1	2143
Innu Liaison	1	
Labrador offices	3	
Subtotal	11	
Contractor Management		
Site Manager	1	0711
Secretary	1	1241
Bookkeeper/Accountant	1	1231
Camp operations	12	
Subtotal	15	
TOTAL - OPERATION	**109**	

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5.0 PROCUREMENT OF GOODS AND SERVICES

Overall, LIM has committed to achieving a minimum of 85 percent of total value of construction and 85 percent of total value of operations phase contracts and goods and services being awarded/procured through companies and suppliers based in the Province.

Regardless of any other provision or statement set out in this Newfoundland and Labrador Benefits Plan, LIM shall, in all cases, meet or exceed all specific targets provided for in this Newfoundland and Labrador Benefits Plan relating to procurement of goods and services.

Labrador Iron Mines will require a wide range of goods and services during both the construction phase and the subsequent ongoing operation of the Project. LIM's policy in the procurement of goods and services will be on a basis which will enable the Project to be and remain competitive.

As a general principle, suppliers that maintain business operations and employees in the Province of Newfoundland and Labrador will be provided full and fair opportunity and first consideration on a competitive basis for the supply of goods and services for the Project during both the construction and operation phase.

The IBA signed with the Innu Nation of Labrador provides first opportunity to Innu Businesses for the supply of goods and services It is also anticipated that some goods and services will be procured from the Aboriginal communities of Matimekush and Kawawachikamach close to the mine site, and from the town of Schefferville. It is expected that substantially all of both construction and operations goods and services will be procured from business and suppliers in the Province of Newfoundland and Labrador.

LIM will use an adjacency policy in selecting suppliers to provide goods and services. First priority, in terms of supply of goods and services, will be given to qualified businesses located in Central and Western Labrador, second priority will be given to qualified companies in other parts of the Labrador, and third priority to qualified companies from elsewhere in the Province of Newfoundland and Labrador.

LIM will select the businesses and suppliers based on criteria which will provide best overall value and service to the Project and the Province taking all factors into consideration, including technical expertise, experience, quality of work, environmental and social responsibility, track record, health and safety record and localized sourcing of goods and services. LIM will retain the right to make decisions in a businesslike manner, relating to the qualifications, competence and suitability of any prospective supplier or contractor. In all cases, selection of suppliers for goods and services will be made based on such goods and services meeting the required specifications and availability on a commercially reasonable and timely basis. LIM may award contracts for goods and services from outside the Province where no provincial supplier can supply such goods and services on competitive terms, including LIM's required delivery schedule.

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Procurement Procedures:

In furtherance of the principle of full and fair opportunity and first consideration to residents and business of the Province, LIM will implement procurement policies which reflect the following:

- Identify on a timely and ongoing basis, opportunities for the supply of goods and commercial services during all phases of the Project and communicate these to potential Provincial suppliers to enable such suppliers to identify and evaluate those opportunities of interest;

- Commit to work co-operatively with the Government agencies and industry organizations to jointly identify suppliers of goods and commercial services;

- For all Major Contracts (defined as any contract for the supply of goods or services with a price or value of more than $250,000), excluding iron ore transportation on the existing TSH, QNS&L and Arnaud railways, LIM will develop and apply a competitive bidding process incorporating the pre-qualification of the potential suppliers. LIM may award a major contract for goods and commercial services without a competitive bidding process where the contract is awarded under the terms of the IBA with the Innu Nation of Labrador.

- Include in each contract provisions requiring the supplier to adhere to this Benefits Policy. Suppliers will be required to incorporate similar provisions in any sub-contract arrangements;

- Ensure that LIM's procurement personnel are familiar with the capacities and capabilities of Newfoundland and Labrador suppliers;

- Ensure that LIM's procurement policies and procedures are posted on its website to promote supplier awareness;

- Ensure that the names and locations and contact details of LIM's procurement personnel are known to local business organizations and economic development groups and are available on the Company's website and at LIM's Labrador offices;

- Participate in trade shows, business conferences, and other business promotion events in the Province.

- Ensure the inclusion of qualified Newfoundland and Labrador suppliers on appropriate bid lists.

- Provide business groups, economic development agencies and the Innu Nation of Labrador with information on upcoming contracts, pre-qualification lists, and final bid lists.

- Meet and maintain an ongoing liaison with provincial, and especially Labrador, business groups and economic development agencies, and with the Innu Nation of Labrador, so that they are informed about goods and services requirements and plans, and to help identify potential Newfoundland and Labrador suppliers.

- Provide feedback to all unsuccessful bidders on Project contracts.

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- Monitor, review and, as necessary, revise LIM's benefits procedures and initiatives to ensure that LIM's commitments under this benefits plan including the attainment of minimum targets have been achieved.

Supplier Development:

- LIM recognizes that the availability of competitive and competent suppliers in the Province, and particularly Labrador, is a key element in the long term success of the Project. LIM is committed to enhancing the capability of Provincial suppliers where possible.

- LIM will work with the Government of Newfoundland and Labrador to identify the capabilities of provincial suppliers and provide recommendations to, and assist the Government of Newfoundland and Labrador to develop, initiatives to improve the capacity of provincial suppliers to provide goods and services to the Project.

- LIM will develop, and update, lists of potential requirements for the supply of goods and commercial services for the operation phase of the Project and will communicate these lists in a timely manner.

5.1 Construction Phase Procurement

The construction phase of the Schefferville Area Iron Ore Project will see the procurement of goods and services, most of which are available in Newfoundland and Labrador. They include:

- earthworks;
- site construction;
- buildings construction;
- camp supply;
- plant construction;
- mine preliminary works and overburden stripping;
- fuel and refuelling services;
- welding and machining goods and services;
- land surveying;
- catering services
- vehicle rental;
- blasting;

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- pipe-laying;
- road construction;
- electrical and mechanical contracting;
- miscellaneous tools and small equipment;
- heavy equipment rental (cranes, excavators, loaders);
- independent environmental monitoring; and
- air transportation.

LIM will ensure that construction management, engineering, procurement and project service activities for the construction phase of the Project shall, to the greatest extent possible, be carried out in the Province. LIM recognizes the existence of significant construction, fabrication and assembly infrastructure within the Province and will encourage utilization of such infrastructure. Specifically, LIM will require that potential contractors bid work on the basis of utilizing, qualified, competitive provincial suppliers of construction, fabrication and assembly services, where available. All material and major construction and supply contracts will be advertised within the Province and potential provincial based contractors and suppliers will be given every opportunity to provide competitive quotations.

Some Project materials and services are not available in Labrador or, indeed, elsewhere in the Province, and there is no reasonable expectation of this changing as a result of the Project or any foreseeable level of demand. The following materials and services may in all likelihood need to be brought to the Project site from outside the Province:

- crusher and beneficiation plant and major open-pit mining equipment;
- rails, rail ties and other track materials;
- rail cars and power units; and
- specialized mine engineering and consulting services.

Where it is not possible to source any of these items from within the Province these goods or services will be procured through Newfoundland and Labrador based distributors or agents whenever economically available.

LIM will make potential contractors from outside the Province aware of the Province's construction, fabrication and assembly infrastructure and provide qualified provincial suppliers of construction, fabrication and assembly services a full and fair opportunity to bid on construction, fabrication and assembly services. Where any such contract for construction, fabrication and assembly services is performed in the Province, LIM will require the supplier carrying out such services to locate, where possible, its fabrication, engineering and procurement activities relating to such contract in the Province.

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Based on the Project parameters LIM has established a Benefits Plan target commitment of having 85 percent of the total value of construction contracts and supply of goods and services , excluding the four items noted above, being awarded to companies and suppliers based in the Province.

5.2 Operations Phase Procurement

Mine and railway spur line operations will require a wide range of goods and services, substantially all of which are available in Newfoundland and Labrador.

A review of local capabilities indicates that the following will be available on a commercial basis from within Newfoundland and Labrador:

- fuel and refuelling services;
- welding and machining goods and services;
- catering services and camp management;
- vehicle rental, rail passenger and air transportation services;
- maintenance operations;
- hardware stores miscellaneous tools and small equipment;
- heavy equipment rental (e.g. cranes, excavators and loaders);
- local contracting services (e.g. construction, electrical and mechanical);
- Mine contractors;
- Beneficiation Equipment operation; and
- Power Supply.

LIM has established a Benefits Plan target commitment of having 85 percent of the total value of operations phase contracts, goods and services (excluding iron ore transportation on the existing TSH, QNS&L and Arnaud railways, locomotive and rail car maintenance and port operations) being procured from companies or businesses based in Newfoundland and Labrador.

Should locomotive and rail car maintenance facilities or services become available in Labradror, LIM commits to ensure that these facilities/services be provided every opportunity to offer competitive quotations for these services.

All material and major construction and supply contracts will be advertised within the Province and potential provincial based contractors and suppliers will be given every opportunity to provide competitive quotations.

For those items that it is not possible to source directly from within the Province then these goods or services will be procured through Newfoundland and Labrador based distributors or agents whenever possible and whenever economically available.

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Schefferville Area Iron Ore Mine
Western Labrador
Women's Employment Plan

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August 21, 2009

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1.0 INTRODUCTION

This Women's Employment Plan covers the construction and operations phases of the Schefferville Area Iron Ore Mine Project (the "Project"). It has been prepared in response to the Guidelines for the Project environmental assessment, and describes how Labrador Iron Mines Limited (LIM) will ensure that the employment of women on the Project is fully promoted and supported throughout the Project.

The Plan is in four main sections. The first (Section 2.0) describes the Project and the occupations required for the construction and operations phases. This is followed, in Section 3.0, by a description of the women's employment planning process, including: the responsibilities of LIM and its main contractors; the process for identifying and implementing women's employment goals and initiatives, including the initial goals; and, the process whereby the implementation of those initiatives, and success in achieving these goals, are monitored and reported. Section 4.0 identifies and describes possible initiatives that LIM and its contractors can use to achieve employment equity for women. Lastly, Section 5.0 summarizes a number of initiatives LIM has already adopted with the aim of delivering employment equity on the Project.

The encouragement of women in the workplace is an important goal of LIM. In respect of LIM's commitment to employment equity, it should be noted that 33% of technical and management positions at the company are currently occupied by women.

2.0 THE PROJECT

The Project is being developed by LIM, which is a wholly-owned subsidiary of Labrador Iron Mines Holdings Limited, a public company listed on the Toronto Stock Exchange. LIM has identified eight separate ore grade deposits located across a 100km strike length all in Labrador. The first phase of the Project involves the development and mining of four 'direct shipping' iron ore deposits in western Labrador in an area of previous iron ore mining.

The James North, James South, Redmond 2B and Redmond 5 deposits are all located within 10 kilometres of the Silver Yard, Labrador, which is some three kilometres west of Schefferville, Quebec. Mining will be carried out in a sequential manner using conventional open pit mining methods. When mined, the rock will be crushed and washed (beneficiated) at Silver Yard. The resultant products will include lump ore and sinter fines for direct rail transport to port and shipping to end users in Europe and possibly Asia. The size of the operation proposed for this Project is modest by world-wide iron ore standards and as compared to other iron ore projects carried out elsewhere in the Province and previously in this area.

Subject to approval, construction of the Project is scheduled to start in 2009/2010, and has an estimated five-year operational life. The LIM operation has been planned with the objective of maintaining a reduced footprint. To achieve this objective, the proposed development has been planned as a small phased seasonal operation, staffed primarily by contractors, and using primarily mobile to semi-mobile equipment. In this respect, the Project differs in scale and character from the historical mining activities in the area as well as other current mines operating in the Province of Newfoundland and Labrador. With the exception of the owner management positions, which will be full-time management positions, operational positions will be held on a seasonal and rotational fly-in fly-out basis. This will limit the opportunities for the employment of apprentices and some other groups. It will

also mean that families associated with the Project are unlikely to settle in the Project area. Although the small numbers of trades-persons involved will make it unlikely to employ apprentices in the journeyperson to apprentice ratios identified by the provincial general conditions concerning apprenticeship, LIM will establish and maintain communication with the Office to Advance Women Apprentices in the event that future opportunities present themselves.

The required LIM and contractor construction phase labour force, by occupation including NOC-2006 codes, is presented in Table 1. The construction phase of the program is expected to last for only a short period of time, currently estimated at eight weeks.

Table 1 Construction Phase Employment

POSITION	NUMBER	NOC
Site Manager	1	0711
Clerk	1	1441
Lead Foreman	1	0721
Surveyor	1	2254
Equipment Operator – heavy	4	7421
Equipment Operator – light	3	7421
Truck Drivers	3	7411
Labourers-specialized	2	7611
Labourers	6	7612
Carpenter	2	7215
Welders	2	7265
Electricians	1	7241
Electrical Helper	1	7611
Crane Operator	1	7371
Boilermakers	1	7262
Ironworkers - steel reinforcement	1	7264
Ironworkers - steel reinforcement-helper	1	7611
Cement Finisher	2	7282
Structural Steel Workers	2	7263
Structural Steel Worker –assistant	1	7611
Pipe Fitters	2	7252
Pipe Fitter-helper	1	7611
TOTAL - CONSTRUCTION	**40**	

The Project operation phase employment, by occupation including NOC-2006 code, is presented in Table 2. Most workers will be employed on a rotational basis for about seven months a year during operations.

Table 2 Operation Phase Employment

Positions	Number	NOC Code
Mine Operations		
Mine Operation Foreman	1	8221
Foreman	3	8221
Drill Operator	3	7372
Blaster	2	7372
Blaster Helper	1	8411
Loader Operator	3	7421
Haulage Truck Operator	9	7411
Dozer Operator	3	7421
Grader Operator	3	7421
Sampler	3	8614
Subtotal	31	
Mine Engineering		
Mine Engineer	2	2143
Mine Technician	1	2212
Surveyor	2	2254
Draftsman CAD	1	2253
Subtotal	6	
Beneficiation Operation		
Plant Manager	1	0721
Process Technician	1	2243
Chemical Technician (Lab)	3	2211
Labourer	1	7612
Administrative Assistant	1	1441
Warehouse Person	3	1472
Maintenance Foreman	1	7211
Utility Crew (pipeline, pumps, etc.)	1	
Primary Crusher Operator	6	9411
Secondary Crusher Operator	3	9411
Secondary Crusher Helper	2	9611
Belt Filter & Load-out Operator	6	9411
Mechanic	2	7312
Mechanic Helper	1	7612
Safety/First Aid personnel	3	
Electrician/Instrumentation	2	7241
Locomotive Engineers	3	7361
Brakemen	3	7362
Yard Workers	3	7432
Subtotal	46	
Owner Management		
General Manager	1	0721
Geologist	3	2113
Environmental Technician	1	
Clerk	1	
Mine Engineer	1	2143
Innu Liaison	1	
Labrador offices	3	
Subtotal	11	
Contractor Management		
Site Manager	1	0711
Secretary	1	1241
Bookkeeper/Accountant	1	1231
Camp operations	12	
Subtotal	15	
TOTAL - OPERATION	**109**	

3.0 THE PLANNING PROCESS

The Schefferville Area Iron Ore Mine Western Labrador Project Women's Employment Plan process requires the involvement of LIM and its Project contractors. This section of the Plan describes the planning process, including: the ways in which it is reflected in the selection of Project contractors; the involvements and responsibilities of contractors; equity goals and initiatives; and, monitoring and reporting.

It should be noted that, as part of its initiatives with the Aboriginal peoples of the region, LIM will promote gender equality in the Project workforce and increase participation of Innu Nation of Labrador women and those of the participating First Nations. The company will develop in cooperation with these Aboriginal groups, and enforce, a policy with respect to all employees that will ensure zero tolerance for discrimination on the basis of race ethnicity, gender, sexual orientation or origin on the Project.

3.1 Selection of Project Contractors

LIM is committed to employment equity. Employment equity involves a systematic approach to achieving fairness in employment, including the elimination of systemic, structural and attitudinal discrimination. Furthermore, LIM's policy is that no one should be denied access to employment opportunities for reasons unrelated to ability. In support of this, LIM:

- Requires the same commitment to employment equity from its contractors; and
- Will take account of employment equity considerations in the awarding of contracts.

This Women's Employment Plan, and hence this commitment and preference, will be attached to relevant Project requests for proposals (RFPs), and all bidders will be required to outline their approach to employment equity.

3.2 Selection of Contractors for Women's Employment Planning Purposes

LIM will identify its main contractors for employment equity planning purposes based on their share of Project employment. This will normally be measured in terms of the person-years of employment involved. The list of main contractors will be reviewed and, as necessary, revised on an annual basis.

3.3 Women's Employment Plan Responsibilities

LIM and each of the main contractors will identify a senior member of their staff responsible for implementing the Women's Employment Plan. Project equity will be monitored and tracked by these representatives in accordance with the commitments of this Plan and requirements of the IBAs.

It is important that employment equity is a consideration of the Project employers from the outset. Experience with other projects has demonstrated the positive impact of early employer engagement in making equity a priority throughout the project. This Project will be greatly assisted by having this Women's Employment Plan in place in advance of the start of work. In addition, LIM will liaise with the Women in Resource Development Committee (WRDC) prior to and throughout the Project, including inviting the WRDC representatives to meet with them within 30 days of Project sanction and periodically

thereafter. During this initial period, LIM will work with WRDC to identify the occupations in which women are under-represented and will, on an ongoing basis, update this information and re-evaluate goals accordingly.

3.4 Women's Employment Goals and Initiatives

LIM has established overall goals for women's employment during construction and operations of the Project, consistent with the approach adopted in the Province's Energy Plan. However, the most recent such report uses data from the 1990s, so the Project goals have been established based on more recent occupational and industry data, adjusted to reflect the nature of the Project. These goals will be communicated to all potential and selected contractors.

LIM and each of its main contractors will identify actions for achieving the goal levels of employment for women. When new main contractors are identified, they will be asked, as part of the tendering process, to provide information concerning their programs to promote employment equity for women.

3.4.1 Construction Phase

Construction occupations have long had small proportions of women workers. In 2001, only 1% of the membership of the Newfoundland and Labrador Construction Trades Council were women, and labour force survey estimates show that women held just 3.4% of construction trades occupations in 2006, somewhat lower than the national average.[1] There are currently a total of 214 females tradespersons registered with the Office to Advance Women Apprentices, including 21 journeypersons and 179 apprentices (G. Hickey, pers. comm.)[2]. Within the Province, participation by women in trades programs at the College of the North Atlantic (CNA) has been approximately 20% between 2006 and 2008. Participation has been greater in Labrador than on the island, and has increased from 24% female graduates in 2006 to 54% in 2008, with the largest numbers of female graduates from the Industrial Mechanic Millwright and Mining Technology programs. The CNA's Labrador campuses also offer the Career Exploration for Women and Orientation to Trades and Technology – Women programs, which are introductory programs designed to introduce women to trades careers (I. Pye, pers. comm.)[3]. However, the Project will require work at a remote location with a projected construction phase of only approximately eight weeks duration, resulting in limited opportunities to train workers.

Accordingly, LIM has established no overall goal for women's employment during the construction phase of the Project.

It is recognized that opportunities may be identified to hire female employees in some employment categories and hence LIM and its contractors will work with the WRDC in order to determine the employment categories where these improvements would be most appropriate.

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[1] Statistics Canada. *Table 282-0008 Labour Force Survey Estimates (LFS), by North American Industry Classification System (NAICS), Sex and Age Group, Annual* (Table). CANSIM (database). Using CHASS (distributor). Version updated April 20, 2007. http://dc2.chass.utoronto.ca.qe2a-proxy.mun.ca/cansim2/ (accessed April 25, 2007).

[2] G. Hickey Executive Director, Office to Advance Women Apprentices, St. John's, NL

[3] I. Pye Policy, Planning and Research Analyst, College of the North Atlantic, St. John's, NL.

The participation of women in design and engineering positions is also traditionally low. In 2008, Memorial University reported that women comprised only 18% of graduates from the Bachelor of Engineering program[4]. Additionally, Professional Engineers and Geoscientists of Newfoundland and Labrador membership data show that as of December 2008 women comprise 9% of professional engineers and engineers-in-training, up from 7% in 2007. This is consistent with female participation in engineering nationally, which was 9% for professional engineers and 19% for engineers-in-training in 2007 (L. Pinsent Parsons, pers. comm.)[5].

Based on this information and the short term period of construction, LIM has established a goal of over 30% (3 women in a workers group total of 8) for women's employment in Project design and engineering during construction.

3.4.2 Operations Phase

It is estimated that the operations phase of the Project will last five years and it will only employ approximately 109 people for about seven months a year.

Mining has traditionally employed relatively small numbers of women, although this is less the case with open pit operations. The most recent employment data from Statistics Canada shows that although women represent approximately 47.5% of total employment across all industries in Newfoundland and Labrador in 2008, women comprised only 15.4% of the workforce in occupations unique to primary industry.[6] In Labrador, female graduates from the CNA's Mining Technology trades program has been 66% between 2006 and 2009 (I. Pye, pers. comm.)[3].

Accordingly, LIM has established an initial 15% goal for women's employment by the end of the second year of Project operations and will strive to increase this during the remaining years of the project.

Operations phase employees will be provided training through a post-employment on-the-job training program. This will provide LIM an opportunity to incorporate goals for women's employment into the initial intake of employees. This has the potential to both increase the opportunity for success in achieving overall goals for employment in the early phase of Project operations and to have a lasting impact on employment equity over its life.

3.4.3 Review of Goals

The above goals will be reviewed and, as necessary, revised after two years of operations, in consultation with the Women's Policy Office, Department of Natural Resources and WRDC. Any revisions will take into consideration women's participation in identified occupational groups as well as labour market conditions generally. It is expected that the employment equity initiatives established by

[4] Memorial University. 2008. Fact Book 2008. Memorial University, St. John's, NL.

[5] L. Pinsent Parsons Registrar and Director of Administration, Professional Engineers and Geoscientists Newfoundland and Labrador, St. John's, NL

[6] Statistics Canada. 2009. CANSIM Table 282-0010 Labour Force Survey Estimates by National Occupational Classification for Statistics (NOC-S) and Sex, Annual 1987-2008. CANSIM Database using CHASS (Distributor) http://dc2.chass.utoronto.ca.qe2a-proxy.mun.ca/cansim2/ (accessed April 25, 2007).

LIM and its major contractors will facilitate an increase in the number of women employed in these positions over the life of the Project.

3.5 Monitoring and Reporting

The performance of the Women's Employment Plan will be reviewed at least every six months. During this review LIM and its main contractors will each: review its employment equity initiatives; discuss its success in implementing them; report on the employment equity of its current Project workforce, by main employment types (e.g. numbers and percentage who are managers, administrative staff, professionals and technicians, and others); and discuss the progress that has been made towards the established goals. Outside resource people, with specialist information about employment equity issues, may be invited to present to the Committee.

Within one month of every second review period (i.e. on an annual basis), LIM and its main contractors will compile an up-to-date list of Project employment equity initiative commitments, together with a short summary report on the employment equity in its current Project workforce. LIM will maintain a file of these commitments and reports, which will be available to the Women's Policy Office, Department of Natural Resources and WRDC. LIM accepts responsibility for the Women's Employment Plan including the consistent application of the plan by any Project Contractors or Subcontractors.

4.0 ACTIONS

This part of the Women's Employment Plan identifies and describes required and optional actions that are designed to achieve employment equity for women. These are:

- Information and Communications;
- Employee Recruitment and Selection;
- Employee Development;
- Working Environments; and
- Community Outreach.

LIM and its main contractors will consider and report on these actions in their own employment equity planning. For each of them, this section of the Women's Employment Plan provides a description of appropriate actions, based on best practice experiences elsewhere.

The scope and scale of actions required of each Project contractor varies according to such things as its size, current labour force composition and activities, and the policies and practices it has already implemented. Other possible initiatives may be identified by companies.

4.1 Information and Communications

Information content and its communication have a major role to play in achieving employment equity. Appropriate actions LIM and its main Project contractors may take in addressing this topic include:

- Hold information sessions specifically targeted at women;

- Ensure women are equitably represented in text and illustrations the companies use for promotional, motivational and information purposes, including handbooks, newsletters, posters and websites; and
- Review all text they use internally and externally to see that it uses gender-inclusive language.

4.2 Employee Recruitment and Selection

The characteristics of the Project workforce will to some degree reflect those of the labour market as a whole and of prospective new entrants to it. However, the recruitment process can serve to either reinforce or counter any under-representation of women. There is, accordingly, a need to use recruitment procedures that actively encourage women to apply for all positions, including full-time, part-time, temporary and co-op student ones. To support an increase in female employment in all phases of the project, LIM will seek to consult with women in the area and/or in related work environments to determine beneficial policies and procedures.

Appropriate other actions LIM and its main Project Contractors might take in addressing this topic include:

- Establish guidelines for writing model job advertisements that aim to reach female candidates;
- Review job descriptions and collective agreements for the use of gender-inclusive titles and text;
- Establish relationships with training institutions and work with them to include female candidates in regular and co-op student positions;
- Implement a system to document outreach recruitment initiatives;
- Initiate and implement a gender-sensitivity and anti-harassment training program for all management, workers and contractors, to encourage equitable selection and treatment of women in the workplace;
- Encourage an environment of mutual respect;
- Implement programs targeted at eliminating violence in the workplace;
- Include an assessment of goal achievements as part of management performance reviews;
- Establish relationships with women's groups and work with them to identify and encourage female candidates; and
- Implement a system to monitor the gender of persons with resumes on file.

4.3 Employee Development

It is important that women be encouraged to develop, and assisted in developing, their capabilities and achieving promotion within LIM and its main contractors. Appropriate actions LIM and its main contractors might take in addressing this topic include:

- Consider the participation of women in all training initiatives; and
- Develop a strategy to increase women's representation in management through mentoring, special assignments, management training, creation of junior management bridging positions, and gender-sensitivity and anti-harassment training.

4.4 Working Environments

During both the construction and operations phases of the Project, LIM will work diligently to create a work environment that is conducive to employment equity. Gender sensitivity training will be required by all LIM and contract employees. LIM's goal is to create a culture that fosters equity and is encouraged by successful implementation of this Women's Employment Plan.

The work environment, and the presence of policies that address harassment and other concerns, can be critical to retaining women in the workforce. Appropriate actions LIM and its main contractors might take in addressing this topic at Project workplaces include:

- Establish respectful workplace guidelines and an anti-harassment and anti-violence in the workplace policies;
- Establish, distribute and publicize the anti-harassment policy and procedures; and
- Provide gender-sensitivity and anti-harassment training for managers and supervisors.

4.5 Community Outreach

The numbers of women in and interested in entering, construction and technical occupations will be a significant constraint to the employment of women on the Project. In the longer term, this is best addressed by initiatives that promote such occupations to girls and young women. Currently, LIM has an active outreach program in local area schools, providing information about the project and encouraging educational activities in schools, both near the Project area and its Toronto-based corporate office. Additional appropriate actions LIM and its main Project contractors may take in this area include:

- Participation in career days and facilitating workplace visits; and
- Support of, or mentoring, Techsploration and other WRDC programs.

5.0 LABRADOR IRON MINES INITIATIVES

In support of the above-noted process (Section 3.0), LIM has already adopted a number of initiatives aimed at delivering women's employment equity on the Project. These will serve, not least, as a demonstration of LIM's equity commitment to its contractors and other stakeholders. Specifically, LIM will:

- Review home community childcare services available to qualifying personnel in Labrador;
- Implement arrangements and policies at the worker accommodations that ensure a respectful living environment for all employees. This will include an anti-harassment program and community sensitivity program, endeavouring to accommodate women in a specific part of the camp, providing women-only access to exercise facilities at some times, and adopting a zero-tolerance policy with respect to harassment at both the workplace and accommodations facility;
- Provide a cultural and gender awareness orientation to all employees; and
- Include in Project-related job advertisements, and require all contractors advertising for positions largely or entirely related to the Project to include, statements encouraging applications from women.

APPENDIX E

Correspondence from DFO

From: Yetman, Dana [mailto:Dana.Yetman@dfo-mpo.gc.ca]

Sent: Thursday, September 25, 2008 1:22 PM

To: Linda Wrong

Cc: Grant, Carole

Subject: Labrador Iron Mines - Schefferville Project

Hi Linda,

This email is in reference to your letter dated September 9, 2008 in which you provided a summary of gill-netting activities for the Schefferville project. Based upon the results, Habitat Management has determined that the historic pits, specifically Redmond Pit 1, Redmond Pit 2, Wishart Pit, and Ruth Pit, do not constitute productive fish habitat that supports, or potentially supports, a commercial, recreational or aboriginal fishery. Therefore a Section 35(2) Fisheries Act Authorization will not be required. Please note that this determination only applies to the aforementioned pits; an official determination regarding all other water bodies within the project area will be forth coming once all requested habitat information has been received and assessed by Habitat Management.

Please do not hesitate to contact me if you require further clarification.

Thanks,

Dana Yetman

Senior Regional Habitat Biologist | Biologiste Principal Régional des Habitats

Fisheries and Oceans Canada | Pêches et Océans Canada

Marine Environment and Habitat Management Division | Division De l'Environnement Marin et de la Gestion de l'Habitat

Oceans and Habitat Management Branch | Direction de la Gestion des Océans et de l'Habitat

Northwest Atlantic Fisheries Centre | Centre des Pêches de l'Atlantique Nord-Ouest

80 East White Hills Road l 80, route White Hills est

PO Box 5667 | CP 5667

St. John's NL A1C 5X1

Telephone | Téléphone: (709) 772-6658

Fax | Télécopieur: (709) 772-5562

Dana.Yetman@dfo-mpo.gc.ca

PLEASE NOTE MY EMAIL ADDRESS HAS CHANGED

APPENDIX F

New Millennium News Release

NEWS RELEASE 08-05

NEW MILLENNIUM ANNOUNCES PRODUCTION DEVELOPMENT UPDATE OF ITS DIRECT SHIPPING ORE PROJECT

Not for Distribution to US newswire services or dissemination in the United States

CALGARY, Alberta, Canada – February 5, 2008 – New Millennium Capital Corp. ("NML" or "the Company") (TSX-V: NML), announced today that it has completed the proposed development plans and schedule for its Direct Shipping Ore ("DSO") Properties in the Schefferville region of Quebec and Newfoundland and Labrador.

Mr. Robert Martin, New Millennium CEO and President, said, "We are very pleased to start development of our DSO Project. With our current robust iron ore markets, there have been many inquiries from potential consumers concerning our intentions. Our plan is to establish a brownfield mining operation that can be developed sooner and with less capital than the KéMag deposit. The expedient and cost effective development of the DSO Project can potentially produce substantial cash flow for the Company while the larger KéMag Project is being developed. Successful development of the DSO Project is aided by management's intimate familiarity with the properties and we are also fortunate in being able to assemble a strong project team with past experience in the Schefferville operations."

NML's DSO holdings are contained in 27 deposits that were previously owned by the Iron Ore Company of Canada ("IOC"). These deposits are outlined on the attached map. They consist of 145 mineral claims in Quebec covering 6,344 hectares and 155 mineral claims in Labrador covering 3,875 hectares. Based on historical estimates, these claims cover approximately 100 million tonnes of direct shipping quality iron ore. The grade of this ore, based on historical operations as published by the American Iron Ore Association in 1978, is in the order of 60% iron (dry analysis).

The historical estimates contained in this news release of quantities of direct shipping quality ore are not in accordance with the mineral resources or mineral reserves classifications contained in the CIM Definition Standards on Mineral Resources and Mineral Reserves, as required by National Instrument 43-101 ("NI 43-101"). Accordingly, NML is not treating these historical estimates as current mineral resources or mineral reserves as defined in NI 43-101 and such historical estimates should not be relied upon. A qualified person has not done sufficient work to date to classify the historical estimates as current mineral resources or mineral reserves. The term "ore" in this release is being used in a descriptive sense for historical accuracy, and is not to be misconstrued as representing current economic viability. A feasibility study has not been completed in respect of the DSO properties and there is no certainty the proposed operations will be economically viable.

The DSO holdings controlled by NML are sub-divided into four areas designated Area 1, Area 2, Area 3 and Area 4. The Company's conceptual plan is to consider mining these areas in two phases.

The first phase, which represents about 20% of the Company's DSO historical estimated resources, includes Area 2 and Area 3. This brownfield phase has semi-developed infrastructure which will permit rapid development. The conceptual plan is to transport the crude ore by haulage truck from the 10 open pit deposits in Area 2 (10 km north of Schefferville) and Area 3 (20 km north of Schefferville) to a wash plant to be built and installed in Area 3. The wash plant is expected to produce two products, a lump ore and a fines product. It is planned to transport these products by rail to a marshalling yard near Schefferville prior to shipment on the main line to Sept Iles.

One of the mines in area 3, Timmins 3, was partially mined and two others, Timmins 4 and Timmins 7 were partially stripped by IOC at the time of closure in 1982. All three would be expected to be reopened by NML.

The second phase, about 75% of NML's DSO historical estimated resources, will entail mining in Area 4. This area, which is about 50 km north of Schefferville is devoid of infrastructure and, as a consequence, will take longer to develop than Area 2 and Area 3. The conceptual mining plan is to transport the crude ore by haulage truck from the 9 open pit deposits in Area 4 to an overland conveyor for transport to the wash plant in Area 3, then via the phase 1 infrastructure to the Port of Sept-Iles.

NML anticipates the startup of its Phase 1 production (Areas 2 and Area 3) in 2010 and its Phase 4 production (Area 4) in 2013. There are nine Area 1 open pit deposits, about 5% of NML's DSO historical estimated resources. Seven of these are jointly owned with Labrador Iron Mines (TSX-V: LIR). Seven of these, the James, the Knob Lake 1, the Redmond 5, the Houston 1, the Houston 2S and the Houston 3 would most likely be mined in accordance with the LIR mining schedule which currently plans to commence production in area 1 in 2009. To date there has not been any agreement reached with LIR regarding NML's claims that partially cover seven of their deposits. As part of this year's program, NML will attempt to negotiate some mutually satisfactory agreement with LIR regarding the mining of NML's ore and the possible cost sharing of infrastructure.

NML's DSO development is being fast-tracked to take advantage of current shortages of iron ore in the world market place. The project is expected to be a relatively low cost capital venture owing to the existence of significant infrastructure in the form of air, rail and hydroelectric links with the Town of Schefferville and, in most cases, road links from Schefferville to the Company's deposits.

Phase 1 development is currently in progress with the commencement of planning related to geology, mining and resource, metallurgy, environmental and pre-feasibility studies. Negotiations with effected First Nations and the TRT railroad are also in progress.

The Company's 2008 DSO Project objectives are: 1) to initiate development drilling and trenching in Area 2, Area 3 and Area 4 in order to publish a NI 43-101 compliant resource estimate; 2) to complete metallurgical testing and finalize the wash plant flowsheet; 3) to complete phase 1 environmental assessment; 4) to finalize Impact and Benefit Agreements ("IBA") with the First Nations, tariff agreements with three railways, land and dock use agreements with the Sept-Iles Port Authority, infrastructure sharing at Pointe Noire with Wabush Mines and the leasing of rolling stock and mining equipment; and, 5) to complete a preliminary feasibility study and financial evaluation.

Approximately 4,000 metres of reverse circulation drilling and 2,000 metres of trenching are scheduled. The drilling and trenching program will be done for twinning purposes. This is expected to supplement and verify the use of the extensive drilling and trenching previously performed on these properties by IOC. It is also expected to upgrade the historical results to current NI 43-101 standards. Results are expected by the end of December 2008.

To complete metallurgical testing, several bulk samples will be taken for crushing and screening tests to determine the amount of lump ore in the run of mine materials along with their respective grades. Samples of both lump and fines will be sent to an outside testing lab for washing and iron recovery tests including product grades which may be expected. This work is expected to be completed by the end of September 2008.

The environmental impact assessment has started and the DSO Project description is currently being prepared. Contracts will be awarded to consultants by the end of March and the Environmental Impact Statement is expected to be sent to the appropriate governmental authorities by the end of October. Government review and approval is expected for Area 2 and Area 3 by the end of March 2009.

IBA meetings have recently started with some of the effected First Nations. Discussions with the Tshiuetin Railway, which requires a major upgrade to its track structure, the QNS&L Railway and the Arnaud Railway will be initiated to plan the railway transportation agreements required to move the ore from the mine sites near Schefferville to the Port of Sept-Iles. Initial discussions with The Port Authority of Sept-Iles have begun and discussions with Wabush regarding the joint use of their ship loading terminal will be scheduled as soon as the Wabush facilities are turned over to its new owner. All agreements are expected to be in place by the end of December 2008.

A Preliminary Feasibility Study will be initiated once the summer program is completed and the sample analysis results start to arrive. The final report and financial analysis is scheduled for completion by the end of December 2008 and the feasibility study is expected by the end of May 2009.

As previously announced, the Corporation, with the assistance of it's financial advisors Credit Suisse ("CS") and Miller Mathis ("MM:"), is actively seeking investment and offtake commitments from potential strategic partners that will permit the Corporation to develop one or more of its iron ore projects located in the provinces of Quebec and Newfoundland and Labrador, Canada. This process includes the DSO Properties. While this process continues, no agreements have been achieved in respect of such commitments. However, this process has elicited a number of expressions of interest, and now can be advanced to a further stage where firm offers are solicited.

Moulaye Melainine, Eng. and Bish Chanda, Eng. are the Qualified Persons as defined in NI 43-101 who have reviewed and verified the scientific and technical mining disclosure contained in this news release on behalf of NML.

About New Millennium

New Millennium holds a 100% interest in the KéMag Property (Quebec) and an 80% interest in the LabMag Property (Newfoundland and Labrador). Both properties are located within the Millennium Iron Range, the centre of which is located approximately 230 km north of Labrador City, NL and 40 km northwest of Schefferville, QC. The Company also has a 100% interest in 300 DSO claims in Quebec and Labrador that contain, based on historical estimates that are not in compliance with NI 43-101, in excess of 100 million tons of direct shipping quality ore. A qualified person has not done sufficient work to classify the historical estimate as current mineral resources. The Company is not treating the historical estimate as current mineral resources and the historical estimate should not be relied upon.

Subject to the completion of positive feasibility studies, project financing and project construction, the concentrate from the KéMag Project would be pumped from the property through a slurry pipeline, about 750 kilometres, to Pointe-Noire, near the Port of Sept-Iles, QC, where it would be both pelletized and sold as concentrate. The concentrate from the LabMag Project would be pumped from the property through a slurry pipeline, about 230 kilometres, to Emeril, NL where it would be pelletized prior to rail transportation via an existing railroad about 390 km to Pointe-Noire, near the Port of Sept-Iles. DSO products are envisioned to be transported by rail to a Port at Pointe-Noire.

These projects envision the construction and operation of ship loading facilities and related infrastructure at the Pointe-Noire terminus from where the various iron ore products would be shipped by ocean vessels to markets in Canada, the United States, Western Europe, North Africa, the Middle East and Asia.

The Corporation's mission is to add shareholder value through the responsible and expeditious development of the Millennium Iron Range and other mineral projects to create a new large source of raw materials for the world's iron and steel industries. For further information, please visit www.nmlresources.com.

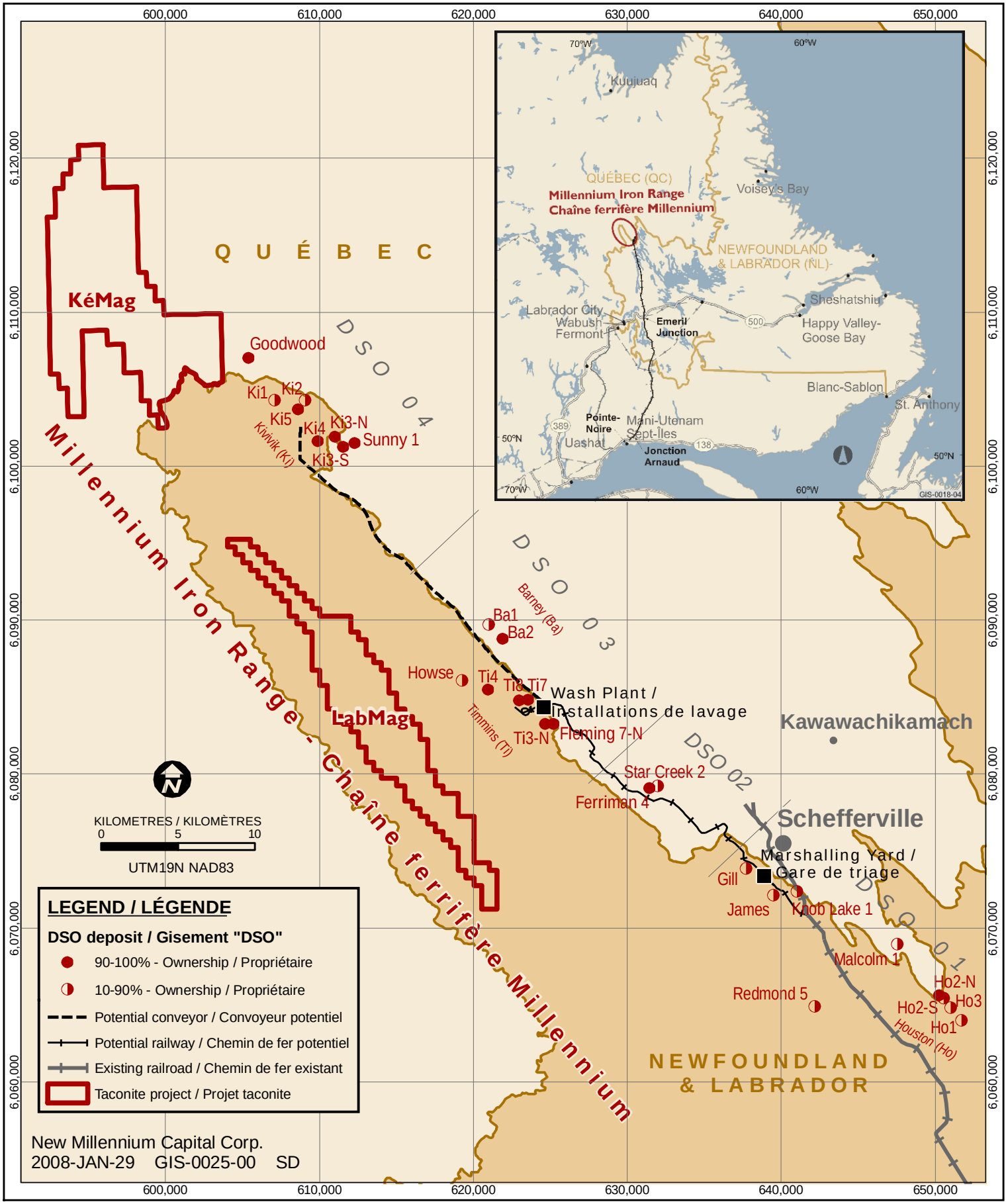
This release may contain forward looking statements within the meaning of the "safe harbor" provisions of US laws. These statements are based on management's current expectations and beliefs and are subject to a number of risks and uncertainties that could cause actual results to differ materially from those described in the forward looking statements. New Millennium does not assume any obligation to update any forward looking information contained in this news release.

NO REGULATORY AUTHORITY HAS APPROVED OR DISAPPROVED THE CONTENT OF THIS RELEASE. THE TSX VENTURE EXCHANGE DOES NOT ACCEPT RESPONSIBILITY FOR THE ADEQUACY OR ACCURACY OF THIS RELEASE.

For more information, please contact

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Sunny 1
Ki3-S
Kivivik (Ki)
DSO 04
Millennium Iron Range - Chaîne ferrifère Millennium
DSO 03
Barney (Ba)
Ba1
Ba2
Howse
Ti4
Ti8
Ti7
Ti3-N
Timmins (Ti)
Wash Plant / Installations de lavage
Fleming 7-N
LabMag
Star Creek 2
Ferriman 4
DSO 02
Kawawachikamach
Schefferville
Marshalling Yard / Gare de triage
Gill
James
Knob Lake 1
Malcolm 1
Redmond 5
Ho2-N
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Houston (Ho)
DSO 01
NEWFOUNDLAND & LABRADOR
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DSO deposit / Gisement "DSO"
90-100% - Ownership / Propriétaire
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New Millennium Capital Corp.
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Chaîne ferrifère Millennium
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Labrador City
Wabush
Fermont
Emeril Junction
500
Happy Valley-Goose Bay
Blanc-Sablon
St. Anthony
Pointe-Noire
389
Uashat
Mani-Utenam
Sept-Îles
138
Jonction Arnaud
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APPENDIX G

Beneficiation Process

APPENDIX G – BENEFICIATION PROCESS

Primary Crushing Circuit

The raw ore from the pits will be delivered via off-highway end dump trucks to the Primary Mobile Crushing Plant and either directly dumped into the feed hopper or stockpiled nearby for subsequent reclaiming into the feed hopper by a Front End Loader or a loader and truck.

The primary mobile crushing plant includes a hopper, vibrating grizzly feeder, jaw crusher, various chutes, bins, and conveyors, lubricating system and hydraulic power pack.

The ROM feed will have a top size of 600mm. It is expected that approximately 50% of the feed will bypass the primary crushing as it will already be minus 100mm.

The primary crushing plant will not be enclosed. There will be a dust collector system accompanying the Primary Crushing circuit. The specifications on the dust collector are not yet available; however the small unit will be designed to meet Newfoundland and Labrador Regulation 39/04.

Tumbling Scrubber Circuit

The discharge from the Primary Crushing will be conveyed to the Tumbling Scrubber circuit. The purpose of this step is to beneficiate the ore by incorporating water to wash the clay materials from the ore materials. It is anticipated that the scrubber will be mounted on a portable chassis.

Primary Screening Circuit

The discharge from the Tumbling Scrubber proceeds to the Primary Screening circuit. This is the first stage of classification.

The oversize material (> 50 mm) on the top deck is sent to the secondary crushing circuit, the undersize material (< 6 mm) from the bottom deck is sent to the Secondary Screening circuit, and the remaining material (> 6 mm, < 50 mm) is conveyed to the Lump Ore Stockpile.

Secondary Crushing Circuit

The oversize (> 50 mm) from the primary screening circuit is transferred to the secondary crushing circuit. The secondary crusher will be a standard cone crusher, GP300 or equivalent. The product from the cone crusher will be transferred back to the primary screening circuit.

Secondary Screening Circuit

The undersize (< 6 mm) from the Primary Screening circuit will be pumped to the Secondary Screening circuit.

The oversize material (> 0.325 mm) on the top deck is conveyed to the Sinter Fines Stockpile, the oversize material (> 0.150 mm, < 0.325 mm) on the bottom deck is pumped to the dewatering circuit equipment for dewatering. The undersize material (< 0.150 mm) from the bottom screen is pumped to the reject rock fines disposal area.

Dewatering Circuit

Material from the Secondary Screens that is less than 0.325 mm and greater than 0.150 mm in size will be transferred to the dewatering circuit via chutes. The purpose of this circuit is to dewater the sinter fine product to a maximum 8% moisture content. The overflow material from this circuit will be conveyed to the Sinter Fines Stockpile. The underflow will be pumped to the reject rock fines disposal area.

Product Storage

The iron ore products from the beneficiation process will be conveyed from the enclosure to the respective radial stackers. The lump ore product and the sinter fines product will be stockpiled separately. An area of approximately 4,300 m^2 is available for clean ore storage. Drainage from the ore stockpiles will be managed through site grading and ditching. The surface run-off will be directed to the Silver Yard Stormwater Management Pond (SWM-1) as shown on Figure 3-4 (site layout).

Reject Fines Handling

The undersize material from the Secondary Screening circuit (< 0.150 mm) and the filtration filtrate will be combined and pumped as a slurry to the reject rock fines disposal area. The reject fines slurry is estimated at 21% solids and will be pumped at an estimated flow rate of 520 m^3/h. The options for the reject fines disposal will include the following:

1) The reject fines slurry will be pumped approximately 3 km via an above ground, 300 mm diameter HDPE pipeline to the Ruth Pit. The Ruth Pit is an exhausted mine that is now flooded. The surface area of the Pit is 61.5 ha and the depth of the pit is 120 m.
2) An emergency disposal/storage area within the Silver Yards area is also designed to provide room in the case the reject fines pipeline or beneficiation process equipment needs to be purged. Its location is coincident with the Silver Yards Stormwater Management Pond (SWM-1).

Rail Loadout

The material from the Sinter Fines stockpile and the Lump Ore stockpile will be reclaimed with front end loaders.. Further details of the rail loadout process are presented under Section 3.1.5.

APPENDIX H

Air Quality Technical Report

Jacques Whitford

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Engineering
Scientific
Management
Consultants

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Carbon Neutral Consulting

Canada's Top 100 Employers 2009 Featured in MACLEAN'S

CANADA'S TOP 20 FAMILY FRIENDLY EMPLOYERS As featured in Today's Parent 2009

REPORT

AIR QUALITY TECHNICAL STUDY

LABRADOR IRON MINES LIMITED

PROJECT NO. 1046156

Jacques Whitford

An Environment
of Exceptional
Solutions

PROJECT NO. 1046156

REPORT TO	**Labrador Iron Mines Limited** **220 Bay Street, Suite 700** **Toronto, Ontario** **M5J 2W4**
FOR	**Air Quality Technical Study**
ON	**West Central Labrador Iron Ore Project**

January 29, 2009 Rev.3

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EXECUTIVE SUMMARY

This document is the Air Quality Technical Study prepared in support of the environmental impact statement (EIS) for the West Central Labrador Iron Ore Project (“the Project"). The Project, proposed by Labrador Iron Mines Ltd, is to mine iron ore at the James and Redmond properties in Labrador, near Schefferville, Quebec. Mining will initially be at a combined rate of one to two million tonnes/year at the three main mine sites, James North, James South and Redmond with an estimated production rate no greater than 3,000 t/d at each mine location.

This Air Quality Technical Study was conducted to assess potential changes in air quality due to Project-related emissions,. The study was conducted following accepted methodologies to establish existing (baseline) conditions, estimate emissions and predict the maximum downwind ground-level concentrations of the pertinent air contaminants. The results of this Technical Study are intended to provide the data needed to assess potential environmental effects as described in the EIS.

The most substantive Project-related emissions during operation are due to fuel combustion and fugitive dust emissions from the beneficiation area (where extracted ore from mining is reduced to particles that can be separated into mineral and waste), the mine site locations, and from trucks hauling ore to the beneficiation area.

The results of the dispersion modelling (which consider all substantive emissions from the beneficiation area) show that although there may be potential exceedances of regulatory standards at locations near the property line during adverse meteorological conditions, these higher values are limited to within about 150 m of the property line. As this region is far from any of the sensitive receptor locations, it is unlikely that prolonged human exposure to air contaminant concentrations at these levels will occur. Therefore, as the predicted exceedances represent worst-case meteorological conditions, and are limited in spatial extent, and are short-term in duration, no substantive changes in air quality are expected.

Although fugitive dust emissions will occur due to truck traffic along the haul routes during operation, the majority of the fugitive dust will remain in the lowest 1-2 meters above ground level and settle within a few hundred meters of the road. The haul route is an existing dirt road, and although traffic along the route is expected to increase with Project activities, no more than five trucks are expected to pass in a given hour. As such, while some dusting of vegetation may occur due to vehicle traffic during certain meteorological conditions, as such emissions as they will be localized in extent and short-term in duration. Therefore, no substantive changes in air quality are expected.

Emissions due to blasting and on-site traffic at the mine site locations are not expected to cause substantive changes in air quality as they will be emitted inside a pit and the transport distances to the nearest sensitive receptors are relatively far (greater than 1.5 km). Emissions from the diesel locomotive used for transporting ore from the beneficiation area are not expected to cause substantive changes in air quality as such emissions will be intermittent (one trip per day) and short-term in duration. Emissions from the standby diesel generators installed at the worker’s camp will be intermittent, short-term in duration, and negligible relative to other emissions during operation.

As emissions occurring during construction are expected to be small compared to those occurring during operation, the maximum model-predicted concentrations during operation provide a conservative envelope for potential changes in air quality due to emissions during this phase.

Therefore, on an overall basis, the modelling results show the changes in air quality due to Project-related emissions, including background, are not expected to be substantive.

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1.0 INTRODUCTION

This document is the Air Quality Technical Study ("the Study") prepared in support of the environmental impact statement (EIS) for the West Central Labrador Iron Ore Project ("the Project"), the proposed iron mining operation west of Schefferville, Quebec.

The Project, proposed by Labrador Iron Mines Ltd, is to mine iron ore at the James and Redmond properties in Labrador, near Schefferville, Quebec. Mining will be conducted using open pit methods. Iron ore remaining at these previously mined locations will be mined, crushed and washed to produce lump ore and sinter fine ores, prior to being transported by rail to Sept-Iles and then shipped to customers. The project will also include the re-establishment of a spur line, approximately 3.5 kilometres in length, between an area known as the Silver Yards, north of the James property, and the existing railway in Schefferville, Quebec. Mining will initially be at a combined rate of one to two million tonnes/year at the three main mine sites, James North, James South and Redmond. The estimated daily production rate will be less than 3,000 t/d at each mine location. Ore will be crushed and washed at the Silver Yards beneficiation area (the area where extracted ore from mining is reduced to particles that can be separated into mineral and waste). Mining will be conducted approximately eight months per year with a winter shutdown.

The primary sources of potential air contaminant emissions during construction will be due to combustion emissions from on-site vehicles and temporary power sources, as well as fugitive dust emissions. During operation, emissions may be emitted from many sources, including the beneficiation area, the locomotives used to transport ore and materials, the open pit mines, a standby diesel generator installed at the worker's camp, and hauling ore along existing dirt roads between the mine sites and the Silver Yards.

1.1 Purpose of this Technical Study

The purpose of this study is to provide the necessary data to support the EIS and meet the requirements set out by the Newfoundland and Labrador Department of Environment & Conservation (NL DEC) in the Draft Guidelines (NL DEC 2008). In this document, the detailed methodology, assumptions, and results of the analysis done to assess potential changes in air quality are presented.

To support the assessment of a potential impact in air quality through this Technical Study, existing ambient air quality baseline conditions were characterized, air contaminant emissions from potential Project sources during construction and operation were estimated, and air quality modelling was conducted to predict the resulting fate and transport of the estimated emissions. A detailed description of the methodology for this Technical Study is presented in Section 2.

1.2 Overview of Report Contents

This Technical Study has been developed in support of the EIS for the West Central Labrador Iron Ore Project, and is presented in ten major sections, as follows.

- In Section 1, a general introduction and background information about the Project and this study is provided.
- In Section 2, an overview of the study methodology is provided.
- In Section 3, the regulatory framework considered for the study is presented.
- In Section 4, the baseline ambient air quality conditions are summarized.
- In Section 5, the emissions inventories are provided.
- In Section 6, the dispersion modelling methodology is outlined.
- In Section 7, the results of the dispersion and deposition modelling are presented.
- In Section 8, the conclusions of this study are summarized.
- In Section 9, a closure statement is provided.
- In Section 10, references consulted as part of the work and personal communications are provided.

2.0 STUDY METHODOLOGY

Several Project activities may cause air contaminants to be emitted to the atmosphere during construction and operation. This detailed Air Quality Technical Study was conducted to assess the potential for a Project-related change in air quality. The study was conducted following generally accepted methodologies to establish existing (baseline) conditions, estimate substantive emissions from Project activities, and predict the maximum downwind concentrations of the pertinent air contaminants.

2.1 Study Components

The Study consists of three key components which are considered together to characterize existing conditions and assess the potential environmental effects of Project-related emissions to the atmosphere.

- Ambient Air Quality Assessment: Existing (baseline) ambient air quality in and around the Project was characterized based on federal monitoring data from other remote locations in Labrador, as well as on-site ambient particulate matter monitoring conducted in support of the EIS. A summary of the existing baseline conditions, based on this analysis, is provided in Section 4 of this study.
- Emissions Inventory Development: Air contaminant emission rates from the Project were estimated based on conceptual engineering design information and published sources of emission factors. Details regarding Project-related emissions, including assumptions and calculations techniques, are provided in Section 5 of this study.
- Dispersion Modelling: The plume dispersion of the substantive air contaminant emissions from the Project was modelled to predict maximum ground-level concentrations (GLC). Details regarding the models used, model input data processing, as well as the model options selected are provided in Section 6. The results of the modelling are presented in Section 7.

Based on this analysis, the potential environmental effects due to air contaminant emissions from the Project are considered and assessed with a high degree of confidence in the EIA/EA.

2.2 Emission Source Screening

As previously mentioned, emissions estimates and dispersion modelling were used to quantitatively assess the potential change in air quality for substantive Project-related emissions which might result in adverse environmental effects. Project-related emissions expected to be negligible in the context of other emissions were not quantified, but are identified and described qualitatively in this section and in Section 5.

2.2.1 Construction

The emissions occurring during construction are expected to be relatively small compared to those occurring during operation. As there are very few buildings/units to be installed in the primary beneficiation area during construction, very few vehicles will be required on-site. Intermittent visits may cause releases of fugitive dust and combustion emissions. Up to two temporary diesel generators installed at the worker's camp may also contribute to emissions during construction. On the other hand,

during operation, as substantive amounts of material will be handled/processed and much larger continuous power sources (diesel generators) are necessary, emissions will be much larger in magnitude than during construction. Therefore, the potential changes in air quality during construction were considered indirectly by considering the predicted concentrations during operation as a worst-case scenario.

2.2.2 Operation

The emission sources quantified and considered in the dispersion modelling included all substantive sources in the beneficiation area during operation such as:

- Combustion emissions from fuel oil boilers and diesel generators (continuous power);
- Particulate matter emissions due to crushing, loading/dumping, wind erosion, and dust from conveyors.

These emissions will only occur seasonally with LIM's operation. No attributable emissions are expected to occur during the winter months when LIM is not operating. The emissions estimates for these sources are provided in Section 5, while the results of the dispersion modelling are provided in Section 7.

Potential emissions due to standing losses from storage tanks at the beneficiation area are not expected to be substantive as the contents will have relatively low vapour pressures (diesel and heavy oil). Similarly, emissions due to on-site vehicle traffic are not expected to be substantive relative to the other combustion and fugitive dust sources in the primary beneficiation area. As these sources are expected to represent only a small fraction of the total emissions from the primary processing facility, emissions from these sources are not expected to cause substantive changes in air quality and were not quantified.

Emissions due to fuel combustion and fugitive dust from trucks hauling ore from the deposits to the beneficiation area during operation were quantified (see Section 5), but not modelled. Although fugitive dust emissions will occur due to vehicle traffic along the road, the majority of the fugitive dust will remain in lowest 1-2 meters above ground level and settle within a few hundred meters of the road (DRI 1999). The haul route is an existing dirt road, and although traffic along the route is expected to increase with Project activities, no more than five trucks are expected to pass in a given hour. As such, while changes in air quality may occur due to fugitive dust emissions during certain meteorological conditions when trucks pass, these events will be localized and short in duration.

Emissions due to blasting and on-site traffic at the mine site locations during operation are not expected to cause substantive changes in air quality as they will be emitted inside a pit and the distances from the site to the nearest sensitive receptors are relatively far (more than 1.5 km). LIM will follow an explosive management program to ensure that environmental concerns are considered during the periodic blasting that may be required at the site. Furthermore, the blasting and associated emissions will be short-term in duration. Therefore, these emissions were not quantified.

Emissions from the diesel locomotive used for transporting ore from the beneficiation area are not expected to cause substantive changes in air quality. The railway is already operating in the area and LIM does not expect to add significantly to the current operation. Any emissions from the locomotive are expected to be intermittent (one trip per day) and short-term in duration. Therefore, these emissions were not quantified.

Similarly, emissions during from the standby diesel generators installed at the worker's camp will be intermittent, short-term in duration, and negligible relative to other emissions during operation. Therefore, these emissions were not quantified.

2.3 Dispersion Modelling

Air quality dispersion modelling was performed to predict maximum ground-level concentration (GLC) from substantive Project emissions and quantitatively assess potential environmental effects. Based on the site-specific conditions in the region, and after consultation with the NL DEC beginning November 11, 2008 (Lawrence 2008), the CALPUFF modelling system (TRC Companies, Inc. 2007) was selected to perform the dispersion and modelling for this assessment. CALPUFF was selected primarily because of its superior ability to characterize atmospheric dispersion in areas with complex, non-steady state meteorological conditions (NL DEC 2006). Atmospheric conditions in the region fit this criterion: areas with complex terrain in the study area create high variability in winds and turbulence. The model has specialized algorithms to deal with calm wind speed conditions and characterize dispersion in regions of complex terrain. Refer to Section 6 for a more detailed description of the CALPUFF modelling system and its algorithms.

To consider a variety of worst-case meteorological events in the dispersion modelling, a five-year simulation period spanning 2002-2006 was selected. As Project operations are expected to cease during the winter months, emissions were not modelled from November to March. The study area considered in the modelling assessment covers a 30 x 30 km area centered over the beneficiation area and is shown in Figure 2-1.

Model results were used to quantitatively assess potential changes in air quality due to Project emissions of NO_X, SO_2, CO, PM, PM_{10}, and $PM_{2.5}$. For each source modelled, emissions and other source characteristics were estimated based on preliminary design information and available literature. The model-predicted maximum GLC were added to estimated background concentrations and compared to the relevant air quality standards. The baseline ambient concentrations considered in the modelling were provided by the NL DEC and are expected to conservatively estimate existing conditions in the region. For more details on the existing ambient air quality in the region, refer to Section 4.

For more details concerning the CALPUFF modelling methodology and results refer to Sections 6 and 7, respectively.

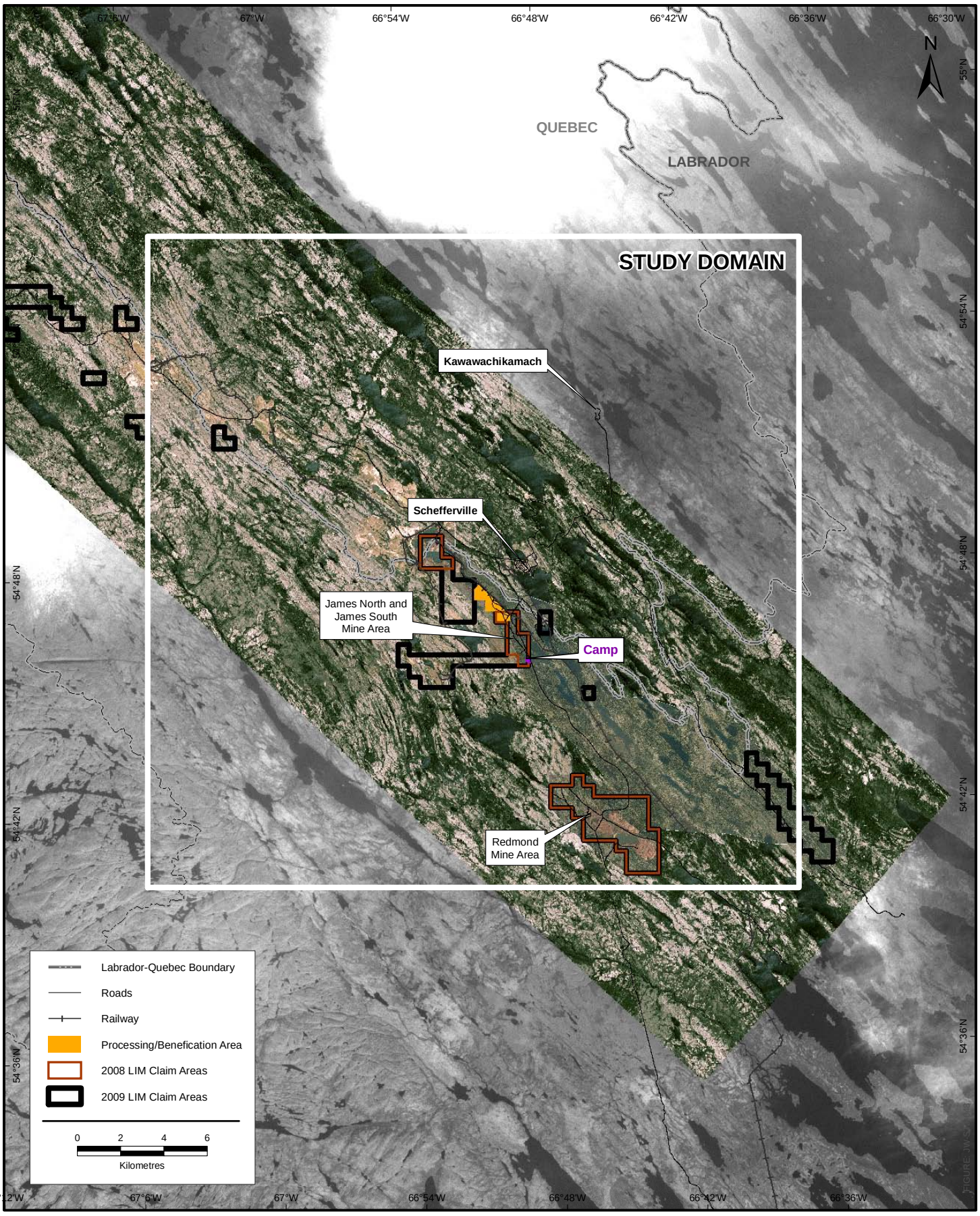


FIGURE NO:		DRAFT DATE:
2-1	**Study Domain**	19/12/2008
		REVISION DATE: 12/8/2009

3.0 REGULATORY FRAMEWORK

Ambient air quality is regulated both federally and provincially for several air contaminants. Ambient air quality objectives and standards are routinely used as a basis of comparison for air quality assessments and are generally chosen by regulators to be protective of human and environmental health. As such, published objectives and standards where available, were used in this study for comparison with measured or predicted values and in characterizing environmental effects.

Provincial standards are in place for all air contaminants considered in this study. Additionally, National Ambient Air Quality Objectives (NAAQO) or Canada Wide Standards (CWS) are available for all but particulate matter less than 10 microns (PM_{10}). A brief summary and description of the air quality standards in Newfoundland and Labrador (NL), and the NAAQO and CWS are presented in the following subsections.

3.1 Newfoundland and Labrador Air Quality Regulation

In NL, ambient air quality standards are published in Schedule A of the *Air Pollution Control Regulation* 39/04 under the *Environmental Protection Act.* A summary of the standards for ambient air quality concentrations in NL are presented below in Table 3.1.

Table 3-1 Summary of Newfoundland and Labrador Ambient Air Quality Standards

Air Contaminant	Averaging Period	Regulatory Standard (µg/m^3)
Nitrogen dioxide (NO_2)	1 hr	400
	24 hr	200
	Annual	100
Sulphur dioxide (SO_2)	1 hr	900
	3 hr	600
	24 hr	300
	Annual	60
Total suspended particulate matter (TSP)	1 hr	-
	24 hr	120
	Annual	60
Particulate matter less than 10 microns (PM_{10})	1 hr	-
	24 hr	50
Particulate matter less than 2.5 microns ($PM_{2.5}$)	1 hr	-
	24 hr	25
Carbon monoxide (CO)	1 hr	35,000
	8 hr	15,000

For the purposes of assessing changes in air quality in this study, the relevant NL regulatory standards were considered preferentially where applicable.

3.2 Federal Air Quality Objectives and Standards

The pertinent federal air quality standards for the assessment are the NAAQO and CWS. The NAAQO were established by the federal government in the early 1970s to protect human health and the environment by setting objectives for the following common air pollutants: carbon monoxide, nitrogen dioxide, ozone, sulphur dioxide and total suspended particulates. The objectives are denoted as "Desirable", "Acceptable" and "Tolerable". The Federal Objectives are defined as follows:

- The Maximum Desirable Level is the long-term goal for air quality and provides a basis for anti-degradation policy for unpolluted parts of the country, and for the continuing development of control technology;
- The Maximum Acceptable Level is intended to provide adequate protection against effects on soil, water, vegetation, materials, animals, visibility, personal comfort and well-being; and
- The Maximum Tolerable Level denotes time-based concentrations of air contaminants beyond which, due to a diminishing margin of safety, appropriate action is required to protect the health of the general population.

The CWS are based on intergovernmental agreements developed under the Canadian Council of Ministers of the Environment (CCME) Canada-wide Environmental Standards Sub-Agreement, which operates under the broader CCME Canada-wide Accord on Environmental Harmonization. The CWS flow from the federal, provincial and territorial Ministers desire to address key environmental protection and health risk issues that require concerted action across Canada. They represent cooperation toward a common goal, but involve no delegation of authority by any federal, provincial or territorial government. The standards may include qualitative or quantitative standards, guidelines or objectives for protecting the environment and human health. A number of these exist to protect air quality, including ambient air quality objectives for $PM_{2.5}$.

Overall, the NAAQO "Acceptable" Levels and the NL ambient air quality standards are very similar. There is no NAAQO for $PM_{2.5.}$ However, the CWS for $PM_{2.5}$ is similar to the NL ambient air quality standard. There is no NAAQO or CWS standard for PM_{10}. The National Ambient Air Quality Objectives and CCME Canada Wide Standards are presented below in Table 3-2.

Table 3-2 National Ambient Air Quality Objectives and Canada Wide Standards

Air Contaminant	Averaging Period	National Ambient Air Quality Objectives: Max Desirable/Acceptable/Tolerable Levels[1] (µg/m^3)	CCME Canada Wide Standards[2] (µg/m^3)
Sulphur dioxide (SO_2)	1 hr	450/900/--	--
	24 hr	150/300/800	--
	Annual	30/60/--	--
Nitrogen oxides as Nitrogen dioxide (NO_2)	1 hr	--/400/1,000	--
	24 hr	--/200/300	--
	Annual	60/100/--	--
Carbon monoxide (CO)	1 hr	15,000/35,000/--	--
	8 hr	5,730/15,000/20,000	--
Total suspended particulate matter (TSP)	24 hr	--/120/400	--
	Annual	60/70/--	--
Particulate matter less than 2.5 microns ($PM_{2.5}$)	24 hr	--	30
Particulate matter less than 10 microns (PM_{10})	--	--	--

Notes:
1 Government of Canada (1999), National Ambient Air Quality Objectives, Maximum Acceptable Levels
2 CCME (2000), Canada Wide Standards for Particulate Matter (Based on 98th percentile of 3 year rolling average)
-- No standard or objective available

4.0 EXISTING BASELINE CONDITIONS

4.1 Climate

The existing physical environment in the area of the LIM operations is presented in the following paragraph. Although all of LIM's properties are located in the Province of Newfoundland and Labrador (NL), the properties are bordered by the Province of Québec (QC), and the nearest town is Schefferville, QC to the north. Hence, the assessment boundary was extended beyond the provincial boundary in order to assess potential impacts in the airshed.

The Schefferville area and vicinity have a sub-arctic continental climate with severe winters. The terrain is comprised of parallel ridges and valleys trending northwest to southeast. The area is thinly forested, with bare rock exposure, and has some low wetland areas including bogs. Surface disturbance is present in the area as a result of previous mining. The climatology described in the following sections is based on 30-year Canadian Climate Normal data obtained from Environment Canada for the Schefferville Airport (1971 to 2000).

4.1.1 Climate Normals

The description of the climate for the region is based on climate normals from 1971-2000 for the Schefferville Airport weather station. These data are presented in Table 4-1 (Environment Canada 2008b). The Schefferville Airport weather data are considered to be an accurate representation of average weather conditions at the Labrador Iron Mines properties.

The daily average temperature for the Schefferville area varies from -24.1ºC in January to 12.4ºC in July with an annual average temperature of -5.3ºC. The extreme maximum and minimum temperatures recorded are 34.3ºC and -50.6ºC recorded during June and February, respectively.

The annual average total precipitation for the area is 822.9 mm of which 408.1 mm is in the form of rain.

The annual average wind speed reported at the Schefferville airport is approximately 17 km/h (kilometres per hour) and the most frequent wind direction, on an annual basis, is winds blowing from the north-west. The maximum wind speeds occur in October with average speeds of 17.8 km/h and the minimum speeds occur in July at an average of 15.1 km/h. The average monthly wind speeds are higher in the winter than in the summer. Maximum gusts, averaged from 1971 to 2000 for each month range from 101 km/h to 153 km/h. Occurrences of extreme winds are uncommon at Schefferville, as over the last three decades there has been an average of 13.9 and 3.3 days per year with winds ≥ 52 km/h and 63 km/h respectively (Environment Canada 2008b).

Table 4-1 Canadian Climate Normals for Schefferville, QC (1971-2000)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Temperature (°C)													
Daily Average	-24.1	-22.6	-16	-7.3	1.2	8.5	12.4	11.2	5.4	-1.7	-9.8	-20.6	-5.3
Daily Maximum	-19	-16.9	-9.8	-1.5	6	13.7	17.2	15.8	8.9	1.3	-6.1	-15.9	-0.5
Daily Minimum	-29.2	-28.1	-22.2	-13.1	-3.6	3.3	7.6	6.5	1.7	-4.6	-13.5	-25.2	-10
Extreme Maximum	5.1	5.1	9.4	13.1	28.3	**34.3**	31.7	28.7	26.7	20.6	9.8	5	
Date of Occurrence (yyyy/dd)	1986/28	1981/24	1953/25	1984/28	1950/31	**1989/24**	1970/25	1990/05	1959/10	1970/10	1977/11	1951/04+	
Extreme Minimum	-48.3	**-50.6**	-45	-36.1	-23.3	-7.8	0	-3.3	-9.4	-19.4	-35.6	-47.2	
Date of Occurrence (yyyy/dd)	1957/15	**1950/07**	1964/10	1950/08	1972/01	1956/08+	1951/14+	1948/30	1948/29	1974/22	1949/23	1989/27	
Precipitation													
Rainfall (mm)	0.2	0.2	1.6	8.4	27.7	65.4	106.8	82.8	85.3	24.4	4.5	0.9	408.1
Snowfall (cm)	57.4	42.6	56.6	54.8	22.9	8	0.5	1.7	12.7	57.2	70.7	55.4	440.5
Precipitation (mm)	53.2	38.7	53.3	61.4	52.1	73.7	107.2	84.5	98.4	80.5	69.4	50.7	822.9
Extreme Daily Precipitation (mm)	29	29	36.8	32.8	33.8	51.3	**54.4**	48.5	49	41.2	35.8	24.6	
Date of Occurrence(yyyy/dd)	1982/18	1976/02	1982/27	1975/19	1992/23	1958/14	**1989/19**	1970/01	1990/15	1990/19	1966/03	1962/10	
Days with:													
Max. Temp. > 0 °C	0.41	0.65	3.4	12.5	27.2	29.9	31	31	29.5	18.9	4	0.55	188.9
Rainfall >= 0.2 mm	0.3	0.3	1	2.9	8.6	14.7	19	18.4	17.2	7.3	1.8	0.64	92.2
Snowfall >= 0.2 cm	17.4	14.3	16.6	14.6	10.3	3.4	0.17	0.33	6.4	19	21.3	19.2	142.9
Precipitation >= 0.2 mm	17.1	14.3	16.4	16.2	15.8	16.1	19	18.4	20.4	21.8	21.3	19	215.9
Wind													
Mean Wind speed (km/h)	16.4	16.8	17.4	16.5	16	16.2	15.1	15.6	16.9	17.8	17.3	16	16.5
Most Frequent Direction	NW	NW	NW	NW	NW	NW	NW	NW	NW	NW	NW	NW	NW
Maximum Gust Speed (km/hr)	134	148	148	130	101	126	103	117	137	137	142	153	

Source: Environment Canada (2008b)

4.1.2 Ambient Air Quality

There is currently no heavy industry in the vicinity of the Project. Therefore, on an overall basis, background concentrations of air contaminants are very low for the purposes of the study in the development area. Fugitive dust levels in the region may be elevated occasionally due to the use of predominantly unpaved roads for transportation in the area wind-blown dust from loose cover material.

4.1.2.1 Supplementary On-Site Ambient Monitoring

A search of the National Air Pollution Surveillance (NAPS) Network data records indicated that there is limited data available to determine background air quality for air contaminants in the vicinity of the proposed operations. The nearest available sources of ambient air quality monitoring data are Goose Bay and Labrador City, both of which are greater than 200 km from the site location. Goose Bay and Labrador City have both more industry and population than the LIM area. Additionally, LIM wanted to estimate what contribution, if any, the mobile crusher had to particulate matter levels.

To address the above issues, an ambient air quality monitoring program was conducted between September and November 2008, specifically monitoring total particulate levels in the beneficiation area known as the Silver Yards on Labrador Iron Mine Ltd. properties, where the highest levels of particulate would be expected. This area was chosen for ambient monitoring since it is nearest to Schefferville which is the nearest residential area.

Samples were obtained near the James Mine property on a six day schedule on days when ore was being crushed as well as on days when operations were not occurring. Results from the program indicated half of the samples had particulate levels that were equal to or below the laboratory detection limit of 0.3 mg (21 $\mu g/m^3$), suggesting that particulate levels in the area were generally low. The highest particulate level sampled was 0.6 mg (42 $\mu g/m^3$), while the average of all samples was 0.3 mg (21 $\mu g/m^3$), which is low compared to the NL standard of 120 $\mu g/m^3$. For more details on the ambient monitoring conducted in support of this assessment, refer to the On-site Ambient Monitoring Report which is included as Attachment A.

4.1.2.2 Ambient Background Values Used for Dispersion Modelling

For the purposes of assessing cumulative environmental effects, conservative estimates for ambient background concentrations were provided by the NL DEC (Lawrence 2008).

To estimate background levels for SO_2, TSP, PM_{10}, and $PM_{2.5}$ in the region, the NL DEC provided the lowest annual ambient levels measured at Labrador City/Wabush. This is considered to be a conservative approach since the Labrador City/Wabush ambient air is influenced by two nearby iron ore pelletizing operations. The value of 15 $\mu g/m^3$ given for TSP is consistent with, and on the same order of magnitude of the results from the on-site ambient monitoring as described in the preceding section and Attachment A.

For the remaining contaminants, CO and NO_2, the lowest annual values for all stations in the NAPS 2005/2006 report (Environment Canada 2008a) were provided by the NL DEC to approximate ambient background values of these contaminants. This approach was considered conservative since NAPS is a community based network (i.e. monitoring is done in populated areas), unlike LIM's project area in a historically developed area. The ambient background concentrations provided for the modelling assessment are located in Table 4-2 below.

Table 4-2 Ambient Background Concentrations Used in Dispersion Modelling

Air Contaminant	Estimated Background Concentration ($\mu g/m^3$)
NO_2	3.8
SO_2	5
TSP	15
PM_{10}	10
$PM_{2.5}$	5
CO	114

Source: (Lawrence 2008)

5.0 EMISSIONS INVENTORY

5.1 Overview

A summary of the processes and activities which are expected to have substantive emissions, and the sources of these emissions, are provided in the following sub-sections. Substantive emissions are those that may be emitted in quantities that could result in ambient concentrations of concern to the regulatory agencies or the public.

Two main source groups were considered for the purposes of this assessment: combustion sources and fugitive dust sources. These sources were considered to operate over an 8-month period, with a winter shut-down consistent with LIM's mining operation.

Combustion sources at the facility include the following:

- Two (2) fuel-oil fired boilers (note that based on updated design, these units are no longer required);
- Three (3) diesel fired generators;
- On-site vehicles (tail pipe emissions);
- Locomotive engines; and,
- Up to two diesel generators at the worker's camp.

Fugitive dust sources at the facility include the following:

- Ore loading/unloading;
- Ore crushing;
- Ore stockpile erosion;
- Conveyor systems; and,
- On-site traffic.

Fugitive dust emissions from blasting as well as fugitive volatile organic compound (VOC) emissions from tank storage were also considered. These sources of emissions will be present at the facility during both construction and operation activities. Heavy construction activities at the site are expected to be minimal due to the few buildings being erected and since the area is already relatively cleared of brush and debris. Construction activities include erecting the main crushing building, the placement of the required generators, boilers, and tanks, and the installation of conveying systems and rail lines. Emissions during construction are expected to occur intermittently over the duration of the construction period as opposed to emissions during operation, which will occur continuously. Also, the amount of fugitive dust emitted due to operational activities (crushing, ore loading/unloading, conveying, and stockpile erosion) will be greater than those observed during construction activities due to the nature of the ore beneficiation process. Therefore, the maximum emissions during operation provide a conservative envelope for those occurring during construction.

An operating scenario with production at 1,500,000 tonnes of ore per year at the LIM facility was used to estimate emissions from the main sources of potential concern. Manufacturer's specifications, where

applicable were used for the on-site equipment and engineering estimates were used where required. Maximum short-term emission rates for each contaminant of concern were calculated and are expected to provide conservative predictions for longer averaging times (greater than 1-hour) when used in the dispersion modelling. Emission rates were calculated using emission factor (EF) approaches and engineering assumptions. The emission calculation methodology for each significant source is described in this section.

An overview of the project boundaries, including the beneficiation area, the James and Redmond claims, and the hauling routes are included in Figure 5-1. A close-up view of the beneficiation area, including major sources of concern is included in Figures 5-2 and 5-3. The following sub-sections detail the combustion and fugitive dust sources considered in this assessment.

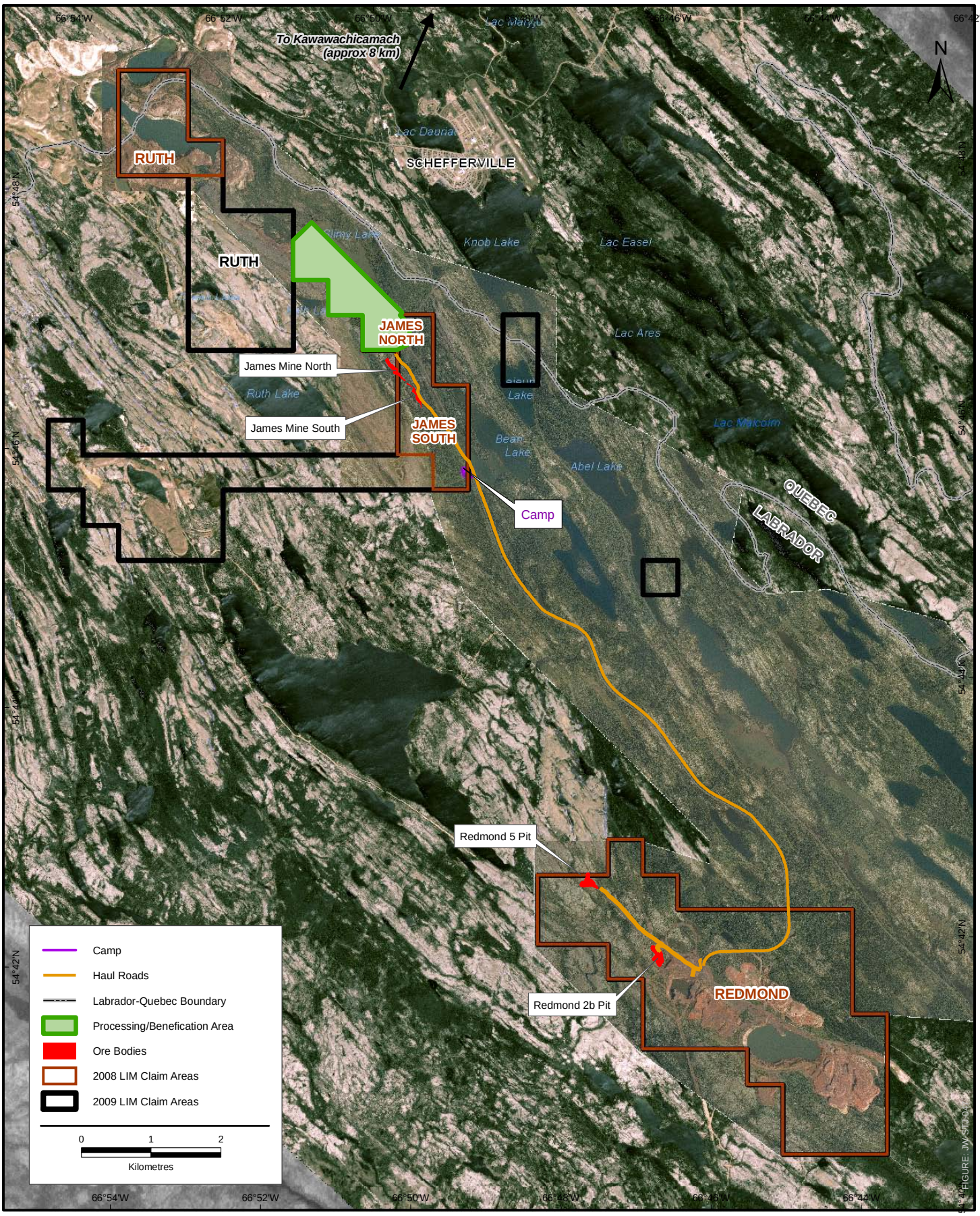


FIGURE NO:		DRAFT DATE:
5-1	**Overview of Project Emission Sources**	08/12/2008
		REVISION DATE: 12/8/2009

Figure 5-2 Emission Sources in Primary Beneficiation Area – Including Site Plan

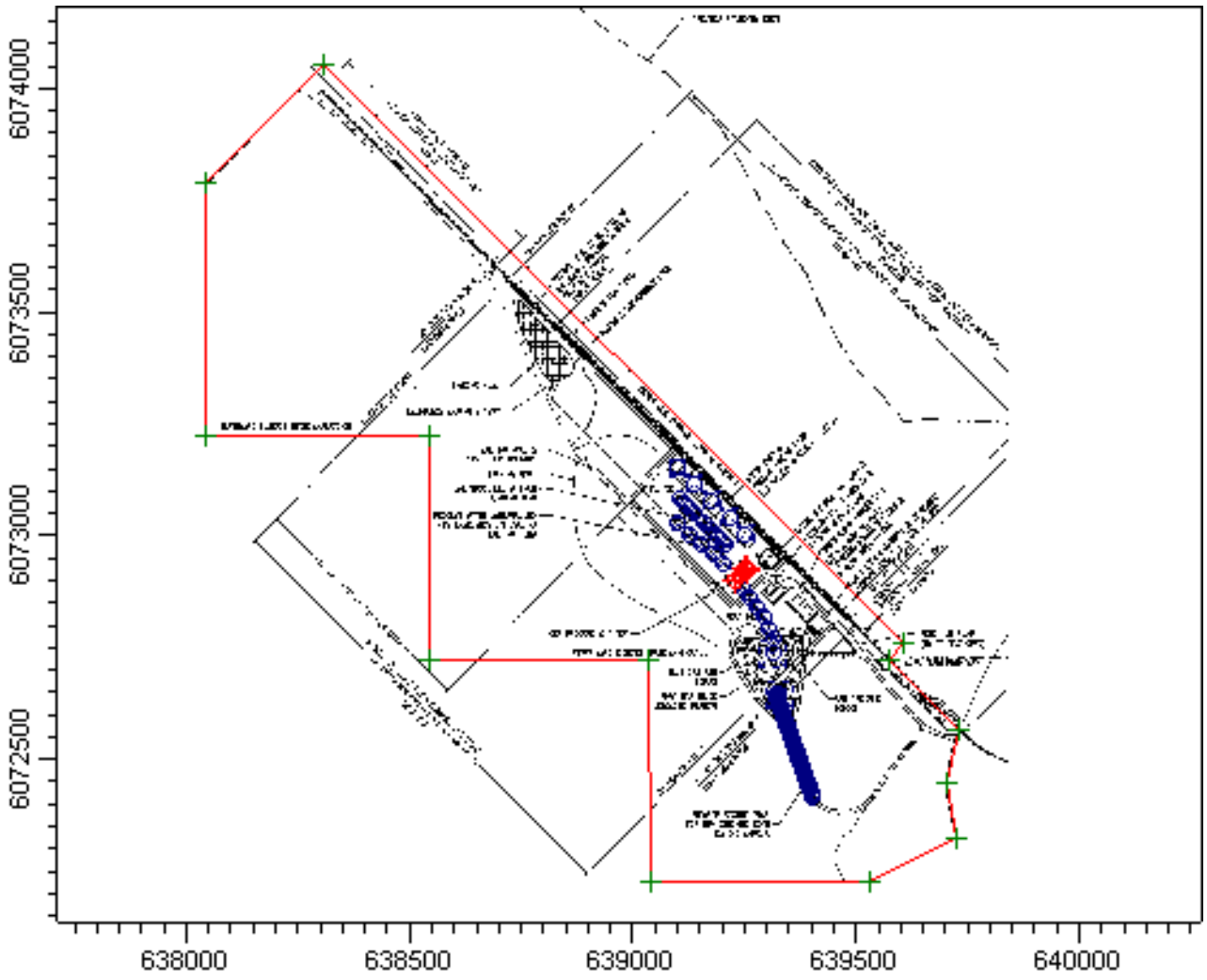
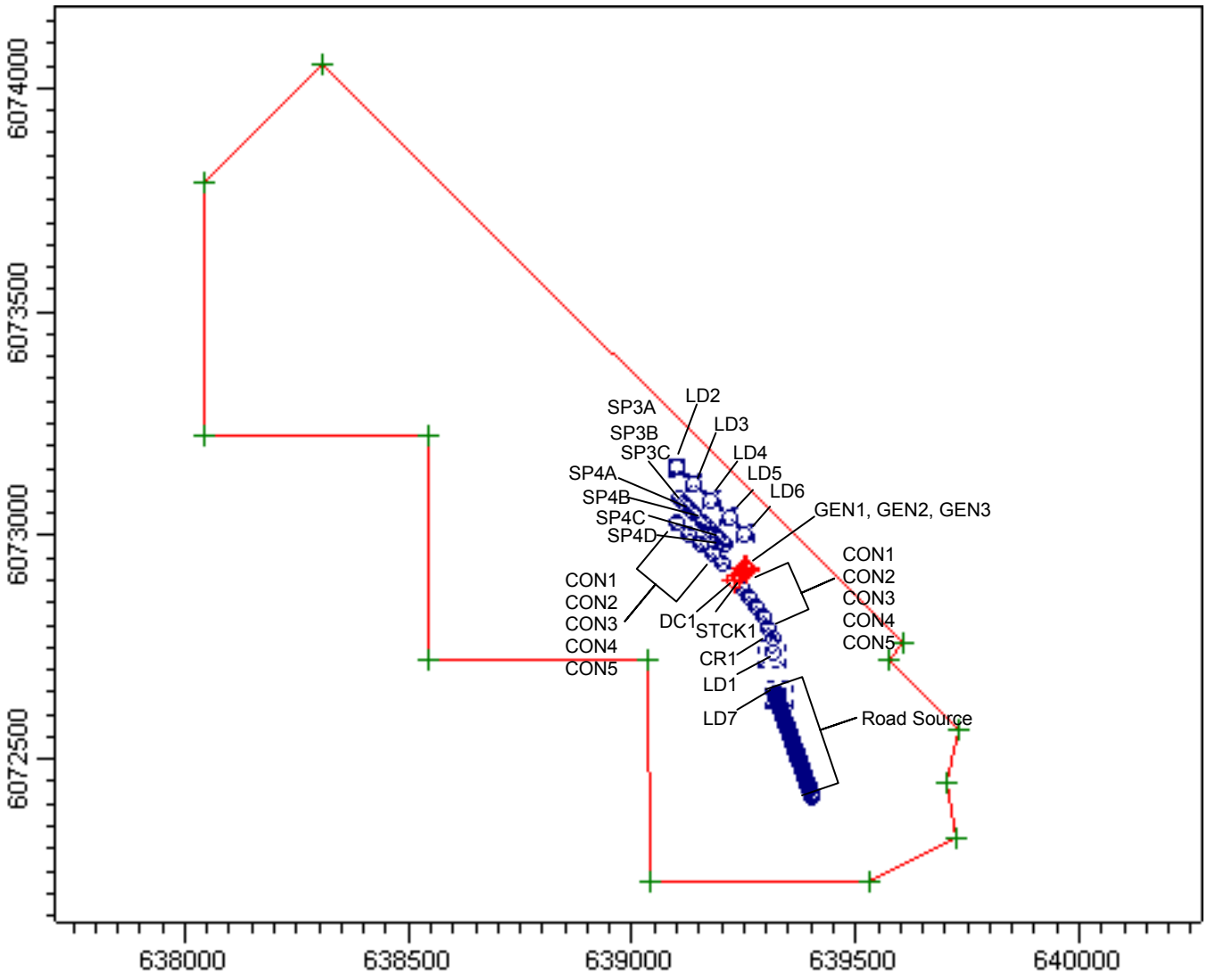


Figure 5-3 Emission Sources in Primary Beneficiation Area – Labeled Sources



5.2 Combustion Emissions

Combustion emissions will occur at the facility during both construction and operation activities. Emissions due to fossil fuel combustion are expected to occur during construction in the beneficiation area and worker's camp from diesel generators as well as tail pipe emissions from on-site traffic. Emissions due to fossil fuel combustion are also expected to occur during operation in the beneficiation area and worker's camp from diesel generators, boilers (note that based on updated design information, these units are no longer required), and tail pipe emissions from on-site traffic and locomotives.

5.2.1 Diesel-Powered Generators

Three (3) mobile diesel generators will be used in the beneficiation area to provide power to the equipment. These are referred to as GEN1, GEN2, and GEN3. The specifications for the set of generators are: continuous duty, 750 kW, 60Hz, and 600V. Each generator will be enclosed and placed on concrete pads. Each generator will emit contaminants to the atmosphere through a stack having an assumed diameter of 0.2 m and a height of 0.7 m above the enclosure, approximately 5 m above grade.

In addition, up to two (2) diesel generators (125 and 175 kw) will be used as a temporary power source for the camp until electricity can be connected from the nearby grid (during the construction phase). Grid access is nearby and no significant construction is anticipated to facilitate the grid connection. During operation, these units will be used for emergency power losses only. Since these emissions will be intermittent, short-term in duration, and negligible compared to other emissions occurring during operation, emissions from these potential sources were not quantified or modelled.

The main contaminants of concern considered from diesel-fired generators are NO_x, CO, SO_2, PM, PM_{10} and $PM_{2.5}$. Emissions for all contaminants from the diesel generators in the beneficiation area were calculated based on emission factors in U.S. EPA AP-42 Chapter 3.4 „Gasoline and Diesel Industrial Engines' (>600-hp), and the power rating of the unit. The NO_X emission factor for controlled generators was used to account for the use of Best Available Control Technology (BACT) at the site. Although no emission factors were provided in Table 3.4-1 of AP-42 for PM_{10} and $PM_{2.5}$, the ratio of each fraction of particulate matter (PM_{10} or $PM_{2.5}$) to PM from table 3.4-2 of the same document was used to estimate emissions.

Sample Calculation – NO_x Emissions for GEN1:

NO_X Generator Emission (g/s) = EF (lb/hp-hr) x Power Rating (kW) x Conversion (hp/kW) x Conversion (g/lb) / 3600 (s/hr)

= 0.013 (lb/hp-hr) x 750 (kW) x 1.34 (hp/kW) x 454 (g/lb) / 3600 (s/hr)

= 1.65 g/s

Emissions from the other expected contaminants were calculated in a similar fashion and are provided in Table 5-1.

Table 5-1 Estimated Emission Rates from Combustion Equipment - Generators

Source	Power Rating (kW)	Contaminant	Emission Factor	EF Units	Emission Rate (g/s)
Generators	750.0	NO_x	0.013	lb/hp-hr	1.65E+00
		CO	0.0055	lb/hp-hr	6.98E-01
		PM	0.0007	lb/hp-hr	8.88E-02
		SO_2	0.0032	lb/hp-hr	4.10E-01
		PM_{10}	0.0006	lb/hp-hr	7.28E-02
		$PM_{2.5}$	0.0006	lb/hp-hr	7.10E-02

Reference: US EPA AP-42 Table 3.4-1 and 3.4-2

5.2.2 Fuel Oil Boilers

Based on the preliminary design information, two (2) 224 kW fuel oil boilers were to be located in the main processing building and will be used for required process water in the tumbling scrubber during the beneficiation process. The boilers would have been powered by No. 2 fuel oil and emitted to the atmosphere through a common stack (STCK1), having a diameter of 0.9 m and an assumed height of 1 m above the roof of the processing building. Based on updated design information, the boilers are no longer required as part of the proposed Project. However, to be conservative, the potential contributions of these sources were still considered quantitatively in the air quality assessment (emissions estimated and dispersion modelling conducted).

The main potential contaminants of concern considered from the fuel-oil fired boilers would be NO_X, CO, SO_2, PM, PM_{10} and $PM_{2.5}$. Emissions for all contaminants from the boilers were calculated based on emission factors in U.S. EPA AP-42 Chapter 1.3 „Fuel Oil Combustion', and the fuel volume requirement of the unit. Emissions estimates for SO_2, NO_X, CO and PM were based on Low-NO_X burners, to account for the required Best Available Control Technology (BACT) used at the site.

Sample Calculation – NO_x Emissions for STCK1:

NO_X Boiler Emission (g/s) = EF (lb/10^3 gal) x Fuel Volume (gal/h) / 1000 (gal/10^3 gal) x Conversion (g/lb) / 3600 (s/hr) x 2 boilers

= 10 (lb/10^3 gal) x 85 (gal/hr) / 1000 (gal/10^3 gal) x 454 (g/lb) / 3600 (s/hr) x 2

= 0.21 g/s

Other emissions were calculated in a similar fashion and are provided in Table 5-2.

Table 5-2 Estimated Emission Rates from Combustion Equipment - Boilers

Source	Max Fuel Flow (gal/hr)	Contaminant	Emission Factor	EF Units	Emission Rate (g/s)
Boilers	85	NO_x	10	lb/10^3 gal	2.14E-01
		CO	5	lb/10^3 gal	1.07E-01
		PM	2	lb/10^3 gal	4.29E-02
		SO_2	7.85	lb/10^3 gal	1.68E-01
		PM_{10}	1	lb/10^3 gal	2.14E-02
		$PM_{2.5}$	0.25	lb/10^3 gal	5.36E-03

Reference: US EPA AP-42 Table 1.3-1 and 1.3-6

5.2.3 On-site traffic

Potential emissions from on-site traffic sources include tail-pipe emissions due to fossil fuel combustion. Emissions from combustion arise from the burning of fuel and are dependent on fuel flow rate, fuel type, and the type of combustion equipment. The primary products from combustion include nitrogen oxides (NO_X), sulphur dioxide (SO_2), carbon monoxide (CO), and particulate matter (PM). Both diesel and gasoline powered vehicles are expected to be operating at the site during both construction and operation activities. Construction vehicles will include dozers, graders, dump trucks, boom trucks and pick-up trucks. Vehicles expected during operation will include pick-up trucks, hauling trucks, tractors and trailers. These emissions will be localized in extent, limited in duration, and occur over the entire property as the vehicles travel.

On-site traffic will be very light and not a substantive contributor to overall emissions at a facility and were therefore not estimated for the purposes of this assessment.

5.2.4 Locomotive emissions

Combustion emissions are expected from the diesel locomotive used for transporting ore from the beneficiation area to Schefferville and beyond. Similar to on-site traffic emissions, emissions from combustion arise from the burning of fuel and are dependent on fuel flow rate, fuel type, and the type of combustion equipment. The primary products from combustion include nitrogen oxides (NO_X), sulphur dioxide (SO_2), carbon monoxide (CO), and particulate matter (PM).

Emission estimation methods for locomotives are available, although published emission rates vary greatly. Due to the infrequent nature of the source at the site (one trip is expected per day), the environmental effect is expected to be minimal therefore emissions estimates for locomotive transport were not estimated.

5.3 Fugitive Dust Emissions

Fugitive dust emissions at the site will occur from several different sources during construction and operation. Potential sources of fugitive dust during construction activities will include railway track installation, the clearing/grubbing for site services area, any necessary excavation and the erection of temporary buildings. Potential sources of fugitive dust during operation may include ore loading/unloading, ore crushing, stockpile erosion and dust from conveyor systems around the site. Fugitive dust emissions during construction are expected to be localized in extent, limited in duration, and smaller in magnitude than those occurring during operation and as such, only potential fugitive dust emissions during operation were quantified. Long term fugitive dust emissions at the site were developed from available data and relevant emission factors.

5.3.1 Ore loading and unloading

Ore will be loaded and unloaded at different locations on the site throughout the operating period. These are referred to as LD1, LD2, LD3, LD4, LD5, LD6, and LD7. Hauling trucks will unload the raw ore from the mine sites at the southern end of the property and processed ore will be loaded onto rail cars at the northern end of the property.

Particulate matter (including PM, PM_{10} and $PM_{2.5}$) is the main air contaminant of concern during ore loading and unloading. Emissions due to ore loading and unloading were calculated using the material

transfer equation in the U.S. EPA AP-42 document Chapter 13.2.4 „Aggregate Handling and Storage Piles'. The equation is:

EF = K (0.0016) (U/2.2) 1.3 / (M/2) 1.4

Where: EF = emission factor (kg/megagram);

K = particle size multiplier (1.0 for PM, 0.35 for PM_{10} and 0.11 for $PM_{2.5}$)

U = mean wind speed (4.4 m/s –average from processed meteorological data from Schefferville airport)

M = material moisture content (%).

The corresponding material emission rate was determined by:

Emission Rate (g/s) = EF x MR x (100 – CE) /100

Where: EF = Emission factor, kg/megagram of material handled

MR = Material transfer rate (megagram/s).

CE = Control efficiency %. These operations were conservatively assumed to be uncontrolled.

The material transfer rate was based on the loading and unloading operations occurring for eight months of the year (the operating period). The emission factor calculation methodology has a US EPA data rating of "B" as described in the AP-42 chapter. The emission rate calculation for this source was based on the equipment operating continuously at its maximum production rate. Emissions estimates for all the loading and unloading operations are provided in Table 5-3.

Table 5-3 Estimated Emission Rates from Fugitive Dust Sources – Ore Loading and Unloading

Source ID	Source Description	Contaminant	Emission Rate
LD1	Ore loading - from raw stockpiles to mobile crusher	PM	4.08E-02
		PM_{10}	1.43E-02
		$PM_{2.5}$	2.16E-03
LD2	Ore loading - from crushed stockpiles to rail 1 of 5	PM	8.16E-03
		PM_{10}	2.86E-03
		$PM_{2.5}$	4.33E-04
LD3	Ore loading - from crushed stockpiles to rail 2 of 5	PM	8.16E-03
		PM_{10}	2.86E-03
		$PM_{2.5}$	4.33E-04
LD4	Ore loading - from crushed stockpiles to rail 3 of 5	PM	8.16E-03
		PM_{10}	2.86E-03
		$PM_{2.5}$	4.33E-04
LD5	Ore loading - from crushed stockpiles to rail 4 of 5	PM	8.16E-03
		PM_{10}	2.86E-03
		$PM_{2.5}$	4.33E-04
LD6	Ore loading - from crushed stockpiles to rail 5 of 5	PM	8.16E-03
		PM_{10}	2.86E-03
		$PM_{2.5}$	4.33E-04

Table 5-3 Estimated Emission Rates from Fugitive Dust Sources – Ore Loading and Unloading

Source ID	Source Description	Contaminant	Emission Rate
LD7	Ore loading - from trucks to raw stockpiles	PM	4.08E-02
		PM_{10}	1.43E-02
		$PM_{2.5}$	2.16E-03

5.3.2 Stockpile Wind Erosion

Particulate (including PM, PM_{10} and $PM_{2.5}$) emissions may be generated by wind erosion of uncovered storage piles and exposed areas within the site boundaries. These sources typically are characterized by nonhomogeneous surfaces interspersed with nonerodible elements (particles larger than approximately 1 centimetre in diameter) and are referred to as SP3A, SP3B, SP3C, SP4A, SP4B, SP4C, and SP4D. These material surfaces are characterized by finite availability of erodible material (mass/area) referred to as the erosion potential. Any natural crusting of the surface can bind the erodible material outer layer, which would reduce the erosion potential.

Fugitive dust emissions due to wind erosion on the different ore stockpiles at the site were estimated based on emission estimation methodology and related emission factors in Chapter 13.2.5 of U.S. EPA AP-42 entitled „Industrial Wind Erosion'. At both James and Redmond properties, there are existing stockpiles that were left behind by previous mining operations. As crusting of the existing stockpile surfaces will occur over time, they were not considered significant sources for the purposes of this assessment.

The emission rate calculations for these sources are based on the maximum size of the stockpiles and the calculated emission rate should be conservative.

The emission factor for wind erosion is expressed as:

$$\mathbf{EF = k \times N \times [58(u - u_t)^2 + 25(u-u_t)]}$$

Where:
- EF = Emission factor, g/m2
- k = Particle size multiplier
- N = Number of times the surface material is disturbed in a given time period
- u = Friction velocity, m/s
- u_t = Threshold friction velocity, m/s

The corresponding erosion emission rate for a given unit of time is determined by:

Emission Rate = EF x Surface area of exposed material

The following parameters were used for this equation:

- Particle Size Coefficients (k):

  PM = 1.0

  PM_{10} = 0.5

  $PM_{2.5}$ = 0.075

- N = 360 (conservatively assumed a pile active area is available is available at least 1.5 times each day during the annual operating period).
- u_t = the threshold friction velocity stipulates the minimum wind speed required to scavenge particulate matter into the air, and can be estimated from the dry aggregate structure of the surface material. A threshold friction velocity of 1.33 m/s for the raw ore piles and 1.12 m/s for the processed ore piles was used.
- u = the friction velocity was calculated from the maximum gust wind speed observed at the Schefferville airport during 2006. A value of 1.22 m/s was used.
- Surface area of exposed material – conservatively estimated the actual area of the piles using length and width as opposed to length and height.

Emissions estimates for these sources are provided in Table 5-4.

Table 5-4 Estimated Emission Rates from Fugitive Dust Sources – Stockpile Wind Erosion

Source ID	Source	Dimension of Pile[1]		Assumed Surface Area (m^2)	Threshold Friction Velocity[2] – U_t* (m/s)	Estimated Emission Rate (g/s)		
		Length (m)	Width (m)			PM	PM_{10}	$PM_{2.5}$
SP1	Blue Ore Pile	65	35	2275	1.33	0	0	0
SP2	Red Ore Pile	65	35	2275	1.33	0	0	0
SP3	Lump Ore Stockpile	75	25	1875	1.12	1.04E-01	5.20E-02	7.80E-03
SP4	Sinter Fines Stockpile	50	25	1250	1.12	6.93E-02	3.47E-02	5.20E-03

Notes:

1. The stockpile dimensions were estimated based on the site plans provided by LIM.
2. Data from Section 13.2.5 of US EPA AP-42 (scoria and uncrusted coal pile data was used).

5.3.3 Primary and Secondary Crushing

Dust emissions from the primary mobile crusher and from the secondary crushing (CR1 and DC1) occurring in the beneficiation area will occur whenever the equipment is operating at the facility. Dust levels from both crushers will be minimized through the use of control equipment (dust collectors). The emission rate calculations for these sources are based on the total annual ore production at the facility (1,500,000 tonnes) and the calculated emission rate is therefore conservative.

Fugitive dust emissions due to primary and secondary crushing at the site were estimated based on emission estimation methodology and related emission factors in Chapter 11.24 of U.S. EPA AP-42 entitled „Metallic Minerals Processing. PM and PM_{10} emissions from the mobile crusher (CR1) were estimated using the emission factors for „Primary Crushing of High-moisture Ore'. The PM and PM_{10} emissions from the processing building crusher (DC1) were estimated using the emission factors for „Secondary Crushing of High-moisture Ore'. The $PM_{2.5}$ emissions for both sources were estimated on a $PM_{2.5}$ to PM_{10} multiplier for „Construction Operations' from the U.S. EPA document „Examination of the Multiplier Used to Estimate $PM_{2.5}$ Fugitive Dust Emissions from PM_{10}" (U.S. EPA, 2005). Dust control efficiency data for the emissions from the secondary crushing area was assumed to be 90%, which is conservative. No information was available in regards to the type of control that will be used in conjunction with the primary crusher. Emissions were conservatively estimated assuming no controls in place.

Emissions estimates for these sources are provided in Table 5-5.

Table 5-5 Estimated Emission Rates from Fugitive Dust Sources – Primary and Secondary Crusher

Source ID	Process Description	Control Efficiency	PM Emission Factor	PM Emission Rate	PM_{10} Emission Factor	PM_{10} Emission Rate	$PM_{2.5}$ Emission Factor	$PM_{2.5}$ Emission Rate
			kg/Mg	g/s	kg/Mg	g/s	kg/Mg	g/s
CR1	Mobile Crushing/Screening	0	1.00E-02	7.23E-01	4.00E-03	2.89E-01	8.00E-04	5.79E-02
DC1	Enclosed Crushing/Screening	90	3.00E-02	2.17E-01	1.20E-02	8.68E-02	2.40E-03	1.74E-02

Notes:
The control efficiency for DC 1 was assumed.
Emission Factors for high-moisture content ore (greater than 4%) were used from Sec 11.24 of U.S. EPA AP-42 (Table 11.24-1)

5.3.4 Conveying Systems

Dust emissions from the conveying systems in use at the site will occur whenever the equipment is operating at the facility. These are referred to as CON1, CON2, CON3, CON4, CON5, CON6, CON7, CON8, CON9, and CON10. Dust levels from the conveyors will be minimized through the use of control equipment (coverings and water suppression). The emission rate calculations for these sources are based on the total annual ore production at the facility (1,500,000 tonnes) and the calculated emission rate are therefore expected to be conservative.

Fugitive dust emissions due to the sue of conveyors at the site were estimated based on emission estimation methodology and related emission factors in Chapter 11.24 of U.S. EPA AP-42 entitled „Metallic Minerals Processing. PM and PM_{10} emissions from the conveyors were estimated using the emission factors for „Material Handling and Transfer – all minerals except bauxite'. The $PM_{2.5}$ emissions for the conveyors were estimated on a $PM_{2.5}$ to PM_{10} multiplier for „Construction Operations' from the U.S. EPA document „Examination of the Multiplier Used to Estimate $PM_{2.5}$ Fugitive Dust Emissions from PM_{10}" (U.S. EPA, 2005). Although water suppression will be used for the conveyors between the mobile crusher and the processing building and coverings may be used for the other conveyors on site, fugitive dust emissions from all conveying systems were conservatively estimated assuming no control systems.

Emissions estimates for these sources are provided in Table 5-6.

Table 5-6 Estimated Emission Rates from Fugitive Dust Sources – Conveying Systems

Source ID	Process Description	PM Emission Factor	PM Emission Rate	PM_{10} Emission Factor	PM_{10} Emission Rate	$PM_{2.5}$ Emission Factor	$PM_{2.5}$ Emission Rate
		kg/Mg	g/s	kg/Mg	g/s	kg/Mg	g/s
CON1/ CON2/ CON3/ CON4/ CON5/	Conveyor - Sinter fines conveyor	5.00E-03	2.17E-01	2.00E-03	8.68E-02	4.00E-04	1.74E-02
	Conveyor - Lump ore conveyor	5.00E-03	5.43E-02	2.00E-03	2.17E-02	4.00E-04	4.34E-03
CON6/ CON7/ CON8/ CON9/ CON10/	Conveyor - Mobile Crusher to Crushing Building	5.00E-03	3.62E-01	2.00E-03	1.45E-01	4.00E-04	2.89E-02

Notes:
The source IDs for the conveyor systems between the processing building and the ore stockpiles were combined for use in the CALPUFF model. The emissions presented for each process were divided into the separate sources for modelling.
Emission Factors for high-moisture content ore (greater than 4%) were used from Sec 11.24 of U.S. EPA AP-42 (Table 11.24-1)

5.3.5 On-Site Traffic other than Ore Hauling

Fugitive dust emissions due to on-site traffic would be proportional to the amount of property disturbed and the frequency of disturbance. The fugitive dust emissions from on-site traffic are not considered to be substantive compared to the other activities occurring at the facility during operation.

5.3.6 Ore Hauling from Mine Site to Beneficiation Area

Emissions from the ore hauling activities are similar to the potential emissions due to on-site traffic as discussed above.

Dust emissions would occur along the haul routes between the James or Redmond mine areas and the beneficiation area. These are all existing dirt roads and would be prone to dust emissions from any type of vehicle traffic. When a vehicle travels along an unpaved road, the vehicle's wheels travelling on the road generate dust which is then lifted and exposed to passing winds.

Emissions due to ore hauling were estimated using standard techniques including equations found in the US EPA's AP-42 guidance documents. Fugitive dust emission estimates varied from 221 – 325 kg/day for the one kilometre hauling route between the James deposit and the beneficiation area and 2869 – 4225 kg/day for the thirteen kilometre hauling route between the Redmond deposit and the beneficiation area.

A small on-property section was used for modelling purposes. Emissions from a road, approximately 250 m in length, were developed to include in the model.

Particulate matter (including PM_{10} and $PM_{2.5}$) is the main contaminant of concern for this on-site travel. Emission factors for this source were calculated using equation (1) in U.S. EPA AP-42, Chapter 13.2 „Unpaved Roads'. The equation is:

$$EF = k\ (s/12)^a\ (W/3)^b$$

Where:

k, a, b, c and d are empirical constants;

EF = size-specific emission factor (lb/VMT) (1 lb/VMT = 281.9 g/VKT) ;

s = surface material silt content (%) ;

W = mean vehicle weight (tons).

The corresponding material emission rate was determined by:

Emission Rate (g/s) = EF x TD x (100 – CE) /100 x # trips/day

Where: EF = general emission factor, kg/vehicle km travelled

TD = Travel distance (km). A one-way travel distance of 250 m was estimated from the site plan.

CE = control efficiency %. No control was assumed to be conservative in the emissions estimates.

Emissions estimates for this road source are included in Table 5-7.

Table 5-7 Estimated Emission Rates from Fugitive Dust Sources – Road Dust

Contaminant	Assumed Road Length - One Way Trip	Total Emissions	Short-Term Emission Rate
	(km)	(kg/day)	(g/s)
PM	0.25	81	9.40E-01
PM_{10}	0.25	20	2.34E-01
$PM_{2.5}$	0.25	2	2.34E-02

5.3.7 Ore Mining

Potential fugitive dust emissions due to the mining operations at the James and Redmond deposits include emissions from loading and blasting operations.

Fugitive dust emissions from loading operations depend on the condition of the storage piles being disturbed. When freshly processed material is loaded onto a pile, there is a greater potential of fine particulate emissions. Over time, as the pile is weathered, or if the material has a high moisture content, potential emissions will be greatly reduced. Other factors influencing fugitive dust emissions during loading and unloading include the frequency of the operation and the local meteorological conditions, including wind speed, humidity, precipitation, and temperature.

The removal of ore and surrounding waste rock involves drilling and blasting. A dust cloud is produced during blasting. Due to the nature of open pit mining, the dust cloud will partially be retained in the pit, although some portion of it will rise out into the local surroundings. However, it should be noted that the elevated levels of particulate matter will be limited in spatial extent and short lived, as the majority of the fugitive dust will settle within a short distance (contained within the pit). Also, based on field investigations to-date, only periodic blasting is expected to be required at the sites. LIM will be following an explosive management program which will consider both safety and environmental factors prior to blasting. Emission estimation methods for blasting operations are available, but not specifically for iron ore mining. As blasting activities at James and Redmond will be infrequent due to the nature of the deposits and the seasonal nature of the operation, estimates were not developed for either deposit.

5.4 Miscellaneous Emissions

5.4.1 Storage Tanks

Volatile organic compounds (VOCs) can be emitted to the atmosphere from storage tanks as a result of both standing and working losses. Standing (breathing) losses are mainly due to evaporation in the tanks and depend on physical tank properties as well as local meteorological conditions. Working losses can occur during filling and drawing of tank products. Emissions due to standing losses and working losses from storage tanks at the primary beneficiation area are not expected to be substantive as the contents will have relatively low vapour pressures (diesel and heavy oil) and were therefore not estimated for the purposes of this assessment.

5.5 Summary of Emissions Considered in Dispersion Modelling

Based on the emissions estimated developed for the sources at the LIM site, some sources were combined and included as volume sources in the CALPUFF model, while others were modelled as point sources. A list of the point sources modelled in this assessment is included in Table 5-8 and a list of volume sources is included in Table 5-9.

Table 5-8 Point Sources used in the CALPUFF Model

Stack ID	Stack Description	Contaminant	Emission Rate (g/s)	Stack Height above building (m)[1]	Release Height Above Ground (m)[1]	Stack Exit Temperature (K)[1]	Stack Exit Velocity (m/s)[1]	Stack Diameter (m)[1]
STCK1	Boiler stack	NO_X	2.1E-01	1	33.4	423	25	0.9
		CO	1.1E-01					
		PM	4.3E-02					
		SO_2	1.7E-01					
		PM_{10}	2.1E-02					
		$PM_{2.5}$	5.4E-03					
GEN1	Generator 1	NO_X	1.6E+00	1	6	423	25	0.2
		CO	7.0E-01					
		PM	8.9E-02					
		SO_2	4.1E-01					
		VOC	8.9E-02					
		PM_{10}	7.3E-02					
		$PM_{2.5}$	7.1E-02					

Table 5-8 Point Sources used in the CALPUFF Model

Stack ID	Stack Description	Contaminant	Emission Rate (g/s)	Stack Height above building (m)[1]	Release Height Above Ground (m)[1]	Stack Exit Temperature (K)[1]	Stack Exit Velocity (m/s)[1]	Stack Diameter (m)[1]
GEN2	Generator 2	NO_X	1.6E+00	1	6	423	25	0.2
		CO	7.0E-01					
		PM	8.9E-02					
		SO_2	4.1E-01					
		VOC	8.9E-02					
		PM_{10}	7.3E-02					
		$PM_{2.5}$	7.1E-02					
GEN3	Generator 3	NO_X	1.6E+00	1	6	423	25	0.2
		CO	7.0E-01					
		PM	8.9E-02					
		SO_2	4.1E-01					
		VOC	8.9E-02					
		PM_{10}	7.3E-02					
		$PM_{2.5}$	7.1E-02					
DC1	Dust Collector	PM	2.2E-01	1	33.4	AMB	10	0.5
		PM_{10}	8.7E-02					
		$PM_{2.5}$	1.7E-02					

Table 5-9 Volume Sources used in the CALPUFF Model

Source ID	Source Description	Contaminant	Emission Rate
SP4A	Sinter fine stockpile 1 of 4	PM	1.73E-02
		PM_{10}	8.67E-03
		$PM_{2.5}$	1.30E-03
SP4B	Sinter fine stockpile 2 of 4	PM	1.73E-02
		PM_{10}	8.67E-03
		$PM_{2.5}$	1.30E-03
SP4C	Sinter fine stockpile 3 of 4	PM	1.73E-02
		PM_{10}	8.67E-03
		$PM_{2.5}$	1.30E-03
SP4D	Sinter fine stockpile 4 of 4	PM	1.73E-02
		PM_{10}	8.67E-03
		$PM_{2.5}$	1.30E-03
SP3A	Lump ore stockpile 1 of 3	PM	3.47E-02
		PM_{10}	1.73E-02
		$PM_{2.5}$	2.60E-03
SP3B	Lump ore stockpile 2 of 3	PM	3.47E-02
		PM_{10}	1.73E-02
		$PM_{2.5}$	2.60E-03
SP3C	Lump ore stockpile 3 of 3	PM	3.47E-02
		PM_{10}	1.73E-02
		$PM_{2.5}$	2.60E-03

Table 5-9 Volume Sources used in the CALPUFF Model

Source ID	Source Description	Contaminant	Emission Rate
LD1	Ore loading - from raw stockpiles to mobile crusher	PM	4.08E-02
		PM_{10}	1.43E-02
		$PM_{2.5}$	2.16E-03
CR1	Mobile crusher	PM	7.23E-01
		PM_{10}	2.89E-01
		$PM_{2.5}$	5.79E-02
LD2	Ore loading - from crushed stockpiles to rail 1 of 5	PM	8.16E-03
		PM_{10}	2.86E-03
		$PM_{2.5}$	4.33E-04
LD3	Ore loading - from crushed stockpiles to rail 2 of 5	PM	8.16E-03
		PM_{10}	2.86E-03
		$PM_{2.5}$	4.33E-04
LD4	Ore loading - from crushed stockpiles to rail 3 of 5	PM	8.16E-03
		PM_{10}	2.86E-03
		$PM_{2.5}$	4.33E-04
LD5	Ore loading - from crushed stockpiles to rail 4 of 5	PM	8.16E-03
		PM_{10}	2.86E-03
		$PM_{2.5}$	4.33E-04
LD6	Ore loading - from crushed stockpiles to rail 5 of 5	PM	8.16E-03
		PM_{10}	2.86E-03
		$PM_{2.5}$	4.33E-04
CON1	Conveyor from crushing building to crushed stockpiles 1 of 5	PM	5.43E-02
		PM_{10}	2.17E-02
		$PM_{2.5}$	4.34E-03
CON2	Conveyor from crushing building to crushed stockpiles 2 of 5	PM	5.43E-02
		PM_{10}	2.17E-02
		$PM_{2.5}$	4.34E-03
CON3	Conveyor from crushing building to crushed stockpiles 3 of 5	PM	5.43E-02
		PM_{10}	2.17E-02
		$PM_{2.5}$	4.34E-03
CON4	Conveyor from crushing building to crushed stockpiles 4 of 5	PM	5.43E-02
		PM_{10}	2.17E-02
		$PM_{2.5}$	4.34E-03
CON5	Conveyor from crushing building to crushed stockpiles 5 of 5	PM	5.43E-02
		PM_{10}	2.17E-02
		$PM_{2.5}$	4.34E-03
CON6	Conveyor from mobile crusher to crushing building 1 of 5	PM	7.23E-02
		PM_{10}	2.89E-02
		$PM_{2.5}$	5.79E-03
CON7	Conveyor from mobile crusher to crushing building 2 of 5	PM	7.23E-02
		PM_{10}	2.89E-02
		$PM_{2.5}$	5.79E-03

Table 5-9 Volume Sources used in the CALPUFF Model

Source ID	Source Description	Contaminant	Emission Rate
CON8	Conveyor from mobile crusher to crushing building 3 of 5	PM	7.23E-02
		PM_{10}	2.89E-02
		$PM_{2.5}$	5.79E-03
CON9	Conveyor from mobile crusher to crushing building 4 of 5	PM	7.23E-02
		PM_{10}	2.89E-02
		$PM_{2.5}$	5.79E-03
CON10	Conveyor from mobile crusher to crushing building 5 of 5	PM	7.23E-02
		PM_{10}	2.89E-02
		$PM_{2.5}$	5.79E-03
LD7	Ore loading - from trucks to raw stockpiles	PM	4.08E-02
		PM_{10}	1.43E-02
		$PM_{2.5}$	2.16E-03
N/A	Road source - 64 volume sources	PM	1.47E-02
		PM_{10}	3.66E-03
		$PM_{2.5}$	3.66E-04

6.0 DISPERSION MODELLING METHODOLOGY

6.1 Introduction

The US EPA CALPUFF modelling system was used to predict maximum ground-level concentrations due to Project-related emissions. The core of this system consists of a meteorological model CALMET, and a transport and dispersion model CALPUFF.

The CALMET meteorological model is used to provide the meteorological data necessary to initialize the CALPUFF dispersion model. This model is initialized with terrain and land use data describing the region of interest, as well as meteorological input from potentially numerous sources. Various user-defined parameters control both how the input meteorological data is interpolated to the grid, as well as which internal algorithms are applied to these input fields. Output from the CALMET model includes hourly temperature and wind fields on a user-specified three-dimensional domain as well as additional two-dimensional variables used by the CALPUFF dispersion model.

CALPUFF is a non-steady-state Gaussian puff dispersion model capable of simulating the effects of time and space-varying meteorological conditions on pollutant transport, transformation, and removal. This model requires time-variant two- and three-dimensional meteorological data output from a model such as CALMET, as well as information regarding the relative location and nature of the sources to be modelled for the application. Output from the CALPUFF model includes ground-level concentrations of the species considered.

The following sections describe in detail the methodology used to conduct the dispersion modeling, including a summary of input data sources and data selected.

6.2 CALMET Meteorological Modelling

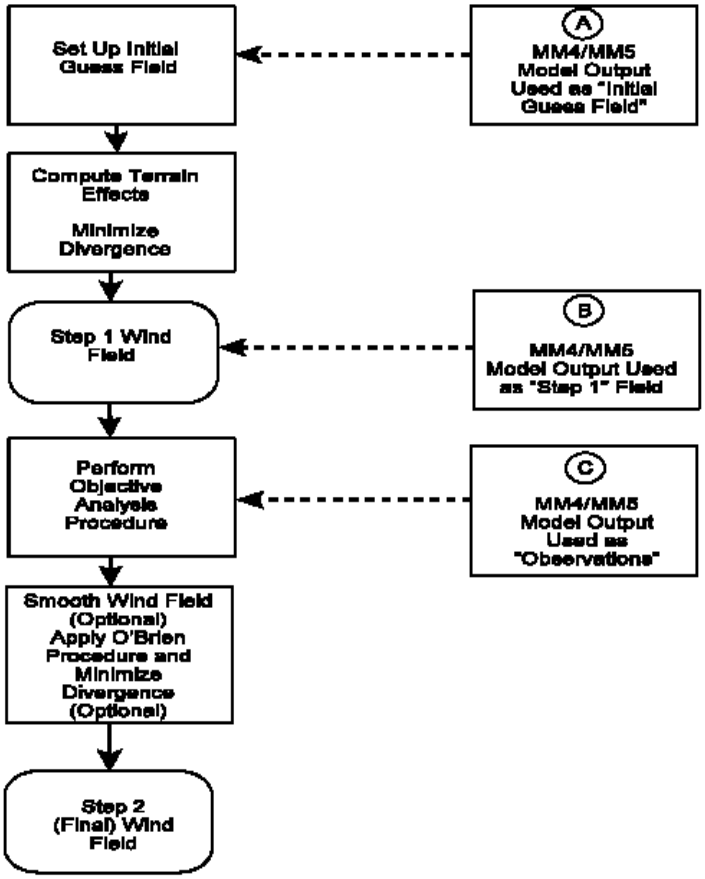
6.2.1 Model Description

The following description of the CALMET model's major model algorithms and options are all excerpts from the CALMET model's user manual (Scire et al. 2000a).

The CALMET meteorological model consists of a diagnostic wind field module and micrometeorological modules for overwater and overland boundary layers. The diagnostic wind field module uses a two-step approach to the computation of the wind fields (Douglas and Kessler 1988), as illustrated in Figure 6-1.

In the first step, an initial guess wind field is adjusted for kinematic effects of terrain, slope flows, and terrain blocking effects to produce a Step 1 wind field. The initial guess field is either a uniform field based on available observational data or the output from the NCAR/PSU Mesoscale Modelling System (MM4/MM5). The second step consists of an objective analysis procedure to introduce observational data into the Step 1 wind field to produce a final wind field. An option is provided to allow gridded prognostic wind fields to be used by CALMET, which may better represent regional flows and certain aspects of slope/valley circulations. Wind fields generated by the prognostic wind field module can be input to CALMET as either the initial guess field or the Step 1 wind field.

Figure 6-1 Flow Diagram of Diagnostic Wind Module in CALMET



Source: Scire et al. 2000a

6.2.1.1 Diagnostic Wind Field Module

Initial Guess Field

Options existing with CALMET to create an initial guess field either by interpolating observation data or by using output from a prognostic meteorological model, such as the NCAR/PSU Mesoscale Modelling System (MM4/MM5). The prognostic model data is usually run over a very large domain with much coarser resolution than that applied with CALMET. The advantage of using CALMET is that it can be used to interpolate the prognostic data to develop a 3-D fine scale first guess field of wind speeds and directions.

Step 1 Wind Field

The step one wind field is adjusted for kinematic effects of terrain, slope flows, and blocking effects as follows:

Kinematic Effects of Terrain: The approach of Liu and Yocke (1980) is used to evaluate kinematic terrain effects. The domain scale winds are used to compute a terrain forced vertical velocity, subject to an exponential, stability dependent decay function. The kinematic effects of terrain on the horizontal

wind components are evaluated by applying a divergence minimisation scheme to the initial guess wind field. The divergence minimisation scheme is applied iteratively until the three dimensional divergence is less than a threshold value.

Slope Flows: An empirical scheme based on Allwine and Whiteman (1985) is used to estimate the magnitude of slope flows in complex terrain. The slope flow is parameterised in terms of the terrain slope, terrain height, domain scale lapse rate, and time of day. The slope flow wind components are added to the wind field adjusted for kinematic effects.

Blocking Effects: The thermodynamic blocking effects of terrain on the wind flow are parameterised in terms of the local Froude number (Allwine and Whiteman 1985). If the Froude number at a particular grid point is less than a critical value and the wind has an uphill component, the wind direction is adjusted to be tangent to the terrain.

Step 2 Wind Field

The wind field resulting from the adjustments of the initial guess wind described above is the Step 1 wind field. The second step of the procedure involves the introduction of observational data into the Step 1 wind field through an objective analysis procedure. An inverse distance squared interpolation scheme is used which weighs observational data heavily in the vicinity of the observational station, while the Step 1 wind field dominates the interpolated wind field in regions with no observational data. The resulting wind field is subject to smoothing, an optional adjustment of vertical velocities based on the O'Brien (1970) method, and divergence minimisation to produce a final Step 2 wind field.

6.2.1.2 Micrometeorology Modules

The CALMET model contains two boundary layer models for application to overland and overwater grid cells:

Overland Boundary Layer Model: Over land surfaces, the energy balance method of Holtslag and van Ulden (1983) is used to compute hourly gridded fields of the sensible heat flux, surface friction velocity, Monin Obukhov length, and convective velocity scale. Mixing heights are determined from the computed hourly surface heat fluxes and observed temperature soundings using a modified Carson (1973) method based on Maul (1980). The model also determines gridded fields of PGT stability class and optional hourly precipitation rates.

Overwater Boundary Layer Model: The aerodynamic and thermal properties of water surfaces suggest that a different method is best suited for calculating the boundary layer parameters in the marine environment. A profile technique (Garratt 1977; Hanna et al. 1985), using air sea temperature differences, is used in CALMET to compute the micrometeorological parameters in the marine boundary layer.

6.2.2 Meteorological Modelling Domain

The CALMET meteorological domain adopted for this project is summarized below in Table 6-1. A map of the approximate area covered by the modelling domain is presented in Figure 2-1.

Table 6-1 Map Projections and Horizontal Grid Parameters

Parameter	Value
Map Projection	UTM
UTM Zone	19N
Datum	WGS-84
Number of Grid Cells (nx,ny)	60, 60
SW Corner (x,y)	623 km, 6,060 km
Grid Spacing	0.5 km

As discussed in Section 2, the meteorological domain was selected to cover the region surrounding the proposed beneficiation area and ore mines as well as nearby sensitive receptor locations. To adequately resolve the terrain and land use features of the region, a 0.5 km grid was chosen for the CALMET modelling.

Eight vertical levels were used to model the atmosphere up to a maximum cell face height of 3300 m above ground level. Cell mid-points were chosen at heights of 20, 50,100, 200, 500,1000, 2000, 3300 m above ground to allow for higher resolution in the layers nearest to the earth's surface than in the levels aloft.

6.2.3 Study Period

The Newfoundland and Labrador Guidance for Plume Dispersion Modelling (NL DEC 2006) requires a minimum period of three years to be considered when conducting dispersion modelling and no reliable source of on-site data is available. For this application, the CALMET meteorological model was run from January 1, 2002 to December 31, 2006. Five years of meteorological data were considered to depict a wide range of meteorological conditions and associated dispersive conditions.

6.2.4 Geophysical Input Data

To initialize the CALMET model, terrain elevation and land use data depicting the geophysical conditions in the selected modelling domain are required. Terrain elevation data is used in CALMET in various model algorithms to characterize meteorological phenomena such as up- and down-slope flows and the terrain-steering of winds. In addition to the terrain elevation data, the CALMET model utilizes surface parameters such as surface roughness length, albedo, Bowen ratio, leaf area index, soil heat flux, and anthropogenic heat flux to estimate meteorological parameters such as surface heat flux and mechanical turbulence. In the model's geophysical pre-processor MAKEGEO, values for each of these surface parameters are specified based on input land use categories.

6.2.4.1 Terrain Data

For the CALMET model grid considered in this study, terrain elevations were initialized with data from the Shuttle Radar Topography Mission (SRTM). This data, a preliminary product from a joint project between the US National Aeronautics and Space Administration (NASA) and the US National Geospatial-Intelligence Agency (NGA), is available at 3 arc-second (approximately 90 m) resolution for the continent of North America (USGS 2007). The SRTM data was processed by the CALPUFF pre-

processor TERREL over the domain of interest to approximate terrain elevations at 0.5 km resolution over the modeling domain.

After processing, the prepared terrain data was compared with local topography maps and satellite imagery to assure quality. The agreement between these data sets was found to be reasonable.

The terrain elevations used as input for CALMET (gridded at 500 m resolution) are shown in Figure 6-2. The proposed Labrador Iron Mines plant is located about 2.3 km southeast of Schefferville. The terrain in the immediate vicinity of the site location can be considered complex, with elevation in the CALMET domain range from approximately 500 to 620 meters above sea level (masl).

6.2.4.2 Land Use Data

Natural Resources Canada's Earth Observation for Sustainable Development of Forests (EOSD) dataset (NRC 2008), with a resolution of approximately 50 m, was used to estimate the dominant land use categories in the CALMET modelling. This high resolution dataset contains detailed information on forest crown closure and is an appropriate input for conducting dispersion modelling in rural/pristine environments. The land use data was rasterized (gridded) at 500 m resolution, exported to a text format, then mapped to the CALMET land use categories and converted into a fraction land use format accepted by the model. The final CALMET land use categories used as input to the model are shown at 500 m resolution in Figure 6-3.

A summary of the mapping from the EOSD land use categories to the CALMET (USGS) land use categories is provided in Table 2-3. All available EOSD land use categories were mapped to existing CALMET categories except for the „Coniferous Open' category (212), which was mapped to a mixed forest/tundra category based on consultation with the NL DOE (Lawrence 2008). The surface parameters defined for this user-specified land-use category as well as the default parameters specified for the CALMET land use categories are provided in Table 2-4.

As no Project operations are planned during the winter time (November – March), a winter land use scenario was not required for this application.

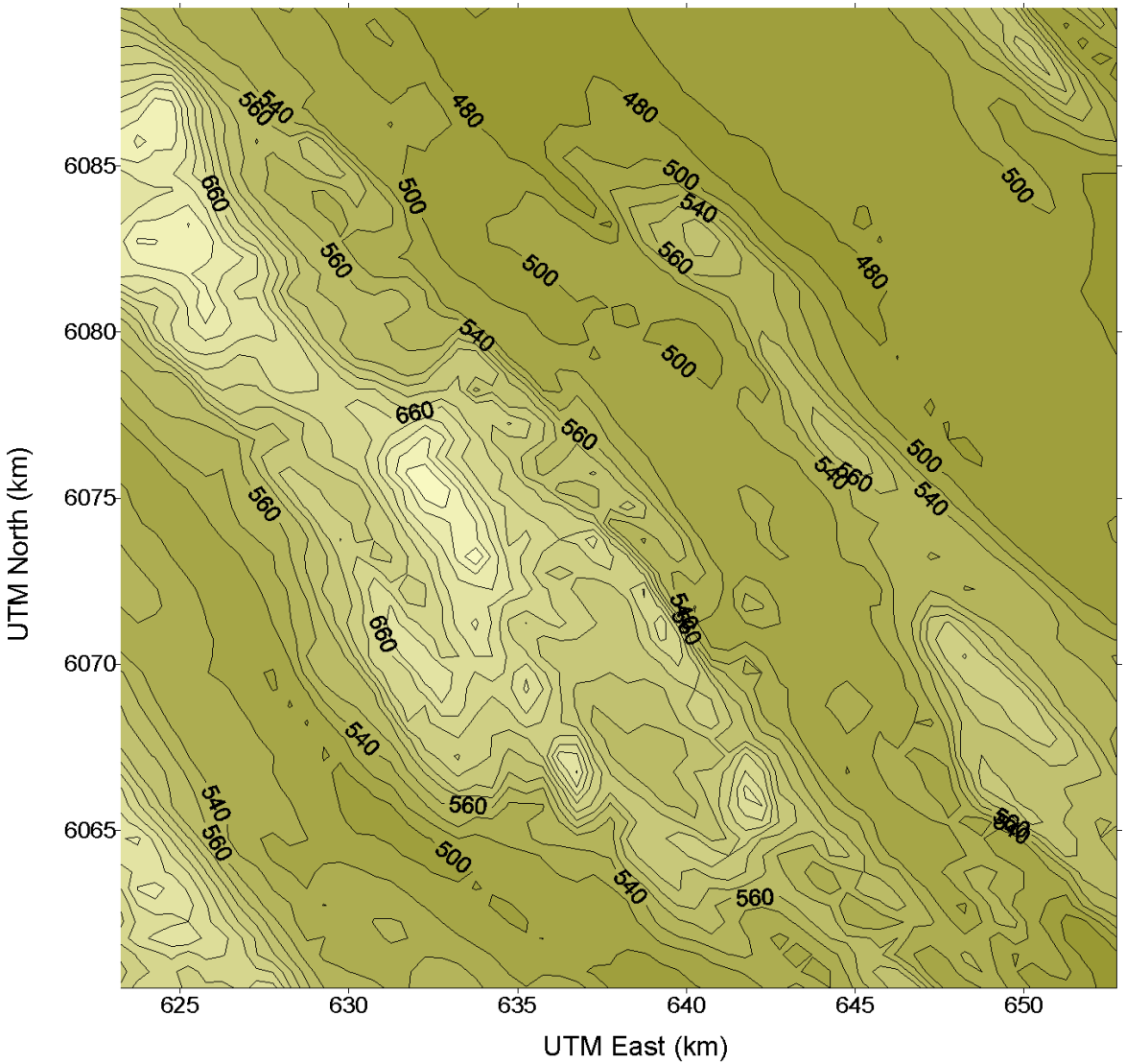


FIGURE 6-2

Terrain Elavations Over the Modeling Domain

Map Parameters
Projection: UTM
Datum: NAD 83
Zone: 19
Map Units: km
Date: 8/14/2009
Project: 1046156

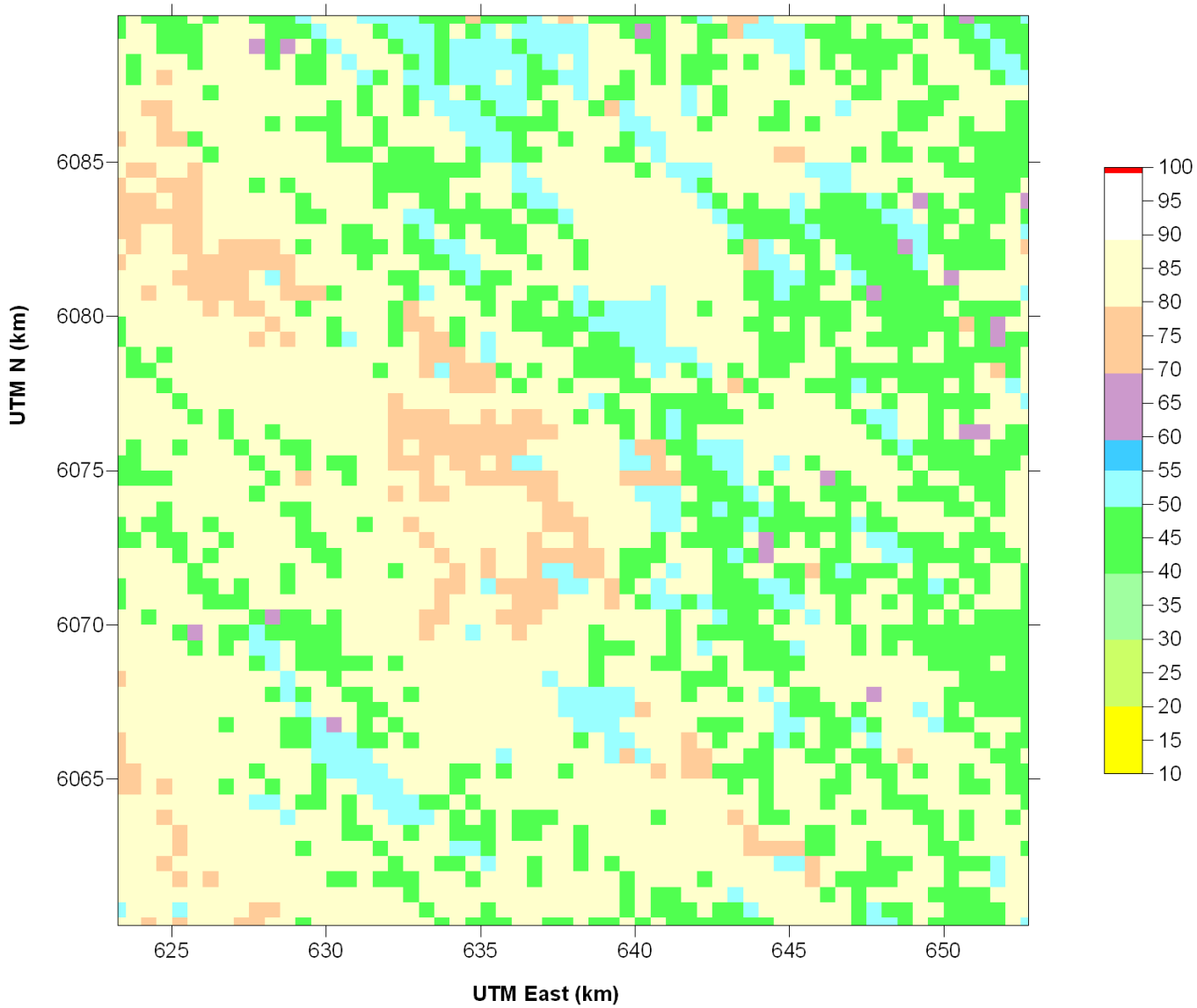


FIGURE 6-3

Dominant CALMET Land Use Categories over the Modeling Domain

Map Parameters
Projection: UTM
Datum: NAD 83
Zone: 19
Map Units: km
Date: 8/14/2009
Project: 1046156

Table 6-2 EOSD to CALMET Land Use Mapping

EOSD Land Cover Classification		CALMET (USGS) Land Use Classification	
Code	**Description**	**Code**	**Description**
20	Water: Lakes, reservoirs, rivers, streams, or salt water.	52	Lakes, streams
32	Rock/Rubble: Bedrock, rubble, talus, blockfield, rubbley mine spoils, or lava beds	77	Mixed barren land
33	Exposed Land: River sediments, exposed soils, pond or lake sediments, reservoir margins, beaches, landings, buildings and parking or other non-vegetated surfaces, burned areas, road surfaces, mudflat sediments, cutbanks, moraines, gravel pits, tailings, railway surfaces,	77	Mixed barren land
40	Bryoids: Bryophytes (mosses, liverworts, and hornworts) and lichen (foliose or fruticose; not crustose); minimum of 20% ground cover or one-third of total vegetation must be a bryophyte or lichen.	85	Mixed tundra
52	Shrub Low: At least 20% ground cover which is at least one-third shrub; average shrub height less than 2 m.	81	Shrub and brush tundra
82	Wetland-Shrub: Land with a water table near/at/above soil surface for enough time to promote wetland or aquatic processes; the majority of vegetation is tall, low, or a mixture of tall and low shrub.	61	Forested wetland
211	Coniferous Dense: Greater than 60% crown closure; coniferous trees are 75% or more of total basal area.	42	Evergreen forest land
212	Coniferous Open: 26-60% crown closure; coniferous trees are 75% or more of total basal area.	43	User Defined (redefined surface parameters to be 1/2 tundra and 1/2 forest)
213	Coniferous Sparse: 10-25% crown closure; coniferous trees are 75% or more of total basal area.	81	Shrub and brush tundra

Table 6-3 Surface Characteristics for CALMET Land Use Categories

Land Use Category	Input Category ID	z_0 (m)	Albedo	Bowen Ratio	Soil Heat Flux (W/m2)	Anthropogenic Heat Flux (W/m2)	Leaf Area Index	Category
Residential	11	0.5	0.18	1	0.2	0	1	10
Other Urban	12	1	0.18	1.5	0.25	0	0.2	10
	13	1	0.18	1.5	0.25	0	0.2	10
	14	1	0.18	1.5	0.25	0	0.2	10
	15	1	0.18	1.5	0.25	0	0.2	10
	16	1	0.18	1.5	0.25	0	0.2	10
	17	1	0.18	1.5	0.25	0	0.2	10
Agricultural	21	0.25	0.15	1	0.15	0	3	20
	22	0.25	0.15	1	0.15	0	3	20
	23	0.25	0.15	1	0.15	0	3	20
	24	0.25	0.15	1	0.15	0	3	20
Rangeland	31	0.05	0.25	1	0.15	0	0.5	30
	32	0.05	0.25	1	0.15	0	0.5	30
	33	0.05	0.25	1	0.15	0	0.5	30
Forestland – Deciduous	41	1	0.1	1	0.15	0	7	40
Forestland – Coniferous	42	1	0.1	1	0.15	0	7	40
User Defined: Mixed forest land (0.5 tundra, 0.5 forest)	43	0.6	0.2	0.75	0.15	0	7	40
Freshwater	51	0.001	0.1	0	1	0	0	51
	52	0.001	0.1	0	1	0	0	51
	53	0.001	0.1	0	1	0	0	51
Bays and Estuaries	54	0.001	0.1	0	1	0	0	54
Ocean and Sea	55	0.001	0.1	0	1	0	0	55
Wetland - Forested	61	1	0.1	0.5	0.25	0	2	61
Wetland - Non-forested	62	0.2	0.1	0.1	0.25	0	1	62
Barren land	71	0.05	0.3	1	0.15	0	0.05	70
	72	0.05	0.3	1	0.15	0	0.05	70
	73	0.05	0.3	1	0.15	0	0.05	70
	74	0.05	0.3	1	0.15	0	0.05	70
	75	0.05	0.3	1	0.15	0	0.05	70
	76	0.05	0.3	1	0.15	0	0.05	70
	77	0.05	0.3	1	0.15	0	0.05	70
Tundra	81	0.2	0.3	0.5	0.15	0	0	80
	82	0.2	0.3	0.5	0.15	0	0	80
	83	0.2	0.3	0.5	0.15	0	0	80
	84	0.2	0.3	0.5	0.15	0	0	80
	85	0.2	0.3	0.5	0.15	0	0	80
Perennial Snow/Ice	91	0.05	0.7	0.5	0.15	0	0	90
	92	0.05	0.7	0.5	0.15	0	0	90

6.2.5 Meteorological Input Data

The CALMET model requires the input of surface and upper air meteorological fields. For this application, CALMET was initialized with surface station information from two surface weather stations one upper-air station over the five year period (2002-2006).

6.2.5.1 Surface Station Input

Hourly observed surface meteorological data were obtained from Environment Canada (EC) and used to initialize CALMET. As shown in Table 6-4, two EC weather stations (Schefferville Airport and Wabush Airport) were used to initialize CALMET. As the Schefferville Airport is relatively close (approximately 3 km) from the primary beneficiation area, and as the dataset over the period is relatively complete, CALMET was initialized by the surface meteorological information the majority of the time. During periods with missing (or calm) data, wind information from Wabush Airport (more than 200 km away) was considered as input. Figure 6-4 below shows the location of the Shefferville Airport relative to Project activities.

Table 6-4 Input Surface Meteorological Stations

Station Name	Type	Easting (km)	Northing (km)	Elevation (masl)	Surface Input Data Used
Schefferville Airport	EC	640.284	6074.848	521.8	Temperature, Wind Speed & Direction, Cloud Cover & Ceiling Height, Station Pressure, Relative Humidity
Wabush Airport	EC	643.38	5866.985	551.1	Temperature, Wind Speed & Direction, Cloud Cover & Ceiling Height, Station Pressure, Relative Humidity

For all input surface station data, quality analysis of the data was performed. For periods with calm winds or missing data, the following protocols were followed:

1) For periods with winds below the threshold of the anemometer, wind directions and speeds were marked as missing. Wind speeds and directions during such periods were thus calculated within CALMET using data from other nearby surface stations.
2) No data fills were required for periods with missing hourly data or missing fields for non-missing records. This is because CALMET requires only one non-missing value for each mandatory input surface meteorological field. In other words, the required surface input data was available from at least one station for each hour of period of interest.

Wind direction and wind speed play an important role in determining the overall transport of airborne pollutants. The hourly surface winds (from 2002 to 2006) from the two weather stations used as input in the CALMET modelling are summarized in the wind rose plots shown in Figure 6-5 below. Wind roses are an efficient and convenient means of presenting wind data. The length of the radial barbs gives the total percent frequency of winds from the indicated direction, while portions of the barbs of different widths indicate the frequency of associated wind speed categories. Note that periods with calm winds cannot be included in these diagrams as such periods often do not have valid measurement for wind direction.

As can be seen in Figure 6-5, wind patterns in the study region can vary considerably due to differences in factors such as synoptic meteorology (large-scale weather trends), terrain, and local surface characteristics. The Schefferville Airport meteorological station, which is the surface station nearest to Project activities, shows a higher proportion of winds from the west, north west, and south. For the other surface meteorological station considered (Wabush Airport), the dominant wind directions are from the west and from the south.

The „Radius of Influence' parameters in CALMET allow the user to specify weightings which control the influence of the input surface winds when the observations are merged with the „Step 1 Wind Field' (see Section 6.1). If the radii of influence are set to higher numbers, winds will be more spatially homogeneous near input stations and more directly reflect the observed surface stations values. If the radii of influence are set to lower numbers, more weighting is given to the „Step 1 Wind Field' which has been treated in CALMET to consider terrain effects, smoothing, and divergence minimization. For this study, the radius of influence parameters were set to allow for the observational winds to have a stronger influence than the „Step 1 Wind Field' within a 2 km radius of the input station locations, and have no influence beyond a distance of 20 km.

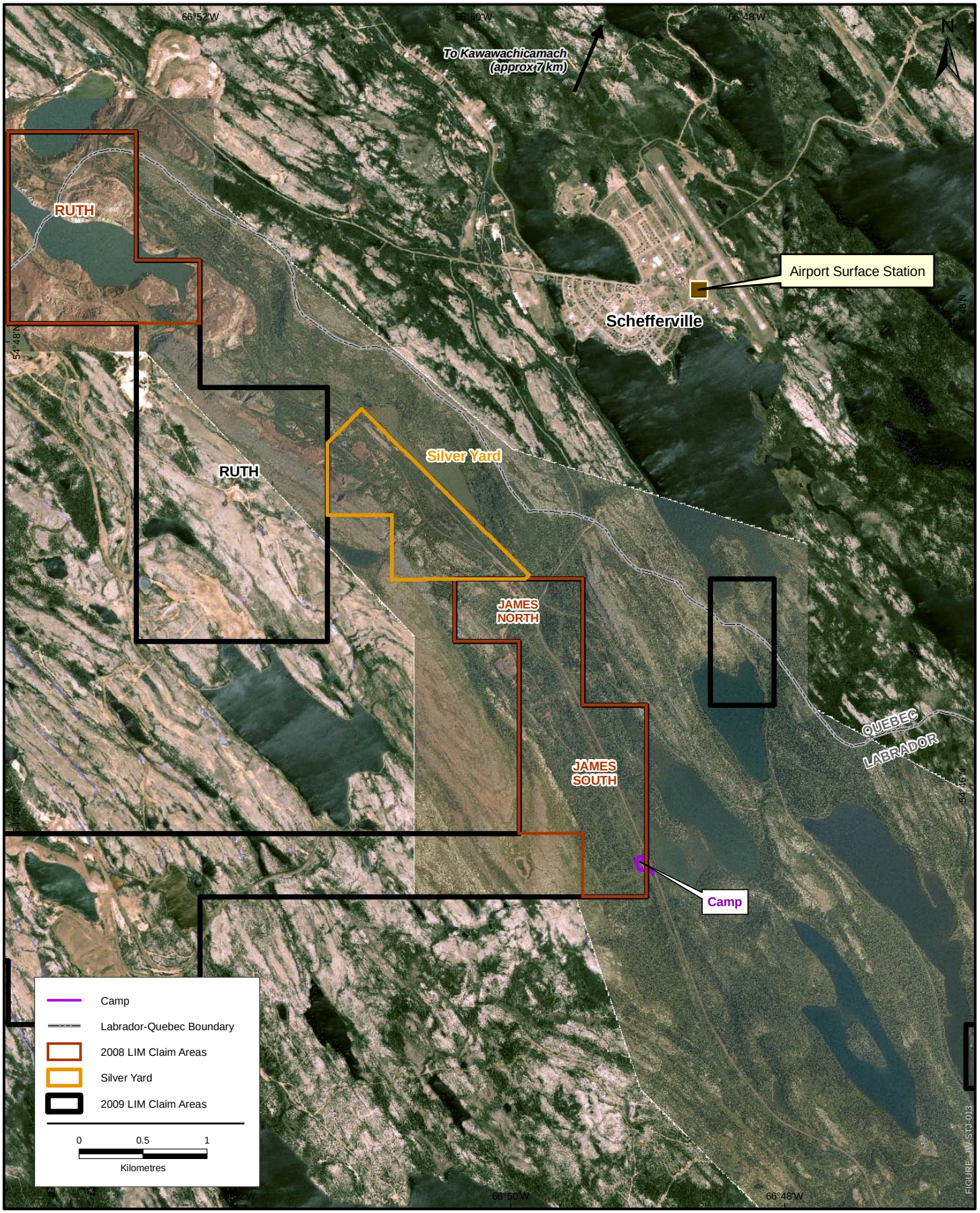
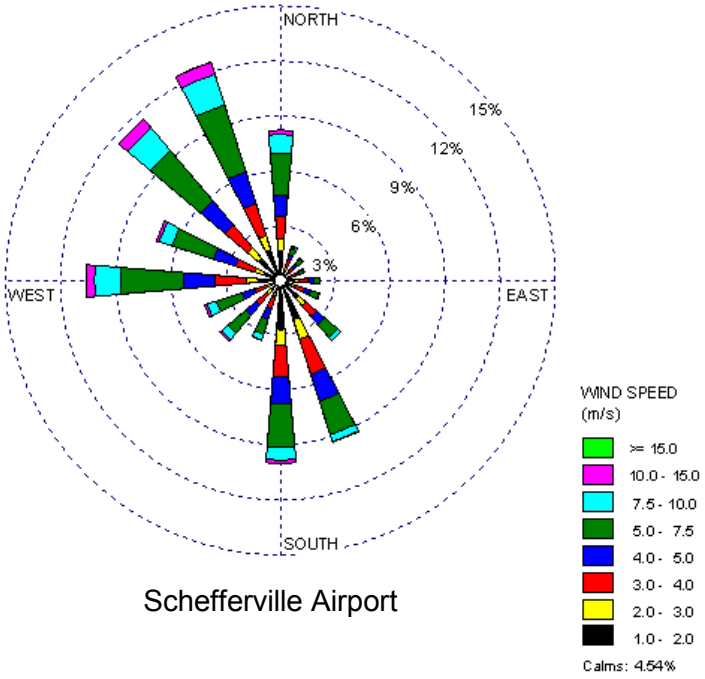
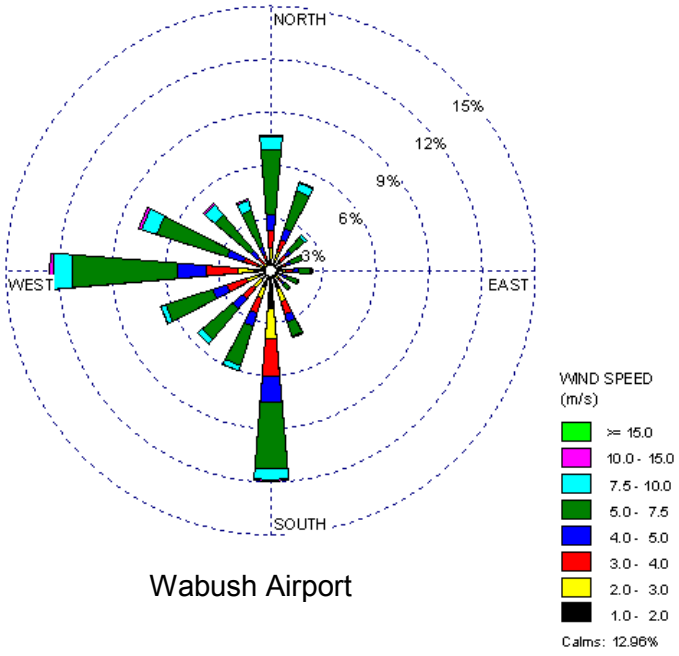


FIGURE NO:		DRAFT DATE:
6-4	**Airport Location**	18/12/2008
		REVISION DATE: 12/8/2009

Figure 6-5 Observed Winds at Input Surface Weather Stations (2002-2006)



Schefferville Airport



Wabush Airport

6.2.5.2 Upper Air Input

Twice-daily upper air sounding data from La Grande IV, located Western Labrador approximately 460 km west of the Project was used to initialize the upper air fields in CALMET. This station was selected based on guidance given in the NL DEC's Guidance for Plume Dispersion Modelling (NL DEC 2006). The model uses the upper level temperature and wind data to parameterize boundary layer parameters and determine upper level air flow. This data was downloaded from the NOAA ROAB Database and was prepared for use in CALMET with the model's READ62 pre-processor.

There were 78 missing soundings found in the period of interest (2002 to 2006) dataset and these were replaced by the sounding from the previous day for the same period (i.e., morning or evening). This was done as CALMET requires a complete upper air dataset to run. There were no extensive periods of missing data in the dataset with a maximum of three consecutive soundings found to be missing.

Sixteen missing surface-level data records in the sounding (i.e., FSL level „9') were replaced by data from the previous day for the same period.

The extrapolation of surface winds within CALMET allows for input surface station winds to also have influence in determining the flow patterns in the levels aloft. Along with choices concerning the method of computation for this extrapolation, the CALMET user is provided with an option to control, for each vertical level, the relative weighting of the extrapolated surface and upper-air values in the final interpolation. This model option is called the „BIAS' parameter.

For this application, the model-default method of extrapolation, using similarity theory and ignoring the influence of upper-air stations in the Level-1 wind field, was applied. A BIAS configuration was chosen to allow for surface wind input data to be more heavily weighted in the three lowest levels of the atmosphere (i.e., with no sounding station influence below 100 meters), but for upper air input wind data to be more heavily weighted in the levels further aloft (i.e., with no surface station influence above 500 meters). A CALMET input file with all parameterization options used for the modelling is proved in Attachment B.

6.2.6 Model Options

The most recent version of the CALMET model (Version 6.326, Level 080709) was used to predict the meteorological parameters required by the CALPUFF model. Model Options were selected based on the NL DEC's Guidance for Plume Dispersion Modelling (NL DEC 2006), consultation with the NL DEC, and guidance published by the U.S. Environmental Protection Agency (US EPA 1998). For model options with no NL DEC or U.S. EPA-recommended values, CALMET model default parameters were selected.

The CALMET input file, showing the values selected for this application, is provided in Attachment B.

6.2.7 CALMET Output

6.2.7.1 Wind Vector Diagrams

Surface wind vector plots provide an overview of how the wind fields predicted by CALMET vary across the modeling domain. The vector plots presented in this section were not selected to illustrate representative conditions, but rather to demonstrate how the CALMET-predicted winds can vary substantially across the domain for a given hour. In these diagrams, an arrow is shown to represent

the direction and velocity of the wind for each meteorological grid cell. The direction of the arrow indicates the direction that the wind is blowing towards and the relative length of the arrow indicates the magnitude of the wind speed.

In Figure 6-6, surface winds for a calm night-time hour on January 6th 2004 at 12:00 Eastern Standard Time (EST) are presented. Atmospheric conditions were relatively stable during this time with a maximum wind speed of about 6 m/s predicted within the modelling domain. The action of CALMET's Diagnostic Wind Module and the influences of terrain, as well as the influence of the Schefferville Airport station data are both apparent during this period. For example, uniform calm winds (smaller in magnitude) from the Schefferville Airport surface station can be distinguished from model-predicted winds at other locations in the study domain (more influenced by the CALMET terrain algorithms).

In Figure 6-7, a wind vector diagram of the surface layer over the CALMET domain for July 16th at 00:00 EST is presented. Atmospheric conditions in the boundary layer were relatively stable during this period and the maximum wind speeds is approximately 5 m/s across the modeling domain. Wind directions are more uniform during this hour than in Figure 6-6.

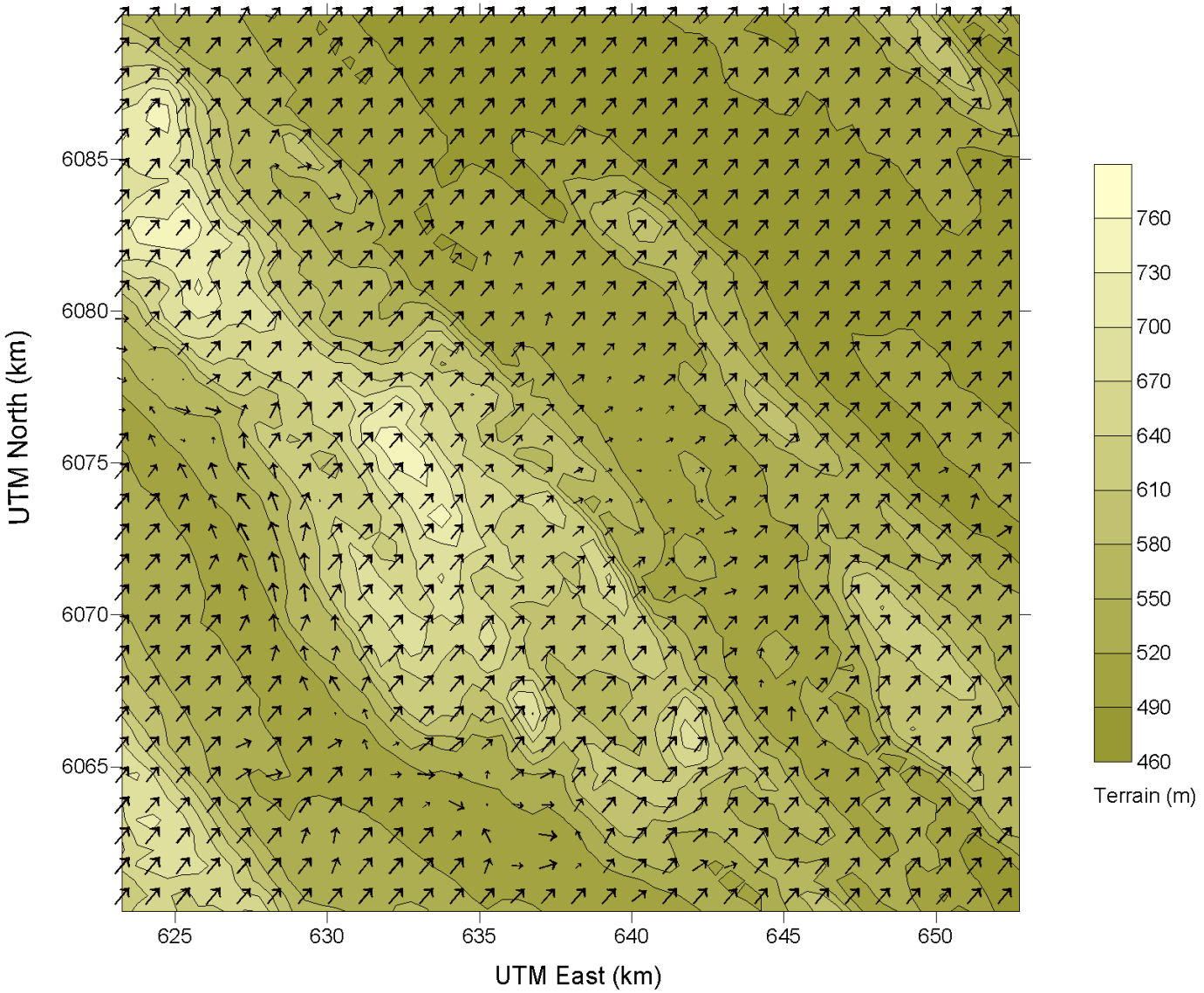


FIGURE 6-6

CALMET Level 1 (10 m) Winds: January 6th at 12:00 EST

Map Parameters
Projection: UTM
Datum: NAD 83
Zone: 19
Map Units: km
Date: 8/14/2009
Project: 1046156

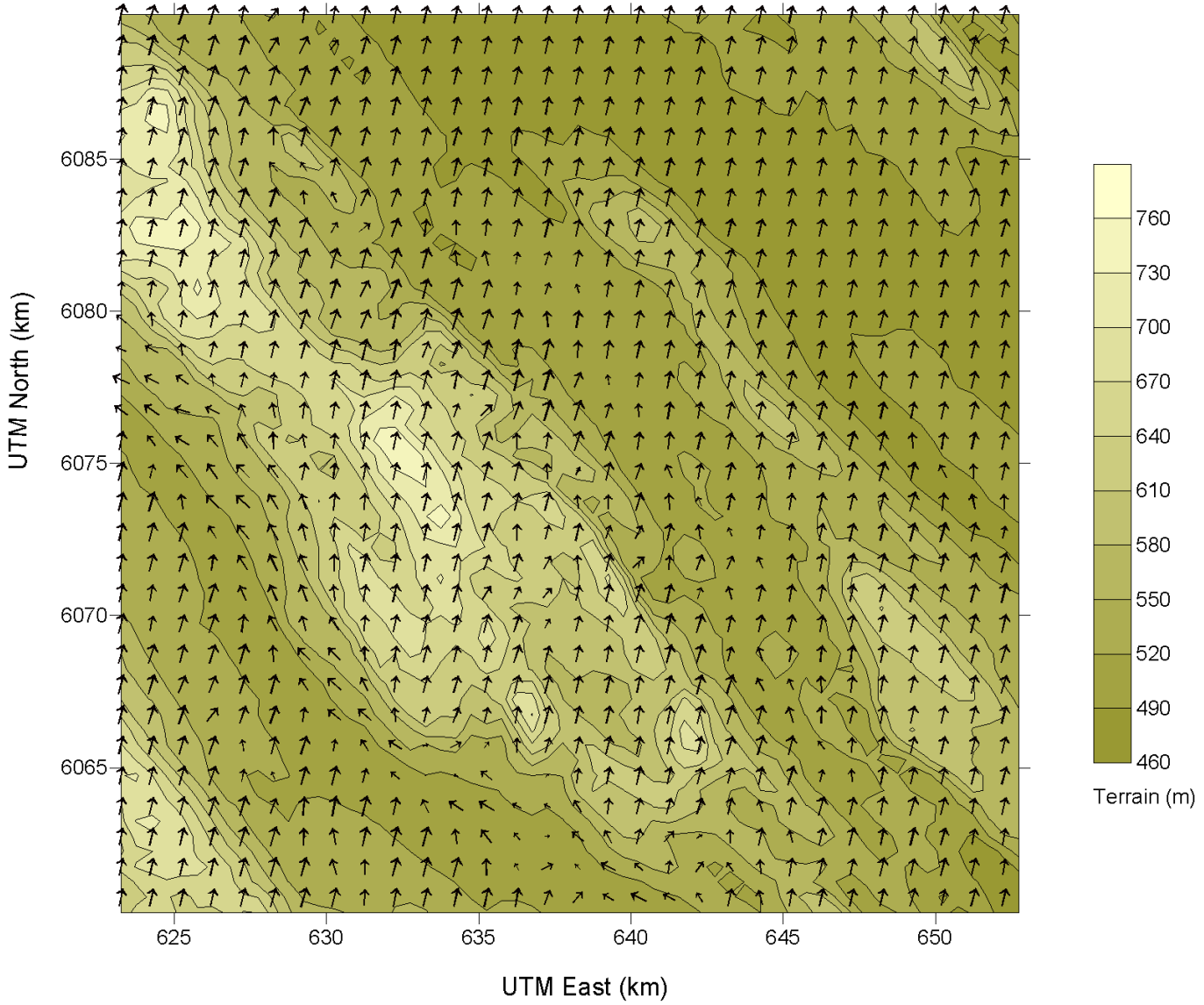


FIGURE 6-7

CALMET Level 1 (10 m) Winds: July 16th at 00:00 EST

Map Parameters
Projection: UTM
Datum: NAD 83
Zone: 19
Map Units: km
Date: 8/14/2009
Project: 1046156

6.2.7.2 Stability and Mixing Heights

Atmospheric turbulence near the earth's surface is often described in terms of atmospheric stability, which is governed by both thermal and mechanical factors. Atmospheric stability can be broadly classified as stable, neutral, or unstable.

Stable atmospheric conditions occur when vertical motion in the atmosphere is suppressed. With respect to air quality, this means pollutants emitted near ground-level are not well-dispersed and are believed to have a larger incremental effect on local ambient levels. This type of situation frequently occurs at night, when the earth's surface emits thermal radiation and cools. Air in contact with the ground thus becomes cooler and denser than the air aloft. This phenomenon is referred to as a ground-based temperature inversion and is often associated with poor air quality conditions.

Unstable atmospheric conditions are also highly dependent on radiation at the earth's surface, and most frequently occur during day-time hours. During such times, as short-wave energy from the sun heats the ground, air in contact with the ground becomes warmer and less dense than the air aloft. Subsequently, vertical motion in the atmosphere is enhanced and the atmosphere is said to be unstable.

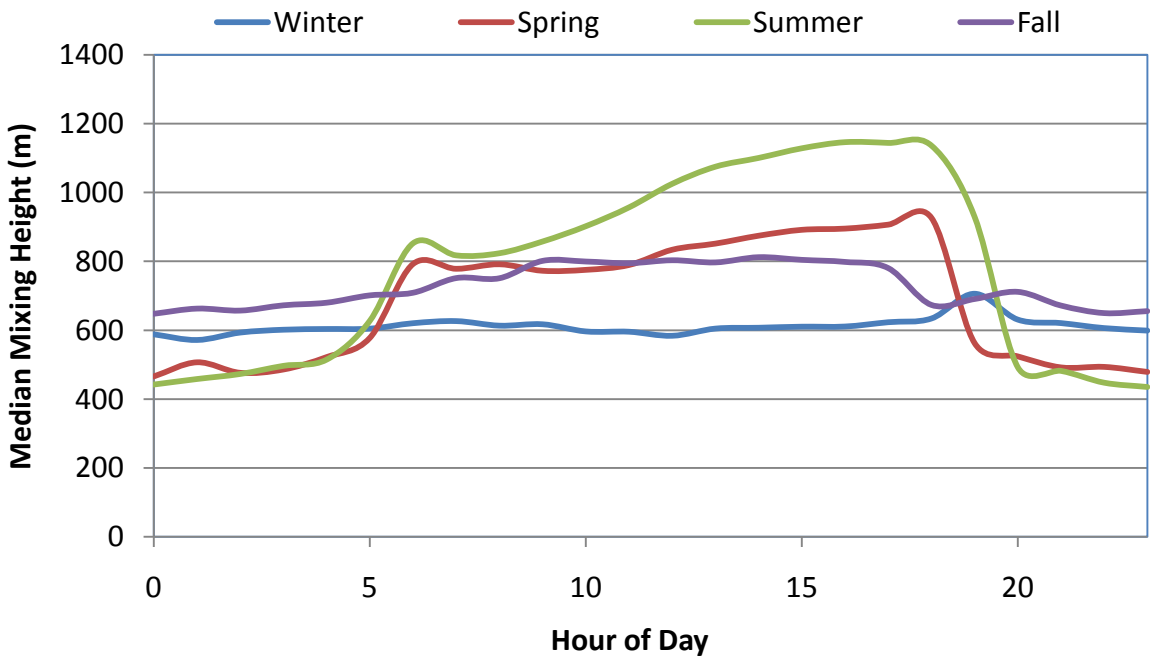
When a balance exists between incoming and outgoing radiation, there is no net heating or cooling of the air in contact with the ground, and vertical motions of the atmosphere are neither enhanced nor suppressed. Such an atmosphere is described as neutral and exists during overcast skies or during transition from unstable to stable conditions.

Mechanical mixing, which is mostly a function of lower level wind speeds (and surface roughness), can also influence atmospheric stability. Higher wind speeds (and a greater surface roughness) promote higher levels of turbulence in the region of discussion. This, in turn, leads to more mechanical mixing, which means that the atmosphere becomes more unstable. Mechanical mixing plays a more important role in determining stability when wind speeds are very high and at night, when convective vertical motion is suppressed.

The CALMET model calculates a maximum mixing height, as determined by either convective or mechanical forces. The convective mixing height is the height to which an air package will rise under the buoyant forces created by the heating of the earth's surface. The convective mixing height is dependent on solar radiation amount, wind speed, as well as the vertical temperature structure of the atmosphere. Mechanical mixing heights are, similarly, the height to which an air package will rise under the influence of mechanical-invoked turbulence. The mechanical mixing height is proportional to low-level wind speeds and surface roughness.

Diurnal variations of median mixing height, as estimated by the CALMET model at the grid cell nearest to the primary processing (beneficiation) area are shown for each season in Figure 6-8. Model mixing heights can vary from several meters to several thousand meters, depending on the intensity of solar radiation and wind speed. Daytime mixing heights are generally greater during the summer than during the winter due to different surface radiation budgets.

Figure 6-8 Median Diurnal Mixing Heights by Season near Beneficiation Area (2002-2006)



As shown in Figure 6-8, night time mixing heights are predicted to be slightly higher in winter under the influence of stronger winds associated with winter weather systems, which increase mechanical mixing heights in the model. In addition, due to the limited daylight and snow cover during the winter period, convective mixing is extremely limited and thus, mixing heights are primarily determined mechanically. On the other hand, during summer daytime hours when the effects of solar heating are greatest due to longer days, higher mixing heights are predicted due to convective motion. Conversely, the lowest mixing heights are predicted during summer nights due to losses of long-wave radiation.

6.3 CALPUFF Dispersion Modelling Methodology

As previously mentioned, the CALPUFF dispersion model was used to evaluate the potential changes in air quality due to the Project for all substantive emission sources.

The primary species considered in the dispersion modelling were NO_X (nitrogen oxides), SO_2 (sulphur dioxide), $PM_{2.5}$ (particulate matter less than 2.5 microns in diameter), PM_{10} (particulate matter less than 10 microns in diameter), TSP (total suspended particulate matter) and CO (carbon monoxide). For all modelled species, maximum ground-level concentrations (GLC) were calculated, then added to estimated ambient background concentrations to predict the cumulative changes in air quality due to Project-related emissions.

6.3.1 CALPUFF Model Description

The following description of the CALPUFF model's major model algorithms and options are all excerpts from the CALPUFF model's user manual (Scire et al. 2000b).

The CALPUFF model is a non-steady-state Gaussian puff dispersion model which incorporates simple chemical transformation mechanisms, wet and dry deposition, complex terrain algorithms and building downwash. The CALPUFF model is suitable for estimating ground level air quality concentrations on both local and regional scales, from tens of meters to hundreds of kilometres. It can accommodate arbitrarily varying point sources and gridded area source emissions. Most of the algorithms contain options to treat the physical processes at different levels of detail depending on the model application.

The major features and options of the CALPUFF model are summarized are briefly described below:

- Chemical Transformation: CALPUFF includes options for parameterizing chemical transformation effects using the five species scheme (SO_2, SO, NO_x, HNO_3, and NO) employed in the MESOPUFF II model, the six species RIVAD/ARM3 scheme, or a set of user-specified, diurnally-varying transformation rates.
- Subgrid Scale Complex Terrain: The complex terrain module in CALPUFF is based on the approach used in the Complex Terrain Dispersion Model (CTDMPLUS) (Perry et al. 1989). Plume impingement on subgrid scale hills is evaluated using a dividing streamline (H_d) to determine which pollutant material is deflected around the sides of a hill (below H_d) and which material is advected over the hill (above H_d). Individual puffs are split into up to three sections for these calculations.
- Puff Sampling Functions: A set of accurate and computationally efficient puff sampling routines are included in CALPUFF which solve many of the computational difficulties with applying a puff model to near-field releases. For near-field applications during rapidly varying meteorological conditions, an elongated puff (slug) sampling function can be used. An integrated puff approached is used during less demanding conditions. Both techniques reproduce continuous plume results exactly under the appropriate steady state conditions.
- Wind Shear Effects: CALPUFF contains an optional puff splitting algorithm that allows vertical wind shear effects across individual puffs to be simulated. Differential rates of dispersion and transport occur on the puffs generated from the original puff, which under some conditions can substantially increase the effective rate of horizontal growth of the plume.
- Building Downwash: The Huber-Snyder and Schulman-Scire downwash models are both incorporated into CALPUFF. An option is provided to use either model for all stacks, or make the choice on a stack-by-stack and wind sector-by-wind sector basis. Both algorithms have been implemented in such a way as to allow the use of wind direction specific building dimensions.
- Overwater and Coastal Interaction Effects: Because the CALMET meteorological model contains overwater and overland boundary layer algorithms, the effects of water bodies on plume transport, dispersion, and deposition can be simulated with CALPUFF. The puff formulation of CALPUFF is designed to handle spatial changes in meteorological and dispersion conditions, including the abrupt changes that occur at the coastline of a major body of water.
- Dispersion Coefficients: Several options are provided in CALPUFF for the computation of dispersion coefficients, including the use of turbulence measurements (σv and σw), the use of similarity theory to estimate σv and σw from modelled surface heat and momentum fluxes, or the use of Pasquill-Gifford (PG) or McElroy-Pooler (MP) dispersion coefficients, or dispersion equations based on the Complex Terrain Dispersion Model (CTDM). Options are provided to apply an averaging time correction or surface roughness length adjustment to the PG coefficients.

- Dry Deposition: A full resistance model is provided in CALPUFF for the computation of dry deposition rates of gases and particulate matter as a function of geophysical parameters, meteorological conditions, and pollutant species. Options are provided to allow user-specified, diurnally varying deposition velocities to be used for one or more pollutants instead of the resistance model (e.g., for sensitivity testing) or to by-pass the dry deposition model completely.
- Wet Deposition: An empirical scavenging coefficient approach is used in CALPUFF to compute the depletion and wet deposition fluxes due to precipitation scavenging. The scavenging coefficients are specified as a function of the pollutant and precipitation type (i.e., frozen vs. liquid precipitation).

6.3.2 Model Initialization

6.3.2.1 Computational Domain

The CALPUFF computational domain is the area in which the transport and dispersion of puffs are considered for the calculation of ground level concentrations. For this application, dispersion modelling was conducted using CALPUFF over a computational domain equal to the CALMET meteorological grid as defined in Section 6.2 of this report. A graphical representation of the modelling domain relative to the beneficiation and mine locations is shown in Figure 2-1.

6.3.2.2 Meteorological Data

Meteorological data such as mixing heights, stability and winds determine the transport and dispersion of pollutants within the CALPUFF model. To account for puff behaviour (plume dispersion) under a variety of meteorological conditions, five years of meteorological data (2002 to 2006) was considered in this application. Hourly three-dimensional meteorological data were prepared using the CALMET model (as described in Section 6.2) and used to drive the dispersion in CALPUFF.

6.3.2.3 Emission Rates and Stack Parameters

As previously mentioned, the CALPUFF model was used to predict maximum GLC due to all substantive Project-related emission sources. A summary of Project-related emissions, including the source characteristics and emission rates used as input to CALPUFF is provided in Section 5 of this report.

6.3.2.4 Building Downwash Effects

For stacks located in the wake region of buildings, enhanced plume dispersion due to turbulent wake and reduced plume rise caused by a combination of descending streamlines in the lee of the building and increased entrainment in the wake may occur. Building wake effects are generally expected to affect a stack if:

1) The stack is located a distance less than 5 times the greater of the building height or width from the building; and,
2) The height of the stack is less than 1.5 times the building height

The point sources in the beneficiation area range from about 5 m (diesel generators) to 33 boiler and dust collection system stacks on top of the primary crusher building). As the primary crusher building is approximately 32 m tall, and as the diesel generators are located within 10 m of the building, during certain meteorological conditions emissions from all of sources may be mixed rapidly down to ground level due to the influence of building downwash.

The U.S. EPA Building Profile Input Program (BPIP) Model (US EPA 1995) was used to estimate downwash effects based on the stack/building configuration presented in Section 5. CALPUFF uses the output from the BPIP model to account for the potential influence of building downwash in determining plume dispersion during certain meteorological conditions. The BPIP input and output files for this application are provided in Attachment C.

CALPUFF has two model options for downwash calculations (Scire et al. 2000b): the ISC downwash method, and the newer PRIME algorithm. The PRIME method was chosen because it is more up-to-date and recommended for most regulatory applications.

6.3.2.5 Receptor Grids

A series of nested Cartesian receptor grids surrounding the beneficiation area were selected following the NL DEC's Guidance for Plume Dispersion Modelling (NL DEC 2006). Terrain heights were calculated at each receptor point based on the previously-mentioned SRTM data (USGS 2007) to predict maximum concentrations at various points within the study domain. The primary purpose of these receptor grids are to predict maximum off-site GLC and depict the variance in predicted concentrations in the study area (isocontour plots). As shown in Figure 6-9, the density of the receptor grid decreases with distance from the Beneficiation Area as fewer receptor points are required to capture the local maxima.

In addition, maximum GLC were predicted at discrete sensitive receptors representing nearby cabins (including the worker's camp), residences, and recreational areas. Figure 6-10 shows the locations of the sensitive receptors relative to the area where Project activities will occur.

6.3.2.6 Terrain Effects

During the dispersion of a plume emitted from a given source, the impingement of the plume on nearby regions with elevated terrain can cause higher concentrations in dispersion models than would occur in regions of simple terrain.

In CALPUFF the effects of terrain between the source and receptor are accounted for in the dispersing plume (*i.e.*, the plume has a "memory" of the terrain that affected it between the source and receptor). To account for the possible distortion of the plume trajectory over elevated terrain, the CALPUFF model's Partial Plume Path Adjustment Method (PPPAM) was used to modify the height of the plume.

The PPPAM employs a plume path coefficient (PPC) to adjust the height of the plume above the ground. Default PPC values of 0.5, 0.5, 0.5, 0.5, 0.35, and 0.35 for Pasquill-Gifford (PG) stability classes A, B, C, D, E, and F, respectively are recommended by the CALPUFF authors and were used in this study.

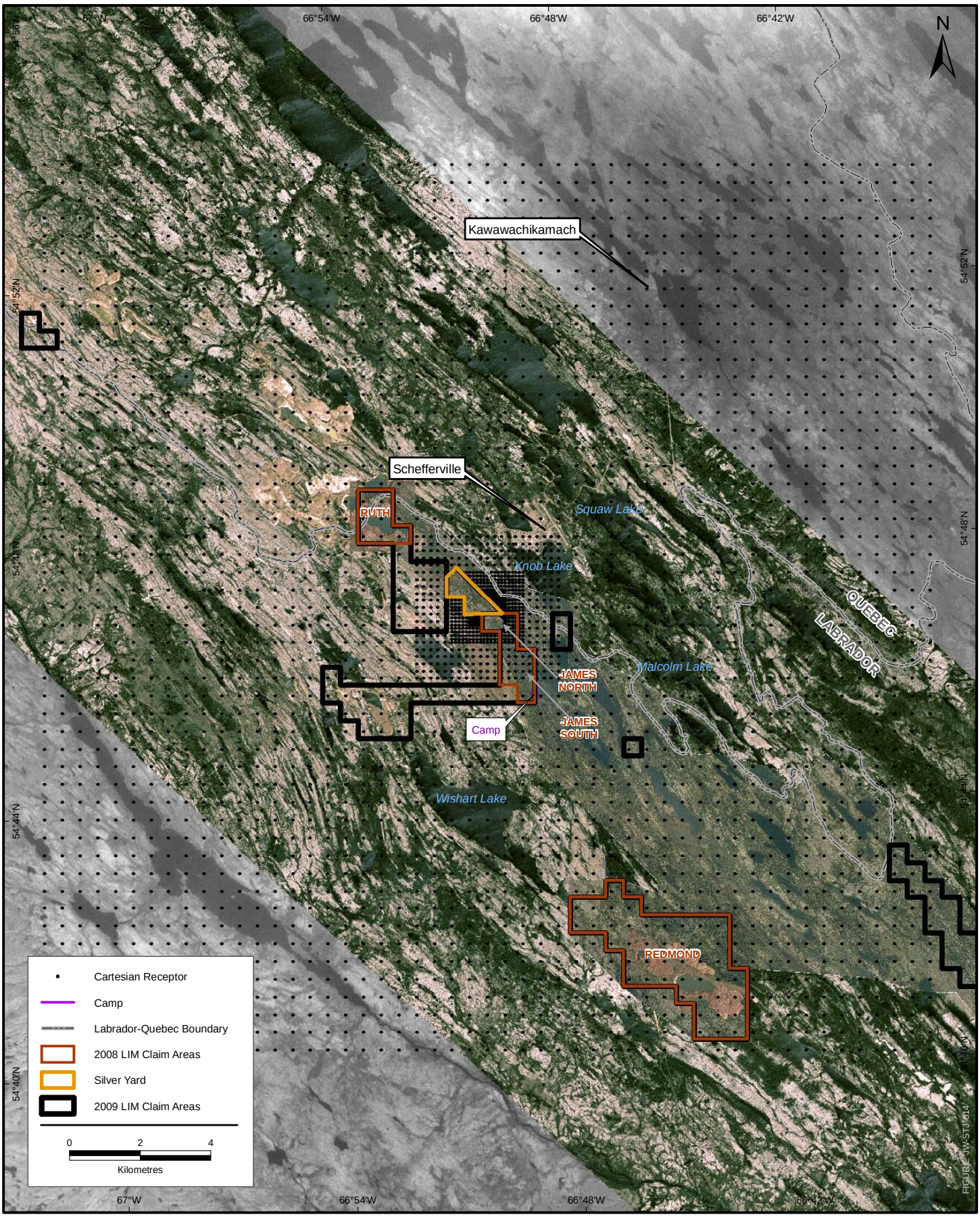


FIGURE NO:	Air Quality Nested Cartesian Receptor Grids	DRAFT DATE: 18/12/2008 REVISION DATE: 12/8/2009
6-9		

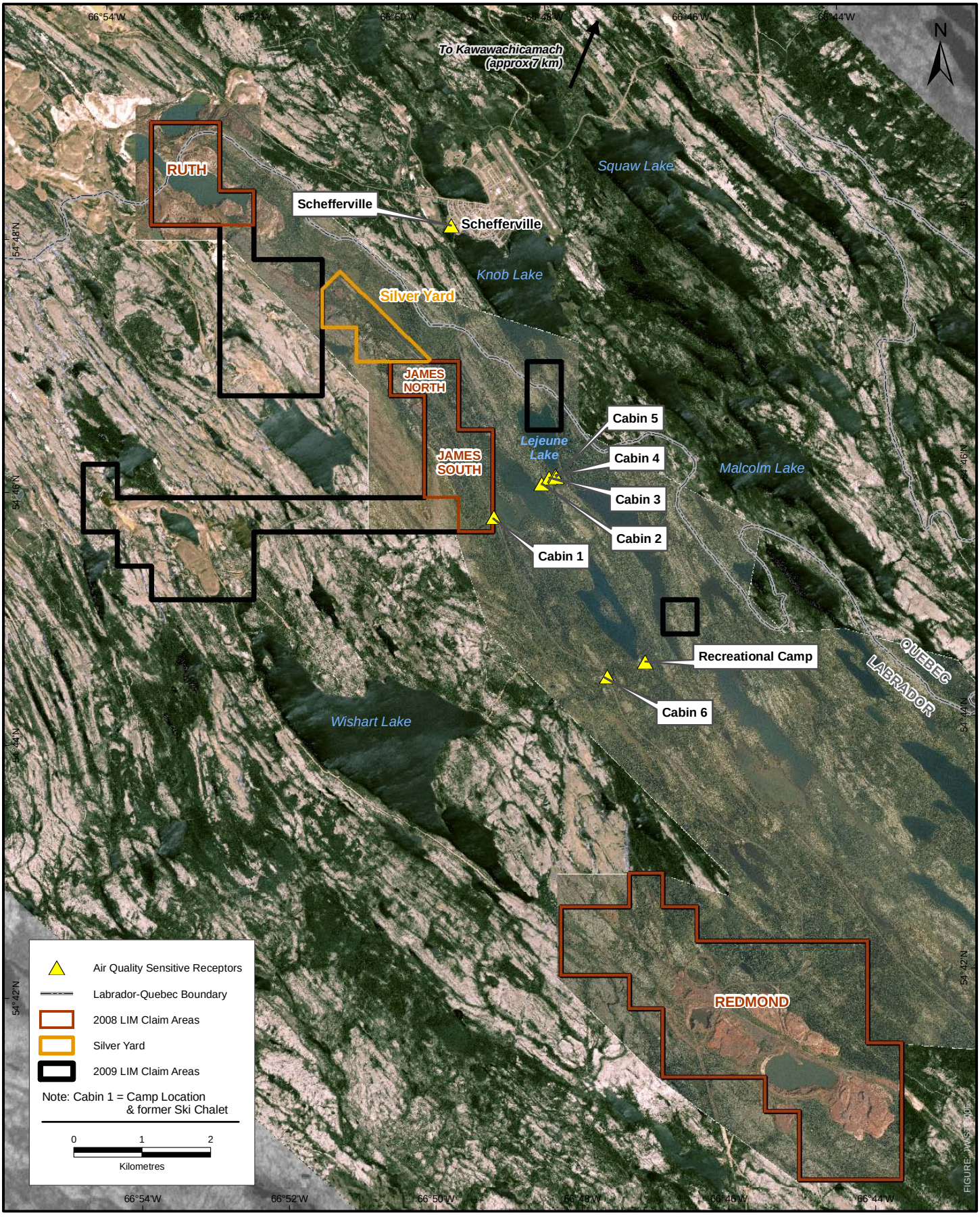


FIGURE NO:		DRAFT DATE:
6-10	**Sensitive Receptors**	18/12/2008
		REVISION DATE: 12/8/2009

6.3.2.7 Dispersion Coefficients

A fundamental parameter controlling plume dispersion in a Gaussian model such as CALPUFF are the dispersion coefficients. These values, which must be specified for both the horizontal as well as the vertical directions in the model, can be computed using several different methods in CALPUFF. The two U.S. EPA-approved methods are:

- From internally calculated turbulence values using micrometeorological variables (MDISP=2; MPDF=1)
- By using the PG dispersion coefficients for RURAL areas and the MP coefficients for urban areas (MDISP=1,MPDF=0)

The first method is similar to that used in the AERMOD regulatory dispersion model, while the second is similar to that used in the now-outdated ISC dispersion model. The first method was chosen for this assessment. This is consistent with the guidance provided in the NL DEC's Guidance for Plume Dispersion Modelling (NL DEC 2006).

6.3.2.8 Particulate Deposition Parameters

The consideration of deposition in dispersion models such as CALPUFF allows for contaminant mass to be depleted from the transporting plume. For emissions of particulate matter from low-lying fugitive sources (*i.e.* roads, loading/unloading), a substantive portion of the resultant plume will remain in lowest 1-2 meters above ground level and settle within a few hundred meters of the source (see for example, DRI 1999).

To account for plume depletion due to settling/deposition of particulate matter (TSP, PM_{10}, $PM_{2.5}$), emitted particles were divided into three size classes, as defined in Table 6-5 below. The deposition parameters shown in Table 6-5 were chosen based on guidance from the NL DOE (Lawrence 2008).

Table 6-5 Particle Size Class Definitions and Deposition Parameters

Particle Size Class ID	Definition	Geometric Mass Mean Diameter (μ)	Geometric Standard Deviation (μ)	Number of Particle Intervals ((μ)
P1	P1 < 2.5(μ)	1.25	1.24	5
P2	2.5 < P2 < 10(μ)	5	1.24	5
P3	P3 > 10(μ)	20	1.24	5

Emission rates were calculated for each particle size class in Table 6-5 based on the estimates for TSP, PM_{10}, and $PM_{2.5}$ provided in Section 5. Each size class was then modelled with dry deposition/plume depletion to predict maximum GLC of P1, P2, and P3. The maximum predicted TSP/PM_{10}/$PM_{2.5}$ ground-level concentrations could then calculated from the intermediate species by summing the relevant size fractions as follows:

- $PM_{2.5}$ = P1;
- PM_{10} = P1 + P2; and,
- TSP = P1 + P2 + P3.

6.3.3 Model Options Selected

The CALPUFF dispersion model (Version 6.262 - Level 080725) was used for all dispersion modelling conducted in this study. Model Options were selected based on the NL DEC's Guidance for Plume Dispersion Modelling (NL DEC 2006), consultation with the NL DEC, and guidance published by the U.S. Environmental Protection Agency (US EPA 1998). For model options with no NL DEC or U.S. EPA-recommended values, CALPUFF model default parameters were selected.

A sample CALPUFF input file, showing the model options selected for this study, is provided in Attachment D. Note that the parameterization provided in this sample file represents a specific emissions scenario used to model specific air contaminants over a particular receptor grid (point source emissions; NO_X, SO_2, CO; nested Cartesian receptor grid). Therefore, case-specific model parameters (*i.e.*, the number of sources modelled, numbers of receptors, species considered, deposition options) would have different values for different model runs.

6.3.4 CALPUFF Post-processing

6.3.4.1 NOx to NO2 Conversion

When initially released from a combustion source into the atmosphere, NO_X is typically comprised of about 5 to 10% NO_2, with the remaining 90 to 95% in the form of NO. However, as a plume travels downwind, the majority of the released NO will convert to NO_2. Different methods are provided by regulatory authorities to account for the fraction of NO_X which will be present as NO_2 for the purposes of modelling assessments. The most conservative assumption to address the NO to NO_2 conversion is to assume that 100% of the NO emitted is immediately converted to NO_2. Another very widely used assumption to account for this conversion is the ozone limiting method (OLM).

Based on consultation with the NL DOE (Lawrence 2008), the OLM was selected to estimate ground-level concentrations of NO_2 from the maximum predicted NO_X in this study. The equations used to predict the maximum NO_2 GLC were the ones provided by the NL DEC for emissions from diesel generators (this is the most significant Project-related source of NO_X):

$$[NO2]_{hourly} = \{0.2 \times [NO_X]_{(predicted)}\} + \text{Minimum of } \{0.8 \times (NO_X]_{(predicted)}, [O_3]\}$$

$$[NO2]_{daily} = \{0.2 \times [NO_X]_{(predicted)}\} + \text{Minimum of } \{0.8 \times [NO_X]_{(predicted)}, [O_3]\}$$

$$[NO2]_{annual} = \{0.2 \times [NO_X]_{(predicted)}\} + \text{Minimum of } \{0.8 \times [NO_X]_{(predicted)}, [O_3]\}$$

where:

$[NO_X]_{(predicted)}$ is the model predicted concentration value in $\mu g/m^3$ for the given time frame

$[NO_2]_{(hourly)}$ is the predicted NO_2 concentration on an hourly basis in $\mu g/m^3$

$[NO_2]_{(daily)}$ is the predicted NO_2 concentration on an daily basis in $\mu g/m^3$

$[NO_2]_{(annual)}$ is the predicted NO_2 concentration on an annual basis in $\mu g/m^3$

and $[O_3]$ is the estimated background O_3 concentration in $\mu g/m^3$ as follows:

Hourly = 65 $\mu g/m^3$, Daily = 60 $\mu g/m^3$, Annual = 35 $\mu g/m^3$

The ozone concentrations used in the equations above are based on ambient monitored values at Goose Bay and were recommended by the NL DEC (Lawrence 2008).

7.0 DISPERSION MODELLING RESULTS

The CALPUFF dispersion model was used to predict maximum ground-level concentrations due to substantive Project-related emission sources during operation. As previously mentioned, emissions occurring during the construction phase are expected to be substantially less than those occurring during operation and were not modelled.

A summary of the dispersion modelling results is presented in Table 7.1. Modelling was conducted over all pertinent averaging periods for CO, SO_2, NO_2, $PM_{2.5}$, PM_{10}, and TSP. Estimated background concentrations, provided by the NL DEC (Lawrence, 2008), were added to the model-predicted values and compared to the NL regulatory standards. Refer to Section 4 for more information concerning the estimated background concentrations used in this assessment.

Overall, ground-level concentrations (GLC) were predicted to be below the regulatory standards most of the time for most averaging periods. However, 1-hour NO_2 and the 24-hour PM, PM_{10}, $PM_{2.5}$ concentrations are predicted to exceed the regulatory standard at locations near the beneficiation area property line during certain meteorological conditions. In general, the highest concentrations were predicted to occur along the northeast property boundary. A detailed description of the dispersion modelling predictions is provided for each contaminant in the following sub-sections.

Table 7-1 Summary of Maximum Predicted Ground-Level Concentrations

Air Contaminant	Averaging Period	Regulatory Standard (µg/m3)	Estimated Background Concentration (µg/m3)	Maximum Predicted Concentration (µg/m3)	Maximum Predicted Concentration with Background (µg/m3)	Percent of Standard (%)
NO_2	1 hr	400	3.8	**405**	**409**	**102%**
	24 hr	200	3.8	185	189	95%
	Annual	100	3.8	38	42	42%
SO_2	1 hr	900	5	436	441	49%
	3 hr	600	5	338	343	57%
	24 hr	300	5	161	166	55%
	Annual	60	5	10	15	25%
TSP	1 hr	-	15	705	720	n/a
	24 hr	120	15	**204**	**219**	**182%**
	Annual	60	15	15	30	49%
PM_{10}	1 hr	-	10	348	358	n/a
	24 hr	50	10	**93**	**103**	**207%**
$PM_{2.5}$	1 hr	-	5	112	117	n/a
	24 hr	25	5	**32**	**37**	**149%**
CO	1 hr	35,000	114	745	859	2%
	8 hr	15,000	114	392	506	3%

Bold Indicates an exceedance of a regulatory standard

7.1 Sulphur Dioxide (SO_2)

A summary of the maximum predicted ground-level SO_2 concentrations, including background, is presented for the 1-hour, 3-hour, 24-hour and annual averaging periods in Table 7.1. There are no predicted exceedances of the NL regulatory standard for any of the averaging periods considered.

Plots of the maximum predicted ground-level SO_2 concentrations, including background, are presented for the 1-hour, 3-hour, 24-hour and annual averaging periods in Figures D-1 to D-4 (Attachment E). The highest predicted SO_2 concentrations generally occur in the immediate vicinity of the beneficiation area, along the northeast property boundary.

7.2 Nitrogen Dioxide (NO_2)

A summary of the maximum predicted ground-level NO_2 concentrations, including background, is presented for the 1-hour, 24-hour and annual averaging periods in Table 7.1. The maximum NO_2 ground-level concentrations are predicted to be below the regulatory standards, with the exception of 1-hour NO_2 which has a maximum predicted value of 409 occurring on the northeast side of property line. However, as shown in Figure D-5 (Attachment E), the maximum predicted concentrations of NO_2 decrease to 380 $\mu g/m^3$ within 130 meters of the property line and there are no sensitive receptors within 2.5 km of the beneficiation area.

A summary of the maximum predicted ground-level NO_2 concentrations at sensitive receptor locations is provided in Attachment F. The results show the maximum predicted GLC are well below the regulatory standards at these locations.

7.3 Carbon Monoxide (CO)

A summary of the maximum predicted ground-level CO concentrations, including background, is presented for the 1-hour, and 8-hour averaging periods in Table 7.1. There are no predicted exceedances of the NL regulatory standard for any of the averaging periods considered.

Plots of the maximum predicted ground-level CO concentrations, including background, are presented for the 1-hour, and 8-hour averaging periods in Figures D-8 to D-9 (Attachment E). The highest predicted CO concentrations generally occur in the immediate vicinity of the beneficiation area, along the northeast property boundary.

7.4 Total Suspended Particulate (TSP)

A summary of the maximum predicted ground-level TSP concentrations, including background, is presented for the 1-hour, and 24-hour, and annual averaging periods in Table 7.1. The maximum TSP ground-level concentrations are predicted to be below the regulatory standards, with the exception of 24-hour TSP which has a maximum predicted value of 219 $\mu g/m^3$ occurring on the northeast side of property line. However, as shown in Figure D-11 (Attachment E), the maximum predicted concentrations of TSP decrease to 110 $\mu g/m^3$ within 135 meters of the property line and there are no sensitive receptors within 2.5 km of the beneficiation area.

A summary of the maximum predicted ground-level TSP concentrations at sensitive receptor locations is provided in Attachment F. The results show the maximum predicted GLC are well below the regulatory standards at these locations.

7.5 Particulate Matter Less than 10 Microns in Diameter (PM_{10})

A summary of the maximum predicted ground-level PM_{10} concentrations, including background, is presented for the 1-hour, and 24-hour, and annual averaging periods in Table 7.1. The maximum PM_{10} ground-level concentrations are predicted to be below the regulatory standards, with the exception of 24-hour PM_{10} which has a maximum predicted value of 103 $\mu g/m^3$ occurring on the northeast side of property line. However, as shown in Figure D-12 (Attachment E), the maximum predicted concentrations of PM_{10} decrease to 50 $\mu g/m^3$ within 153 meters of the property line and there are no sensitive receptors within 2.5 km of the beneficiation area.

A summary of the maximum predicted ground-level PM_{10} concentrations at sensitive receptor locations is provided in Attachment F. The results show the maximum predicted GLC are well below the regulatory standards at these locations.

7.6 Particulate Matter Less than 2.5 microns in Diameter ($PM_{2.5}$)

A summary of the maximum predicted ground-level $PM_{2.5}$ concentrations, including background, is presented for the 1-hour, and 24-hour, and annual averaging periods in Table 7.1. The maximum $PM_{2.5}$ ground-level concentrations are predicted to be below the regulatory standards, with the exception of 24-hour $PM_{2.5}$ which has a maximum predicted value of 37 $\mu g/m^3$ occurring on the northeast side of property line. However, as shown in Figure D-13 (Attachment E), the maximum predicted concentrations of PM_{10} decrease to 24 $\mu g/m^3$ within 58 meters of the property line and there are no sensitive receptors within 2.5 km of the beneficiation area.

A summary of the maximum predicted ground-level $PM_{2.5}$ concentrations at sensitive receptor locations is provided in Attachment F. The results show the maximum predicted GLC are well below the regulatory standards at these locations.

8.0 CONCLUSIONS

To assess the potential for a change in air quality due to Project-related emissions, a detailed Air Quality Technical Study was conducted. The study was conducted following generally accepted methodologies to establish existing (baseline) conditions, estimate emissions from potential Project activities, and predict the maximum downwind concentrations of the pertinent air contaminants. The results of this study provide the necessary data to assess potential environmental effects due to air contaminant emissions from the Project in the EIS this study supports.

The most substantive Project-related emissions during operation are due to fuel combustion and fugitive dust emissions. The emission sources can be categorized into three groups:

- Emissions from the beneficiation area;
- Emissions due to trucks hauling ore from the mines to the beneficiation area; and,
- Emissions due to blasting and on-site traffic at the mine site locations.

The results of the dispersion modelling (which consider all substantive emissions from the beneficiation area) show that although there may be potential exceedances of regulatory standards at locations near the property line during adverse meteorological conditions, these higher values are limited to within about 150 m of the property line. As this region is far from any of the sensitive receptor locations, it is unlikely that prolonged human exposure to air contaminant concentrations at these levels will occur. Therefore, as the predicted exceedances represent worst-case meteorological conditions, are limited in spatial extent, seasonal, and are short-term in duration, no substantive changes in air quality are expected on the local or regional scales due to emissions from the primary processing facility.

Although fugitive dust emissions will occur due to vehicle traffic along the road during operations, the majority of the fugitive dust will remain in lowest 1-2 meters above ground level and settle within a few hundred meters of the road (DRI 1999). The haul route is an existing dirt road, and although traffic along the route is expected to increase with Project activities, no more than five trucks are expected to pass in a given hour. As such, while some dusting of vegetation may occur due to vehicle traffic during certain meteorological conditions, no substantive changes in air quality are expected due to such emissions as they will be localized in extent and short-term in duration.

Emissions due to blasting and on-site traffic at the mine site locations are not expected to cause substantive changes in air quality as they will be emitted inside a pit and the transport distances to the nearest sensitive receptors are relatively far (greater than 1.5 km). Emissions from the diesel locomotive used for transporting ore from the beneficiation area are not expected to increase from the current levels and should not cause substantive changes in air quality as such emissions will be intermittent (one trip per day) and short-term in duration. Emissions from the standby diesel generators installed at the worker's camp will be intermittent, short-term in duration, and negligible relative to other emissions during operation.

As emissions occurring during construction are expected to be fractionally small compared to those occurring during operation, the maximum model-predicted concentrations during operation provide a conservative envelope for potential air changes in air quality due to emissions during this phase.

Therefore, on an overall basis, the modelling results show the local and regional changes in air quality due to Project-related emissions, including background, are not expected to be substantive.

9.0 CLOSURE

This report has been prepared by Jacques Whitford with the input and assistance of Labrador Iron Mines Ltd. for the sole benefit of Labrador Iron Mines Ltd. The report may not be relied upon by any other person, entity, other than for its intended purposes, without the express written consent of Jacques Whitford and Labrador Iron Mines Ltd.

This report was undertaken exclusively for the purpose outlined herein and is limited to the scope and purpose specifically expressed in this report. This report cannot be used or applied under any circumstances to another location or situation or for any other purpose without further evaluation of the data and related limitations. Any use of this report by a third party, or any reliance on decisions made based upon it, are the responsibility of such third parties. Jacques Whitford accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions taken based on this report.

Jacques Whitford makes no representation or warranty with respect to this report, other than the work was undertaken by trained professional and technical staff in accordance with generally accepted engineering and scientific practices current at the time the work was performed. Any information or facts provided by others and referred to or used in the preparation of this report should not be construed as legal advice.

This report presents the best professional judgement of Jacques Whitford personnel available at the time of its preparation. Jacques Whitford reserves the right to modify the contents of this report, in whole or in part, to reflect any new information that becomes available. If any conditions become apparent that differ significantly from our understanding of conditions as presented in this report, we request that we be notified immediately to reassess the conclusions provided herein.

This report has been prepared by a team of Jacques Whitford professionals on behalf of Labrador Iron Mines Ltd.

10.0 REFERENCES

Allwine, K.J., and C.D. Whiteman. 1985. *MELSAR: A mesoscale air quality model for complex terrain: Volume 1 – Overview, technical description and user's guide*. Pacific Northwest Laboratory, Richland, Washington.

Desert Research Institute (DRI). 1999. *Reconciling Urban Dust Emissions Inventory and Ambient Source Contribution Estimates: Summary of Current Knowledge and Needed Research*. Prepared by J.G. Watson and J.C. Chow. DRI Document No 6110.4D2.

Douglas, S., and R. Kessler. 1988. *User's guide to* the *diagnostic wind model*. California Air Resources Board, Sacramento, CA.

Environment Canada. 2008a. *National Air Pollution Surveillance Network (NAPS) Data (2005-2006).* Available at: http://www.etc-cte.ec.gc.ca/napsdata/Default.aspx. Accessed November 2008.

Environment Canada. 2008b. *Canadian Climate Normals; Schefferville, QC*. Available at: http://climate.weatheroffice.ec.gc.ca/climate_normals/index_e.html. Accessed November 2008.

Garratt, J.R. 1977. Review of drag coefficients over oceans and continents. *Mon. Wea. Rev*., 105, 915-929.

Hanna, S.R., L.L. Schulman, R.J. Paine, J.E. Pleim and M. Baer. 1985. Development and evaluation of the Offshore and Coastal Dispersion Model. JAPCA, 35, 1039-1047.

Holtslag, A.A.M., and A.P. van Ulden. 1983. *A simple scheme for daytime estimates of the surface fluxes from routine weather data*, J. Clim. and Appl. Meteor., **22**: 517-529.

Liu, M. K. and M. A. Yocke. 1980. *Siting of wind turbine generators in complex terrain*. Journal of Energy, **4**: 10:16.

Maul, P.R. 1980. Atmospheric transport of sulphur compound pollutants. Central Electricity Generating Bureau MID/SSD/80/0026/R. Nottingham, England.

Natural Resources Canada. 2008. Available at: http://cfs.nrcan.gc.ca/subsite/eosd/home. Accessed November 2008.

Newfoundland and Labrador Department of Environment and Conservation (NL DEC). 2008. Draft *Guidelines for Environmental Impact Statement Assessment: Schefferville Area Iron Ore Mine*, Issued to Labrador Iron Mines Limited, October 24, 2008.

Newfoundland and Labrador Department of Environment and Conservation (NL DEC). 2006. *Guideline for Plume Dispersion Modelling (1st Revision)*. Saint John's, NL. November 20, 2006.

O'Brien, J.J. 1970. A note on the vertical structure of the eddy exchange coefficient in the planetary boundary layer. *J. Atmos. Sci*., 27, 1213-1215.

Perry, S.G., D.J. Burns, L.H. Adams, R.J. Paine, M.G. Dennis, M.T. Mills, D.G. Strimaitis, R.J. Yamartino, E.M. Insley. 1989. User's Guide to the Complex Terrain Dispersion Model Plus Algorithms for Unstable Situations (CTDMPLUS) Volume 1: Model Description and User Instructions. EPA/600/8-89/041, U.S. Environmental Protection Agency, Research Triangle Park, North Carolina.

Scire, J.S., F.R. Robe, M.E. Fernau, and R.J. Yamartino. 2000a. *A User's Guide for the CALMET Meteorological Model (Version 5).* Earth Tech, Inc., Concord, MA.

Scire, J.S., D.G. Strimaitis, and R.J. Yamartino. 2000b. *A User's Guide for the CALPUFF* Dispersion Model *(Version 5).* Earth Tech, Inc., Concord, MA.

TRC Companies Inc. 2008. *CALPUFF Modelling System, Version 6.262*. Available at: http://www.src.com/calpuff/calpuff1.htm. Accessed November 2008.

United States Environmental Protection Agency. (USEPA). 1995. Amended 1996, 1997, 1998, 1999 and 2006. *Compilation of Air Pollutant Emission Factors, AP-42, Fifth Edition, Volume I: Stationary Point and Area Sources*.

United States Environmental Protection Agency (U.S. EPA). 1998. *Interagency Workgroup on Air Quality Model*ling *(IWAQM) Phase 1 Summary* Report *and Recommendations for Modelling Long Range Transport Impacts*. EPA-454/R-98-019.

United States Environmental Protection Agency. (USEPA). 2005. *Examination of the Multiplier Used to Estimate $PM_{2.5}$ Fugitive Dust Emissions from PM_{10}*. Available at: http://www.epa.gov/ttn/chief/conference/ei14/session5/pace.pdf. Accessed November 2008.

United States Geological Survey (USGS). 2008 Available at: http://edcsns17.cr.usgs.gov/glcc/ Accessed November 2008.

PERSONAL COMMUNICATIONS

Lawrence Barrie. Personal Communication. November 10 to 28, 2008. Environmental Scientist, NL DEC, Newfoundland Labrador.

ATTACHMENT A

On-site Ambient Monitoring Report

Jacques Whitford

Jacques Whitford

Environmental
Engineering
Scientific
Management
Consultants

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Canada L3R 5X5

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VIA E-MAIL

Project No.: 1043706

December 19, 2008

Linda Wrong
Labrador Iron Mines Limited
220 Bay Street, Suite 700
Toronto, Ontario
M5J 2W4

Dear Linda,

Re: Summary of Ambient Monitoring – Schefferville, Quebec
September to November 2008

This report summarizes the results of ambient air monitoring conducted by Jacques Whitford Limited for the period between September 11, 2008 and November 11, 2008 at the Silver Yards site near the James North Mine and Schefferville, Quebec. Labrador Iron Mines (LIM) is intending on using this property as the beneficiation area for an iron ore mining operation beginning in the spring of 2009. Due to the potential fugitive dust emissions present during the ore beneficiation operations and the proposed mine operations in the area, a baseline of particulate matter concentrations was requested.

The site is located approximately 3.5 km from the town of Schefferville, away from any major industry or emissions sources. The public roads to access the site are all unpaved, and could be used by both LIM personnel and local residents. A mobile ore crusher was being used on-site for some initial ore crushing as part of the 2008 exploration program during the ambient monitoring period.

MONITORING METHODOLOGY

Total Suspended Particulate (TSP) sampling was conducted following the Ontario Ministry of the Environment (MOE) Operation Manual for Point Source Air Quality Monitoring and U.S. Environmental Protection Agency (U.S. EPA) Procedures, for 24-hour periods. A sampling frequency of one sample every six days was attempted, although due to operator error and local weather conditions, there were some modifications that were deemed necessary to the original schedule.

Canada's Top 100 Employers 2008

CANADA'S TOP 10 FAMILY FRIENDLY EMPLOYERS As featured in Today's Parent 2008

Jacques Whitford

An Environment of Exceptional Solutions

The beneficiation area is located in a natural valley oriented from the north-west to the south-east. The sides of the valley reach peaks approximately 650 m high, with the beneficiation area located at an elevation of approximately 530 m. The beneficiation area is approximately 500 m from the highest point of the valley on either side. One air sampler was located 25 m south-east from where the mobile crusher was operating, 150 m west from the main road onto the site, and 50 m west from an on-site unpaved road. The sampler was located on a rise of the south-west side of the valley floor, approximately 8 m above the crushing area, and at grade with the onsite road. A site map showing the location of the LIM site and the monitoring station is presented in Attachment A and photos of the site are presented in Attachment B

Ambient suspended particulate matter was collected onto pre-weighed, conditioned quartz fibre filters for a 24-hour period using a BGI Incorporated portable particulate monitor (model PQ100). The PQ100 operates by continuously drawing ambient air through a filter onto which particulate matter is deposited. After a pre-determined period of time (24-hours), a measurable amount of particulate is deposited on the filter. The exposed filters were collected and transported to a laboratory (Maxxam Analytics Inc.) where the filters were conditioned then weighed to determine the mass of deposited particulate. The particulate on the filter was subsequently analyzed for metals content using an Inductively Coupled Plasma (ICP) analytical technique. Operation of these instruments required changing of the filters on a six-day basis.

METEOROLOGICAL DATA

The meteorological data used in this report was obtained from Environment Canada for the Schefferville Airport. The hourly average meteorological data (atmospheric pressure, temperature, wind speed and wind direction) were averaged over each 24-hour sampling period for use in the PQ100 flow rate calculations and analysis.

RESULTS

Detailed monitoring results for TSP and metals are presented in Attachment C.

TSP MONITORING RESULTS

Table 1 presents the maximum and minimum TSP concentrations measured during the sampling period at the site. All samples from the site were below the Newfoundland and Labrador Department of Environment and Conservation (NL DEC) ambient air quality standard for TSP (120 µg/m^3).

To estimate the potential contribution of onsite crushing emissions to the measured TSP data at the monitoring station, the directionality of the wind during each sample period was examined. A TSP pollution rose for the site is presented as Figure 1. This figure plots the maximum measured particulate concentration in wind sectors of 22.5 degree increments.

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The analysis of the TSP results and on-site conditions indicate that the highest TSP concentration measured at the site (42 µg/m^3) was from the west. During this measurement, the sampler was upwind of both the exploration crushing operations and the ore piles, although the mobile crusher was not operating during this sampling event. The next highest TSP concentration (28 µg/m^3) was also from the west.

Two measurements were taken while the wind direction was predominantly from the east, which would give an indication of localized ambient particulate levels. In both cases (samples from September 29, 2008 and October 29, 2008), the measured TSP concentration was 21 µg/m^3.

METALS RESULTS

The measured ambient metals concentrations for the monitoring station are presented in Attachment C. A total of nine metals were analysed for each of the eight samples collected during the monitoring period. There are no NL DEC standards for metals, so Ontario MOE criteria were used where applicable.

Table 2 summarizes the data for the analysed metals at the site. The majority of samples had metals concentrations below the laboratory detection limit and all measured concentrations were well below the relevant MOE criteria (less than 10%).

CONCLUSIONS

The following conclusions were made from the ambient monitoring data at the LIM site:

- All measured ambient TSP samples were below the NL DEC air quality 24-hour standard for TSP;
- All measured ambient metals samples were below the relevant Ontario MOE air quality criteria;
- The highest measured TSP concentrations at the site occurred when the mobile ore crusher was not operating;
- Measurements that were taken during days when the predominant wind direction was from the east indicate ambient TSP concentrations to be approximately 21 µg/m^3; and,
- Samples taken during the crushing operations were below the NL DEC air quality 24-hour standard for TSP.

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CLOSURE

The assessment represents the conditions at the subject property at the time of the monitoring. The conclusions presented herein represent the best judgment of the assessor based on current environmental standards.

Should you have any questions, please do not hesitate to contact me at (905) 474-7700, Fax: (905) 479-9326 or my E-mail at ddsouza@jacqueswhitford.com at your convenience.

Yours truly,

JACQUES WHITFORD LIMITED

Original signed by: ***Orginial signed by:***

Don D'Souza, B.A.Sc.
Project Scientist

Ben Coulson, P. Eng., M.A.Sc.
Group Leader

cc: Dana Feltham, Jacques Whitford Limited

Enclosures: Tables 1-2
Figure 1
Attachment A: Site Plan
Attachment B: Photographs
Attachment C: Air Quality Monitoring Analyses

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Table 1 Summary of TSP Monitoring Results - Silver Yards ambient monitoring

Sampling Date	TSP[1]	WS	WD	Temp	% of TSP Standard[1]	Activities in vicinity of sampler
(mm/dd/yyyy)	(µg/m3)	(km/hr)	(°) (Direction)	(°C)		
9/11/2008	10	16	264 (W)	8.3	9%	Crusher Operating
9/23/2008	10	19	307 (NW)	1.4	9%	Crusher Operating
9/29/2008	21	14	59 (NE)	3.2	17%	N/A
10/18/2008	28	15	292 (NW)	-3.7	23%	Hauling ore from Silver Yards
10/23/2008	28	19	268 (W)	-0.9	23%	N/A
10/29/2008	21	21	145 (SE)	6.2	17%	N/A
11/4/2008	10	13	238 (SW)	-4.0	9%	N/A
11/10/2008	42	7	279 (W)	-0.2	35%	N/A
# of Samples	8					
Minimum	10				9%	
Maximum	42				35%	
Average	21				18%	

Notes:
The results from 11/4/2008 and 11/10/2008 are preliminary and subject to change. Maxxam Analytics will provide finalized results at a later date.
1 – NL DEC Standard for TSP is 120 µg/m^3

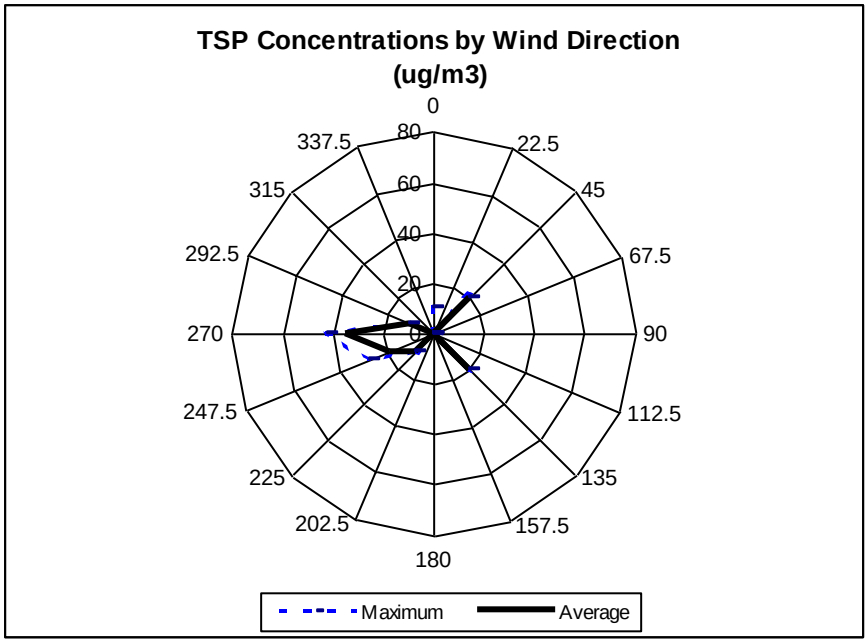
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Table 2 Metal Results for Silver Yards Ambient Monitoring

Site ID	Metal	Maximum Concentration (µg/m3)	Minimum Concentration (µg/m3)	Mean Concentration (µg/m3)	MOE[1] Criteria (µg/m3)	% of MOE Criteria (using Maximum Concentration)
Silver Yards	Antimony	0.03	0.03	0.03	25	<1%
	Arsenic	0.02	0.02	0.02	0.3	7%
	Bismuth	0.02	0.02	0.02	N/A	N/A
	Phosphorus	0.09	0.09	0.09	N/A	N/A
	Selenium	0.03	0.03	0.03	10	<1%
	Silicon	1.90	0.83	1.39	N/A	N/A
	Sulphur	0.33	0.09	0.19	N/A	N/A
	Uranium	0.53	0.10	0.17	N/A	N/A
	Zirconium	0.01	0.003	0.00	N/A	N/A

Notes:
There are no NL DEC standards for ambient metals concentrations. Ontario MOE criteria were used where applicable.

Figure 1: TSP Pollution Rose



Attachment A

Site Map Showing Monitoring Station Locations

Jacques Whitford



Reference: Google Earth, 2008

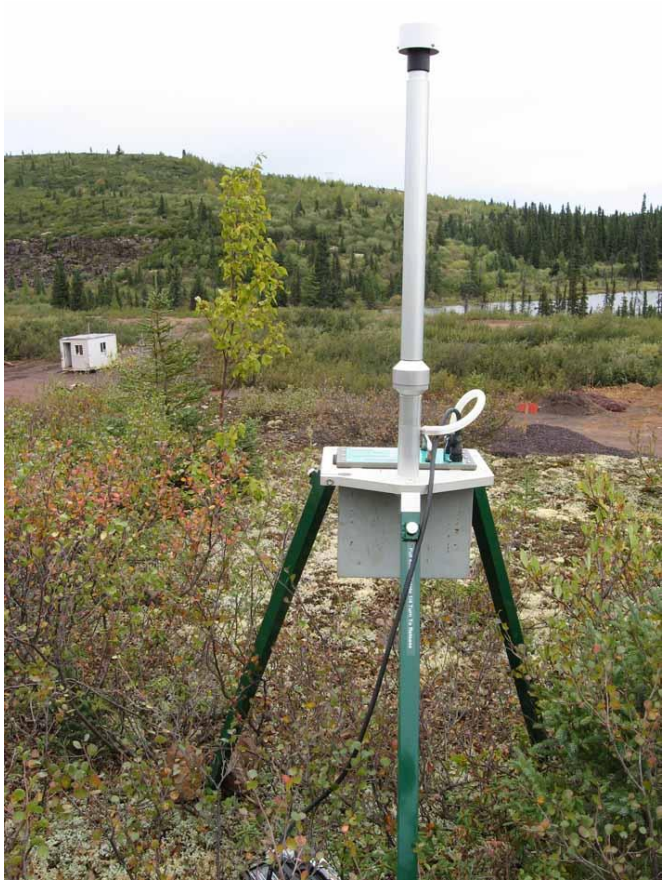
Jacques Whitford © 2008

Attachment B

Monitoring Station Photos

Jacques Whitford

Photograph 1: View of Sampler Location (facing north-east)



Photograph 2: View of Sampler Location (facing north-west)



Photograph 3: In front of Sampler Location (facing east)



Jacques Whitford

Attachment C

Air Quality Monitoring Analyses

Jacques Whitford

Your P.O. #: NSD016400
Your Project #: 1043706 PHASE Z9100
Site:LIM
Your C.O.C. #: EO223608

Attention: Don D'Souza
Jacques Whitford Limited
7271 Warden Ave
Markham, ON
L3R 5X5

Report Date: 2008/11/19

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: A8D0558
Received: 2008/11/05, 10:24

Sample Matrix: Filter
Samples Received: 4

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Method Reference
Total Metals on Low-Vol Filter(6010Bmod) (1,2)	4	2008/11/11	2008/11/11	BRL SOP-00100 / BRL SOP-00102	EPA 6010Bmod
Particulates on Filter (M5/315/NJATM1) (1,2)	4	N/A	2008/11/11	BRL SOP-00109	EPA 5/315/NJATM1

* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

(1) This test was performed by Maxxam Analytics Mississauga
(2) This test was performed in Maxxam Mississauga under Maxxam Burlington SCC Accreditation

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.

THERESA STEPHENSON, Project Manager
Email: Theresa.Stephenson@MaxxamAnalytics.com
Phone# (905) 817-5763

==========

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. SCC and CALA have approved this reporting process and electronic report format.

For Service Group specific validation please refer to the Validation Signature Page

Total cover pages: 1

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Maxxam Analytics International Corporation o/a Maxxam Analytics 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.maxxam.ca

Maxxam Job #: A8D0558
Report Date: 2008/11/19

Jacques Whitford Limited
Client Project #: 1043706 PHASE Z9100
Project name: LIM
Your P.O. #: NSD016400

RESULTS OF ANALYSES OF FILTER

Maxxam ID		AZ1571	AZ1572	AZ1573	AZ1574		
Sampling Date		2008/09/11	2008/09/23	2008/09/29	2008/09/18		
COC Number		EO223608	EO223608	EO223608	EO223608		
	Units	**8090402**	**8090409**	**8090410**	**8090403**	**RDL**	**QC Batch**
Particulate Weight on Filter	mg	<0.30	<0.30	0.30	0.40	0.30	1668753

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

Maxxam Analytics International Corporation o/a Maxxam Analytics 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.maxxam.ca

Maxxam Job #: A8D0558
Report Date: 2008/11/19

Jacques Whitford Limited
Client Project #: 1043706 PHASE Z9100
Project name: LIM
Your P.O. #: NSD016400

MISCELLANEOUS (FILTER)

Maxxam ID		AZ1571	AZ1572	AZ1573	AZ1574		
Sampling Date		2008/09/11	2008/09/23	2008/09/29	2008/09/18		
COC Number		EO223608	EO223608	EO223608	EO223608		
	Units	**8090402**	**8090409**	**8090410**	**8090403**	**RDL**	**QC Batch**
Metals							
Antimony (Sb)	ug	<1.0	<1.0	<1.0	<1.0	1.0	1669114
Arsenic (As)	ug	<0.60	<0.60	<0.60	<0.60	0.60	1669114
Bismuth (Bi)	ug	<0.60	<0.60	<0.60	<0.60	0.60	1669114
Phosphorus (P)	ug	<2.5	<2.5	<2.5	<2.5	2.5	1669114
Selenium (Se)	ug	<1.0	<1.0	<1.0	<1.0	1.0	1669114
Silicon (Si)	ug	18.1	18.8	12.0	16.8	1.0	1669114
Sulphur (S)	ug	3.4	<2.5	<2.5	<2.5	2.5	1669114
Uranium (U)	ug	<3.0	<3.0	<3.0	<3.0	3.0	1669114
Zirconium (Zr)	ug	<0.10	<0.10	<0.10	<0.10	0.10	1669114

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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Maxxam Job #: A8D0558
Report Date: 2008/11/19

Jacques Whitford Limited
Client Project #: 1043706 PHASE Z9100
Project name: LIM
Your P.O. #: NSD016400

GENERAL COMMENTS

Results relate only to the items tested.

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Jacques Whitford Limited
Attention: Don D'Souza
Client Project #: 1043706 PHASE Z9100
P.O. #: NSD016400
Project name: LIM

Quality Assurance Report

Maxxam Job Number: GA8D0558

QA/QC Batch Num	Init	QC Type	Parameter	Date Analyzed yyyy/mm/dd	Value	Recovery	Units	QC Limits
1669114	KCO	Spiked Blank	Antimony (Sb)	2008/11/11		108	%	85 - 115
		RPD	Antimony (Sb)	2008/11/11	3.9		%	20
		Spiked Blank	Arsenic (As)	2008/11/11		105	%	85 - 115
		RPD	Arsenic (As)	2008/11/11	4.0		%	20
		Spiked Blank	Bismuth (Bi)	2008/11/11		104	%	85 - 115
		RPD	Bismuth (Bi)	2008/11/11	2.9		%	20
		Spiked Blank	Phosphorus (P)	2008/11/11		104	%	85 - 115
		RPD	Phosphorus (P)	2008/11/11	0.08		%	20
		Spiked Blank	Selenium (Se)	2008/11/11		103	%	85 - 115
		RPD	Selenium (Se)	2008/11/11	0.4		%	20
		Spiked Blank	Silicon (Si)	2008/11/11		103	%	85 - 115
		RPD	Silicon (Si)	2008/11/11	0.5		%	20
		Spiked Blank	Sulphur (S)	2008/11/11		101	%	85 - 115
		RPD	Sulphur (S)	2008/11/11	0.3		%	20
		Spiked Blank	Uranium (U)	2008/11/11		105	%	85 - 115
		RPD	Uranium (U)	2008/11/11	2.8		%	20
		Spiked Blank	Zirconium (Zr)	2008/11/11		101	%	85 - 115
		RPD	Zirconium (Zr)	2008/11/11	0.4		%	20
		Method Blank	Antimony (Sb)	2008/11/11	<1.0		ug	
			Arsenic (As)	2008/11/11	<0.60		ug	
			Bismuth (Bi)	2008/11/11	<0.60		ug	
			Phosphorus (P)	2008/11/11	<2.5		ug	
			Selenium (Se)	2008/11/11	<1.0		ug	
			Silicon (Si)	2008/11/11	<1.0		ug	
			Sulphur (S)	2008/11/11	<2.5		ug	
			Uranium (U)	2008/11/11	<3.0		ug	
			Zirconium (Zr)	2008/11/11	<0.10		ug	

RPD = Relative Percent Difference
SPIKE = Fortified sample

This document is in electronic format, hard copy is available on request.

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Validation Signature Page

Maxxam Job #: A8D0558

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).



FRANK MO, B.Sc., Inorganic Lab. Manager

==========

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. SCC and CALA have approved this reporting process and electronic report format.

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Your Project #: 1043706,Z9100
Site:SCHEFFERVILLE
Your C.O.C. #: EO227308

Attention: Don D'Souza
Jacques Whitford Limited
7271 Warden Ave
Markham, ON
L3R 5X5

Report Date: 2008/12/04

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: A8D6812
Received: 2008/11/18, 13:13

Sample Matrix: Filter
Samples Received: 2

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Method Reference
Total Metals on Low-Vol Filter(6010Bmod) (1)	2	2008/12/02	2008/12/03	BRL SOP-00100 / BRL SOP-00102	EPA 6010Bmod
Particulates on Filter (M5/315/NJATM1) (1)	2	N/A	2008/12/02	BRL SOP-00109	EPA 5/315/NJATM1

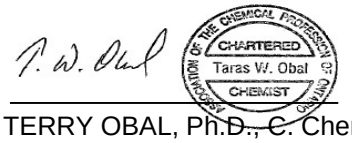
(1) This test was performed in Maxxam Mississauga under Maxxam Burlington SCC Accreditation

MAXXAM ANALYTICS

THERESA STEPHENSON
Project Manager

TDS/poh
encl.

Authorized By :



TERRY OBAL, Ph.D., C. Chem
Manager, Scientific Services

Total cover pages: 1

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Maxxam Job #: A8D6812
Report Date: 2008/12/04

Jacques Whitford Limited
Client Project #: 1043706,Z9100
Project name: SCHEFFERVILLE

RESULTS OF ANALYSES OF FILTER

Maxxam ID		BC2709	BC2710		
Sampling Date		2008/10/29	2008/11/09		
COC Number		EO227308	EO227308		
	Units	**8090407**	**8090406**	**DL**	**QC Batch**
Particulate Weight on Filter	mg	0.30	0.40	0.30	1688596

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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Maxxam Job #: A8D6812
Report Date: 2008/12/04

Jacques Whitford Limited
Client Project #: 1043706,Z9100
Project name: SCHEFFERVILLE

MISCELLANEOUS (FILTER)

Maxxam ID		BC2709	BC2710		
Sampling Date		2008/10/29	2008/11/09		
COC Number		EO227308	EO227308		
	Units	**8090407**	**8090406**	**DL**	**QC Batch**
Antimony (Sb)	ug	<1.0	<1.0	1.0	1689225
Arsenic (As)	ug	<0.60	<0.60	0.60	1689225
Bismuth (Bi)	ug	<0.60	<0.60	0.60	1689225
Phosphorus (P)	ug	<2.5	<2.5	2.5	1689225
Selenium (Se)	ug	<1.0	<1.0	1.0	1689225
Silicon (Si)	ug	27.3	27.4	1.0	1689225
Sulphur (S)	ug	4.5	4.8	2.5	1689225
Uranium (U)	ug	7.6	<3.0	3.0	1689225
Zirconium (Zr)	ug	0.11	<0.10	0.10	1689225

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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Maxxam Job #: A8D6812
Report Date: 2008/12/04

Jacques Whitford Limited
Client Project #: 1043706,Z9100
Project name: SCHEFFERVILLE

GENERAL COMMENTS

Results relate only to the items tested.

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Jacques Whitford Limited
Attention: Don D'Souza
Client Project #: 1043706,Z9100
P.O. #:
Project name: SCHEFFERVILLE

Quality Assurance Report

Maxxam Job Number: GA8D6812

QA/QC Batch Num	Init	QC Type	Parameter	Date Analyzed yyyy/mm/dd	Value	Recovery	Units	QC Limits
1689225	KCO	Spiked Blank	Antimony (Sb)	2008/12/03		107	%	85 - 115
		RPD	Antimony (Sb)	2008/12/02	4.5		%	20
		Spiked Blank	Arsenic (As)	2008/12/03		95	%	85 - 115
		RPD	Arsenic (As)	2008/12/02	5.3		%	20
		Spiked Blank	Bismuth (Bi)	2008/12/03		98	%	85 - 115
		RPD	Bismuth (Bi)	2008/12/02	9.1		%	20
		Spiked Blank	Phosphorus (P)	2008/12/03		100	%	85 - 115
		RPD	Phosphorus (P)	2008/12/02	1.0		%	20
		Spiked Blank	Selenium (Se)	2008/12/03		100	%	85 - 115
		RPD	Selenium (Se)	2008/12/02	2.6		%	20
		Spiked Blank	Silicon (Si)	2008/12/03		97	%	85 - 115
		RPD	Silicon (Si)	2008/12/02	2.9		%	20
		Spiked Blank	Sulphur (S)	2008/12/03		101	%	85 - 115
		RPD	Sulphur (S)	2008/12/02	0.9		%	20
		Spiked Blank	Uranium (U)	2008/12/03		98	%	85 - 115
		RPD	Uranium (U)	2008/12/02	8.4		%	20
		Spiked Blank	Zirconium (Zr)	2008/12/03		102	%	85 - 115
		RPD	Zirconium (Zr)	2008/12/02	1.1		%	20
		Method Blank	Antimony (Sb)	2008/12/02	<1.0		ug	
			Arsenic (As)	2008/12/02	<0.60		ug	
			Bismuth (Bi)	2008/12/02	<0.60		ug	
			Phosphorus (P)	2008/12/02	<2.5		ug	
			Selenium (Se)	2008/12/02	<1.0		ug	
			Silicon (Si)	2008/12/02	<1.0		ug	
			Sulphur (S)	2008/12/02	<2.5		ug	
			Uranium (U)	2008/12/02	<3.0		ug	
			Zirconium (Zr)	2008/12/02	<0.10		ug	

RPD = Relative Percent Difference
SPIKE = Fortified sample

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ATTACHMENT B

CALMET Input File

Jacques Whitford

```
CALMET.INP      2.1             Hour Start and End Times with Seconds
met data from 2002 to 2006 - lab. lim facility -NOV 18-08


---------------- Run title (3 lines)
----------------------------------------

                    CALMET MODEL CONTROL FILE
                    -------------------------

-------------------------------------------------------------------------
-------

INPUT GROUP: 0 -- Input and Output File Names


Subgroup (a)
------------
Default Name  Type          File Name
------------  ----          ---------
GEO.DAT       input    ! GEODAT=geo.dat       !
SURF.DAT      input    ! SRFDAT=surf.dat      !
CLOUD.DAT     input    * CLDDAT=              *
PRECIP.DAT    input    * PRCDAT=              *
WT.DAT        input    * WTDAT=               *

CALMET.LST    output   ! METLST=CMET.LST     !
CALMET.DAT    output   ! METDAT=CMET.DAT    !
PACOUT.DAT    output   * PACDAT=             *

All file names will be converted to lower case if LCFILES = T
Otherwise, if LCFILES = F, file names will be converted to UPPER CASE
         T = lower case      ! LCFILES = T !
         F = UPPER CASE

NUMBER OF UPPER AIR & OVERWATER STATIONS:

    Number of upper air stations (NUSTA)  No default     ! NUSTA =  1  !
    Number of overwater met stations
                                  (NOWSTA) No default     ! NOWSTA =  0
!

NUMBER OF PROGNOSTIC and IGF-CALMET FILEs:

    Number of MM4/MM5/3D.DAT files
                                  (NM3D) No default       ! NM3D =  0  !

    Number of IGF-CALMET.DAT files
                                  (NIGF)   No default     ! NIGF =  0  !

                       !END!
-------------------------------------------------------------------------
--------
Subgroup (b)
---------------------------------
Upper air files (one per station)
---------------------------------
Default Name  Type       File Name
------------  ----       ---------
UP1.DAT       input     1  ! UPDAT=up.dat!    !END!
```

```
------------------------------------------------------------------------
--------
Subgroup (c)
-----------------------------------------
Overwater station files (one per station)
-----------------------------------------
Default Name  Type       File Name
------------  ----       ---------
SEA1.DAT       input     1  * SEADAT=SEA_449.DAT *    *END*
------------------------------------------------------------------------
--------
Subgroup (d)
------------------------------------------------
MM4/MM5/3D.DAT files (consecutive or overlapping)
------------------------------------------------
Default Name  Type       File Name
------------  ----       ---------
MM51.DAT       input     1  * M3DDAT=LSP2003.DAT *    *END*
------------------------------------------------------------------------
--------
Subgroup (e)
------------------------------------------------
IGF-CALMET.DAT files (consecutive or overlapping)
------------------------------------------------
Default Name  Type       File Name
------------  ----       ---------
IGFn.DAT       input     1  * IGFDAT=CALMET0.DAT *    *END*
------------------------------------------------------------------------
--------
Subgroup (f)
----------------
Other file names
----------------

Default Name  Type       File Name
------------  ----       ---------
DIAG.DAT      input      * DIADAT=                  *
PROG.DAT      input      * PRGDAT=                  *

TEST.PRT      output     * TSTPRT=                  *
TEST.OUT      output     * TSTOUT=                  *
TEST.KIN      output     * TSTKIN=                  *
TEST.FRD      output     * TSTFRD=                  *
TEST.SLP      output     * TSTSLP=                  *
DCST.GRD      output     * DCSTGD=                  *

------------------------------------------------------------------------
--------
NOTES: (1) File/path names can be up to 70 characters in length
       (2) Subgroups (a) and (f) must have ONE 'END' (surrounded by
           delimiters) at the end of the group
       (3) Subgroups (b) through (e) are included ONLY if the
corresponding
           number of files (NUSTA, NOWSTA, NM3D, NIGF) is not 0, and
each must have
           an 'END' (surround by delimiters) at the end of EACH LINE

                        !END!
```

```
------------------------------------------------------------------------
-------

INPUT GROUP: 1 -- General run control parameters
--------------

     Starting date:    Year   (IBYR)  --    No default   ! IBYR  =  2002
!
                       Month  (IBMO)  --    No default   ! IBMO  =  1  !
                       Day    (IBDY)  --    No default   ! IBDY  =  1  !
     Starting time:    Hour   (IBHR)  --    No default   ! IBHR  =  0  !
                       Second (IBSEC) --    No default   ! IBSEC =  0  !

     Ending date:      Year   (IEYR)  --    No default   ! IEYR  =  2006
!
                       Month  (IEMO)  --    No default   ! IEMO  =  12
!
                       Day    (IEDY)  --    No default   ! IEDY  =  31
!
     Ending time:      Hour   (IEHR)  --    No default   ! IEHR  =  23
!
                       Second (IESEC) --    No default   ! IESEC =  0  !

      UTC time zone         (ABTZ) -- No default       ! ABTZ= UTC-0400
!
         (character*8)
         PST = UTC-0800, MST = UTC-0700 , GMT = UTC-0000
         CST = UTC-0600, EST = UTC-0500

     Length of modeling time-step (seconds)
     Must divide evenly into 3600 (1 hour)
     (NSECDT)                        Default:3600     ! NSECDT =  3600
!
                                     Units: seconds

     Run type            (IRTYPE) -- Default: 1       ! IRTYPE=  1  !

        0 = Computes wind fields only
        1 = Computes wind fields and micrometeorological variables
            (u*, w*, L, zi, etc.)
        (IRTYPE must be 1 to run CALPUFF or CALGRID)

     Compute special data fields required
     by CALGRID (i.e., 3-D fields of W wind
     components and temperature)
     in additional to regular            Default: T    ! LCALGRD = T !
     fields ? (LCALGRD)
     (LCALGRD must be T to run CALGRID)

      Flag to stop run after
      SETUP phase (ITEST)             Default: 2       ! ITEST=  2   !
      (Used to allow checking
      of the model inputs, files, etc.)
      ITEST = 1 - STOPS program after SETUP phase
      ITEST = 2 - Continues with execution of
                  COMPUTATIONAL phase after SETUP


     Test options specified to see if
     they conform to regulatory
```

```
     values? (MREG)                    No Default       ! MREG =   1   !

        0 = NO checks are made
        1 = Technical options must conform to USEPA guidance
                  IMIXH    -1       Maul-Carson convective mixing height
                                    over land; OCD mixing height
overwater
                  ICOARE   0        OCD deltaT method for overwater
fluxes
                  THRESHL  0.0      Threshold buoyancy flux over land
needed
                                    to sustain convective mixing height
growth
                  ISURFT   > 0      Pick one representative station, OR
                           -2       in NOOBS mode (ITPROG=2) average all
                                    surface prognostic temperatures to
get
                                    a single representative surface
temp.
                  IUPT     > 0      Pick one representative station, OR
                           -2       in NOOBS mode (ITPROG>0) average all
surface
                                    prognostic temperatures to get a
single
                                    representative surface temp.

!END!

----------------------------------------------------------------------
-------

INPUT GROUP: 2 -- Map Projection and Grid control parameters
--------------

     Projection for all (X,Y):
     -------------------------

     Map projection
     (PMAP)                    Default: UTM    ! PMAP = UTM  !

         UTM :  Universal Transverse Mercator
         TTM :  Tangential Transverse Mercator
         LCC :  Lambert Conformal Conic
          PS :  Polar Stereographic
          EM :  Equatorial Mercator
        LAZA :  Lambert Azimuthal Equal Area

     False Easting and Northing (km) at the projection origin
     (Used only if PMAP= TTM, LCC, or LAZA)
     (FEAST)                   Default=0.0     ! FEAST  = 0.000  !
     (FNORTH)                  Default=0.0     ! FNORTH = 0.000  !

     UTM zone (1 to 60)
     (Used only if PMAP=UTM)
     (IUTMZN)                  No Default      ! IUTMZN =  19   !

     Hemisphere for UTM projection?
     (Used only if PMAP=UTM)
     (UTMHEM)                  Default: N      ! UTMHEM = N  !
         N   :  Northern hemisphere projection
```

```
         S   :  Southern hemisphere projection

     Latitude and Longitude (decimal degrees) of projection origin
     (Used only if PMAP= TTM, LCC, PS, EM, or LAZA)
     (RLAT0)                    No Default      ! RLAT0 = 54N  !
     (RLON0)                    No Default      ! RLON0 = 67E  !

         TTM :  RLON0 identifies central (true N/S) meridian of
projection
                RLAT0 selected for convenience
         LCC :  RLON0 identifies central (true N/S) meridian of
projection
                RLAT0 selected for convenience
         PS  :  RLON0 identifies central (grid N/S) meridian of
projection
                RLAT0 selected for convenience
         EM  :  RLON0 identifies central meridian of projection
                RLAT0 is REPLACED by 0.0N (Equator)
         LAZA:  RLON0 identifies longitude of tangent-point of mapping
plane
                RLAT0 identifies latitude of tangent-point of mapping
plane

     Matching parallel(s) of latitude (decimal degrees) for projection
     (Used only if PMAP= LCC or PS)
     (XLAT1)                    No Default      ! XLAT1 = 0N  !
     (XLAT2)                    No Default      ! XLAT2 = 0N  !

         LCC :  Projection cone slices through Earth's surface at XLAT1
and XLAT2
         PS  :  Projection plane slices through Earth at XLAT1
                (XLAT2 is not used)

     ----------
     Note:  Latitudes and longitudes should be positive, and include a
            letter N,S,E, or W indicating north or south latitude, and
            east or west longitude.  For example,
            35.9  N Latitude  =  35.9N
            118.7 E Longitude = 118.7E


     Datum-region
     ------------

     The Datum-Region for the coordinates is identified by a character
     string.  Many mapping products currently available use the model of
the
     Earth known as the World Geodetic System 1984 (WGS-84).  Other
local
     models may be in use, and their selection in CALMET will make its
output
     consistent with local mapping products.  The list of Datum-Regions
with
     official transformation parameters is provided by the National
Imagery and
     Mapping Agency (NIMA).

     NIMA Datum - Regions(Examples)

-------------------------------------------------------------------------
```

```
------
     WGS-84    WGS-84 Reference Ellipsoid and Geoid, Global coverage
(WGS84)
     NAS-C     NORTH AMERICAN 1927 Clarke 1866 Spheroid, MEAN FOR CONUS
(NAD27)
     NAR-C     NORTH AMERICAN 1983 GRS 80 Spheroid, MEAN FOR CONUS
(NAD83)
     NWS-84    NWS 6370KM Radius, Sphere
     ESR-S     ESRI REFERENCE 6371KM Radius, Sphere

     Datum-region for output coordinates
     (DATUM)                    Default: WGS-84    ! DATUM = WGS-84  !


     Horizontal grid definition:
     ---------------------------

     Rectangular grid defined for projection PMAP,
     with X the Easting and Y the Northing coordinate

            No. X grid cells (NX)      No default     ! NX =   60  !
            No. Y grid cells (NY)      No default     ! NY =   60  !

     Grid spacing (DGRIDKM)            No default     ! DGRIDKM = 0.5 !
                                       Units: km

     Reference grid coordinate of
     SOUTHWEST corner of grid cell (1,1)

        X coordinate (XORIGKM)         No default     ! XORIGKM =
623.000 !
        Y coordinate (YORIGKM)         No default     ! YORIGKM =
6060.000 !
                                       Units: km


     Vertical grid definition:
     -------------------------

        No. of vertical layers (NZ)    No default     ! NZ =  8  !

        Cell face heights in arbitrary
        vertical grid (ZFACE(NZ+1))    No defaults
                                       Units: m
         ! ZFACE = 0.,20.,50.,100.,200.,500.,1000.,2000.,3300. !

!END!


------------------------------------------------------------------------
-------

INPUT GROUP: 3 -- Output Options
--------------


    DISK OUTPUT OPTION

       Save met. fields in an unformatted
       output file ?              (LSAVE)  Default: T     ! LSAVE = T !
```

```
   (F = Do not save, T = Save)

   Type of unformatted output file:
   (IFORMO)                          Default: 1    ! IFORMO =  1
!

        1 = CALPUFF/CALGRID type file (CALMET.DAT)
        2 = MESOPUFF-II type file     (PACOUT.DAT)


LINE PRINTER OUTPUT OPTIONS:

   Print met. fields ?  (LPRINT)       Default: F     ! LPRINT = F !
   (F = Do not print, T = Print)
   (NOTE: parameters below control which
          met. variables are printed)

   Print interval
   (IPRINF) in hours                   Default: 1     ! IPRINF =  1
!
   (Meteorological fields are printed
    every  1  hours)


   Specify which layers of U, V wind component
   to print (IUVOUT(NZ)) -- NOTE: NZ values must be entered
   (0=Do not print, 1=Print)
   (used only if LPRINT=T)        Defaults: NZ*0
   ! IUVOUT =  0 ,  0 ,  0 ,  0 ,  0 ,  0 ,  0 ,  0 ,  0 ,  0  !
   -----------------------


   Specify which levels of the W wind component to print
   (NOTE: W defined at TOP cell face --  10  values)
   (IWOUT(NZ)) -- NOTE: NZ values must be entered
   (0=Do not print, 1=Print)
   (used only if LPRINT=T & LCALGRD=T)
   -----------------------------------
                                       Defaults: NZ*0
    ! IWOUT =  0 ,  0 ,  0 ,  0 ,  0 ,  0 ,  0 ,  0 ,  0 ,  0  !


   Specify which levels of the 3-D temperature field to print
   (ITOUT(NZ)) -- NOTE: NZ values must be entered
   (0=Do not print, 1=Print)
   (used only if LPRINT=T & LCALGRD=T)
   -----------------------------------
                                       Defaults: NZ*0
    ! ITOUT =  0 ,  0 ,  0 ,  0 ,  0 ,  0 ,  0 ,  0 ,  0 ,  0  !

   Specify which meteorological fields
   to print
   (used only if LPRINT=T)             Defaults: 0 (all variables)
   -----------------------


     Variable           Print ?
                     (0 = do not print,
                      1 = print)
     --------        ------------------
```

```
      !  STABILITY  =          0          ! - PGT stability class
      !  USTAR      =          0          ! - Friction velocity
      !  MONIN      =          0          ! - Monin-Obukhov length
      !  MIXHT      =          0          ! - Mixing height
      !  WSTAR      =          0          ! - Convective velocity
scale
      !  PRECIP     =          0          ! - Precipitation rate
      !  SENSHEAT   =          0          ! - Sensible heat flux
      !  CONVZI     =          0          ! - Convective mixing ht.


       Testing and debug print options for micrometeorological module

          Print input meteorological data and
          internal variables (LDB)         Default: F       ! LDB = F !
          (F = Do not print, T = print)
          (NOTE: this option produces large amounts of output)

          First time step for which debug data
          are printed (NN1)                Default: 1       ! NN1 =  1
!

          Last time step for which debug data
          are printed (NN2)                Default: 1       ! NN2 =  2
!

          Print distance to land
          internal variables (LDBCST)      Default: F       ! LDBCST = F
!
          (F = Do not print, T = print)
          (Output in .GRD file DCST.GRD, defined in input group 0)

       Testing and debug print options for wind field module
       (all of the following print options control output to
        wind field module's output files: TEST.PRT, TEST.OUT,
        TEST.KIN, TEST.FRD, and TEST.SLP)

          Control variable for writing the test/debug
          wind fields to disk files (IOUTD)
          (0=Do not write, 1=write)        Default: 0       ! IOUTD =  0
!

          Number of levels, starting at the surface,
          to print (NZPRN2)                Default: 1       ! NZPRN2 =
1  !

          Print the INTERPOLATED wind components ?
          (IPR0) (0=no, 1=yes)             Default: 0       !  IPR0 =  0
!

          Print the TERRAIN ADJUSTED surface wind
          components ?
          (IPR1) (0=no, 1=yes)             Default: 0       !  IPR1 =  0
!

          Print the SMOOTHED wind components and
          the INITIAL DIVERGENCE fields ?
          (IPR2) (0=no, 1=yes)             Default: 0       !  IPR2 =  0
!
```

```
          Print the FINAL wind speed and direction
          fields ?
          (IPR3) (0=no, 1=yes)             Default: 0       !  IPR3 =  0
!

          Print the FINAL DIVERGENCE fields ?
          (IPR4) (0=no, 1=yes)             Default: 0       !  IPR4 =  0
!

          Print the winds after KINEMATIC effects
          are added ?
          (IPR5) (0=no, 1=yes)             Default: 0       !  IPR5 =  0
!

          Print the winds after the FROUDE NUMBER
          adjustment is made ?
          (IPR6) (0=no, 1=yes)             Default: 0       !  IPR6 =  0
!

          Print the winds after SLOPE FLOWS
          are added ?
          (IPR7) (0=no, 1=yes)             Default: 0       !  IPR7 =  0
!

          Print the FINAL wind field components ?
          (IPR8) (0=no, 1=yes)             Default: 0       !  IPR8 =  0
!

!END!


-------------------------------------------------------------------------
-------

INPUT GROUP: 4 -- Meteorological data options
--------------

    NO OBSERVATION MODE             (NOOBS)  Default: 0     ! NOOBS =  0
!
          0 = Use surface, overwater, and upper air stations
          1 = Use surface and overwater stations (no upper air
observations)
              Use MM4/MM5/3D.DAT for upper air data
          2 = No surface, overwater, or upper air observations
              Use MM4/MM5/3D.DAT for surface, overwater, and upper air
data

    NUMBER OF SURFACE & PRECIP. METEOROLOGICAL STATIONS

       Number of surface stations   (NSSTA)  No default     ! NSSTA =  2
!

       Number of precipitation stations
       (NPSTA=-1: flag for use of MM5/3D.DAT precip data)
                                    (NPSTA)  No default     ! NPSTA =  0
!

    CLOUD DATA OPTIONS
       Gridded cloud fields:
```

```
                                   (ICLOUD)  Default: 0     ! ICLOUD =
0  !
       ICLOUD = 0 - Gridded clouds not used
       ICLOUD = 1 - Gridded CLOUD.DAT generated as OUTPUT
       ICLOUD = 2 - Gridded CLOUD.DAT read as INPUT
       ICLOUD = 3 - Gridded cloud cover from Prognostic Rel. Humidity
                    at 850mb (Teixera)
       ICLOUD = 4 - Gridded cloud cover from Prognostic Rel. Humidity
                    at all levels (MM5toGrads algorithm)

    FILE FORMATS

       Surface meteorological data file format
                                   (IFORMS)  Default: 2     ! IFORMS =
2  !
       (1 = unformatted (e.g., SMERGE output))
       (2 = formatted   (free-formatted user input))

       Precipitation data file format
                                   (IFORMP)  Default: 2     ! IFORMP =
2  !
       (1 = unformatted (e.g., PMERGE output))
       (2 = formatted   (free-formatted user input))

       Cloud data file format
                                   (IFORMC)  Default: 2     ! IFORMC =
2  !
       (1 = unformatted - CALMET unformatted output)
       (2 = formatted   - free-formatted CALMET output or user input)

!END!


-------------------------------------------------------------------------
-------

INPUT GROUP: 5 -- Wind Field Options and Parameters
--------------


    WIND FIELD MODEL OPTIONS
       Model selection variable (IWFCOD)     Default: 1      ! IWFCOD =
1  !
          0 = Objective analysis only
          1 = Diagnostic wind module

       Compute Froude number adjustment
       effects ? (IFRADJ)                    Default: 1      ! IFRADJ =
1  !
       (0 = NO, 1 = YES)

       Compute kinematic effects ? (IKINE)   Default: 0      ! IKINE  =
0  !
       (0 = NO, 1 = YES)

       Use O'Brien procedure for adjustment
       of the vertical velocity ? (IOBR)     Default: 0      ! IOBR =  0
!
       (0 = NO, 1 = YES)
```

```
       Compute slope flow effects ? (ISLOPE) Default: 1      ! ISLOPE  =
1  !
       (0 = NO, 1 = YES)

       Extrapolate surface wind observations
       to upper layers ? (IEXTRP)            Default: -4     ! IEXTRP =
-4  !
       (1 = no extrapolation is done,
        2 = power law extrapolation used,
        3 = user input multiplicative factors
            for layers 2 - NZ used (see FEXTRP array)
        4 = similarity theory used
        -1, -2, -3, -4 = same as above except layer 1 data
            at upper air stations are ignored

       Extrapolate surface winds even
       if calm? (ICALM)                      Default: 0      ! ICALM  =
0  !
       (0 = NO, 1 = YES)

       Layer-dependent biases modifying the weights of
       surface and upper air stations (BIAS(NZ))
         -1<=BIAS<=1
       Negative BIAS reduces the weight of upper air stations
         (e.g. BIAS=-0.1 reduces the weight of upper air stations
       by 10%; BIAS= -1, reduces their weight by 100 %)
       Positive BIAS reduces the weight of surface stations
         (e.g. BIAS= 0.2 reduces the weight of surface stations
       by 20%; BIAS=1 reduces their weight by 100%)
       Zero BIAS leaves weights unchanged (1/R**2 interpolation)
       Default: NZ*0
                                ! BIAS = -1 , -1 , -1 , -0.5 , -0.2 , 0.
, 0. , 0. !

       Minimum distance from nearest upper air station
       to surface station for which extrapolation
       of surface winds at surface station will be allowed
       (RMIN2: Set to -1 for IEXTRP = 4 or other situations
        where all surface stations should be extrapolated)
                                             Default: 4.     ! RMIN2 =
4.0 !

       Use gridded prognostic wind field model
       output fields as input to the diagnostic
       wind field model (IPROG)              Default: 0      ! IPROG =
0  !
       (0 = No, [IWFCOD = 0 or 1]
        1 = Yes, use CSUMM prog. winds as Step 1 field, [IWFCOD = 0]
        2 = Yes, use CSUMM prog. winds as initial guess field [IWFCOD =
1]
        3 = Yes, use winds from MM4.DAT file as Step 1 field [IWFCOD =
0]
        4 = Yes, use winds from MM4.DAT file as initial guess field
[IWFCOD = 1]
        5 = Yes, use winds from MM4.DAT file as observations [IWFCOD =
1]
        13 = Yes, use winds from MM5/3D.DAT file as Step 1 field [IWFCOD
= 0]
        14 = Yes, use winds from MM5/3D.DAT file as initial guess field
[IWFCOD = 1]
```

```
        15 = Yes, use winds from MM5/3D.DAT file as observations [IWFCOD
= 1]

       Timestep (seconds) of the prognostic
       model input data   (ISTEPPGS)         Default: 3600   ! ISTEPPGS
=  3600   !

       Use coarse CALMET fields as initial guess fields (IGFMET)
       (overwrites IGF based on prognostic wind fields if any)
                                            Default: 0      ! IGFMET =
0  !

    RADIUS OF INFLUENCE PARAMETERS

       Use varying radius of influence      Default: F      ! LVARY =
F!
       (if no stations are found within RMAX1,RMAX2,
        or RMAX3, then the closest station will be used)

       Maximum radius of influence over land
       in the surface layer (RMAX1)         No default      ! RMAX1 =
20. !
                                            Units: km
       Maximum radius of influence over land
       aloft (RMAX2)                        No default      ! RMAX2 =
20. !
                                            Units: km
       Maximum radius of influence over water
       (RMAX3)                              No default      ! RMAX3 =
20. !
                                            Units: km


    OTHER WIND FIELD INPUT PARAMETERS

       Minimum radius of influence used in
       the wind field interpolation (RMIN)  Default: 0.1    ! RMIN =
0.1 !
                                            Units: km
       Radius of influence of terrain
       features (TERRAD)                    No default      ! TERRAD =
5. !

                                            Units: km
       Relative weighting of the first
       guess field and observations in the
       SURFACE layer (R1)                   No default      ! R1 = 2. !
       (R1 is the distance from an          Units: km
       observational station at which the
       observation and first guess field are
       equally weighted)

       Relative weighting of the first
       guess field and observations in the
       layers ALOFT (R2)                    No default      ! R2 = 2. !
       (R2 is applied in the upper layers   Units: km
       in the same manner as R1 is used in
       the surface layer).

       Relative weighting parameter of the
```

```
       prognostic wind field data (RPROG)    No default      ! RPROG =
0. !
       (Used only if IPROG = 1)              Units: km
       ------------------------

       Maximum acceptable divergence in the
       divergence minimization procedure
       (DIVLIM)                              Default: 5.E-6  ! DIVLIM=
5.0E-06 !

       Maximum number of iterations in the
       divergence min. procedure (NITER)     Default: 50     ! NITER =
50  !

       Number of passes in the smoothing
       procedure (NSMTH(NZ))
       NOTE: NZ values must be entered
            Default: 2,(mxnz-1)*4 ! NSMTH =
 2 ,  4 ,  4 ,  4 ,  4 ,  4 ,  4 ,  4  !

       Maximum number of stations used in
       each layer for the interpolation of
       data to a grid point (NINTR2(NZ))
       NOTE: NZ values must be entered       Default: 99.    ! NINTR2 =
 4 ,  4 ,  4 ,  4 ,  4 ,  4 ,  4 ,  4  !

       Critical Froude number (CRITFN)       Default: 1.0    ! CRITFN =
1. !

       Empirical factor controlling the
       influence of kinematic effects
       (ALPHA)                               Default: 0.1    ! ALPHA =
0.1 !

       Multiplicative scaling factor for
       extrapolation of surface observations
       to upper layers (FEXTR2(NZ))          Default: NZ*0.0
       ! FEXTR2 = 0., 0., 0., 0., 0., 0., 0. !
       (Used only if IEXTRP = 3 or -3)


    BARRIER INFORMATION

       Number of barriers to interpolation
       of the wind fields (NBAR)             Default: 0      ! NBAR =  0
!

       Level (1 to NZ) up to which barriers
       apply (KBAR)                          Default: NZ     ! KBAR =  8
!

       THE FOLLOWING 4 VARIABLES ARE INCLUDED
       ONLY IF NBAR > 0
       NOTE: NBAR values must be entered     No defaults
             for each variable               Units: km

          X coordinate of BEGINNING
          of each barrier (XBBAR(NBAR))      ! XBBAR = 0. !
          Y coordinate of BEGINNING
          of each barrier (YBBAR(NBAR))      ! YBBAR = 0. !
```

```
          X coordinate of ENDING
          of each barrier (XEBAR(NBAR))      ! XEBAR = 0. !
          Y coordinate of ENDING
          of each barrier (YEBAR(NBAR))      ! YEBAR = 0. !


    DIAGNOSTIC MODULE DATA INPUT OPTIONS

       Surface temperature (IDIOPT1)         Default: 0      ! IDIOPT1 =
0  !
          0 = Compute internally from
              hourly surface observations or prognostic fields
          1 = Read preprocessed values from
              a data file (DIAG.DAT)

          Surface met. station to use for
          the surface temperature (ISURFT)   Default: -1    ! ISURFT = 1
!
          (Must be a value from 1 to NSSTA,
           or -1 to use 2-D spatially varying
              surface temperatures,
           or -2 to use a domain-average prognostic
              surface temperatures (only with ITPROG=2))
          (Used only if IDIOPT1 = 0)
          --------------------------

       Temperature lapse rate used in the    Default: 0     ! IDIOPT2 =
0  !
          computation of terrain-induced
          circulations (IDIOPT2)
          0 = Compute internally from (at least) twice-daily
              upper air observations or prognostic fields
          1 = Read hourly preprocessed values
              from a data file (DIAG.DAT)

          Upper air station to use for
          the domain-scale lapse rate (IUPT) Default: -1    ! IUPT   = 1
!
          (Must be a value from 1 to NUSTA,
           or -1 to use 2-D spatially varying lapse rate,
           or -2 to use a domain-average prognostic
              lapse rate (only with ITPROG>0))
          (Used only if IDIOPT2 = 0)
          --------------------------

          Depth through which the domain-scale
          lapse rate is computed (ZUPT)      Default: 200.  ! ZUPT =
200. !
          (Used only if IDIOPT2 = 0)         Units: meters
          --------------------------

       Initial Guess Field Winds
       (IDIOPT3)                             Default: 0     ! IDIOPT3 =
0  !
          0 = Compute internally from
              observations or prognostic wind fields
          1 = Read hourly preprocessed domain-average wind values
              from a data file (DIAG.DAT)
```

```
          Upper air station to use for
          the initial guess winds (IUPWND)   Default: -1    ! IUPWND = 1
!
          (Must be a value from -1 to NUSTA, with
          -1 indicating 3-D initial guess fields,
          and IUPWND>1 domain-scaled (i.e. constant) IGF)
          (Used only if IDIOPT3 = 0 and noobs=0)
          ------------------------------------

          Bottom and top of layer through
          which the domain-scale winds
          are computed
          (ZUPWND(1), ZUPWND(2))        Defaults: 1., 1000. ! ZUPWND=
1., 1000. !
          (Used only if IDIOPT3 = 0, NOOBS>0 and IUPWND>0)    Units:
meters
          -------------------------

       Observed surface wind components
       for wind field module (IDIOPT4)  Default: 0     ! IDIOPT4 =  0  !
          0 = Read WS, WD from a surface
              data file (SURF.DAT)
          1 = Read hourly preprocessed U, V from
              a data file (DIAG.DAT)

       Observed upper air wind components
       for wind field module (IDIOPT5)  Default: 0     ! IDIOPT5 =  0  !
          0 = Read WS, WD from an upper
              air data file (UP1.DAT, UP2.DAT, etc.)
          1 = Read hourly preprocessed U, V from
              a data file (DIAG.DAT)

       LAKE BREEZE INFORMATION

          Use Lake Breeze Module  (LLBREZE)
                                          Default: F      ! LLBREZE = F
!

           Number of lake breeze regions (NBOX)           ! NBOX =  0
!

        X Grid line 1 defining the region of interest
                                                         ! XG1 = 0. !
        X Grid line 2 defining the region of interest
                                                         ! XG2 = 0. !
        Y Grid line 1 defining the region of interest
                                                         ! YG1 = 0. !
        Y Grid line 2 defining the region of interest
                                                         ! YG2 = 0. !

         X Point defining the coastline (Straight line)
                   (XBCST)  (KM)   Default: none    ! XBCST = 0. !

         Y Point defining the coastline (Straight line)
                   (YBCST)  (KM)   Default: none    ! YBCST = 0. !

         X Point defining the coastline (Straight line)
                   (XECST)  (KM)   Default: none    ! XECST = 0. !

         Y Point defining the coastline (Straight line)
```

```
                    (YECST)  (KM)   Default: none    ! YECST = 0. !

       Number of stations in the region     Default: none ! NLB =  0 !
       (Surface stations + upper air stations)

       Station ID's  in the region   (METBXID(NLB))
       (Surface stations first, then upper air stations)
         ! METBXID =  0 !

!END!


-------------------------------------------------------------------------
-------

INPUT GROUP: 6 -- Mixing Height, Temperature and Precipitation
Parameters
--------------

    EMPIRICAL MIXING HEIGHT CONSTANTS

       Neutral, mechanical equation
       (CONSTB)                                Default: 1.41   ! CONSTB =
1.41 !
       Convective mixing ht. equation
       (CONSTE)                                Default: 0.15   ! CONSTE =
0.15 !
       Stable mixing ht. equation
       (CONSTN)                                Default: 2400.  ! CONSTN =
2400.!
       Overwater mixing ht. equation
       (CONSTW)                                Default: 0.16   ! CONSTW =
0.16 !
       Absolute value of Coriolis
       parameter (FCORIOL)                     Default: 1.E-4  ! FCORIOL =
1.0E-04!
                                               Units: (1/s)

    SPATIAL AVERAGING OF MIXING HEIGHTS

       Conduct spatial averaging
       (IAVEZI)  (0=no, 1=yes)                 Default: 1      ! IAVEZI =
1  !

       Max. search radius in averaging
       process (MNMDAV)                        Default: 1      ! MNMDAV =
1  !
                                               Units: Grid
                                                      cells
       Half-angle of upwind looking cone
       for averaging (HAFANG)                  Default: 30.    ! HAFANG =
30. !
                                               Units: deg.
       Layer of winds used in upwind
       averaging (ILEVZI)                      Default: 1      ! ILEVZI =
1  !
       (must be between 1 and NZ)
```

```
    CONVECTIVE MIXING HEIGHT OPTIONS:
       Method to compute the convective
       mixing height(IMIHXH)                Default: 1      ! IMIXH =
-1  !
           1: Maul-Carson for land and water cells
          -1: Maul-Carson for land cells only -
              OCD mixing height overwater
           2: Batchvarova and Gryning for land and water cells
          -2: Batchvarova and Gryning for land cells only
              OCD mixing height overwater

       Threshold buoyancy flux required to
       sustain convective mixing height growth
       overland (THRESHL)                   Default: 0.0    ! THRESHL =
0. !
       (expressed as a heat flux            units: W/m3
        per meter of boundary layer)


       Threshold buoyancy flux required to
       sustain convective mixing height growth
       overwater (THRESHW)                  Default: 0.05   ! THRESHW =
0.05 !
       (expressed as a heat flux            units: W/m3
        per meter of boundary layer)


       Option for overwater lapse rates used
       in convective mixing height growth
       (ITWPROG)                            Default: 0      ! ITWPROG =
0  !
       0 : use SEA.DAT lapse rates and deltaT (or assume neutral
           conditions if missing)
       1 : use prognostic lapse rates (only if IPROG>2)
           and SEA.DAT deltaT (or neutral if missing)
       2 : use prognostic lapse rates and prognostic delta T
           (only if iprog>12 and 3D.DAT version# 2.0 or higher)

       Land Use category ocean in 3D.DAT datasets
       (ILUOC3D)                            Default: 16     ! ILUOC3D =
16  !
       Note: if 3D.DAT from MM5 version 3.0, iluoc3d = 16
             if MM4.DAT,           typically iluoc3d = 7


    OTHER MIXING HEIGHT VARIABLES

       Minimum potential temperature lapse
       rate in the stable layer above the
       current convective mixing ht.        Default: 0.001  ! DPTMIN =
0.001 !
       (DPTMIN)                             Units: deg. K/m
       Depth of layer above current conv.
       mixing height through which lapse    Default: 200.   ! DZZI =
200. !
       rate is computed (DZZI)              Units: meters

       Minimum overland mixing height       Default:  50.   ! ZIMIN =
50. !
       (ZIMIN)                              Units: meters
```

```
       Maximum overland mixing height        Default: 3000.  ! ZIMAX =
3000. !
       (ZIMAX)                               Units: meters
       Minimum overwater mixing height       Default:   50.  ! ZIMINW =
50. !
       (ZIMINW) -- (Not used if observed     Units: meters
       overwater mixing hts. are used)
       Maximum overwater mixing height       Default: 3000.  ! ZIMAXW =
3000. !
       (ZIMAXW) -- (Not used if observed     Units: meters
       overwater mixing hts. are used)


    OVERWATER SURFACE FLUXES METHOD and PARAMETERS
          (ICOARE)                           Default: 10      ! ICOARE =
0   !
           0: original deltaT method (OCD)
          10: COARE with no wave parameterization (jwave=0, Charnock)
          11: COARE with wave option jwave=1 (Oost et al.)
              and default wave properties
         -11: COARE with wave option jwave=1 (Oost et al.)
              and observed wave properties (must be in SEA.DAT files)
          12: COARE with wave option 2 (Taylor and Yelland)
               and default wave properties
         -12: COARE with wave option 2 (Taylor and Yelland)
              and observed wave properties (must be in SEA.DAT files)

          Note:  When ICOARE=0, similarity wind profile stability PSI
functions
                 based on Van Ulden and Holtslag (1985) are substituted
for
                 later formulations used with the COARE module, and
temperatures
                 used for surface layer parameters are obtained from
either the
                 nearest surface station temperature or prognostic model
2D
                 temperatures (if ITPROG=2).


          Coastal/Shallow water length scale (DSHELF)
          (for modified z0 in shallow water)
          ( COARE fluxes only)
                                        Default : 0.        ! DSHELF =
0. !
                                        units: km

           COARE warm layer computation (IWARM)             ! IWARM =
0   !
           1: on - 0: off (must be off if SST measured with
           IR radiometer)               Default: 0

           COARE cool skin layer computation (ICOOL)        ! ICOOL =
0   !
           1: on - 0: off (must be off if SST measured with
           IR radiometer)               Default: 0

    RELATIVE HUMIDITY PARAMETERS

       3D relative humidity from observations or
```

```
       from prognostic data? (IRHPROG)       Default:0        ! IRHPROG
=  0   !

          0 = Use RH from SURF.DAT file
              (only if NOOBS = 0,1)
          1 = Use prognostic RH
              (only if NOOBS = 0,1,2)

    TEMPERATURE PARAMETERS

       3D temperature from observations or
       from prognostic data? (ITPROG)        Default:0        ! ITPROG =
0   !

          0 = Use Surface and upper air stations
              (only if NOOBS = 0)
          1 = Use Surface stations (no upper air observations)
              Use MM5/3D.DAT for upper air data
              (only if NOOBS = 0,1)
          2 = No surface or upper air observations
              Use MM5/3D.DAT for surface and upper air data
              (only if NOOBS = 0,1,2)

       Interpolation type
       (1 = 1/R ; 2 = 1/R**2)                Default:1         ! IRAD =
1  !

       Radius of influence for temperature
       interpolation (TRADKM)                Default: 500.     ! TRADKM
= 500. !
                                             Units: km

       Maximum Number of stations to include
       in temperature interpolation (NUMTS)  Default: 5        ! NUMTS =
5  !

       Conduct spatial averaging of temp-
       eratures (IAVET)  (0=no, 1=yes)       Default: 1        ! IAVET =
1  !
       (will use mixing ht MNMDAV,HAFANG
        so make sure they are correct)

       Default temperature gradient          Default: -.0098   ! TGDEFB
= -0.0098 !
       below the mixing height over          Units: K/m
       water (TGDEFB)

       Default temperature gradient          Default: -.0045   ! TGDEFA
= -0.0045 !
       above the mixing height over          Units: K/m
       water (TGDEFA)

       Beginning (JWAT1) and ending (JWAT2)
       land use categories for temperature                     ! JWAT1 =
55  !
       interpolation over water -- Make                        ! JWAT2 =
55  !
       bigger than largest land use to disable

   PRECIP INTERPOLATION PARAMETERS
```

```
       Method of interpolation (NFLAGP)      Default: 2       ! NFLAGP =
2  !
        (1=1/R,2=1/R**2,3=EXP/R**2)
       Radius of Influence  (SIGMAP)         Default: 100.0   ! SIGMAP =
50. !
        (0.0 => use half dist. btwn          Units: km
         nearest stns w & w/out
         precip when NFLAGP = 3)
       Minimum Precip. Rate Cutoff (CUTP)    Default: 0.01    ! CUTP =
0.01 !
        (values < CUTP = 0.0 mm/hr)          Units: mm/hr
!END!


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-------

INPUT GROUP: 7 -- Surface meteorological station parameters
--------------

     SURFACE STATION VARIABLES
     (One record per station --  4  records in all)


             1     2
         Name   ID            X coord.   Y coord.   Time   Anem.
                               (km)       (km)      zone   Ht.(m)
       ------------------------------------------------------------
! SS1  ='SCH'       101         640.284     6074.848    4    10 !
! SS2  ='WEB'       102         643.38      5866.985    4    10  !
-------------------
      1
        Four character string for station name
        (MUST START IN COLUMN 9)

      2
        Six digit integer for station ID

!END!


-------------------------------------------------------------------------
-------

INPUT GROUP: 8 -- Upper air meteorological station parameters
--------------

     UPPER AIR STATION VARIABLES
     (One record per station --  1  records in all)

             1     2
         Name    ID      X coord.   Y coord.  Time zone
                           (km)       (km)
        ---------------------------------------------
! US1  ='WLAB'   15708    192.814    5956.791       5  !
-------------------
      1
        Four character string for station name
        (MUST START IN COLUMN 9)
```

```
      2
        Five digit integer for station ID

!END!


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-------

INPUT GROUP: 9 -- Precipitation station parameters
--------------

     PRECIPITATION STATION VARIABLES
     (One record per station --  4  records in all)
     (NOT INCLUDED IF NPSTA = 0)

            1          2
         Name   Station    X coord.  Y coord.
                  Code       (km)      (km)
         ------------------------------------


-------------------
      1
        Four character string for station name
        (MUST START IN COLUMN 9)

      2
        Six digit station code composed of state
        code (first 2 digits) and station ID (last
        4 digits)

!END!
```

ATTACHMENT C

BPIP Input and Output Files

Jacques Whitford

P:\CMiC Jobs\1045xxx\1046156\Background\bpip\LIM1.bpv

BPIP (Dated: 04274)
DATE : 11/28/2008
TIME : 17:29:29
P:\CMiC Jobs\1045xxx\1046156\Background\bpip\LIM1.bpv

==========
BPIP PROCESSING INFORMATION:
==========

The P flag has been set for preparing downwash related data for a model run utilizing the PRIME algorithm.

Inputs entered in Meters will be converted to meters using a conversion factor of 1.0000. Output will be in meters.

UTMP is set to UTMN. The input is assumed to be in a local X-Y coordinate system as opposed to a UTM coordinate system. True North is in the positive Y direction.

Plant north is set to 0.00 degrees with respect to True North.

P:\CMiC Jobs\1045xxx\1046156\Background\bpip\LIM1.bpv

PRELIMINARY* GEP STACK HEIGHT RESULTS TABLE
(Output Units: meters)

Stack Name	Stack Height	Stack-Building Base Elevation Differences	GEP** EQN1	Preliminary* GEP Stack Height Value
STCK1	33.40	0.00	81.00	81.00
GEN1	5.00	0.00	81.00	81.00
GEN2	5.00	0.00	81.00	81.00
GEN3	5.00	0.00	81.00	81.00
GEN4	5.00	0.00	81.00	81.00
DC1	33.40	0.00	81.00	81.00

* Results are based on Determinants 1 & 2 on pages 1 & 2 of the GEP Technical Support Document. Determinant 3 may be investigated for additional stack height credit. Final values result after Determinant 3 has been taken into consideration.

** Results were derived from Equation 1 on page 6 of GEP Technical Support Document. Values have been adjusted for any stack-building base elevation differences.

Note: Criteria for determining stack heights for modeling emission limitations for a source can be found in Table 3.1 of the GEP Technical Support Document.

BPIP (Dated: 04274)

DATE : 11/28/2008
TIME : 17:29:29

P:\CMiC Jobs\1045xxx\1046156\Background\bpip\LIM1.bpv

BPIP output is in meters

```
     SO BUILDHGT STCK1      32.40   32.40   32.40   32.40   32.40
32.40
     SO BUILDHGT STCK1      32.40   32.40   32.40   32.40   32.40
32.40
     SO BUILDHGT STCK1      32.40   32.40   32.40   32.40   32.40
32.40
     SO BUILDHGT STCK1      32.40   32.40   32.40   32.40   32.40
32.40
     SO BUILDHGT STCK1      32.40   32.40   32.40   32.40   32.40
32.40
     SO BUILDHGT STCK1      32.40   32.40   32.40   32.40   32.40
32.40
     SO BUILDWID STCK1      55.53   54.75   52.50   48.25   47.00
52.50
     SO BUILDWID STCK1      56.50   59.00   59.50   57.50   55.00
50.00
     SO BUILDWID STCK1      44.00   36.50   42.00   47.75   52.00
54.62
     SO BUILDWID STCK1      55.53   54.75   52.25   48.25   47.00
52.50
     SO BUILDWID STCK1      56.50   59.00   59.50   58.00   55.00
50.00
     SO BUILDWID STCK1      44.00   36.00   42.00   47.75   52.00
54.56
     SO BUILDLEN STCK1      58.00   55.00   50.00   44.00   36.00
42.00
     SO BUILDLEN STCK1      47.75   52.00   54.62   55.50   54.75
52.50
     SO BUILDLEN STCK1      48.50   47.00   52.50   56.50   58.50
59.50
     SO BUILDLEN STCK1      58.00   55.00   50.00   43.50   36.00
42.25
     SO BUILDLEN STCK1      47.75   52.00   54.56   55.53   54.88
52.50
     SO BUILDLEN STCK1      48.25   47.00   52.50   56.50   59.00
59.00
     SO XBADJ    STCK1     -14.00  -14.00  -14.00  -13.00  -11.50  -
17.25
     SO XBADJ    STCK1     -23.00  -28.00  -32.19  -35.41  -37.62  -
38.75
     SO XBADJ    STCK1     -38.25  -39.00  -42.50  -45.00  -46.00  -
46.00
     SO XBADJ    STCK1     -43.50  -40.50  -36.50  -30.50  -24.50  -
25.00
     SO XBADJ    STCK1     -24.75  -24.00  -22.38  -20.16  -17.38  -
14.25
     SO XBADJ    STCK1     -10.00   -8.00  -10.00  -11.00  -12.50  -
13.50
     SO YBADJ    STCK1       7.55   10.12   12.25   13.88   15.50
16.25
     SO YBADJ    STCK1      16.75   16.50   16.25   14.75   13.00
```

```
11.00
     SO YBADJ    STCK1       9.00    6.25    3.75    0.88   -2.00   -
4.88
     SO YBADJ    STCK1      -7.64  -10.12  -12.12  -14.12  -15.50  -
16.25
     SO YBADJ    STCK1     -17.25  -16.50  -15.75  -15.00  -13.50  -
11.50
     SO YBADJ    STCK1      -9.00   -6.50   -3.75   -0.88    2.00
4.91


     SO BUILDHGT GEN1       32.40   32.40   32.40   32.40   32.40
32.40
     SO BUILDHGT GEN1       32.40   32.40   32.40   32.40   32.40
32.40
     SO BUILDHGT GEN1       32.40    4.30    4.30   32.40   32.40
32.40
     SO BUILDHGT GEN1       32.40   32.40   32.40   32.40   32.40
32.40
     SO BUILDHGT GEN1       32.40   32.40   32.40   32.40   32.40
32.40
     SO BUILDHGT GEN1       32.40    4.30    4.30   32.40   32.40
32.40
     SO BUILDWID GEN1       55.53   54.75   52.50   48.25   47.00
52.50
     SO BUILDWID GEN1       56.50   59.00   59.50   57.50   55.00
50.00
     SO BUILDWID GEN1       44.00    8.50    8.75   47.75   52.00
54.62
     SO BUILDWID GEN1       55.53   54.75   52.25   48.25   47.00
52.50
     SO BUILDWID GEN1       56.50   59.00   59.50   58.00   55.00
50.00
     SO BUILDWID GEN1       44.00    8.50    9.25   47.75   52.00
54.56
     SO BUILDLEN GEN1       58.00   55.00   50.00   44.00   36.00
42.00
     SO BUILDLEN GEN1       47.75   52.00   54.62   55.50   54.75
52.50
     SO BUILDLEN GEN1       48.50    4.50    5.50   56.50   58.50
59.50
     SO BUILDLEN GEN1       58.00   55.00   50.00   43.50   36.00
42.25
     SO BUILDLEN GEN1       47.75   52.00   54.56   55.53   54.88
52.50
     SO BUILDLEN GEN1       48.25    4.50    6.00   56.50   59.00
59.00
     SO XBADJ    GEN1      -44.00  -49.00  -52.00  -53.50  -53.00  -
58.50
     SO XBADJ    GEN1      -62.75  -65.12  -65.50  -63.88  -60.38  -
55.00
     SO XBADJ    GEN1      -47.75   -8.50  -18.50  -33.00  -27.00  -
21.00
     SO XBADJ    GEN1      -13.00   -5.50    2.00   10.00   17.00
16.25
     SO XBADJ    GEN1       15.00   13.12   10.94    8.31    5.38
2.25
     SO XBADJ    GEN1       -0.75   -2.00   -3.00  -23.50  -31.50  -
38.50
     SO YBADJ    GEN1       36.02   32.88   28.75   23.38   17.50
```

```
11.25
     SO YBADJ    GEN1        4.25   -2.00   -8.75  -15.75  -21.50  -
27.00
     SO YBADJ    GEN1      -31.50   -2.75   -5.88  -38.88  -39.12  -
38.19
     SO YBADJ    GEN1      -36.11  -32.88  -28.38  -23.62  -17.50  -
11.25
     SO YBADJ    GEN1       -4.75    2.50    9.25   15.50   21.50
27.00
     SO YBADJ    GEN1       31.50    2.25    2.38   38.88   39.25
38.22


     SO BUILDHGT GEN2       32.40   32.40   32.40   32.40   32.40
32.40
     SO BUILDHGT GEN2       32.40   32.40   32.40   32.40   32.40
32.40
     SO BUILDHGT GEN2       32.40    4.30   32.40   32.40   32.40
32.40
     SO BUILDHGT GEN2       32.40   32.40   32.40   32.40   32.40
32.40
     SO BUILDHGT GEN2       32.40   32.40   32.40   32.40   32.40
32.40
     SO BUILDHGT GEN2       32.40    4.30   32.40   32.40   32.40
32.40
     SO BUILDWID GEN2       55.53   54.75   52.50   48.25   47.00
52.50
     SO BUILDWID GEN2       56.50   59.00   59.50   57.50   55.00
50.00
     SO BUILDWID GEN2       44.00    8.50   42.00   47.75   52.00
54.62
     SO BUILDWID GEN2       55.53   54.75   52.25   48.25   47.00
52.50
     SO BUILDWID GEN2       56.50   59.00   59.50   58.00   55.00
50.00
     SO BUILDWID GEN2       44.00    8.50   42.00   47.75   52.00
54.56
     SO BUILDLEN GEN2       58.00   55.00   50.00   44.00   36.00
42.00
     SO BUILDLEN GEN2       47.75   52.00   54.62   55.50   54.75
52.50
     SO BUILDLEN GEN2       48.50    4.50   52.50   56.50   58.50
59.50
     SO BUILDLEN GEN2       58.00   55.00   50.00   43.50   36.00
42.25
     SO BUILDLEN GEN2       47.75   52.00   54.56   55.53   54.88
52.50
     SO BUILDLEN GEN2       48.25    4.50   52.50   56.50   59.00
59.00
     SO XBADJ    GEN2      -47.50  -51.50  -54.00  -54.00  -53.00  -
57.50
     SO XBADJ    GEN2      -60.75  -62.25  -61.88  -59.59  -55.62  -
49.75
     SO XBADJ    GEN2      -42.50   -3.00  -32.50  -28.00  -22.50  -
17.00
     SO XBADJ    GEN2      -10.00   -3.00    3.50   11.00   17.00
15.25
     SO XBADJ    GEN2       13.00   10.25    7.31    4.03    0.62   -
3.00
     SO XBADJ    GEN2       -6.00   -7.50  -20.50  -28.50  -36.00  -
```

```
42.50
     SO YBADJ    GEN2       31.77   28.12   23.50   18.12   12.00
6.25
     SO YBADJ    GEN2       -0.75   -7.00  -12.75  -18.75  -24.50  -
29.00
     SO YBADJ    GEN2      -32.00   -2.75  -36.25  -36.88  -36.25  -
34.56
     SO YBADJ    GEN2      -31.83  -28.12  -23.38  -18.38  -12.00   -
6.25
     SO YBADJ    GEN2        0.25    7.00   13.25   19.00   24.00
28.50
     SO YBADJ    GEN2       32.00    1.75   36.50   36.88   36.38
34.59


     SO BUILDHGT GEN3       32.40   32.40   32.40   32.40   32.40
32.40
     SO BUILDHGT GEN3       32.40   32.40   32.40   32.40   32.40
32.40
     SO BUILDHGT GEN3       32.40    4.30   32.40   32.40   32.40
32.40
     SO BUILDHGT GEN3       32.40   32.40   32.40   32.40   32.40
32.40
     SO BUILDHGT GEN3       32.40   32.40   32.40   32.40   32.40
32.40
     SO BUILDHGT GEN3       32.40    4.30   32.40   32.40   32.40
32.40
     SO BUILDWID GEN3       55.53   54.75   52.50   48.25   47.00
52.50
     SO BUILDWID GEN3       56.50   59.00   59.50   57.50   55.00
50.00
     SO BUILDWID GEN3       44.00    8.50   42.00   47.75   52.00
54.62
     SO BUILDWID GEN3       55.53   54.75   52.25   48.25   47.00
52.50
     SO BUILDWID GEN3       56.50   59.00   59.50   58.00   55.00
50.00
     SO BUILDWID GEN3       44.00    8.00   42.00   47.75   52.00
54.56
     SO BUILDLEN GEN3       58.00   55.00   50.00   44.00   36.00
42.00
     SO BUILDLEN GEN3       47.75   52.00   54.62   55.50   54.75
52.50
     SO BUILDLEN GEN3       48.50    4.50   52.50   56.50   58.50
59.50
     SO BUILDLEN GEN3       58.00   55.00   50.00   43.50   36.00
42.25
     SO BUILDLEN GEN3       47.75   52.00   54.56   55.53   54.88
52.50
     SO BUILDLEN GEN3       48.25    4.50   52.50   56.50   59.00
59.00
     SO XBADJ    GEN3      -51.00  -54.00  -55.50  -54.50  -52.50  -
56.00
     SO XBADJ    GEN3      -58.50  -59.12  -57.94  -55.03  -50.50  -
44.50
     SO XBADJ    GEN3      -36.75    2.50  -27.00  -23.00  -18.00  -
13.00
     SO XBADJ    GEN3       -6.50   -1.00    5.00   11.50   16.50
13.75
     SO XBADJ    GEN3       10.75    7.00    3.38   -0.53   -4.38   -
```

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8.25
     SO XBADJ    GEN3      -11.50    3.50  -26.00  -33.50  -40.50  -
46.50
     SO YBADJ    GEN3       27.17   23.12   18.00   12.62    6.50
0.75
     SO YBADJ    GEN3       -5.75  -11.50  -16.75  -22.25  -26.50  -
30.50
     SO YBADJ    GEN3      -32.50   -2.25  -35.00  -34.38  -33.12  -
30.62
     SO YBADJ    GEN3      -27.27  -23.00  -17.88  -12.62   -6.50   -
0.75
     SO YBADJ    GEN3        5.25   11.50   17.25   22.00   26.50
30.00
     SO YBADJ    GEN3       33.00    2.50   35.00   34.62   33.12
30.66


     SO BUILDHGT GEN4       32.40   32.40   32.40   32.40   32.40
32.40
     SO BUILDHGT GEN4       32.40   32.40   32.40   32.40   32.40
32.40
     SO BUILDHGT GEN4       32.40    4.30   32.40   32.40   32.40
32.40
     SO BUILDHGT GEN4       32.40   32.40   32.40   32.40   32.40
32.40
     SO BUILDHGT GEN4       32.40   32.40   32.40   32.40   32.40
32.40
     SO BUILDHGT GEN4       32.40   32.40   32.40   32.40   32.40
32.40
     SO BUILDWID GEN4       55.53   54.75   52.50   48.25   47.00
52.50
     SO BUILDWID GEN4       56.50   59.00   59.50   57.50   55.00
50.00
     SO BUILDWID GEN4       44.00    8.50   42.00   47.75   52.00
54.62
     SO BUILDWID GEN4       55.53   54.75   52.25   48.25   47.00
52.50
     SO BUILDWID GEN4       56.50   59.00   59.50   58.00   55.00
50.00
     SO BUILDWID GEN4       44.00   36.00   42.00   47.75   52.00
54.56
     SO BUILDLEN GEN4       58.00   55.00   50.00   44.00   36.00
42.00
     SO BUILDLEN GEN4       47.75   52.00   54.62   55.50   54.75
52.50
     SO BUILDLEN GEN4       48.50    4.50   52.50   56.50   58.50
59.50
     SO BUILDLEN GEN4       58.00   55.00   50.00   43.50   36.00
42.25
     SO BUILDLEN GEN4       47.75   52.00   54.56   55.53   54.88
52.50
     SO BUILDLEN GEN4       48.25   47.00   52.50   56.50   59.00
59.00
     SO XBADJ    GEN4      -53.50  -56.00  -57.00  -55.50  -52.50  -
55.00
     SO XBADJ    GEN4      -56.75  -56.62  -54.81  -51.34  -46.38  -
40.00
     SO XBADJ    GEN4      -32.25    7.50  -22.00  -18.50  -14.00   -
9.50
     SO XBADJ    GEN4       -3.50    1.50    6.50   12.00   16.50
```

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12.75
     SO XBADJ    GEN4        9.00    4.62    0.25   -4.22   -8.50  -
12.75
     SO XBADJ    GEN4      -16.25  -21.50  -30.50  -37.50  -44.50  -
50.00
     SO YBADJ    GEN4       23.48   18.88   13.75    7.88    2.00   -
3.75
     SO YBADJ    GEN4      -10.25  -15.50  -20.25  -24.75  -29.00  -
31.50
     SO YBADJ    GEN4      -33.50   -2.25  -34.00  -32.62  -30.62  -
27.50
     SO YBADJ    GEN4      -23.58  -18.88  -13.38   -8.12   -2.00
3.75
     SO YBADJ    GEN4        9.75   15.50   20.75   25.00   28.50
31.50
     SO YBADJ    GEN4       33.50   34.00   34.00   32.88   30.62
27.53


     SO BUILDHGT DC1        32.40   32.40   32.40   32.40   32.40
32.40
     SO BUILDHGT DC1        32.40   32.40   32.40   32.40   32.40
32.40
     SO BUILDHGT DC1        32.40   32.40   32.40   32.40   32.40
32.40
     SO BUILDHGT DC1        32.40   32.40   32.40   32.40   32.40
32.40
     SO BUILDHGT DC1        32.40   32.40   32.40   32.40   32.40
32.40
     SO BUILDHGT DC1        32.40   32.40   32.40   32.40   32.40
32.40
     SO BUILDWID DC1        55.53   54.75   52.50   48.25   47.00
52.50
     SO BUILDWID DC1        56.50   59.00   59.50   57.50   55.00
50.00
     SO BUILDWID DC1        44.00   36.50   42.00   47.75   52.00
54.62
     SO BUILDWID DC1        55.53   54.75   52.25   48.25   47.00
52.50
     SO BUILDWID DC1        56.50   59.00   59.50   58.00   55.00
50.00
     SO BUILDWID DC1        44.00   36.00   42.00   47.75   52.00
54.56
     SO BUILDLEN DC1        58.00   55.00   50.00   44.00   36.00
42.00
     SO BUILDLEN DC1        47.75   52.00   54.62   55.50   54.75
52.50
     SO BUILDLEN DC1        48.50   47.00   52.50   56.50   58.50
59.50
     SO BUILDLEN DC1        58.00   55.00   50.00   43.50   36.00
42.25
     SO BUILDLEN DC1        47.75   52.00   54.56   55.53   54.88
52.50
     SO BUILDLEN DC1        48.25   47.00   52.50   56.50   59.00
59.00
     SO XBADJ    DC1       -27.50  -28.50  -29.00  -28.00  -26.50  -
31.50
     SO XBADJ    DC1       -36.00  -39.50  -41.75  -42.72  -42.50  -
41.00
     SO XBADJ    DC1       -38.00  -36.00  -37.00  -37.00  -36.00  -
```

```
34.00
     SO XBADJ    DC1       -30.00  -26.00  -21.00  -15.00   -9.50  -
10.75
     SO XBADJ    DC1       -11.75  -12.50  -12.81  -12.81  -12.50  -
11.75
     SO XBADJ    DC1       -10.50  -11.00  -15.50  -19.00  -22.50  -
25.50
     SO YBADJ    DC1        14.89   15.00   14.50   13.62   12.50
10.75
     SO YBADJ    DC1         8.75    6.50    4.25    1.25   -1.50   -
4.00
     SO YBADJ    DC1        -6.00   -8.75  -10.50  -12.12  -13.50  -
14.44
     SO YBADJ    DC1       -14.98  -15.00  -14.38  -13.88  -12.50  -
10.75
     SO YBADJ    DC1        -9.25   -6.50   -3.75   -1.50    1.00
3.50
     SO YBADJ    DC1         6.50    8.50   10.50   12.12   13.50
14.47
```

```
'P:\CMiC Jobs\1045xxx\1046156\Background\bpip\LIM1.bpv'
'P'
'Meters'  1.00000000
'UTMN'  0.0000
14
'BLDG1'  1         532.000  'Crushing building'
    4          32.400
           639250.070     6073005.700
           639275.910     6073030.180
           639304.650     6072995.500
           639278.450     6072970.900
'SP3'  1         532.000  'Lump ore stockpile'
    8          10.000
           639146.700     6073228.070
           639137.860     6073221.950
           639137.860     6073206.990
           639175.260     6073162.790
           639188.180     6073161.430
           639195.660     6073168.230
           639197.020     6073181.150
           639160.300     6073226.710
'SP4'  1         532.000  'Sinter fine ore stockpile'
    8          10.000
           639202.460     6073160.070
           639194.300     6073153.270
           639194.300     6073138.980
           639251.430     6073071.660
           639265.030     6073069.620
           639273.870     6073077.100
           639273.190     6073090.700
           639213.340     6073159.390
'TK1'  1         532.000  'Diesel storage tank'
    8          10.700
           639371.790     6073030.410
           639377.400     6073032.730
           639379.720     6073038.340
           639377.400     6073043.950
           639371.790     6073046.270
           639366.190     6073043.950
           639363.860     6073038.340
           639366.190     6073032.730
'T1'  1          532.000  'Transformers'
    4           2.100
           639307.190     6072996.180
           639312.420     6073001.050
           639320.110     6072992.780
           639314.640     6072987.620
'GENE1'  1         532.000  'Diesel generator 1'
    4           4.300
           639315.430     6073012.700
           639318.170     6073009.410
           639311.730     6073003.710
           639308.990     6073006.830
'GENE2'  1         532.000  'generator enclosure 2'
    4           4.300
           639305.030     6073010.970
           639311.290     6073017.160
           639314.160     6073013.720
           639307.850     6073007.980
'GENE3'  1         532.000  'generator enclosure 3'
```

```
    4           4.300
            639301.250     6073014.860
            639307.560     6073020.890
            639310.430     6073017.450
            639303.880     6073011.830
'GENE4'  1         532.000  'generator enclosure 4'
    4           4.300
            639297.890     6073019.270
            639300.890     6073015.940
            639306.930     6073021.190
            639304.090     6073024.490
'TK2'  1         532.000  'Process water tank'
    8          10.700
            639282.640     6072956.960
            639287.260     6072958.870
            639289.180     6072963.490
            639287.260     6072968.110
            639282.640     6072970.030
            639278.020     6072968.110
            639276.110     6072963.490
            639278.020     6072958.870
'PWP1'  1         532.000  'Process water pump'
    4           4.300
            639272.810     6072961.620
            639266.880     6072955.900
            639274.460     6072947.290
            639280.660     6072952.800
'SP1'  1         542.000  'Blue ore stockpile'
    8          10.000
            639291.030     6072768.250
            639317.870     6072728.000
            639331.290     6072727.100
            639341.120     6072736.050
            639336.650     6072782.560
            639317.870     6072799.550
            639305.340     6072799.550
            639295.510     6072793.290
'SP2'  1         542.000  'Red ore stockpile'
    8          10.000
            639389.430     6072775.400
            639393.900     6072729.780
            639407.320     6072719.050
            639423.420     6072725.310
            639435.940     6072771.830
            639424.310     6072793.290
            639411.790     6072796.870
            639397.480     6072792.400
'BLDG2'  1         532.000  'Mobile offices'
    4           3.200
            639354.830     6072953.920
            639372.030     6072969.840
            639378.400     6072962.830
            639361.200     6072945.640
6
'STCK1'         532.000         33.400      639282.240     6072984.480
'Boiler'
'GEN1'          532.000          5.000      639315.570     6073009.700
'Genset 1'
'GEN2'          532.000          5.000      639311.920     6073013.630
'Genset 2'
```

```
'GEN3'          532.000           5.000      639307.990     6073017.560
'Genset 3'
'GEN4'          532.000           5.000      639304.900     6073021.210
'Genset 4'
'DC1'           532.000          33.400      639291.830     6072996.410
'Dust collector'
```

ATTACHMENT D

Sample CALPUFF Input File

Jacques Whitford

Labrador Lim -Nov 26, 2008

---------- Run title (3 lines)

CALPUFF MODEL CONTROL FILE

INPUT GROUP: 0 -- Input and Output File Names

Default Name Type File Name
--- --- ---
CALMET.DAT input ! METDAT =CMET.DAT !
  or
ISCMET.DAT input * ISCDAT = *
  or
PLMMET.DAT input * PLMDAT = *
  or
PROFILE.DAT input * PRFDAT = *
SURFACE.DAT input * SFCDAT = *
RESTARTB.DAT input * RSTARTB= *

CALPUFF.LST output ! PUFLST =CPUFF.LST !
CONC.DAT output ! CONDAT =CPUFF.CON !
DFLX.DAT output * DFDAT = *
WFLX.DAT output * WFDAT = *

VISB.DAT output * VISDAT = *
TK2D.DAT output * T2DDAT = *
RHO2D.DAT output * RHODAT = *
RESTARTE.DAT output * RSTARTE= *

Emission Files

PTEMARB.DAT input * PTDAT = *
VOLEMARB.DAT input * VOLDAT = *
BAEMARB.DAT input * ARDAT = *
LNEMARB.DAT input * LNDAT = *

Other Files

OZONE.DAT input * OZDAT = *
VD.DAT input * VDDAT = *
CHEM.DAT input * CHEMDAT= *
H2O2.DAT input * H2O2DAT= *
HILL.DAT input * HILDAT= *
HILLRCT.DAT input * RCTDAT= *
COASTLN.DAT input * CSTDAT= *
FLUXBDY.DAT input * BDYDAT= *
BCON.DAT input * BCNDAT= *
DEBUG.DAT output * DEBUG = *
MASSFLX.DAT output * FLXDAT= *

```
MASSBAL.DAT   output   * BALDAT=             *
FOG.DAT       output   * FOGDAT=             *
RISE.DAT      output   * RISDAT=             *
------------------------------------------------------------------------
--------
All file names will be converted to lower case if LCFILES = T
Otherwise, if LCFILES = F, file names will be converted to UPPER CASE
         T = lower case      ! LCFILES = T !
         F = UPPER CASE
NOTE: (1) file/path names can be up to 70 characters in length


Provision for multiple input files
----------------------------------

     Number of CALMET.DAT files for run (NMETDAT)
                                     Default: 1       ! NMETDAT =   1
!

     Number of PTEMARB.DAT files for run (NPTDAT)
                                     Default: 0       ! NPTDAT =  0  !

     Number of BAEMARB.DAT files for run (NARDAT)
                                     Default: 0       ! NARDAT =  0  !

     Number of VOLEMARB.DAT files for run (NVOLDAT)
                                     Default: 0       ! NVOLDAT =  0  !

!END!

-------------
Subgroup (0a)
-------------

  The following CALMET.DAT filenames are processed in sequence if
NMETDAT>1

Default Name  Type          File Name
------------  ----          ---------
 none         input    * METDAT=     *   *END*


------------------------------------------------------------------------
--------

INPUT GROUP: 1 -- General run control parameters
--------------

    Option to run all periods found
    in the met. file     (METRUN)   Default: 0       ! METRUN =   0  !

         METRUN = 0 - Run period explicitly defined below
         METRUN = 1 - Run all periods in met. file

     Starting date:    Year   (IBYR)  --    No default   ! IBYR  =  2002
!
                       Month  (IBMO)  --    No default   ! IBMO  =  4  !
                       Day    (IBDY)  --    No default   ! IBDY  =  1  !
     Starting time:    Hour   (IBHR)  --    No default   ! IBHR  =  0  !
                       Minute (IBMIN) --    No default   ! IBMIN =  0  !
```

```
                    Second (IBSEC) --    No default   ! IBSEC =  0  !

     Ending date:   Year   (IEYR)  --    No default   ! IEYR  =  2002
!
                    Month  (IEMO)  --    No default   ! IEMO  =  10
!
                    Day    (IEDY)  --    No default   ! IEDY  =  31
!
     Ending time:   Hour   (IEHR)  --    No default   ! IEHR  =  0  !
                    Minute (IEMIN) --    No default   ! IEMIN =  0  !
                    Second (IESEC) --    No default   ! IESEC =  0  !

     (These are only used if METRUN = 0)

     Base time zone        (XBTZ) -- No default       ! XBTZ= 4.0  !
     The zone is the number of hours that must be
     ADDED to the time to obtain UTC (or GMT)
     Examples: PST = 8., MST = 7.
               CST = 6., EST = 5.

     Length of modeling time-step (seconds)
     Equal to update period in the primary
     meteorological data files, or an
     integer fraction of it (1/2, 1/3 ...)
     Must be no larger than 1 hour
     (NSECDT)                         Default:3600     ! NSECDT =  3600
!
                                      Units: seconds

     Number of chemical species (NSPEC)
                                      Default: 5       ! NSPEC =  4   !

     Number of chemical species
     to be emitted  (NSE)             Default: 3       ! NSE =  4   !

     Flag to stop run after
     SETUP phase (ITEST)              Default: 2       ! ITEST =  2   !
     (Used to allow checking
     of the model inputs, files, etc.)
           ITEST = 1 - STOPS program after SETUP phase
           ITEST = 2 - Continues with execution of program
                       after SETUP

     Restart Configuration:

        Control flag (MRESTART)       Default: 0       ! MRESTART =  0
!

           0 = Do not read or write a restart file
           1 = Read a restart file at the beginning of
               the run
           2 = Write a restart file during run
           3 = Read a restart file at beginning of run
               and write a restart file during run

        Number of periods in Restart
        output cycle (NRESPD)         Default: 0       ! NRESPD =  0   !

           0 = File written only at last period
          >0 = File updated every NRESPD periods
```

```
     Meteorological Data Format (METFM)
                                    Default: 1       ! METFM =  1   !

           METFM = 1 - CALMET binary file (CALMET.MET)
           METFM = 2 - ISC ASCII file (ISCMET.MET)
           METFM = 3 - AUSPLUME ASCII file (PLMMET.MET)
           METFM = 4 - CTDM plus tower file (PROFILE.DAT) and
                       surface parameters file (SURFACE.DAT)
           METFM = 5 - AERMET tower file (PROFILE.DAT) and
                       surface parameters file (SURFACE.DAT)

     Meteorological Profile Data Format (MPRFFM)
            (used only for METFM = 1, 2, 3)
                                    Default: 1       ! MPRFFM =  1   !

           MPRFFM = 1 - CTDM plus tower file (PROFILE.DAT)
           MPRFFM = 2 - AERMET tower file (PROFILE.DAT)

     PG sigma-y is adjusted by the factor (AVET/PGTIME)**0.2
     Averaging Time (minutes) (AVET)
                                    Default: 60.0    ! AVET = 60. !
     PG Averaging Time (minutes) (PGTIME)
                                    Default: 60.0    ! PGTIME = 60. !


!END!


-------------------------------------------------------------------------
-------

INPUT GROUP: 2 -- Technical options
--------------


     Vertical distribution used in the
     near field (MGAUSS)                  Default: 1     ! MGAUSS =  1
!
        0 = uniform
        1 = Gaussian

     Terrain adjustment method
     (MCTADJ)                             Default: 3     ! MCTADJ =  3
!
        0 = no adjustment
        1 = ISC-type of terrain adjustment
        2 = simple, CALPUFF-type of terrain
            adjustment
        3 = partial plume path adjustment

     Subgrid-scale complex terrain
     flag (MCTSG)                         Default: 0     ! MCTSG =  0
!
        0 = not modeled
        1 = modeled

     Near-field puffs modeled as
     elongated slugs? (MSLUG)             Default: 0     ! MSLUG =  0
!
```

```
         0 = no
         1 = yes (slug model used)

      Transitional plume rise modeled?
      (MTRANS)                              Default: 1     ! MTRANS =  1
!
         0 = no  (i.e., final rise only)
         1 = yes (i.e., transitional rise computed)

      Stack tip downwash? (MTIP)            Default: 1     ! MTIP =  1  !
         0 = no  (i.e., no stack tip downwash)
         1 = yes (i.e., use stack tip downwash)

      Method used to compute plume rise for
      point sources not subject to building
      downwash? (MRISE)                     Default: 1     ! MRISE =  1
!
         1 = Briggs plume rise
         2 = Numerical plume rise

      Method used to simulate building
      downwash? (MBDW)                      Default: 1     ! MBDW =   2
!
         1 = ISC method
         2 = PRIME method

      Vertical wind shear modeled above
      stack top? (MSHEAR)                   Default: 0     ! MSHEAR =  1
!
         0 = no  (i.e., vertical wind shear not modeled)
         1 = yes (i.e., vertical wind shear modeled)

      Puff splitting allowed? (MSPLIT)      Default: 0     ! MSPLIT =  1
!
         0 = no (i.e., puffs not split)
         1 = yes (i.e., puffs are split)

      Chemical mechanism flag (MCHEM)       Default: 1     ! MCHEM =  0
!
         0 = chemical transformation not
             modeled
         1 = transformation rates computed
             internally (MESOPUFF II scheme)
         2 = user-specified transformation
             rates used
         3 = transformation rates computed
             internally (RIVAD/ARM3 scheme)
         4 = secondary organic aerosol formation
             computed (MESOPUFF II scheme for OH)

      Aqueous phase transformation flag (MAQCHEM)
      (Used only if MCHEM = 1, or 3)        Default: 0     ! MAQCHEM =  0
!
         0 = aqueous phase transformation
             not modeled
         1 = transformation rates adjusted
             for aqueous phase reactions

      Wet removal modeled ? (MWET)          Default: 1     ! MWET =  0
!
```

```
         0 = no
         1 = yes

      Dry deposition modeled ? (MDRY)       Default: 1     ! MDRY =  0
!
         0 = no
         1 = yes
         (dry deposition method specified
          for each species in Input Group 3)


      Gravitational settling (plume tilt)
      modeled ? (MTILT)                     Default: 0     ! MTILT =  0
!
         0 = no
         1 = yes
         (puff center falls at the gravitational
          settling velocity for 1 particle species)

      Restrictions:
          - MDRY  = 1
          - NSPEC = 1  (must be particle species as well)
          - sg    = 0  GEOMETRIC STANDARD DEVIATION in Group 8 is
                       set to zero for a single particle diameter

      Method used to compute dispersion
      coefficients (MDISP)                  Default: 3     ! MDISP =  2
!

         1 = dispersion coefficients computed from measured values
             of turbulence, sigma v, sigma w
         2 = dispersion coefficients from internally calculated
             sigma v, sigma w using micrometeorological variables
             (u*, w*, L, etc.)
         3 = PG dispersion coefficients for RURAL areas (computed using
             the ISCST multi-segment approximation) and MP coefficients
in
             urban areas
         4 = same as 3 except PG coefficients computed using
             the MESOPUFF II eqns.
         5 = CTDM sigmas used for stable and neutral conditions.
             For unstable conditions, sigmas are computed as in
             MDISP = 3, described above.  MDISP = 5 assumes that
             measured values are read

      Sigma-v/sigma-theta, sigma-w measurements used? (MTURBVW)
      (Used only if MDISP = 1 or 5)         Default: 3     ! MTURBVW =  3
!
         1 = use sigma-v or sigma-theta measurements
             from PROFILE.DAT to compute sigma-y
             (valid for METFM = 1, 2, 3, 4, 5)
         2 = use sigma-w measurements
             from PROFILE.DAT to compute sigma-z
             (valid for METFM = 1, 2, 3, 4, 5)
         3 = use both sigma-(v/theta) and sigma-w
             from PROFILE.DAT to compute sigma-y and sigma-z
             (valid for METFM = 1, 2, 3, 4, 5)
         4 = use sigma-theta measurements
             from PLMMET.DAT to compute sigma-y
             (valid only if METFM = 3)
```

```
     Back-up method used to compute dispersion
     when measured turbulence data are
     missing (MDISP2)                     Default: 3     ! MDISP2 =  3
!
     (used only if MDISP = 1 or 5)
        2 = dispersion coefficients from internally calculated
            sigma v, sigma w using micrometeorological variables
            (u*, w*, L, etc.)
        3 = PG dispersion coefficients for RURAL areas (computed using
            the ISCST multi-segment approximation) and MP coefficients
in
            urban areas
        4 = same as 3 except PG coefficients computed using
            the MESOPUFF II eqns.

     [DIAGNOSTIC FEATURE]
     Method used for Lagrangian timescale for Sigma-y
     (used only if MDISP=1,2 or MDISP2=1,2)
     (MTAULY)                             Default: 0     ! MTAULY =  0
!
        0 = Draxler default 617.284 (s)
        1 = Computed as Lag. Length / (.75 q) -- after SCIPUFF
       10 < Direct user input (s)             -- e.g., 306.9


     [DIAGNOSTIC FEATURE]
     Method used for Advective-Decay timescale for Turbulence
     (used only if MDISP=2 or MDISP2=2)
     (MTAUADV)                            Default: 0     ! MTAUADV =  0
!
        0 = No turbulence advection
        1 = Computed (OPTION NOT IMPLEMENTED)
       10 < Direct user input (s)   -- e.g., 800


     Method used to compute turbulence sigma-v &
     sigma-w using micrometeorological variables
     (Used only if MDISP = 2 or MDISP2 = 2)
     (MCTURB)                             Default: 1     ! MCTURB =  1
!
        1 = Standard CALPUFF subroutines
        2 = AERMOD subroutines

     PG sigma-y,z adj. for roughness?     Default: 0     ! MROUGH =  0
!
     (MROUGH)
        0 = no
        1 = yes

     Partial plume penetration of         Default: 1     ! MPARTL =  1
!
     elevated inversion modeled for
     point sources?
     (MPARTL)
        0 = no
        1 = yes

     Partial plume penetration of         Default: 1     ! MPARTLBA =
1  !
```

```
     elevated inversion modeled for
     buoyant area sources?
     (MPARTLBA)
        0 = no
        1 = yes

     Strength of temperature inversion     Default: 0     ! MTINV =  0
!
     provided in PROFILE.DAT extended records?
     (MTINV)
        0 = no (computed from measured/default gradients)
        1 = yes

     PDF used for dispersion under convective conditions?
                                           Default: 0     ! MPDF =  1  !
     (MPDF)
        0 = no
        1 = yes

     Sub-Grid TIBL module used for shore line?
                                           Default: 0     ! MSGTIBL = 0
!
     (MSGTIBL)
        0 = no
        1 = yes

     Boundary conditions (concentration) modeled?
                                           Default: 0     ! MBCON = 0  !
     (MBCON)
        0 = no
        1 = yes, using formatted BCON.DAT file
        2 = yes, using unformatted CONC.DAT file

     Note:  MBCON > 0 requires that the last species modeled
            be 'BCON'.  Mass is placed in species BCON when
            generating boundary condition puffs so that clean
            air entering the modeling domain can be simulated
            in the same way as polluted air.  Specify zero
            emission of species BCON for all regular sources.

     Individual source contributions saved?
                                           Default: 0     ! MSOURCE = 0
!
     (MSOURCE)
        0 = no
        1 = yes


     Analyses of fogging and icing impacts due to emissions from
     arrays of mechanically-forced cooling towers can be performed
     using CALPUFF in conjunction with a cooling tower emissions
     processor (CTEMISS) and its associated postprocessors.  Hourly
     emissions of water vapor and temperature from each cooling tower
     cell are computed for the current cell configuration and ambient
     conditions by CTEMISS. CALPUFF models the dispersion of these
     emissions and provides cloud information in a specialized format
     for further analysis. Output to FOG.DAT is provided in either
     'plume mode' or 'receptor mode' format.

     Configure for FOG Model output?
```

```
                                          Default: 0     ! MFOG =  0
!
     (MFOG)
        0 = no
        1 = yes  - report results in PLUME Mode format
        2 = yes  - report results in RECEPTOR Mode format


     Test options specified to see if
     they conform to regulatory
     values? (MREG)                       Default: 1     ! MREG =  0
!

        0 = NO checks are made
        1 = Technical options must conform to USEPA
            Long Range Transport (LRT) guidance
                       METFM    1 or 2
                       AVET     60. (min)
                       PGTIME   60. (min)
                       MGAUSS   1
                       MCTADJ   3
                       MTRANS   1
                       MTIP     1
                       MRISE    1
                       MCHEM    1 or 3 (if modeling SOx, NOx)
                       MWET     1
                       MDRY     1
                       MDISP    2 or 3
                       MPDF     0 if MDISP=3
                                1 if MDISP=2
                       MROUGH   0
                       MPARTL   1
                       MPARTLBA 0
                       SYTDEP   550. (m)
                       MHFTSZ   0
                       SVMIN    0.5 (m/s)


!END!


-------------------------------------------------------------------------
-------

INPUT GROUP: 3a, 3b -- Species list
-------------------

------------
Subgroup (3a)
------------

  The following species are modeled:

! CSPEC =          SO2 !         !END!
! CSPEC =          NOX !         !END!
! CSPEC =          VOC !         !END!
! CSPEC =           CO !         !END!

                                                          Dry

OUTPUT GROUP
```

```
    SPECIES          MODELED          EMITTED       DEPOSITED
NUMBER
     NAME         (0=NO, 1=YES)    (0=NO, 1=YES)    (0=NO,
(0=NONE,
   (Limit: 12                                        1=COMPUTED-GAS
1=1st CGRUP,
    Characters                                       2=COMPUTED-PARTICLE
2=2nd CGRUP,
    in length)                                       3=USER-SPECIFIED)
3= etc.)

!          SO2  =         1,               1,           0,
0   !
!          NOX  =         1,               1,           0,
0   !
!          VOC  =         1,               1,           0,
0   !
!           CO  =         1,               1,           0,
0   !

!END!
```

Note: The last species in (3a) must be 'BCON' when using the boundary condition option (MBCON > 0). Species BCON should typically be modeled as inert (no chem transformation or removal).

Subgroup (3b)

The following names are used for Species-Groups in which results for certain species are combined (added) prior to output. The CGRUP name will be used as the species name in output files. Use this feature to model specific particle-size distributions by treating each size-range as a separate species. Order must be consistent with 3(a) above.

INPUT GROUP: 4 -- Map Projection and Grid control parameters

Projection for all (X,Y):

Map projection (PMAP) Default: UTM ! PMAP = UTM !

- UTM : Universal Transverse Mercator
- TTM : Tangential Transverse Mercator
- LCC : Lambert Conformal Conic
- PS : Polar Stereographic
- EM : Equatorial Mercator
- LAZA : Lambert Azimuthal Equal Area

```
     False Easting and Northing (km) at the projection origin
     (Used only if PMAP= TTM, LCC, or LAZA)
     (FEAST)                   Default=0.0     ! FEAST  = 0.000  !
     (FNORTH)                  Default=0.0     ! FNORTH = 0.000  !

     UTM zone (1 to 60)
     (Used only if PMAP=UTM)
     (IUTMZN)                  No Default      ! IUTMZN =  19   !

     Hemisphere for UTM projection?
     (Used only if PMAP=UTM)
     (UTMHEM)                  Default: N      ! UTMHEM = N  !
         N   :  Northern hemisphere projection
         S   :  Southern hemisphere projection

     Latitude and Longitude (decimal degrees) of projection origin
     (Used only if PMAP= TTM, LCC, PS, EM, or LAZA)
     (RLAT0)                   No Default      ! RLAT0 = 0N  !
     (RLON0)                   No Default      ! RLON0 = 0E  !

         TTM :  RLON0 identifies central (true N/S) meridian of
projection
                RLAT0 selected for convenience
         LCC :  RLON0 identifies central (true N/S) meridian of
projection
                RLAT0 selected for convenience
         PS  :  RLON0 identifies central (grid N/S) meridian of
projection
                RLAT0 selected for convenience
         EM  :  RLON0 identifies central meridian of projection
                RLAT0 is REPLACED by 0.0N (Equator)
         LAZA:  RLON0 identifies longitude of tangent-point of mapping
plane
                RLAT0 identifies latitude of tangent-point of mapping
plane

     Matching parallel(s) of latitude (decimal degrees) for projection
     (Used only if PMAP= LCC or PS)
     (XLAT1)                   No Default      ! XLAT1 = 0N  !
     (XLAT2)                   No Default      ! XLAT2 = 0N  !

         LCC :  Projection cone slices through Earth's surface at XLAT1
and XLAT2
         PS  :  Projection plane slices through Earth at XLAT1
                (XLAT2 is not used)

     ----------
     Note:  Latitudes and longitudes should be positive, and include a
            letter N,S,E, or W indicating north or south latitude, and
            east or west longitude.  For example,
            35.9  N Latitude  =  35.9N
            118.7 E Longitude = 118.7E


     Datum-region
     ------------

     The Datum-Region for the coordinates is identified by a character
     string.  Many mapping products currently available use the model of
the
```

Earth known as the World Geodetic System 1984 (WGS-84). Other local models may be in use, and their selection in CALMET will make its output consistent with local mapping products. The list of Datum-Regions with official transformation parameters is provided by the National Imagery and Mapping Agency (NIMA).

NIMA Datum - Regions(Examples)

WGS-84	WGS-84 Reference Ellipsoid and Geoid, Global coverage (WGS84)
NAS-C	NORTH AMERICAN 1927 Clarke 1866 Spheroid, MEAN FOR CONUS (NAD27)
NAR-C	NORTH AMERICAN 1983 GRS 80 Spheroid, MEAN FOR CONUS (NAD83)
NWS-84	NWS 6370KM Radius, Sphere
ESR-S	ESRI REFERENCE 6371KM Radius, Sphere

Datum-region for output coordinates
(DATUM) Default: WGS-84 ! DATUM = WGS-84 !

METEOROLOGICAL Grid:

Rectangular grid defined for projection PMAP,
with X the Easting and Y the Northing coordinate

No. X grid cells (NX)	No default	! NX = 60 !
No. Y grid cells (NY)	No default	! NY = 60 !
No. vertical layers (NZ)	No default	! NZ = 8 !
Grid spacing (DGRIDKM)	No default Units: km	! DGRIDKM = .5 !
Cell face heights (ZFACE(nz+1))	No defaults Units: m	

! ZFACE = .0, 20.0, 50.0, 100.0, 200.0, 500.0, 1000.0, 2000.0, 3300.0 !

Reference Coordinates of SOUTHWEST corner of grid cell(1, 1):		
X coordinate (XORIGKM)	No default	! XORIGKM = 623.0 !
Y coordinate (YORIGKM)	No default Units: km	! YORIGKM = 6060.0 !

COMPUTATIONAL Grid:

The computational grid is identical to or a subset of the MET. grid.

```
     The lower left (LL) corner of the computational grid is at grid
point
     (IBCOMP, JBCOMP) of the MET. grid.  The upper right (UR) corner of
the
     computational grid is at grid point (IECOMP, JECOMP) of the MET.
grid.
     The grid spacing of the computational grid is the same as the MET.
grid.

        X index of LL corner (IBCOMP)      No default     ! IBCOMP =  1
!
                  (1 <= IBCOMP <= NX)

        Y index of LL corner (JBCOMP)      No default     ! JBCOMP =  1
!
                  (1 <= JBCOMP <= NY)


        X index of UR corner (IECOMP)      No default     ! IECOMP =  60
!
                  (1 <= IECOMP <= NX)

        Y index of UR corner (JECOMP)      No default     ! JECOMP =  60
!
                  (1 <= JECOMP <= NY)



SAMPLING Grid (GRIDDED RECEPTORS):

     The lower left (LL) corner of the sampling grid is at grid point
     (IBSAMP, JBSAMP) of the MET. grid.  The upper right (UR) corner of
the
     sampling grid is at grid point (IESAMP, JESAMP) of the MET. grid.
     The sampling grid must be identical to or a subset of the
computational
     grid.  It may be a nested grid inside the computational grid.
     The grid spacing of the sampling grid is DGRIDKM/MESHDN.

        Logical flag indicating if gridded
        receptors are used (LSAMP)         Default: T     ! LSAMP = F !
        (T=yes, F=no)

        X index of LL corner (IBSAMP)      No default     ! IBSAMP =  0
!
         (IBCOMP <= IBSAMP <= IECOMP)

        Y index of LL corner (JBSAMP)      No default     ! JBSAMP =  0
!
         (JBCOMP <= JBSAMP <= JECOMP)


        X index of UR corner (IESAMP)      No default     ! IESAMP =  0
!
         (IBCOMP <= IESAMP <= IECOMP)

        Y index of UR corner (JESAMP)      No default     ! JESAMP =  0
!
         (JBCOMP <= JESAMP <= JECOMP)
```

```
       Nesting factor of the sampling
        grid (MESHDN)                      Default: 1     ! MESHDN =  1
!
        (MESHDN is an integer >= 1)

!END!


-------------------------------------------------------------------------
-------


INPUT GROUP: 5 -- Output Options
--------------
                                              *
*
     FILE                        DEFAULT VALUE             VALUE THIS RUN
     ----                        -------------             --------------

   Concentrations (ICON)              1                    !  ICON =  1
!
   Dry Fluxes (IDRY)                  1                    !  IDRY =  0
!
   Wet Fluxes (IWET)                  1                    !  IWET =  0
!
   2D Temperature (IT2D)              0                    !  IT2D =  0
!
   2D Density (IRHO)                  0                    !  IRHO =  0
!
   Relative Humidity (IVIS)           1                    !  IVIS =  0
!
    (relative humidity file is
     required for visibility
     analysis)
   Use data compression option in output file?
   (LCOMPRS)                           Default: T          ! LCOMPRS = T
!

   *
    0 = Do not create file, 1 = create file


    QA PLOT FILE OUTPUT OPTION:

       Create a standard series of output files (e.g.
       locations of sources, receptors, grids ...)
       suitable for plotting?
       (IQAPLOT)                       Default: 1         !  IQAPLOT =
1   !
         0 = no
         1 = yes

    DIAGNOSTIC MASS FLUX OUTPUT OPTIONS:

       Mass flux across specified boundaries
       for selected species reported?
       (IMFLX)                         Default: 0         ! IMFLX =  0
!
         0 = no
```

```
          1 = yes (FLUXBDY.DAT and MASSFLX.DAT filenames
                   are specified in Input Group 0)

       Mass balance for each species
       reported?
       (IMBAL)                         Default: 0         ! IMBAL =  0
!
          0 = no
          1 = yes (MASSBAL.DAT filename is
               specified in Input Group 0)


    NUMERICAL RISE OUTPUT OPTION:

       Create a file with plume properties for each rise
       increment, for each model timestep?
       This applies to sources modeled with numerical rise
       and is limited to ONE source in the run.
       (INRISE)                        Default: 0         ! INRISE =  0
!
          0 = no
          1 = yes (RISE.DAT filename is
                   specified in Input Group 0)


    LINE PRINTER OUTPUT OPTIONS:

       Print concentrations (ICPRT)    Default: 0         ! ICPRT =  0
!
       Print dry fluxes (IDPRT)        Default: 0         ! IDPRT =  0
!
       Print wet fluxes (IWPRT)        Default: 0         ! IWPRT =  0
!
       (0 = Do not print, 1 = Print)

       Concentration print interval
       (ICFRQ) in timesteps            Default: 1         ! ICFRQ =  1
!
       Dry flux print interval
       (IDFRQ) in timesteps            Default: 1         ! IDFRQ =  1
!
       Wet flux print interval
       (IWFRQ) in timesteps            Default: 1         ! IWFRQ =  1
!

       Units for Line Printer Output
       (IPRTU)                         Default: 1         ! IPRTU =  1
!
                        for             for
                    Concentration    Deposition
              1 =       g/m**3          g/m**2/s
              2 =      mg/m**3         mg/m**2/s
              3 =      ug/m**3         ug/m**2/s
              4 =      ng/m**3         ng/m**2/s
              5 =     Odour Units

       Messages tracking progress of run
       written to the screen ?
       (IMESG)                         Default: 2         ! IMESG =  2
!
```

```
         0 = no
         1 = yes (advection step, puff ID)
         2 = yes (YYYYJJJHH, # old puffs, # emitted puffs)


     SPECIES (or GROUP for combined species) LIST FOR OUTPUT OPTIONS

                  ---- CONCENTRATIONS ----   ------ DRY FLUXES ------
------ WET FLUXES ------   -- MASS FLUX --
   SPECIES
   /GROUP        PRINTED?  SAVED ON DISK?   PRINTED?  SAVED ON DISK?
PRINTED?  SAVED ON DISK?   SAVED ON DISK?
   -------       ------------------------   ------------------------
------------------------   ---------------
!          SO2 =     0,           1,           0,           0,
0,           0,           0   !
!          NOX =     0,           1,           0,           0,
0,           0,           0   !
!          VOC =     0,           1,           0,           0,
0,           0,           0   !
!           CO =     0,           1,           0,           0,
0,           0,           0   !

  Note:  Species BCON (for MBCON > 0) does not need to be saved on disk.


     OPTIONS FOR PRINTING "DEBUG" QUANTITIES (much output)

       Logical for debug output
       (LDEBUG)                                  Default: F     ! LDEBUG
= F !

       First puff to track
       (IPFDEB)                                  Default: 1     ! IPFDEB
=  1  !

       Number of puffs to track
       (NPFDEB)                                  Default: 1     ! NPFDEB
=  1  !

       Met. period to start output
       (NN1)                                     Default: 1     ! NN1 =
1   !

       Met. period to end output
       (NN2)                                     Default: 10    ! NN2 =
10  !

!END!


-------------------------------------------------------------------------
-------


INPUT GROUP: 6a, 6b, & 6c -- Subgrid scale complex terrain inputs
-------------------------

---------------
Subgroup (6a)
```

```
---------------
       Number of terrain features (NHILL)       Default: 0     ! NHILL =
0   !

       Number of special complex terrain
       receptors  (NCTREC)                      Default: 0     ! NCTREC
=  0   !

       Terrain and CTSG Receptor data for
       CTSG hills input in CTDM format ?
       (MHILL)                                  No Default     ! MHILL =
2   !
       1 = Hill and Receptor data created
           by CTDM processors & read from
           HILL.DAT and HILLRCT.DAT files
       2 = Hill data created by OPTHILL &
           input below in Subgroup (6b);
           Receptor data in Subgroup (6c)

       Factor to convert horizontal dimensions  Default: 1.0   ! XHILL2M
= 1.0 !
       to meters (MHILL=1)

       Factor to convert vertical dimensions    Default: 1.0   ! ZHILL2M
= 1.0 !
       to meters (MHILL=1)

       X-origin of CTDM system relative to      No Default     ! XCTDMKM
= 0 !
       CALPUFF coordinate system, in Kilometers (MHILL=1)

       Y-origin of CTDM system relative to      No Default     ! YCTDMKM
= 0 !
       CALPUFF coordinate system, in Kilometers (MHILL=1)

! END !

---------------
Subgroup (6b)
---------------

                      1 **
     HILL information


HILL           XC         YC        THETAH  ZGRID  RELIEF    EXPO 1
EXPO 2   SCALE 1    SCALE 2    AMAX1     AMAX2
 NO.          (km)       (km)       (deg.)   (m)     (m)       (m)
(m)       (m)        (m)        (m)       (m)
----          ----       ----       ------  -----  ------    ------
------   -------    -------    -----     -----

---------------
Subgroup (6c)
---------------

    COMPLEX TERRAIN RECEPTOR INFORMATION

                     XRCT         YRCT        ZRCT          XHH
                     (km)         (km)         (m)
```

```
                  ------        -----      ------         ----


-------------------
1
     Description of Complex Terrain Variables:
          XC, YC  = Coordinates of center of hill
          THETAH  = Orientation of major axis of hill (clockwise from
                    North)
          ZGRID   = Height of the  0  of the grid above mean sea
                    level
          RELIEF  = Height of the crest of the hill above the grid
elevation
          EXPO 1  = Hill-shape exponent for the major axis
          EXPO 2  = Hill-shape exponent for the major axis
          SCALE 1 = Horizontal length scale along the major axis
          SCALE 2 = Horizontal length scale along the minor axis
          AMAX    = Maximum allowed axis length for the major axis
          BMAX    = Maximum allowed axis length for the major axis

          XRCT, YRCT = Coordinates of the complex terrain receptors
          ZRCT    = Height of the ground (MSL) at the complex terrain
                    Receptor
          XHH     = Hill number associated with each complex terrain
receptor
                    (NOTE: MUST BE ENTERED AS A REAL NUMBER)

   **
     NOTE: DATA for each hill and CTSG receptor are treated as a
separate
           input subgroup and therefore must end with an input group
terminator.

-------------------------------------------------------------------------
-------


INPUT GROUP: 7 -- Chemical parameters for dry deposition of gases
--------------

      SPECIES     DIFFUSIVITY      ALPHA STAR      REACTIVITY
MESOPHYLL RESISTANCE     HENRY'S LAW COEFFICIENT
       NAME        (cm**2/s)
(s/cm)               (dimensionless)
      -------     -----------      ----------      ----------
--------------------     ----------------------


!END!


-------------------------------------------------------------------------
-------


INPUT GROUP: 8 -- Size parameters for dry deposition of particles
--------------

     For SINGLE SPECIES, the mean and standard deviation are used to
     compute a deposition velocity for NINT (see group 9) size-ranges,
```

```
     and these are then averaged to obtain a mean deposition velocity.

     For GROUPED SPECIES, the size distribution should be explicitly
     specified (by the 'species' in the group), and the standard
deviation
     for each should be entered as 0.  The model will then use the
     deposition velocity for the stated mean diameter.

      SPECIES      GEOMETRIC MASS MEAN        GEOMETRIC STANDARD
       NAME             DIAMETER                 DEVIATION
                        (microns)                (microns)
      -------      -------------------        ------------------

!END!


-------------------------------------------------------------------------
-------


INPUT GROUP: 9 -- Miscellaneous dry deposition parameters
--------------

     Reference cuticle resistance (s/cm)
     (RCUTR)                          Default: 30    !  RCUTR = 30.0 !
     Reference ground resistance  (s/cm)
     (RGR)                            Default: 10    !    RGR = 10.0 !
     Reference pollutant reactivity
     (REACTR)                         Default: 8     ! REACTR = 8.0 !

     Number of particle-size intervals used to
     evaluate effective particle deposition velocity
     (NINT)                           Default: 9     !   NINT =  9  !

     Vegetation state in unirrigated areas
     (IVEG)                           Default: 1     !   IVEG =  1   !
        IVEG=1 for active and unstressed vegetation
        IVEG=2 for active and stressed vegetation
        IVEG=3 for inactive vegetation

!END!


-------------------------------------------------------------------------
-------


INPUT GROUP: 10 -- Wet Deposition Parameters
---------------


                     Scavenging Coefficient -- Units: (sec)**(-1)

       Pollutant      Liquid Precip.       Frozen Precip.
       ---------      --------------       --------------

!END!


-------------------------------------------------------------------------
```

```
-------


INPUT GROUP: 11 -- Chemistry Parameters
---------------

     Ozone data input option (MOZ)     Default: 1            ! MOZ =  0
!
     (Used only if MCHEM = 1, 3, or 4)
        0 = use a monthly background ozone value
        1 = read hourly ozone concentrations from
            the OZONE.DAT data file

     Monthly ozone concentrations
     (Used only if MCHEM = 1, 3, or 4 and
      MOZ = 0 or MOZ = 1 and all hourly O3 data missing)
     (BCKO3) in ppb                    Default: 12*80.
     !  BCKO3 = 80.00, 80.00, 80.00, 80.00, 80.00, 80.00, 80.00, 80.00,
80.00, 80.00, 80.00, 80.00 !

     Monthly ammonia concentrations
     (Used only if MCHEM = 1, or 3)
     (BCKNH3) in ppb                   Default: 12*10.
     !  BCKNH3 = 10.00, 10.00, 10.00, 10.00, 10.00, 10.00, 10.00, 10.00,
10.00, 10.00, 10.00, 10.00 !

     Nighttime SO2 loss rate (RNITE1)
     in percent/hour                   Default: 0.2          ! RNITE1 =
.2 !

     Nighttime NOx loss rate (RNITE2)
     in percent/hour                   Default: 2.0          ! RNITE2 =
2.0 !

     Nighttime HNO3 formation rate (RNITE3)
     in percent/hour                   Default: 2.0          ! RNITE3 =
2.0 !

     H2O2 data input option (MH2O2)    Default: 1            ! MH2O2 =
1   !
     (Used only if MAQCHEM = 1)
        0 = use a monthly background H2O2 value
        1 = read hourly H2O2 concentrations from
            the H2O2.DAT data file

     Monthly H2O2 concentrations
     (Used only if MQACHEM = 1 and
      MH2O2 = 0 or MH2O2 = 1 and all hourly H2O2 data missing)
     (BCKH2O2) in ppb                  Default: 12*1.
     !  BCKH2O2 = 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00,
1.00, 1.00, 1.00 !


 --- Data for SECONDARY ORGANIC AEROSOL (SOA) Option
     (used only if MCHEM = 4)

     The SOA module uses monthly values of:
          Fine particulate concentration in ug/m^3 (BCKPMF)
          Organic fraction of fine particulate     (OFRAC)
          VOC / NOX ratio (after reaction)         (VCNX)
```

to characterize the air mass when computing
the formation of SOA from VOC emissions.
Typical values for several distinct air mass types are:

Month	1	2	3	4	5	6	7	8	9	10	11	12
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Clean Continental												
BCKPMF	1.	1.	1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
OFRAC	.15	.15	.20	.20	.20	.20	.20	.20	.20	.20	.20	.15
VCNX	50.	50.	50.	50.	50.	50.	50.	50.	50.	50.	50.	50.
Clean Marine (surface)												
BCKPMF	.5	.5	.5	.5	.5	.5	.5	.5	.5	.5	.5	.5
OFRAC	.25	.25	.30	.30	.30	.30	.30	.30	.30	.30	.30	.25
VCNX	50.	50.	50.	50.	50.	50.	50.	50.	50.	50.	50.	50.
Urban - low biogenic (controls present)												
BCKPMF	30.	30.	30.	30.	30.	30.	30.	30.	30.	30.	30.	30.
OFRAC	.20	.20	.25	.25	.25	.25	.25	.25	.20	.20	.20	.20
VCNX	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.
Urban - high biogenic (controls present)												
BCKPMF	60.	60.	60.	60.	60.	60.	60.	60.	60.	60.	60.	60.
OFRAC	.25	.25	.30	.30	.30	.55	.55	.55	.35	.35	.35	.25
VCNX	15.	15.	15.	15.	15.	15.	15.	15.	15.	15.	15.	15.
Regional Plume												
BCKPMF	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.
OFRAC	.20	.20	.25	.35	.25	.40	.40	.40	.30	.30	.30	.20
VCNX	15.	15.	15.	15.	15.	15.	15.	15.	15.	15.	15.	15.
Urban - no controls present												
BCKPMF	100.	100.	100.	100.	100.	100.	100.	100.	100.	100.	100.	100.
OFRAC	.30	.30	.35	.35	.35	.55	.55	.55	.35	.35	.35	.30
VCNX	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.

Default: Clean Continental
! BCKPMF = 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00 !

```
     !  OFRAC  = 0.15, 0.15, 0.20, 0.20, 0.20, 0.20, 0.20, 0.20, 0.20,
0.20, 0.20, 0.15 !
     !  VCNX   = 50.00, 50.00, 50.00, 50.00, 50.00, 50.00, 50.00, 50.00,
50.00, 50.00, 50.00, 50.00 !


!END!


------------------------------------------------------------------------
-------


INPUT GROUP: 12 -- Misc. Dispersion and Computational Parameters
---------------

     Horizontal size of puff (m) beyond which
     time-dependent dispersion equations (Heffter)
     are used to determine sigma-y and
     sigma-z (SYTDEP)                          Default: 550.   ! SYTDEP
= 5.5E02 !

     Switch for using Heffter equation for sigma z
     as above (0 = Not use Heffter; 1 = use Heffter
     (MHFTSZ)                                  Default: 0      ! MHFTSZ
=  0   !

     Stability class used to determine plume
     growth rates for puffs above the boundary
     layer (JSUP)                              Default: 5      ! JSUP =
5   !

     Vertical dispersion constant for stable
     conditions (k1 in Eqn. 2.7-3)  (CONK1)    Default: 0.01   ! CONK1
= .01 !

     Vertical dispersion constant for neutral/
     unstable conditions (k2 in Eqn. 2.7-4)
     (CONK2)                                   Default: 0.1    ! CONK2
= .1 !

     Factor for determining Transition-point from
     Schulman-Scire to Huber-Snyder Building Downwash
     scheme (SS used for Hs < Hb + TBD * HL)
     (TBD)                                     Default: 0.5    ! TBD =
.5 !
        TBD < 0   ==> always use Huber-Snyder
        TBD = 1.5 ==> always use Schulman-Scire
        TBD = 0.5 ==> ISC Transition-point

     Range of land use categories for which
     urban dispersion is assumed
     (IURB1, IURB2)                            Default: 10     ! IURB1
=  10  !
                                                       19     ! IURB2
=  19  !

     Site characterization parameters for single-point Met data files
---------
     (needed for METFM = 2,3,4,5)
```

```
        Land use category for modeling domain
        (ILANDUIN)                              Default: 20     !
ILANDUIN =  20  !

        Roughness length (m) for modeling domain
        (Z0IN)                                  Default: 0.25   ! Z0IN =
.25 !

        Leaf area index for modeling domain
        (XLAIIN)                                Default: 3.0    ! XLAIIN
= 3.0 !

        Elevation above sea level (m)
        (ELEVIN)                                Default: 0.0    ! ELEVIN
= .0 !

        Latitude (degrees) for met location
        (XLATIN)                                Default: -999.  ! XLATIN
= -999.0 !

        Longitude (degrees) for met location
        (XLONIN)                                Default: -999.  ! XLONIN
= -999.0 !

     Specialized information for interpreting single-point Met data
files -----

        Anemometer height (m) (Used only if METFM = 2,3)
        (ANEMHT)                                Default: 10.    ! ANEMHT
= 10.0 !

        Form of lateral turbulance data in PROFILE.DAT file
        (Used only if METFM = 4,5 or MTURBVW = 1 or 3)
        (ISIGMAV)                               Default: 1      !
ISIGMAV =  1  !
            0 = read sigma-theta
            1 = read sigma-v

        Choice of mixing heights (Used only if METFM = 4)
        (IMIXCTDM)                              Default: 0      !
IMIXCTDM =  0  !
            0 = read PREDICTED mixing heights
            1 = read OBSERVED mixing heights

     Maximum length of a slug (met. grid units)
     (XMXLEN)                                   Default: 1.0    ! XMXLEN
= 1.0 !

     Maximum travel distance of a puff/slug (in
     grid units) during one sampling step
     (XSAMLEN)                                  Default: 1.0    !
XSAMLEN = 1.0 !

     Maximum Number of slugs/puffs release from
     one source during one time step
     (MXNEW)                                    Default: 99     ! MXNEW
=  99   !

     Maximum Number of sampling steps for
```

```
     one puff/slug during one time step
     (MXSAM)                                    Default: 99     ! MXSAM
=  99   !

     Number of iterations used when computing
     the transport wind for a sampling step
     that includes gradual rise (for CALMET
     and PROFILE winds)
     (NCOUNT)                                   Default: 2      ! NCOUNT
=  2   !

     Minimum sigma y for a new puff/slug (m)
     (SYMIN)                                    Default: 1.0    ! SYMIN
= 1.0  !

     Minimum sigma z for a new puff/slug (m)
     (SZMIN)                                    Default: 1.0    ! SZMIN
= 1.0  !

     Maximum sigma z (m) allowed to avoid
     numerical problem in calculating virtual
     time or distance.  Cap should be large
     enough to have no influence on normal events.
     Enter a negative cap to disable.
     (SZCAP_M)                                  Default: 5.0e06 !
SZCAP_M = 5.0E06 !

     Default minimum turbulence velocities sigma-v and sigma-w
     for each stability class over land and over water (m/s)
     (SVMIN(12) and SWMIN(12))

                     ----------  LAND  ----------       ---------  WATER
----------
        Stab Class :  A    B    C    D    E    F         A    B    C
D    E    F
                     ---  ---  ---  ---  ---  ---       ---  ---  ---
---  ---  ---
     Default SVMIN : .50, .50, .50, .50, .50, .50,      .37, .37, .37,
.37, .37, .37
     Default SWMIN : .20, .12, .08, .06, .03, .016,     .20, .12, .08,
.06, .03, .016

          ! SVMIN = 0.500, 0.500, 0.500, 0.500, 0.500, 0.500, 0.370,
0.370, 0.370, 0.370, 0.370, 0.370!
          ! SWMIN = 0.200, 0.120, 0.080, 0.060, 0.030, 0.016, 0.200,
0.120, 0.080, 0.060, 0.030, 0.016!

     Divergence criterion for dw/dz across puff
     used to initiate adjustment for horizontal
     convergence (1/s)
     Partial adjustment starts at CDIV(1), and
     full adjustment is reached at CDIV(2)
     (CDIV(2))                                  Default: 0.0,0.0  ! CDIV
= .0, .0 !

     Search radius (number of cells) for nearest
     land and water cells used in the subgrid
     TIBL module
     (NLUTIBL)                                  Default: 4      !
NLUTIBL =  4  !
```

```
     Minimum wind speed (m/s) allowed for
     non-calm conditions. Also used as minimum
     speed returned when using power-law
     extrapolation toward surface
     (WSCALM)                                  Default: 0.5    ! WSCALM
= .5 !

     Maximum mixing height (m)
     (XMAXZI)                                  Default: 3000.  ! XMAXZI
= 3000.0 !

     Minimum mixing height (m)
     (XMINZI)                                  Default: 50.    ! XMINZI
= 50.0 !

     Default wind speed classes --
     5 upper bounds (m/s) are entered;
     the 6th class has no upper limit
     (WSCAT(5))                      Default   :
                                     ISC RURAL : 1.54, 3.09, 5.14, 8.23,
10.8 (10.8+)

                               Wind Speed Class :  1     2     3     4
5
                                                   ---   ---   ---   ---
---
                                       ! WSCAT = 1.54, 3.09, 5.14, 8.23,
10.80 !

     Default wind speed profile power-law
     exponents for stabilities 1-6
     (PLX0(6))                       Default   : ISC RURAL values
                                     ISC RURAL : .07, .07, .10, .15,
.35, .55
                                     ISC URBAN : .15, .15, .20, .25,
.30, .30

                                Stability Class :  A     B     C     D
E     F
                                                   ---   ---   ---   ---
---   ---
                                          ! PLX0 = 0.07, 0.07, 0.10, 0.15,
0.35, 0.55 !

     Default potential temperature gradient
     for stable classes E, F (degK/m)
     (PTG0(2))                       Default: 0.020, 0.035
                                        ! PTG0 = 0.020,   0.035 !

     Default plume path coefficients for
     each stability class (used when option
     for partial plume height terrain adjustment
     is selected -- MCTADJ=3)
     (PPC(6))                   Stability Class :  A     B     C     D
E     F
                                   Default  PPC : .50,  .50,  .50,  .50,
.35,  .35
                                                   ---   ---   ---   ---
---   ---
```

```
                                        !  PPC = 0.50, 0.50, 0.50, 0.50,
0.35, 0.35 !

     Slug-to-puff transition criterion factor
     equal to sigma-y/length of slug
     (SL2PF)                            Default: 10.        ! SL2PF =
10.0 !

     Puff-splitting control variables -----------------------

       VERTICAL SPLIT
       --------------

       Number of puffs that result every time a puff
       is split - nsplit=2 means that 1 puff splits
       into 2
       (NSPLIT)                         Default:   3        ! NSPLIT
=  3  !

       Time(s) of a day when split puffs are eligible to
       be split once again; this is typically set once
       per day, around sunset before nocturnal shear develops.
       24 values: 0 is midnight (00:00) and 23 is 11 PM (23:00)
       0=do not re-split    1=eligible for re-split
       (IRESPLIT(24))                   Default:  Hour 17 = 1
       !  IRESPLIT = 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,1,0,0,0,0,0,0 !

       Split is allowed only if last hour's mixing
       height (m) exceeds a minimum value
       (ZISPLIT)                        Default: 100.       ! ZISPLIT
= 100.0 !

       Split is allowed only if ratio of last hour's
       mixing ht to the maximum mixing ht experienced
       by the puff is less than a maximum value (this
       postpones a split until a nocturnal layer develops)
       (ROLDMAX)                        Default: 0.25       ! ROLDMAX
= 0.25 !


       HORIZONTAL SPLIT
       ----------------

       Number of puffs that result every time a puff
       is split - nsplith=5 means that 1 puff splits
       into 5
       (NSPLITH)                        Default:   5        ! NSPLITH
=  5  !

       Minimum sigma-y (Grid Cells Units) of puff
       before it may be split
       (SYSPLITH)                       Default:  1.0       !
SYSPLITH = 1.0 !

       Minimum puff elongation rate (SYSPLITH/hr) due to
       wind shear, before it may be split
       (SHSPLITH)                       Default:  2.        !
SHSPLITH = 2.0 !

       Minimum concentration (g/m^3) of each
```

```
       species in puff before it may be split
       Enter array of NSPEC values; if a single value is
       entered, it will be used for ALL species
       (CNSPLITH)                          Default:  1.0E-07   !
CNSPLITH = 1.0E-07 !

     Integration control variables -----------------------

       Fractional convergence criterion for numerical SLUG
       sampling integration
       (EPSSLUG)                           Default:   1.0e-04  ! EPSSLUG
= 1.0E-04 !

       Fractional convergence criterion for numerical AREA
       source integration
       (EPSAREA)                           Default:   1.0e-06  ! EPSAREA
= 1.0E-06 !

       Trajectory step-length (m) used for numerical rise
       integration
       (DSRISE)                            Default:   1.0      ! DSRISE
= 1.0 !

       Boundary Condition (BC) Puff control variables
------------------------

       Minimum height (m) to which BC puffs are mixed as they are
emitted
       (MBCON=2 ONLY).  Actual height is reset to the current mixing
height
       at the release point if greater than this minimum.
       (HTMINBC)                           Default:   500.     ! HTMINBC
= 500.0 !

       Search radius (km) about a receptor for sampling nearest BC puff.
       BC puffs are typically emitted with a spacing of one grid cell
       length, so the search radius should be greater than DGRIDKM.
       (RSAMPBC)                           Default:   10.      ! RSAMPBC
= 10.0 !

       Near-Surface depletion adjustment to concentration profile used
when
       sampling BC puffs?
       (MDEPBC)                            Default:   1        ! MDEPBC
=  1  !
          0 = Concentration is NOT adjusted for depletion
          1 = Adjust Concentration for depletion

!END!


----------------------------------------------------------------------
-------


INPUT GROUPS: 13a, 13b, 13c, 13d -- Point source parameters
--------------------------------

---------------
Subgroup (13a)
```

```
---------------

     Number of point sources with
     parameters provided below      (NPT1)  No default  !  NPT1 =  5  !

     Units used for point source
     emissions below                (IPTU)  Default: 1  !  IPTU =   1  !
           1 =        g/s
           2 =       kg/hr
           3 =       lb/hr
           4 =     tons/yr
           5 =     Odour Unit * m**3/s  (vol. flux of odour compound)
           6 =     Odour Unit * m**3/min
           7 =     metric tons/yr

     Number of source-species
     combinations with variable
     emissions scaling factors
     provided below in (13d)        (NSPT1) Default: 0  !  NSPT1 =  0  !

     Number of point sources with
     variable emission parameters
     provided in external file      (NPT2)  No default  !  NPT2 =  0  !

     (If NPT2 > 0, these point
     source emissions are read from
     the file: PTEMARB.DAT)

!END!

---------------
Subgroup (13b)
---------------
                                      a
          POINT SOURCE: CONSTANT DATA
          ----------------------------

b          c
  Source       X         Y       Stack    Base     Stack    Exit  Exit
Bldg.  Emission
   No.     Coordinate Coordinate Height Elevation Diameter  Vel.  Temp.
Dwash   Rates
              (km)      (km)       (m)      (m)       (m)  (m/s) (deg.
K)
  ------   ---------- ---------- ------  ------   -------- -----
-------- ----- --------
   1 ! SRCNAM = STCK1 !
   1 ! X =  639.282, 6072.984,    33.4,532.25,        .9,  25.0,  500.0,
1.0,1.7E-01, 2.1E-01,  0.0E00,
      1.1E-01 !
   1 ! ZPLTFM  =       .0 !
   1 ! FMFAC  =      1.0 !   !END!
   2 ! SRCNAM = GEN1 !
   2 ! X =639.31557,6073.0097,    5.0,532.25,        .2,  25.0,  500.0,
1.0,4.1E-01,  1.6E00, 8.9E-02,
      7.0E-01 !
   2 ! ZPLTFM  =       .0 !
   2 ! FMFAC  =      1.0 !   !END!
   3 ! SRCNAM = GEN2 !
   3 ! X =639.31192,6073.01363,    5.0,532.25,        .2,  25.0,  500.0,
```

```
1.0,4.1E-01,  1.6E00, 8.9E-02,
      7.0E-01 !
   3 ! ZPLTFM  =       .0 !
   3 ! FMFAC  =      1.0 !   !END!
   4 ! SRCNAM = GEN3 !
   4 ! X =639.30799,6073.01756,    5.0,532.25,        .2,  25.0,  500.0,
1.0,4.1E-01,  1.6E00, 8.9E-02,
      7.0E-01 !
   4 ! ZPLTFM  =       .0 !
   4 ! FMFAC  =      1.0 !   !END!
   5 ! SRCNAM = DC1 !
   5 ! X =639.29183,6072.99641,    33.4,532.25,        .5,  10.0,
.0,  1.0, 0.0E00,  0.0E00,  0.0E00,
       0.0E00 !
   5 ! ZPLTFM  =       .0 !
   5 ! FMFAC  =      1.0 !   !END!

--------
```

a

Data for each source are treated as a separate input subgroup and therefore must end with an input group terminator.

SRCNAM is a 12-character name for a source
(No default)

X is an array holding the source data listed by the column headings
(No default)

SIGYZI is an array holding the initial sigma-y and sigma-z (m)
(Default: 0.,0.)

FMFAC is a vertical momentum flux factor (0. or 1.0) used to represent the effect of rain-caps or other physical configurations that reduce momentum rise associated with the actual exit velocity.
(Default: 1.0 -- full momentum used)

ZPLTFM is the platform height (m) for sources influenced by an isolated structure that has a significant open area between the surface and the bulk of the structure, such as an offshore oil platform. The Base Elevation is that of the surface (ground or ocean), and the Stack Height is the release height above the Base (not above the platform). Building heights entered in Subgroup 13c must be those of the buildings on the platform, measured from the platform deck. ZPLTFM is used only with MBDW=1 (ISC downwash method) for sources with building downwash.
(Default: 0.0)

b

0. = No building downwash modeled
1. = Downwash modeled for buildings resting on the surface
2. = Downwash modeled for buildings raised above the surface (ZPLTFM > 0.)

NOTE: must be entered as a REAL number (i.e., with decimal point)

c
An emission rate must be entered for every pollutant modeled.
Enter emission rate of zero for secondary pollutants that are
modeled, but not emitted. Units are specified by IPTU
(e.g. 1 for g/s).

Subgroup (13c)

BUILDING DIMENSION DATA FOR SOURCES SUBJECT TO DOWNWASH

Source
a
No. Effective building height, width, length and X/Y offset (in meters)
every 10 degrees. LENGTH, XBADJ, and YBADJ are only needed for
MBDW=2 (PRIME downwash option)

```
 1    ! SRCNAM  =   STCK1 !
 1    ! HEIGHT  =  32.4,   32.4,   32.4,   32.4,   32.4,   32.4,
                   32.4,   32.4,   32.4,   32.4,   32.4,   32.4,
                   32.4,   32.4,   32.4,   32.4,   32.4,   32.4,
                   32.4,   32.4,   32.4,   32.4,   32.4,   32.4,
                   32.4,   32.4,   32.4,   32.4,   32.4,   32.4,
                   32.4,   32.4,   32.4,   32.4,   32.4,   32.4!
 1    ! WIDTH   =   55.53,   54.75,   52.5,   48.25,   47.0,   52.5,
                   56.5,   59.0,   59.5,   57.5,   55.0,   50.0,
                   44.0,   36.5,   42.0,   47.75,   52.0,   54.62,
                   55.53,   54.75,   52.25,   48.25,   47.0,   52.5,
                   56.5,   59.0,   59.5,   58.0,   55.0,   50.0,
                   44.0,   36.0,   42.0,   47.75,   52.0,   54.56!
 1    ! LENGTH =   58.0,   55.0,   50.0,   44.0,   36.0,   42.0,
                   47.75,   52.0,   54.62,   55.5,   54.75,   52.5,
                   48.5,   47.0,   52.5,   56.5,   58.5,   59.5,
                   58.0,   55.0,   50.0,   43.5,   36.0,   42.25,
                   47.75,   52.0,   54.56,   55.53,   54.88,   52.5,
                   48.25,   47.0,   52.5,   56.5,   59.0,   59.0!
 1    ! XBADJ   =   -14.0,   -14.0,   -14.0,   -13.0,   -11.5,   -17.25,
                   -23.0,   -28.0,   -32.19,   -35.41,   -37.62,   -
38.75,
                   -38.25,   -39.0,   -42.5,   -45.0,   -46.0,   -46.0,
                   -43.5,   -40.5,   -36.5,   -30.5,   -24.5,   -25.0,
                   -24.75,   -24.0,   -22.38,   -20.16,   -17.38,   -
14.25,
                   -10.0,   -8.0,   -10.0,   -11.0,   -12.5,   -13.5!
 1    ! YBADJ   =   7.55,   10.12,   12.25,   13.88,   15.5,   16.25,
                   16.75,   16.5,   16.25,   14.75,   13.0,   11.0,
                   9.0,   6.25,   3.75,   .88,   -2.0,   -4.88,
                   -7.64,   -10.12,   -12.12,   -14.12,   -15.5,   -
16.25,
                   -17.25,   -16.5,   -15.75,   -15.0,   -13.5,   -11.5,
                   -9.0,   -6.5,   -3.75,   -.88,   2.0,   4.91!
!END!
 2    ! SRCNAM  =   GEN1 !
```

```
 2    ! HEIGHT  =  32.4,   32.4,   32.4,   32.4,   32.4,   32.4,
                   32.4,   32.4,   32.4,   32.4,   32.4,   32.4,
                   32.4,   4.3,   4.3,   32.4,   32.4,   32.4,
                   32.4,   32.4,   32.4,   32.4,   32.4,   32.4,
                   32.4,   32.4,   32.4,   32.4,   32.4,   32.4,
                   32.4,   4.3,   4.3,   32.4,   32.4,   32.4!
 2    ! WIDTH   =   55.53,   54.75,   52.5,   48.25,   47.0,   52.5,
                   56.5,   59.0,   59.5,   57.5,   55.0,   50.0,
                   44.0,   8.5,   8.75,   47.75,   52.0,   54.62,
                   55.53,   54.75,   52.25,   48.25,   47.0,   52.5,
                   56.5,   59.0,   59.5,   58.0,   55.0,   50.0,
                   44.0,   8.5,   9.25,   47.75,   52.0,   54.56!
 2    ! LENGTH =   58.0,   55.0,   50.0,   44.0,   36.0,   42.0,
                   47.75,   52.0,   54.62,   55.5,   54.75,   52.5,
                   48.5,   4.5,   5.5,   56.5,   58.5,   59.5,
                   58.0,   55.0,   50.0,   43.5,   36.0,   42.25,
                   47.75,   52.0,   54.56,   55.53,   54.88,   52.5,
                   48.25,   4.5,   6.0,   56.5,   59.0,   59.0!
 2    ! XBADJ   =   -44.0,   -49.0,   -52.0,   -53.5,   -53.0,   -58.5,
                   -62.75,   -65.12,   -65.5,   -63.88,   -60.38,   -
55.0,
                   -47.75,   -8.5,   -18.5,   -33.0,   -27.0,   -21.0,
                   -13.0,   -5.5,   2.0,   10.0,   17.0,   16.25,
                   15.0,   13.12,   10.94,   8.31,   5.38,   2.25,
                   -.75,   -2.0,   -3.0,   -23.5,   -31.5,   -38.5!
 2    ! YBADJ   =   36.02,   32.88,   28.75,   23.38,   17.5,   11.25,
                   4.25,   -2.0,   -8.75,   -15.75,   -21.5,   -27.0,
                   -31.5,   -2.75,   -5.88,   -38.88,   -39.12,   -
38.19,
                   -36.11,   -32.88,   -28.38,   -23.62,   -17.5,   -
11.25,
                   -4.75,   2.5,   9.25,   15.5,   21.5,   27.0,
                   31.5,   2.25,   2.38,   38.88,   39.25,   38.22!
!END!
 3    ! SRCNAM  =   GEN2 !
 3    ! HEIGHT  =  32.4,   32.4,   32.4,   32.4,   32.4,   32.4,
                   32.4,   32.4,   32.4,   32.4,   32.4,   32.4,
                   32.4,   4.3,   32.4,   32.4,   32.4,   32.4,
                   32.4,   32.4,   32.4,   32.4,   32.4,   32.4,
                   32.4,   32.4,   32.4,   32.4,   32.4,   32.4,
                   32.4,   4.3,   32.4,   32.4,   32.4,   32.4!
 3    ! WIDTH   =   55.53,   54.75,   52.5,   48.25,   47.0,   52.5,
                   56.5,   59.0,   59.5,   57.5,   55.0,   50.0,
                   44.0,   8.5,   42.0,   47.75,   52.0,   54.62,
                   55.53,   54.75,   52.25,   48.25,   47.0,   52.5,
                   56.5,   59.0,   59.5,   58.0,   55.0,   50.0,
                   44.0,   8.5,   42.0,   47.75,   52.0,   54.56!
 3    ! LENGTH =   58.0,   55.0,   50.0,   44.0,   36.0,   42.0,
                   47.75,   52.0,   54.62,   55.5,   54.75,   52.5,
                   48.5,   4.5,   52.5,   56.5,   58.5,   59.5,
                   58.0,   55.0,   50.0,   43.5,   36.0,   42.25,
                   47.75,   52.0,   54.56,   55.53,   54.88,   52.5,
                   48.25,   4.5,   52.5,   56.5,   59.0,   59.0!
 3    ! XBADJ   =   -47.5,   -51.5,   -54.0,   -54.0,   -53.0,   -57.5,
                   -60.75,   -62.25,   -61.88,   -59.59,   -55.62,   -
49.75,
                   -42.5,   -3.0,   -32.5,   -28.0,   -22.5,   -17.0,
                   -10.0,   -3.0,   3.5,   11.0,   17.0,   15.25,
                   13.0,   10.25,   7.31,   4.03,   .62,   -3.0,
                   -6.0,   -7.5,   -20.5,   -28.5,   -36.0,   -42.5!
```

```
 3    ! YBADJ  =   31.77,   28.12,   23.5,   18.12,   12.0,   6.25,
                   -.75,   -7.0,   -12.75,   -18.75,   -24.5,   -29.0,
                   -32.0,   -2.75,   -36.25,   -36.88,   -36.25,   -
34.56,
                   -31.83,   -28.12,   -23.38,   -18.38,   -12.0,   -
6.25,
                   .25,   7.0,   13.25,   19.0,   24.0,   28.5,
                   32.0,   1.75,   36.5,   36.88,   36.38,   34.59!
!END!
 4    ! SRCNAM  =   GEN3 !
 4    ! HEIGHT  =  32.4,   32.4,   32.4,   32.4,   32.4,   32.4,
                   32.4,   32.4,   32.4,   32.4,   32.4,   32.4,
                   32.4,   4.3,   32.4,   32.4,   32.4,   32.4,
                   32.4,   32.4,   32.4,   32.4,   32.4,   32.4,
                   32.4,   32.4,   32.4,   32.4,   32.4,   32.4,
                   32.4,   4.3,   32.4,   32.4,   32.4,   32.4!
 4    ! WIDTH  =   55.53,   54.75,   52.5,   48.25,   47.0,   52.5,
                   56.5,   59.0,   59.5,   57.5,   55.0,   50.0,
                   44.0,   8.5,   42.0,   47.75,   52.0,   54.62,
                   55.53,   54.75,   52.25,   48.25,   47.0,   52.5,
                   56.5,   59.0,   59.5,   58.0,   55.0,   50.0,
                   44.0,   8.0,   42.0,   47.75,   52.0,   54.56!
 4    ! LENGTH =   58.0,   55.0,   50.0,   44.0,   36.0,   42.0,
                   47.75,   52.0,   54.62,   55.5,   54.75,   52.5,
                   48.5,   4.5,   52.5,   56.5,   58.5,   59.5,
                   58.0,   55.0,   50.0,   43.5,   36.0,   42.25,
                   47.75,   52.0,   54.56,   55.53,   54.88,   52.5,
                   48.25,   4.5,   52.5,   56.5,   59.0,   59.0!
 4    ! XBADJ  =   -51.0,   -54.0,   -55.5,   -54.5,   -52.5,   -56.0,
                   -58.5,   -59.12,   -57.94,   -55.03,   -50.5,   -
44.5,
                   -36.75,   2.5,   -27.0,   -23.0,   -18.0,   -13.0,
                   -6.5,   -1.0,   5.0,   11.5,   16.5,   13.75,
                   10.75,   7.0,   3.38,   -.53,   -4.38,   -8.25,
                   -11.5,   3.5,   -26.0,   -33.5,   -40.5,   -46.5!
 4    ! YBADJ  =   27.17,   23.12,   18.0,   12.62,   6.5,   .75,
                   -5.75,   -11.5,   -16.75,   -22.25,   -26.5,   -30.5,
                   -32.5,   -2.25,   -35.0,   -34.38,   -33.12,   -
30.62,
                   -27.27,   -23.0,   -17.88,   -12.62,   -6.5,   -.75,
                   5.25,   11.5,   17.25,   22.0,   26.5,   30.0,
                   33.0,   2.5,   35.0,   34.62,   33.12,   30.66!
!END!
 5    ! SRCNAM  =   DC1 !
 5    ! HEIGHT  =  32.4,   32.4,   32.4,   32.4,   32.4,   32.4,
                   32.4,   32.4,   32.4,   32.4,   32.4,   32.4,
                   32.4,   32.4,   32.4,   32.4,   32.4,   32.4,
                   32.4,   32.4,   32.4,   32.4,   32.4,   32.4,
                   32.4,   32.4,   32.4,   32.4,   32.4,   32.4,
                   32.4,   32.4,   32.4,   32.4,   32.4,   32.4!
 5    ! WIDTH  =   55.53,   54.75,   52.5,   48.25,   47.0,   52.5,
                   56.5,   59.0,   59.5,   57.5,   55.0,   50.0,
                   44.0,   36.5,   42.0,   47.75,   52.0,   54.62,
                   55.53,   54.75,   52.25,   48.25,   47.0,   52.5,
                   56.5,   59.0,   59.5,   58.0,   55.0,   50.0,
                   44.0,   36.0,   42.0,   47.75,   52.0,   54.56!
 5    ! LENGTH =   58.0,   55.0,   50.0,   44.0,   36.0,   42.0,
                   47.75,   52.0,   54.62,   55.5,   54.75,   52.5,
                   48.5,   47.0,   52.5,   56.5,   58.5,   59.5,
                   58.0,   55.0,   50.0,   43.5,   36.0,   42.25,
```

```
                  47.75,   52.0,   54.56,   55.53,   54.88,   52.5,
                  48.25,   47.0,   52.5,   56.5,   59.0,   59.0!
 5    ! XBADJ  =   -27.5,   -28.5,   -29.0,   -28.0,   -26.5,   -31.5,
                  -36.0,   -39.5,   -41.75,   -42.72,   -42.5,   -41.0,
                  -38.0,   -36.0,   -37.0,   -37.0,   -36.0,   -34.0,
                  -30.0,   -26.0,   -21.0,   -15.0,   -9.5,   -10.75,
                  -11.75,   -12.5,   -12.81,   -12.81,   -12.5,   -
11.75,
                  -10.5,   -11.0,   -15.5,   -19.0,   -22.5,   -25.5!
 5    ! YBADJ  =   14.89,   15.0,   14.5,   13.62,   12.5,   10.75,
                  8.75,   6.5,   4.25,   1.25,   -1.5,   -4.0,
                  -6.0,   -8.75,   -10.5,   -12.12,   -13.5,   -14.44,
                  -14.98,   -15.0,   -14.38,   -13.88,   -12.5,   -
10.75,
                  -9.25,   -6.5,   -3.75,   -1.5,   1.0,   3.5,
                  6.5,   8.5,   10.5,   12.12,   13.5,   14.47!
!END!
```

---

[a] Building height, width, length, and X/Y offset from the source are treated as a separate input subgroup for each source and therefore must end with an input group terminator. The X/Y offset is the position, relative to the stack, of the center of the upwind face of the projected building, with the x-axis pointing along the flow direction.

Subgroup (13d)

POINT SOURCE: VARIABLE EMISSIONS DATA [a]

Use this subgroup to describe temporal variations in the emission rates given in 13b. Factors entered multiply the rates in 13b. Skip sources here that have constant emissions. For more elaborate variation in source parameters, use PTEMARB.DAT and NPT2 > 0.

IVARY determines the type of variation, and is source-specific:

(IVARY) Default: 0

- 0 = Constant
- 1 = Diurnal cycle (24 scaling factors: hours 1-24)
- 2 = Monthly cycle (12 scaling factors: months 1-12)
- 3 = Hour & Season (4 groups of 24 hourly scaling factors, where first group is DEC-JAN-FEB)
- 4 = Speed & Stab. (6 groups of 6 scaling factors, where first group is Stability Class A, and the speed classes have upper bounds (m/s) defined in Group 12
- 5 = Temperature (12 scaling factors, where temperature classes have upper bounds (C) of: 0, 5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 50+)

----
[a] Data for each species are treated as a separate input subgroup and therefore must end with an input group terminator.

INPUT GROUPS: 14a, 14b, 14c, 14d -- Area source parameters

Subgroup (14a)

Number of polygon area sources with parameters specified below (NAR1) No default ! NAR1 = 0 !

Units used for area source emissions below (IARU) Default: 1 ! IARU = 1 !

1 = g/m**2/s
2 = kg/m**2/hr
3 = lb/m**2/hr
4 = tons/m**2/yr
5 = Odour Unit * m/s (vol. flux/m**2 of odour compound)
6 = Odour Unit * m/min
7 = metric tons/m**2/yr

Number of source-species combinations with variable emissions scaling factors provided below in (14d) (NSAR1) Default: 0 ! NSAR1 = 0 !

Number of buoyant polygon area sources with variable location and emission parameters (NAR2) No default ! NAR2 = 0 !
(If NAR2 > 0, ALL parameter data for these sources are read from the file: BAEMARB.DAT)

!END!

Subgroup (14b)

---

[a]
AREA SOURCE: CONSTANT DATA

[b]

Source No.	Effect. Height (m)	Base Elevation (m)	Initial Sigma z (m)	Emission Rates
-------	------	------	--------	---------

----
[a] Data for each source are treated as a separate input subgroup and therefore must end with an input group terminator.

[b] An emission rate must be entered for every pollutant modeled. Enter emission rate of zero for secondary pollutants that are modeled, but not emitted. Units are specified by IARU (e.g. 1 for g/m**2/s).

Subgroup (14c)

Source No.	COORDINATES (km) FOR EACH VERTEX(4) OF EACH POLYGON[a] Ordered list of X followed by list of Y, grouped by source

----
[a] Data for each source are treated as a separate input subgroup and therefore must end with an input group terminator.

Subgroup (14d)

AREA SOURCE: VARIABLE EMISSIONS DATA[a]

Use this subgroup to describe temporal variations in the emission rates given in 14b. Factors entered multiply the rates in 14b. Skip sources here that have constant emissions. For more elaborate variation in source parameters, use BAEMARB.DAT and NAR2 > 0.

IVARY determines the type of variation, and is source-specific:
(IVARY) Default: 0

- 0 = Constant
- 1 = Diurnal cycle (24 scaling factors: hours 1-24)
- 2 = Monthly cycle (12 scaling factors: months 1-12)
- 3 = Hour & Season (4 groups of 24 hourly scaling factors, where first group is DEC-JAN-FEB)
- 4 = Speed & Stab. (6 groups of 6 scaling factors, where first group is Stability Class A, and the speed classes have upper bounds (m/s) defined in Group 12
- 5 = Temperature (12 scaling factors, where temperature classes have upper bounds (C) of: 0, 5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 50+)

```
--------
    a
     Data for each species are treated as a separate input subgroup
     and therefore must end with an input group terminator.


------------------------------------------------------------------------
-------

INPUT GROUPS: 15a, 15b, 15c -- Line source parameters
---------------------------

---------------
Subgroup (15a)
---------------

     Number of buoyant line sources
     with variable location and emission
     parameters (NLN2)                                  No default  !  NLN2
=  0   !

     (If NLN2 > 0, ALL parameter data for
      these sources are read from the file: LNEMARB.DAT)

     Number of buoyant line sources (NLINES)        No default   !
NLINES =  0  !

     Units used for line source
     emissions below               (ILNU)          Default: 1  !  ILNU
=   1  !
           1 =        g/s
           2 =       kg/hr
           3 =       lb/hr
           4 =     tons/yr
           5 =     Odour Unit * m**3/s  (vol. flux of odour compound)
           6 =     Odour Unit * m**3/min
           7 =     metric tons/yr

     Number of source-species
     combinations with variable
     emissions scaling factors
     provided below in (15c)        (NSLN1) Default: 0  !  NSLN1 =  0  !

     Maximum number of segments used to model
     each line (MXNSEG)                                 Default: 7   !
MXNSEG =  7  !

     The following variables are required only if NLINES > 0.  They are
     used in the buoyant line source plume rise calculations.

        Number of distances at which                    Default: 6   !
NLRISE =  6  !
        transitional rise is computed

        Average building length (XL)                    No default   ! XL =
.0 !
                                                        (in meters)

        Average building height (HBL)                   No default   ! HBL =
.0 !
```

(in meters)

Average building width (WBL) No default ! WBL = .0 !

(in meters)

Average line source width (WML) No default ! WML = .0 !

(in meters)

Average separation between buildings (DXL) No default ! DXL = .0 !

(in meters)

Average buoyancy parameter (FPRIMEL) No default ! FPRIMEL = .0 !

(in m**4/s**3)

!END!

Subgroup (15b)

BUOYANT LINE SOURCE: CONSTANT DATA

---

a

Source No.	Beg. X Coordinate (km)	Beg. Y Coordinate (km)	End. X Coordinate (km)	End. Y Coordinate (km)	Release Height (m)	Base Emission Elevation (m)	Emission Rates

---

a
Data for each source are treated as a separate input subgroup and therefore must end with an input group terminator.

b
An emission rate must be entered for every pollutant modeled. Enter emission rate of zero for secondary pollutants that are modeled, but not emitted. Units are specified by ILNTU (e.g. 1 for g/s).

Subgroup (15c)

BUOYANT LINE SOURCE: VARIABLE EMISSIONS DATA a

Use this subgroup to describe temporal variations in the emission rates given in 15b. Factors entered multiply the rates in 15b. Skip sources here that have constant emissions.

IVARY determines the type of variation, and is source-specific:

```
     (IVARY)                                  Default: 0
           0 =       Constant
           1 =       Diurnal cycle (24 scaling factors: hours 1-24)
           2 =       Monthly cycle (12 scaling factors: months 1-12)
           3 =       Hour & Season (4 groups of 24 hourly scaling
factors,
                                    where first group is DEC-JAN-FEB)
           4 =       Speed & Stab. (6 groups of 6 scaling factors, where
                                    first group is Stability Class A,
                                    and the speed classes have upper
                                    bounds (m/s) defined in Group 12
           5 =       Temperature   (12 scaling factors, where
temperature
                                    classes have upper bounds (C) of:
                                    0, 5, 10, 15, 20, 25, 30, 35, 40,
                                    45, 50, 50+)



--------
    a
     Data for each species are treated as a separate input subgroup
     and therefore must end with an input group terminator.


-------------------------------------------------------------------------
-------


INPUT GROUPS: 16a, 16b, 16c -- Volume source parameters
---------------------------

---------------
Subgroup (16a)
---------------

     Number of volume sources with
     parameters provided in 16b,c (NVL1)     No default  !  NVL1 =  0
!

     Units used for volume source
     emissions below in 16b       (IVLU)     Default: 1  !  IVLU =   1
!
           1 =        g/s
           2 =       kg/hr
           3 =       lb/hr
           4 =     tons/yr
           5 =     Odour Unit * m**3/s  (vol. flux of odour compound)
           6 =     Odour Unit * m**3/min
           7 =     metric tons/yr

     Number of source-species
     combinations with variable
     emissions scaling factors
     provided below in (16c)      (NSVL1)    Default: 0  !  NSVL1 =  0
!

     Number of volume sources with
     variable location and emission
     parameters                   (NVL2)     No default  !  NVL2 =   0
```

!

(If NVL2 > 0, ALL parameter data for
these sources are read from the VOLEMARB.DAT file(s))

!END!

Subgroup (16b)

VOLUME SOURCE: CONSTANT DATA [a]

---

[b]

X Coordinate (km)	Y Coordinate (km)	Effect. Height (m)	Base Elevation (m)	Initial Sigma y (m)	Initial Sigma z (m)	Emission Rates

---

[a] Data for each source are treated as a separate input subgroup and therefore must end with an input group terminator.

[b] An emission rate must be entered for every pollutant modeled. Enter emission rate of zero for secondary pollutants that are modeled, but not emitted. Units are specified by IVLU (e.g. 1 for g/s).

Subgroup (16c)

VOLUME SOURCE: VARIABLE EMISSIONS DATA [a]

Use this subgroup to describe temporal variations in the emission rates given in 16b. Factors entered multiply the rates in 16b. Skip sources here that have constant emissions. For more elaborate variation in source parameters, use VOLEMARB.DAT and NVL2 > 0.

IVARY determines the type of variation, and is source-specific:
(IVARY) Default: 0

- 0 = Constant
- 1 = Diurnal cycle (24 scaling factors: hours 1-24)
- 2 = Monthly cycle (12 scaling factors: months 1-12)
- 3 = Hour & Season (4 groups of 24 hourly scaling factors, where first group is DEC-JAN-FEB)
- 4 = Speed & Stab. (6 groups of 6 scaling factors, where first group is Stability Class A, and the speed classes have upper bounds (m/s) defined in Group 12
- 5 = Temperature (12 scaling factors, where

temperature
classes have upper bounds (C) of:
0, 5, 10, 15, 20, 25, 30, 35, 40,
45, 50, 50+)

---

[a] Data for each species are treated as a separate input subgroup and therefore must end with an input group terminator.

INPUT GROUPS: 17a & 17b -- Non-gridded (discrete) receptor information

---

Subgroup (17a)

Number of non-gridded receptors (NREC) No default ! NREC = 3621
!

!END!

Subgroup (17b)

NON-GRIDDED (DISCRETE) RECEPTOR DATA[a]

Receptor No.	X Coordinate (km)	Y Coordinate (km)	Ground Elevation (m)	Height Above Ground[b] (m)

---

[a] Data for each receptor are treated as a separate input subgroup and therefore must end with an input group terminator.

[b] Receptor height above ground is optional. If no value is entered, the receptor is placed on the ground.

ATTACHMENT E

Contour Plots

Jacques Whitford

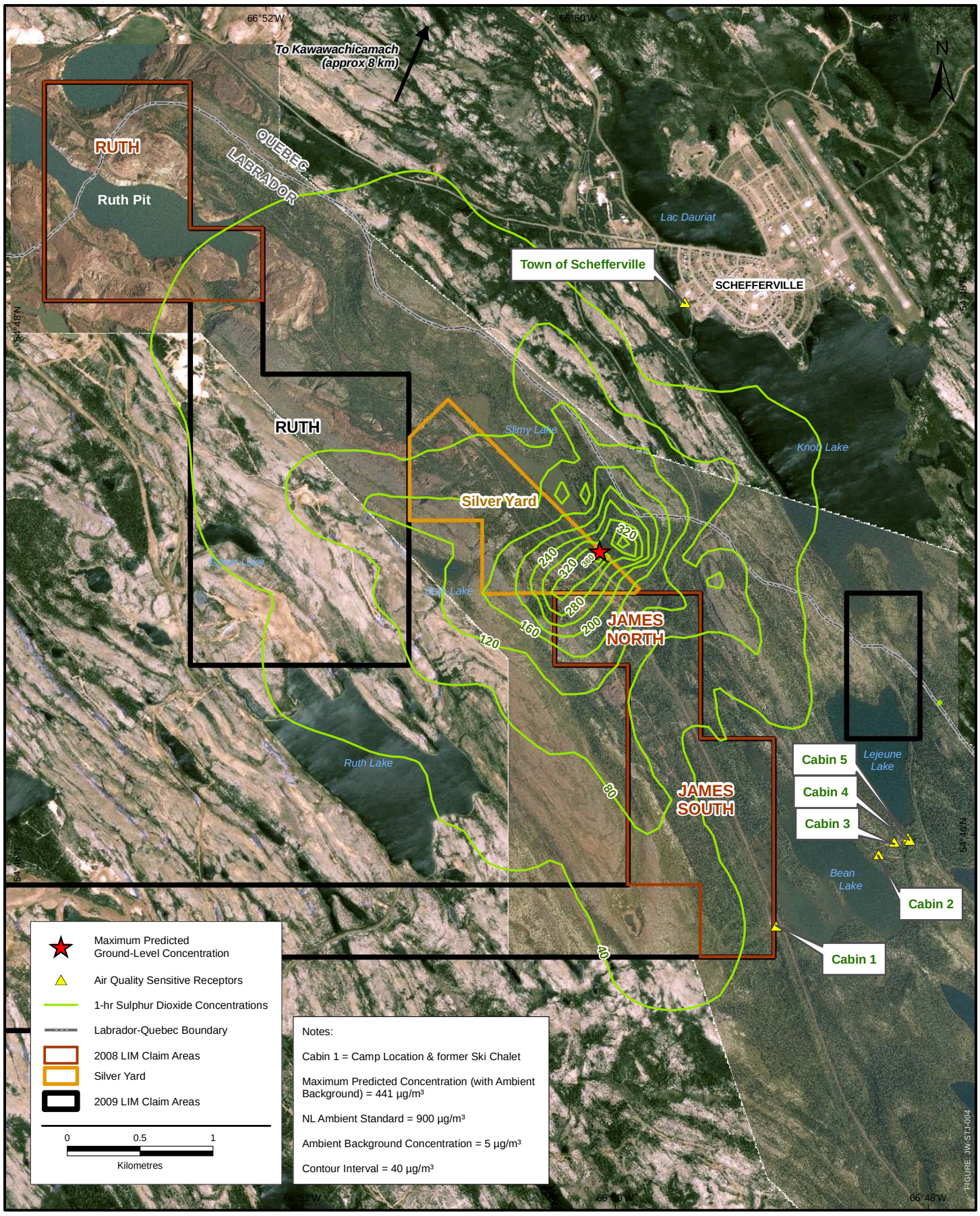


FIGURE NO:		DRAFT DATE:
E-1	**Maximum Predicted 1-hr Total Sulphur Dioxide Ground-level Concentrations**	08/12/2008
		REVISION DATE: 12/8/2009

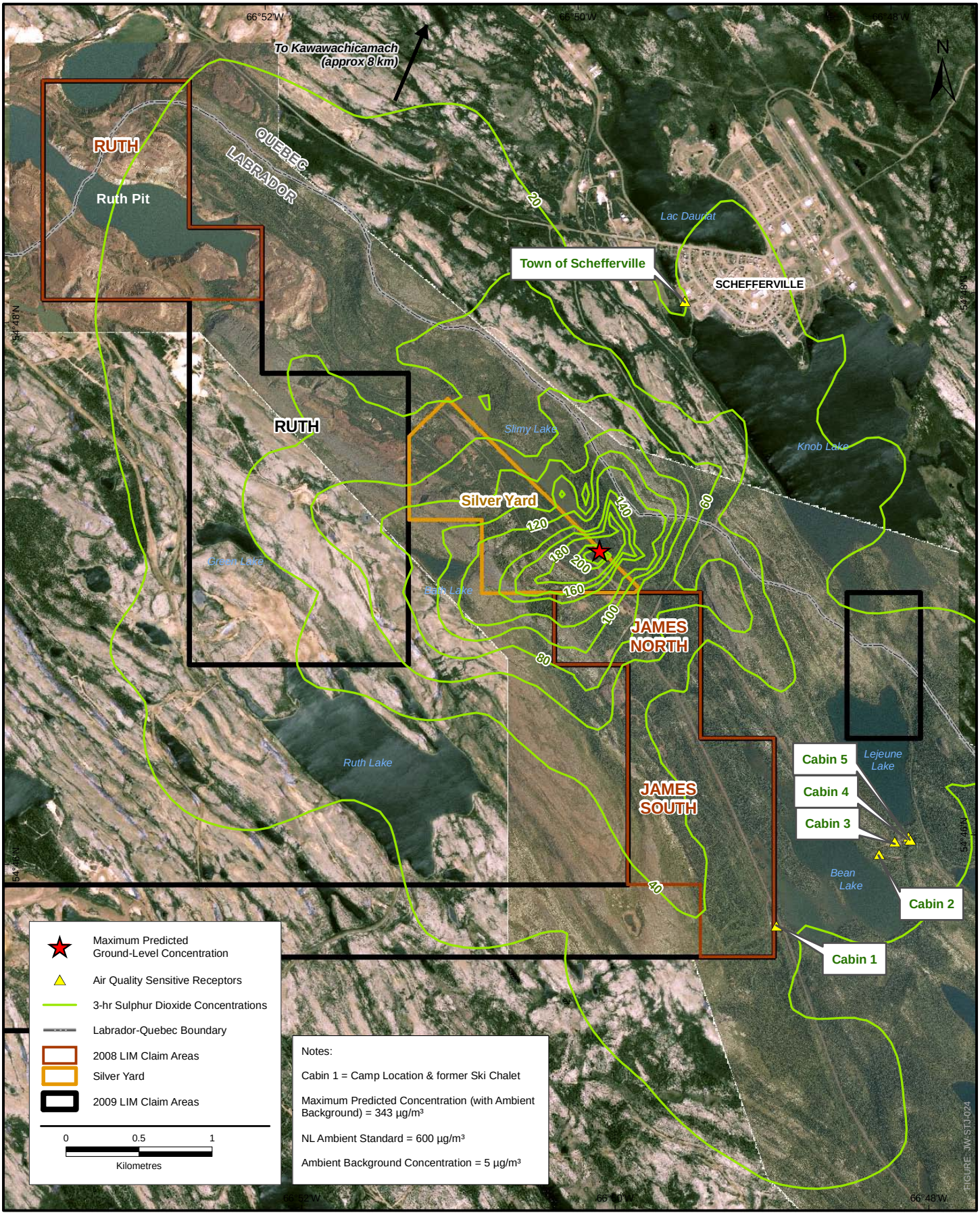


FIGURE NO:	Maximum Predicted 3-hr Sulphur Dioxide Ground-level Concentrations	DRAFT DATE: 08/12/2008
E-2		REVISION DATE: 12/8/2009

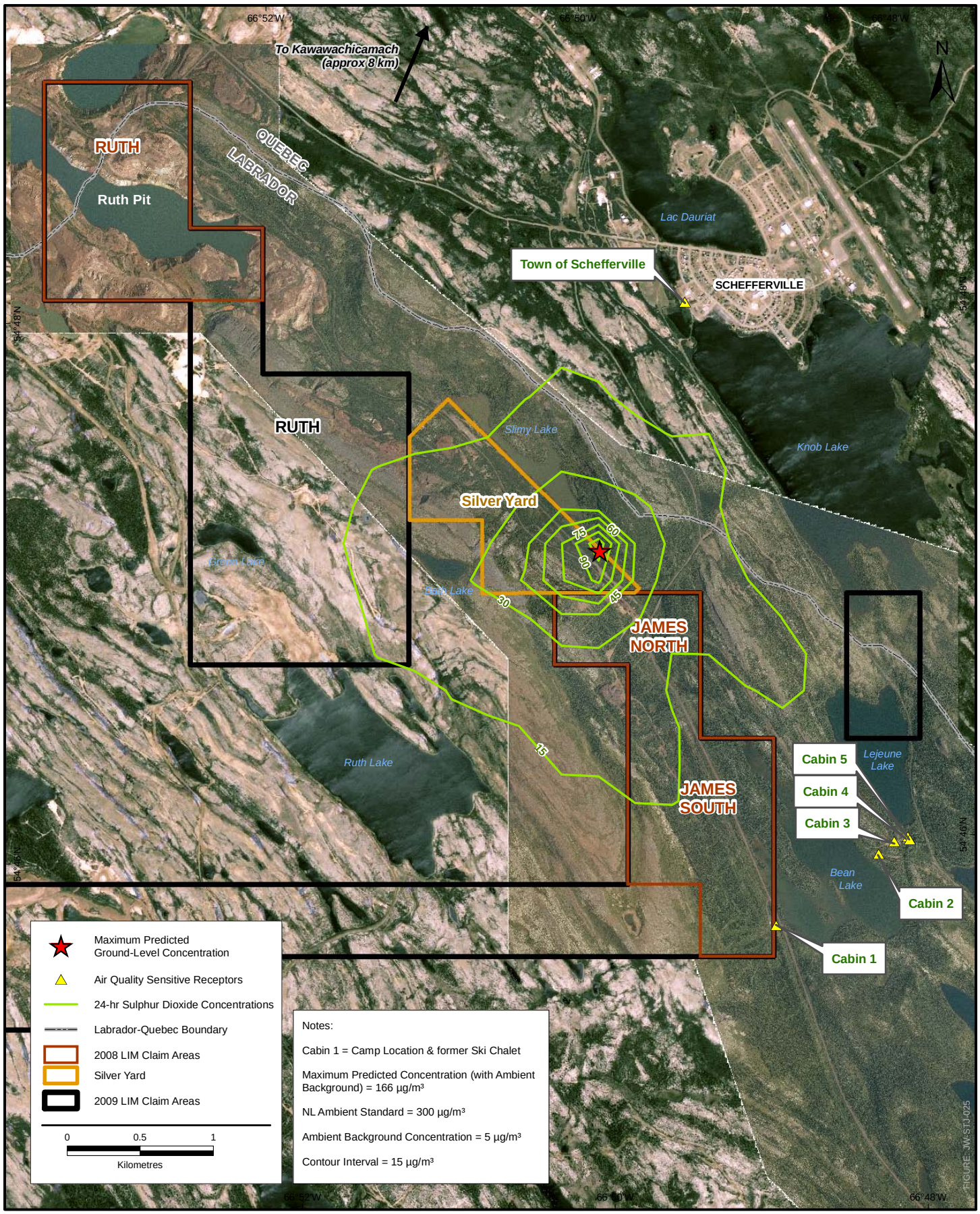


FIGURE NO:		DRAFT DATE:
E-3	**Maximum Predicted 24-hr Sulphur Dioxide Ground-level Concentrations**	08/12/2008
		REVISION DATE: 12/8/2009

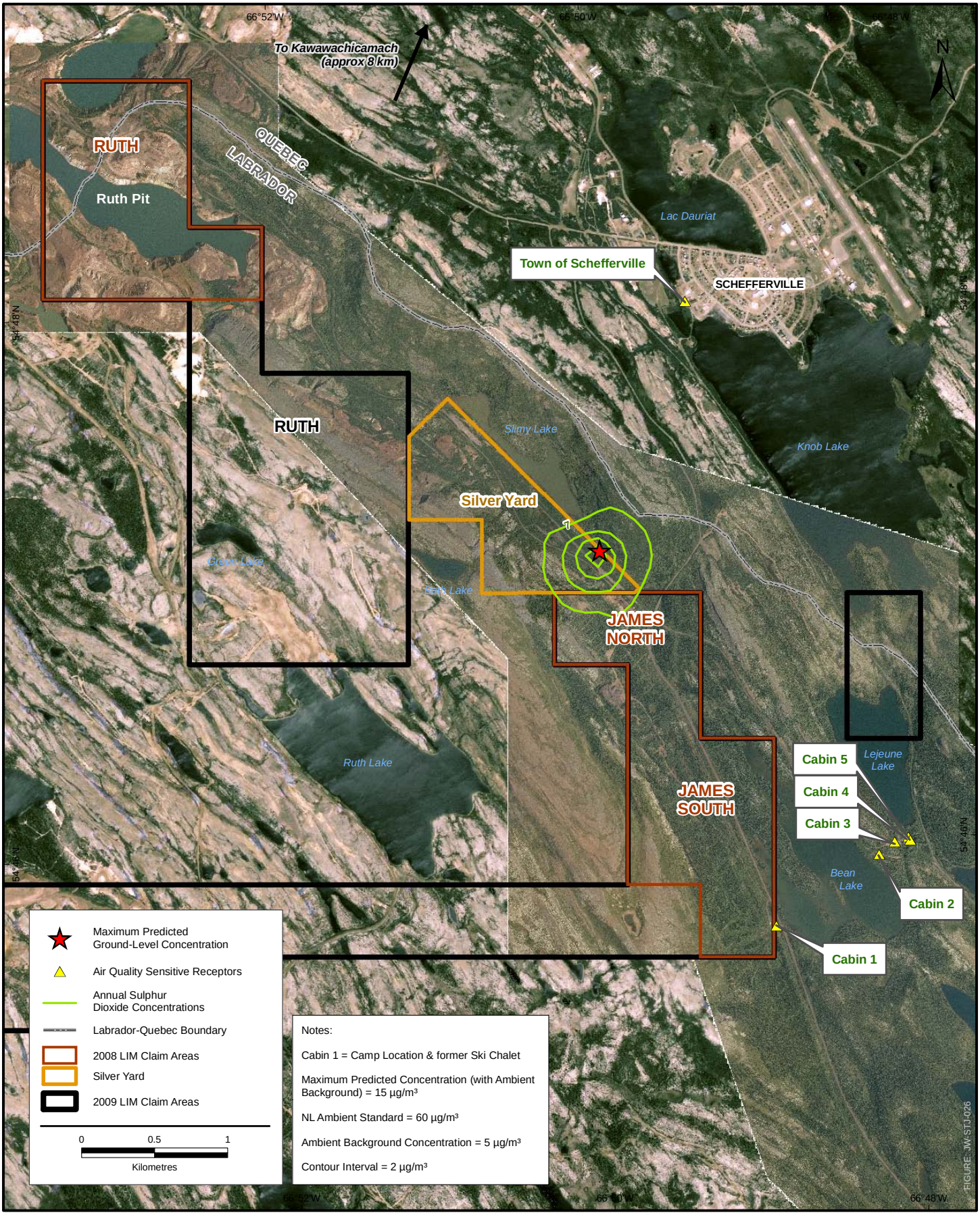


FIGURE NO:		DRAFT DATE:
E-4	**Maximum Predicted Annual Sulphur Dioxide Ground-level Concentrations**	08/12/2008
		REVISION DATE: 12/8/2009

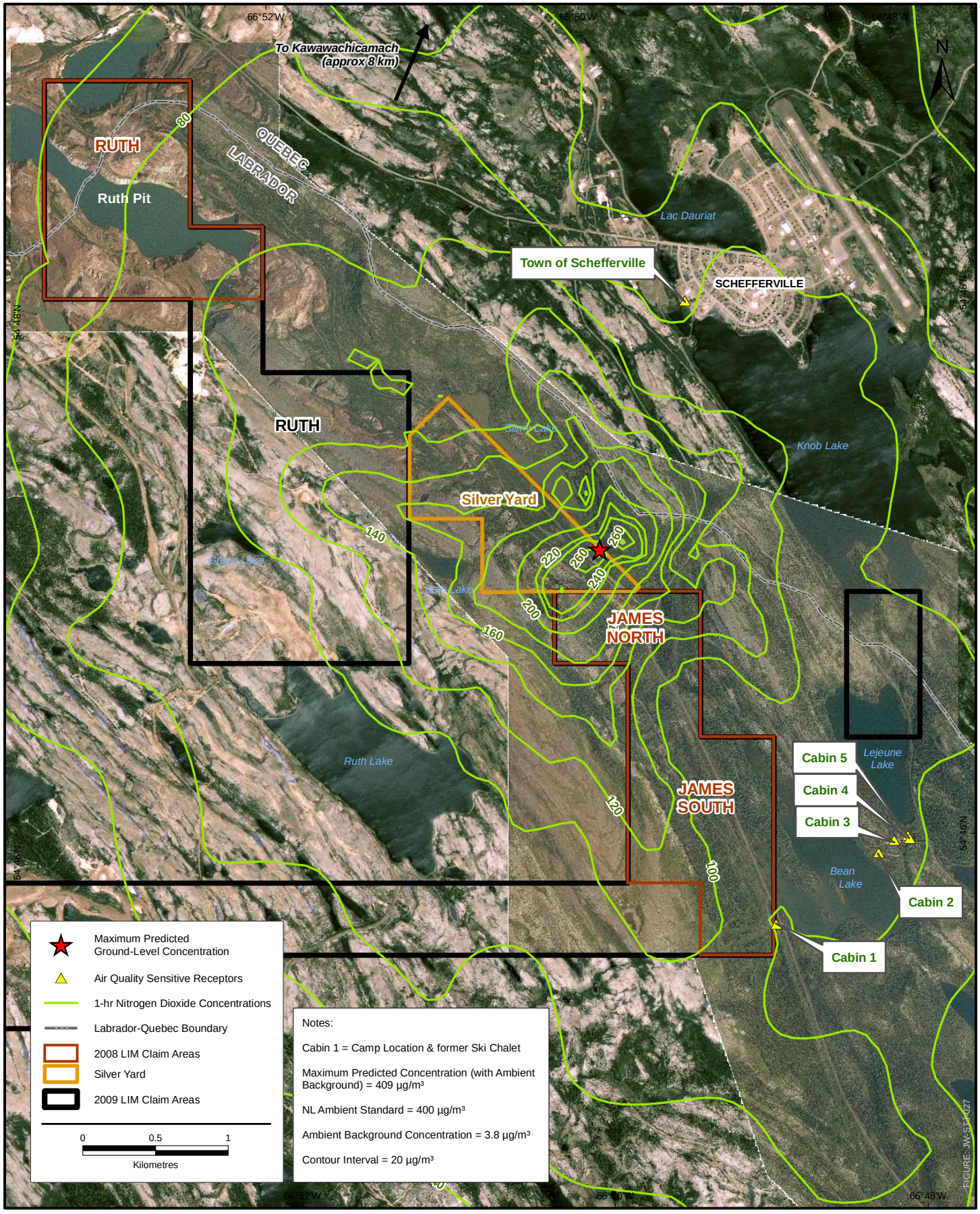


FIGURE NO:		DRAFT DATE:
E-5	**Maximum Predicted 1-hr Nitrogen Dioxide Ground-level Concentrations**	08/12/2008
		REVISION DATE: 12/8/2009

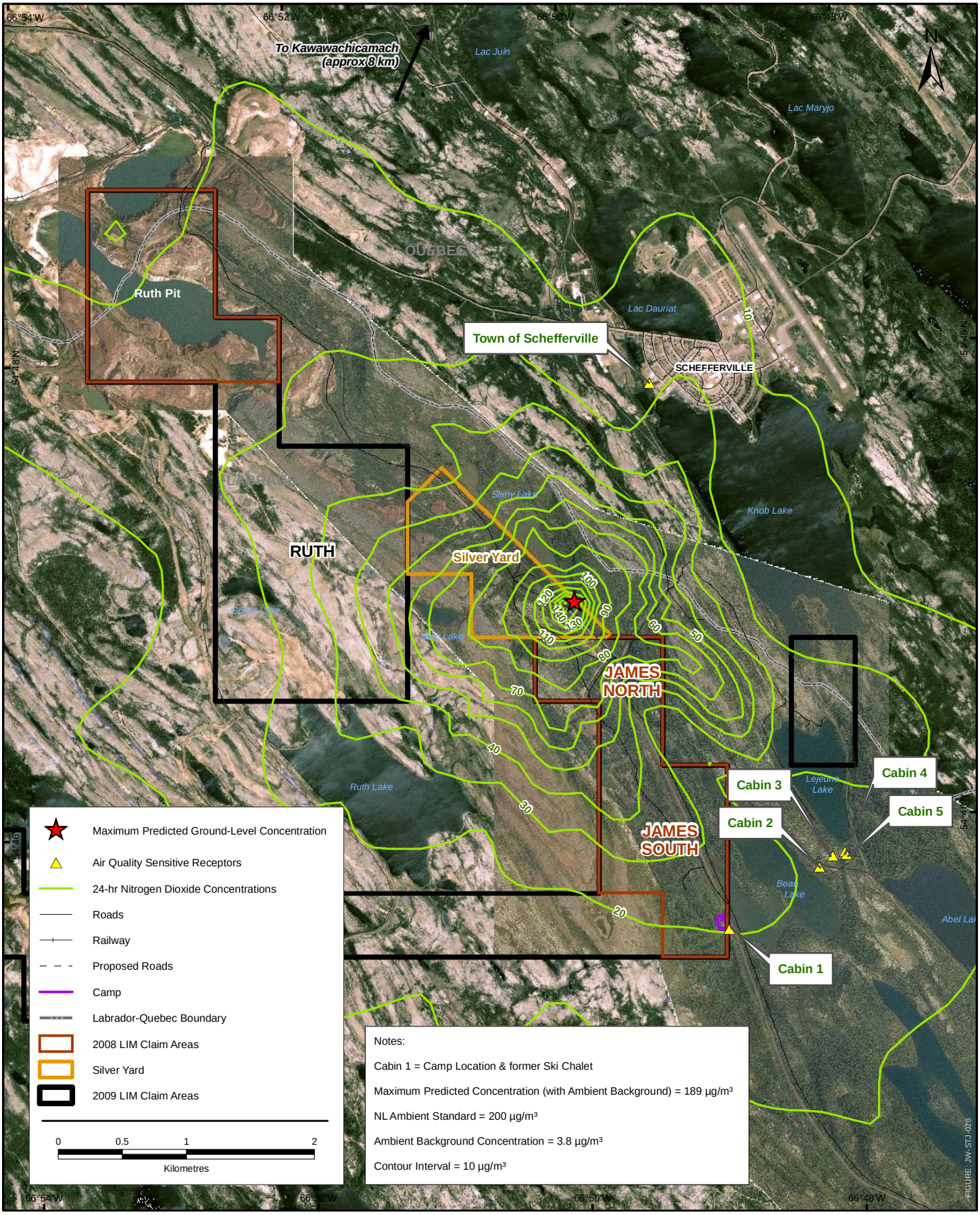


FIGURE NO:		DRAFT DATE:
E-6	**Maximum Predicted 24-hr Nitrogen Dioxide Ground-level Concentrations**	08/12/2008
		REVISION DATE: 13/8/2009

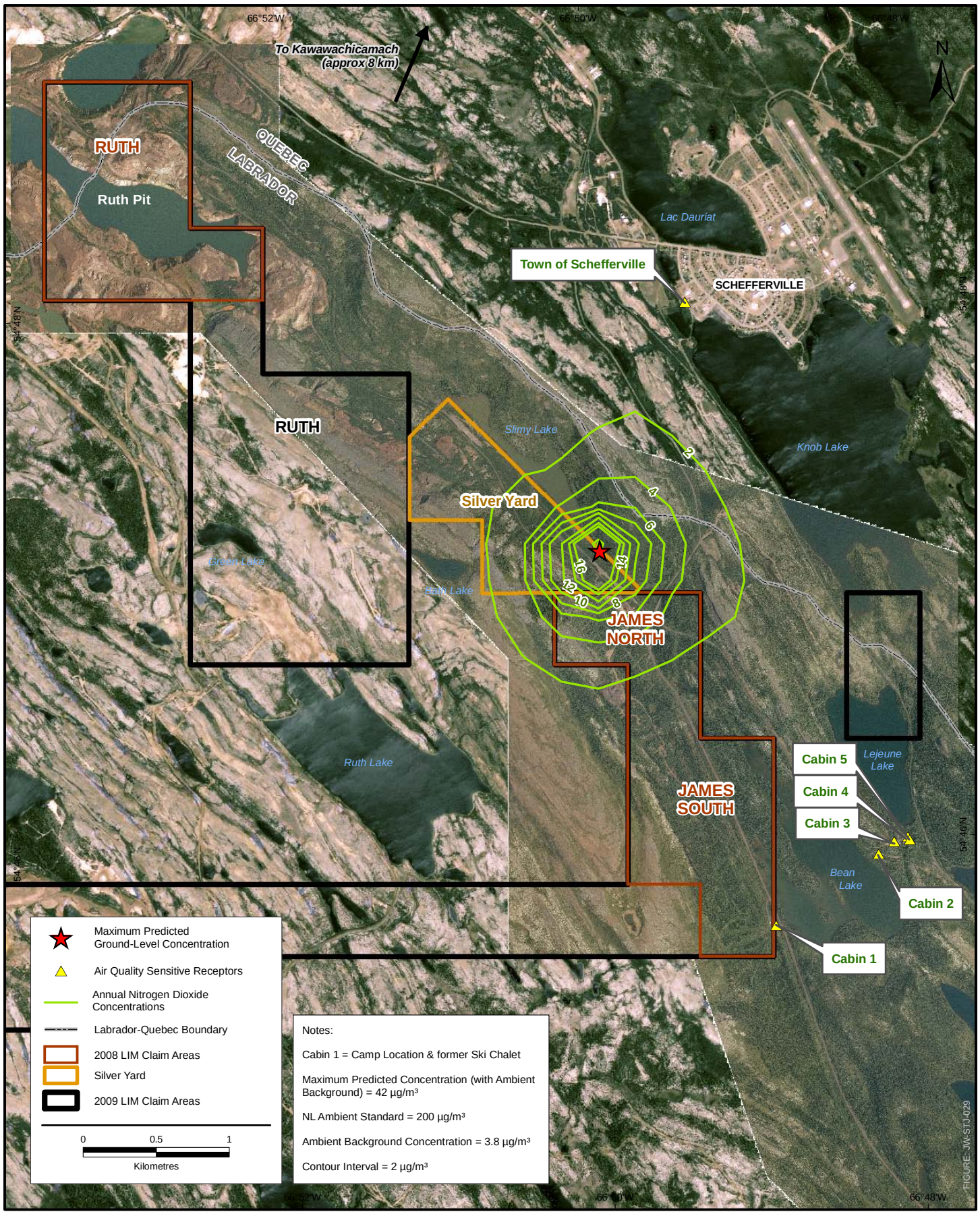


FIGURE NO:		DRAFT DATE:
E-7	**Maximum Predicted Annual Nitrogen Dioxide Ground-level Concentrations**	08/12/2008
		REVISION DATE: 12/8/2009

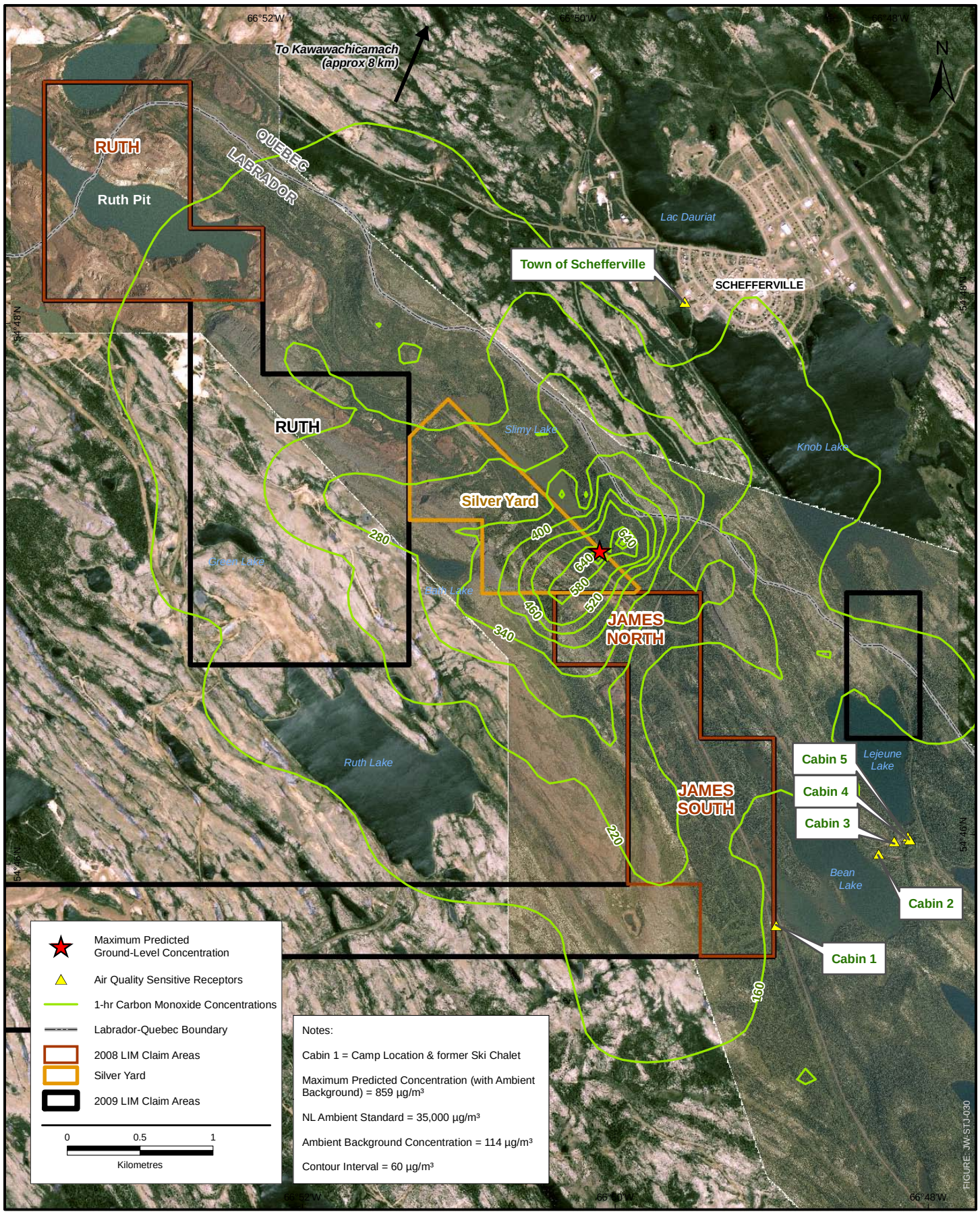


FIGURE NO:		DRAFT DATE:
E-8	**Maximum Predicted 1-hr Carbon Monoxide Ground-level Concentrations**	08/12/2008
		REVISION DATE: 12/8/2009

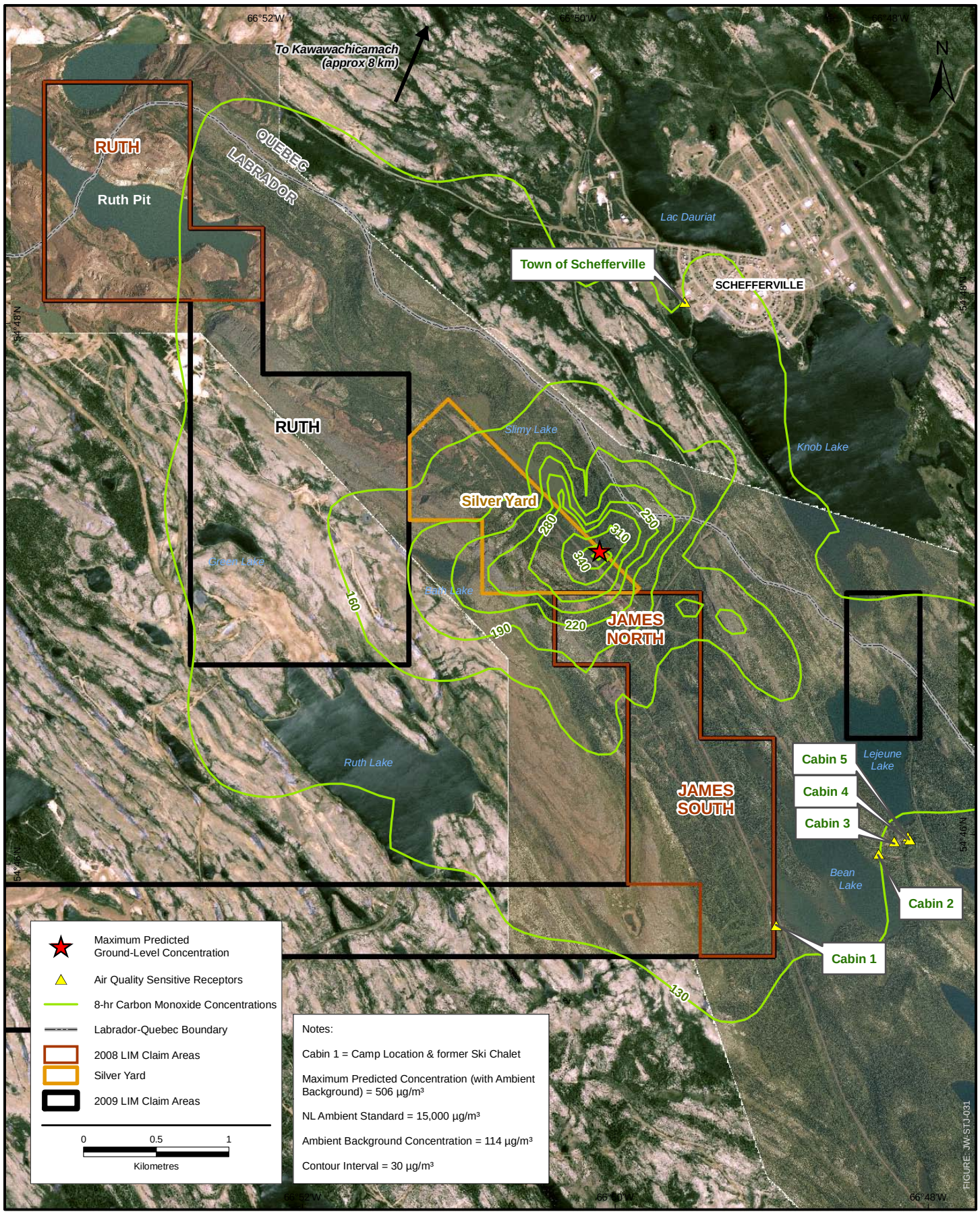


FIGURE NO:	Maximum Predicted 8-hr Carbon Monoxide Ground-level Concentrations	DRAFT DATE:
E-9		08/12/2008
		REVISION DATE: 12/8/2009

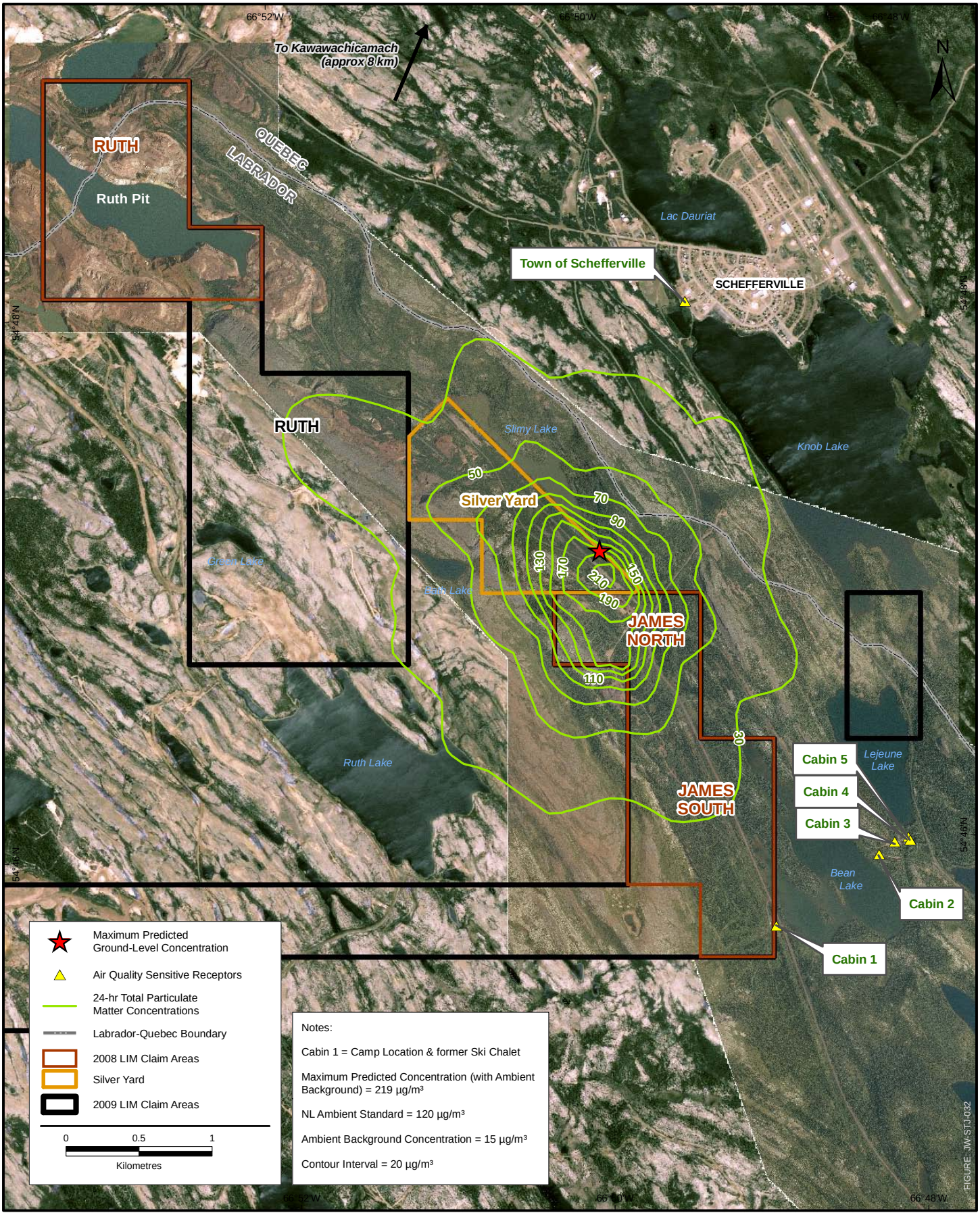


FIGURE NO:		DRAFT DATE:
E-10	**Maximum Predicted 24-hr Total Particulate matter Ground-level Concentrations**	08/12/2008
		REVISION DATE: 12/8/2009

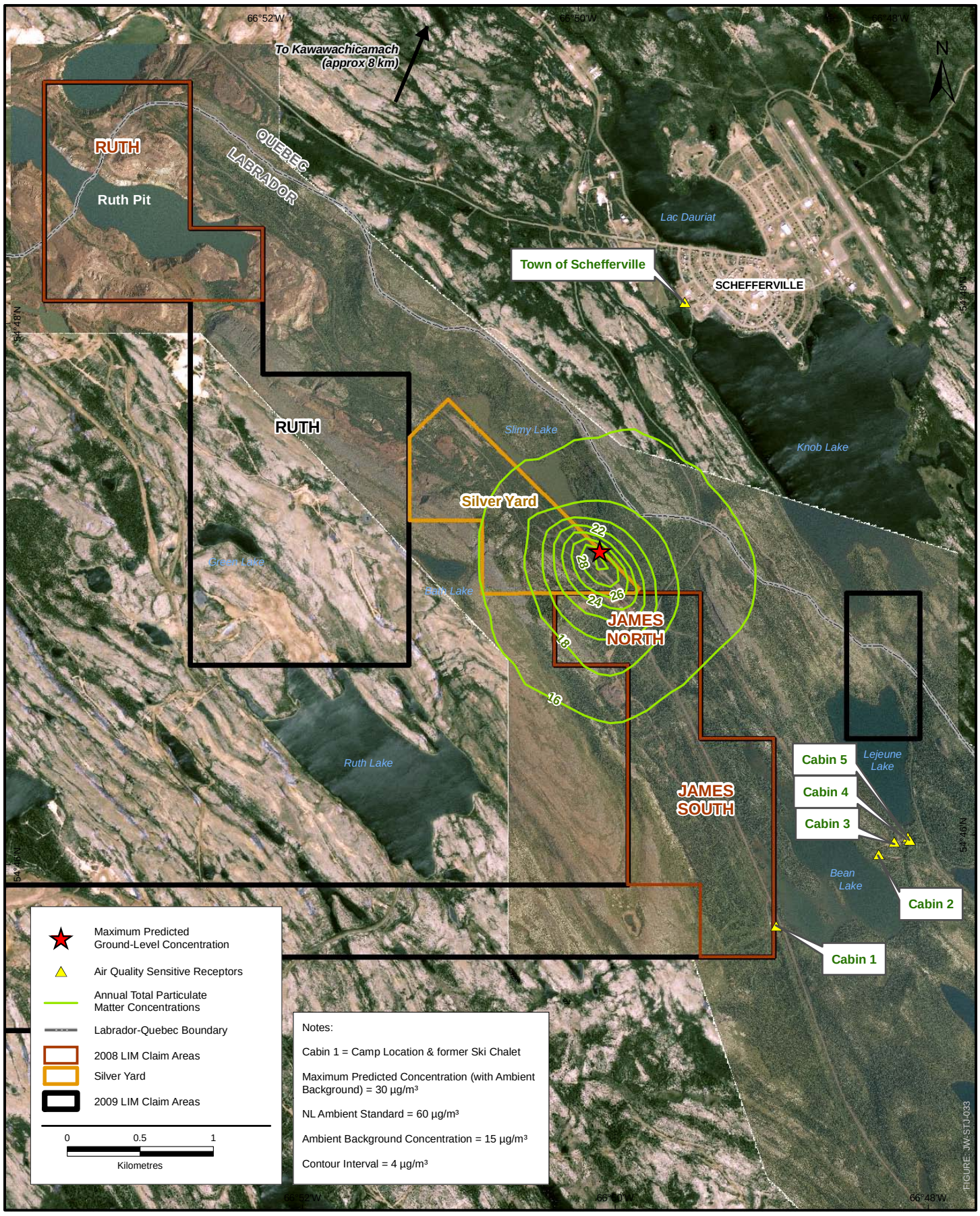


FIGURE NO:		DRAFT DATE:
E-11	**Maximum Predicted Annual Total Particulate matter Ground-level Concentrations**	08/12/2008
		REVISION DATE: 12/8/2009

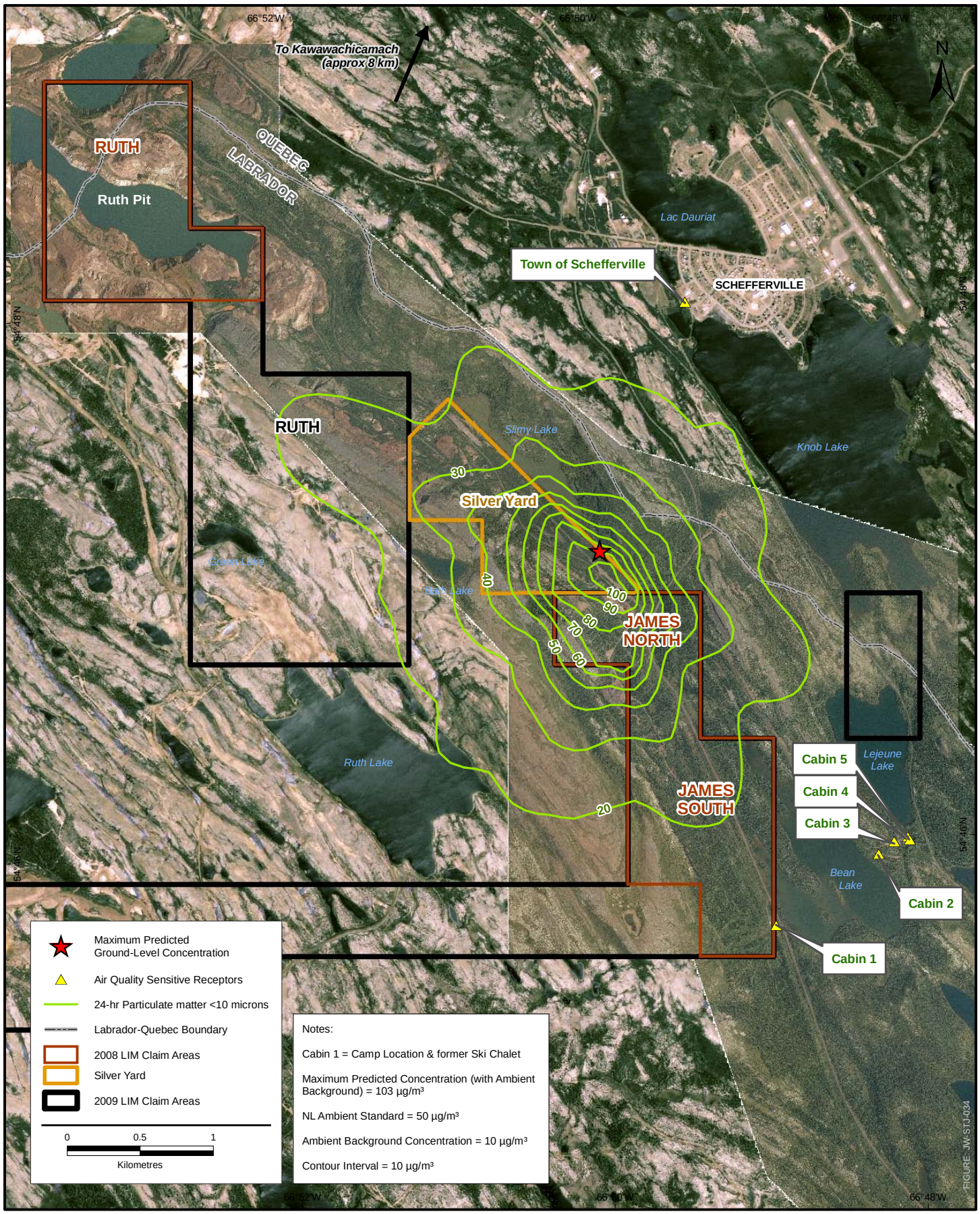


FIGURE NO:		DRAFT DATE:
E-12	**Maximum Predicted 24-hr Ground-level Concentrations Particulate matter less than 10 microns**	08/12/2008
		REVISION DATE: 12/8/2009

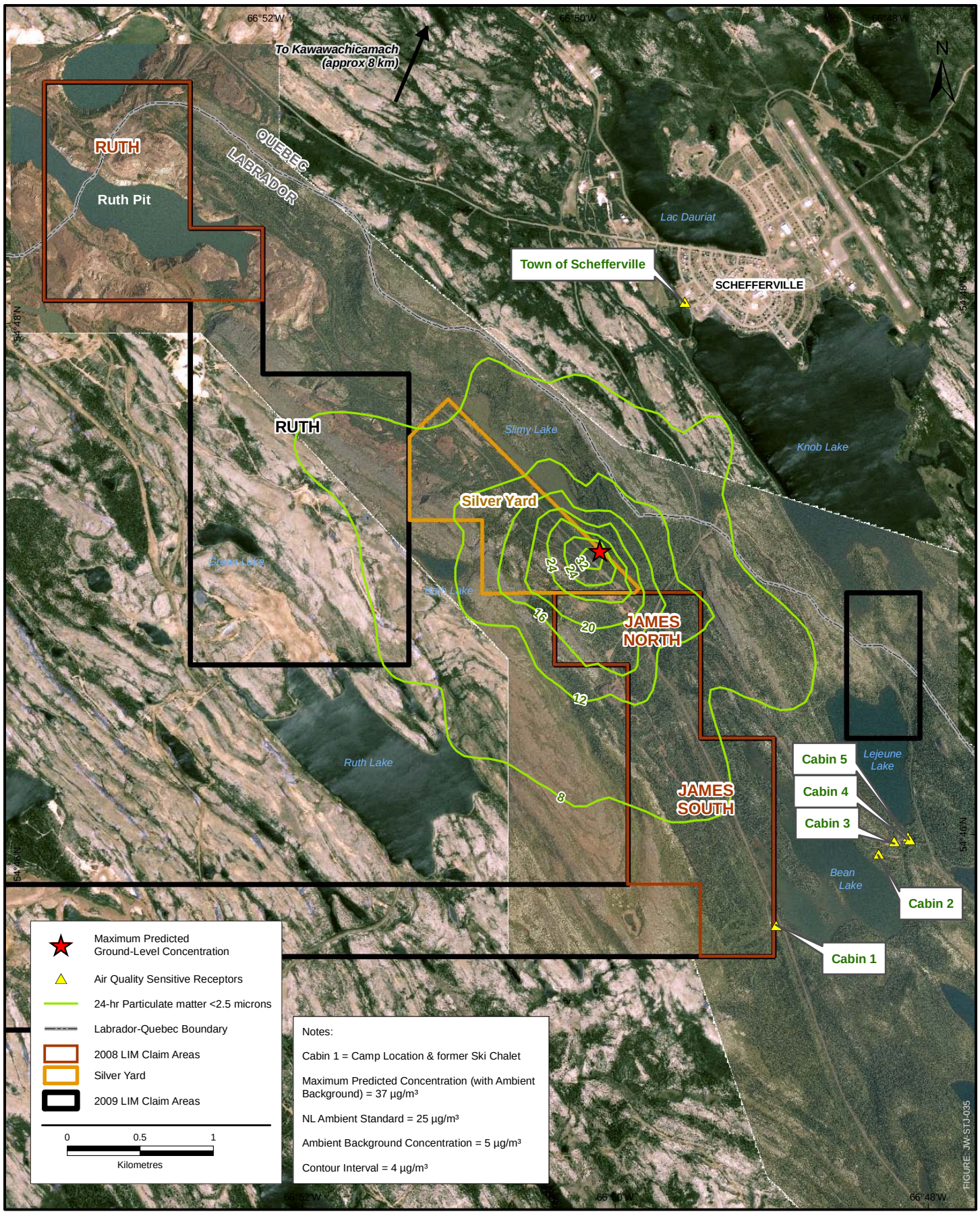


FIGURE NO:		DRAFT DATE:
E-13	**Maximum Predicted 24-hr Ground-level Concentrations Particulate matter less than 2.5 microns**	08/12/2008
		REVISION DATE: 12/8/2009

ATTACHMENT F

Maximum Predicted Concentrations at Sensitive Receptor Locations

Jacques Whitford

Table F-1- Summary of Maximum Predicted Ground-Level Concentrations at Schefferville - (639939.60, 6074715.34)

Air Contaminant	Averaging Period	Regulatory Standard ($\mu g/m^3$)	Estimated Background Concentration ($\mu g/m^3$)	Maximum Predicted Concentration ($\mu g/m^3$)	Predicted Concentration with Background ($\mu g/m^3$)	Percent of Criteria (%)
NO_2	1 hr	400	3.8	75.9	80	20%
	24 hr	200	3.8	17.4	21	11%
	ann	100	3.8	0.7	5	5%
SO_2	1 hr	900	5	19.4	24	3%
	3 hr	600	5	14.1	19	3%
	24 hr	300	5	4.5	10	3%
	ann	60	5	0.2	5	9%
TSP	1 hr	-	15	40.0	55	n/a
	24 hr	120	15	8.7	24	20%
	ann	60	15	0.3	15	26%
PM_{10}	1 hr	-	10	25.6	36	n/a
	24 hr	50	10	5.4	15	31%
$PM_{2.5}$	1 hr	-	5	6.7	12	n/a
	24 hr	25	5	1.5	7	26%
CO	1 hr	35,000	114	33.2	147	0%
	8 hr	15,000	114	16.2	130	1%

Table F-2- Summary of Maximum Predicted Ground-Level Concentrations at Cabin 1- (640.569, 6070.471)

Air Contaminant	Averaging Period	Regulatory Standard ($\mu g/m^3$)	Estimated Background Concentration ($\mu g/m^3$)	Maximum Predicted Concentration ($\mu g/m^3$)	Predicted Concentration with Background ($\mu g/m^3$)	Percent of Criteria (%)
NO_2	1 hr	400	3.8	77.0	81	20%
	24 hr	200	3.8	20.9	25	12%
	ann	100	3.8	0.3	4	4%
SO_2	1 hr	900	5	19.7	25	3%
	3 hr	600	5	15.2	20	3%
	24 hr	300	5	5.5	10	3%
	ann	60	5	0.1	5	8%
TSP	1 hr	-	15	31.8	47	n/a
	24 hr	120	15	7.4	22	19%
	ann	60	15	0.1	15	25%
PM_{10}	1 hr	-	10	24.4	34	n/a
	24 hr	50	10	7.4	17	35%
$PM_{2.5}$	1 hr	-	5	6.7	12	n/a
	24 hr	25	5	1.7	7	27%
CO	1 hr	35,000	114	33.7	148	0%
	8 hr	15,000	114	16.1	130	1%

Jacques Whitford

Table F-3- Summary of Maximum Predicted Ground-Level Concentrations at Cabin 2 - (641.271, 6070.926)

Air Contaminant	Averaging Period	Regulatory Standard ($\mu g/m^3$)	Estimated Background Concentration ($\mu g/m^3$)	Maximum Predicted Concentration ($\mu g/m^3$)	Predicted Concentration with Background ($\mu g/m^3$)	Percent of Criteria (%)
	1 hr	400	3.8	85.0	89	22%
	24 hr	200	3.8	17.6	21	11%
NO_2	ann	100	3.8	0.4	4	4%
	1 hr	900	5	25.6	31	3%
	3 hr	600	5	21.0	26	4%
	24 hr	300	5	4.5	10	3%
SO_2	ann	60	5	0.1	5	9%
	1 hr	-	15	27.6	43	n/a
	24 hr	120	15	6.9	22	18%
TSP	ann	60	15	0.2	15	25%
	1 hr	-	10	18.7	29	n/a
PM_{10}	24 hr	50	10	6.9	17	34%
	1 hr	-	5	6.8	12	n/a
$PM_{2.5}$	24 hr	25	5	1.5	7	26%
	1 hr	35,000	114	43.7	158	0%
CO	8 hr	15,000	114	16.4	130	1%

Table F-4- Summary of Maximum Predicted Ground-Level Concentrations at Cabin 3 - (641.376, 6071.014)

Air Contaminant	Averaging Period	Regulatory Standard ($\mu g/m^3$)	Estimated Background Concentration ($\mu g/m^3$)	Maximum Predicted Concentration ($\mu g/m^3$)	Predicted Concentration with Background ($\mu g/m^3$)	Percent of Criteria (%)
NO_2	1 hr	400	3.8	83.5	87	22%
	24 hr	200	3.8	16.1	20	10%
	ann	100	3.8	0.4	4	4%
SO_2	1 hr	900	5	23.8	29	3%
	3 hr	600	5	20.1	25	4%
	24 hr	300	5	4.2	9	3%
	ann	60	5	0.1	5	9%
TSP	1 hr	-	15	27.1	42	n/a
	24 hr	120	15	6.5	22	18%
	ann	60	15	0.2	15	25%
PM_{10}	1 hr	-	10	20.6	31	n/a
	24 hr	50	10	4.9	15	30%
$PM_{2.5}$	1 hr	-	5	6.4	11	n/a
	24 hr	25	5	1.5	6	26%
CO	1 hr	35,000	114	40.6	155	0%
	8 hr	15,000	114	15.3	129	1%

Table F-5- Summary of Maximum Predicted Ground-Level Concentrations at Cabin 4 - (641.471, 6071.047)

Air Contaminant	Averaging Period	Regulatory Standard ($\mu g/m^3$)	Estimated Background	Maximum Predicted Concentration ($\mu g/m^3$)	Predicted Concentration with	Percent of Criteria (%)
NO_2	1 hr	400	3.8	82.3	86	22%
	24 hr	200	3.8	15.3	19	10%
	ann	100	3.8	0.4	4	4%
SO_2	1 hr	900	5	22.2	27	3%
	3 hr	600	5	19.0	24	4%
	24 hr	300	5	4.0	9	3%
	ann	60	5	0.1	5	9%
TSP	1 hr	-	15	24.0	39	n/a
	24 hr	120	15	6.0	21	17%
	ann	60	15	0.2	15	25%
PM_{10}	1 hr	-	10	18.3	28	n/a
	24 hr	50	10	4.5	15	29%
$PM_{2.5}$	1 hr	-	5	6.0	11	n/a
	24 hr	25	5	1.4	6	26%
CO	1 hr	35,000	114	37.9	152	0%
	8 hr	15,000	114	14.5	128	1%

Jacques Whitford

Table F-6- Summary of Maximum Predicted Ground-Level Concentrations at Cabin 5 - (641.484, 6071.026)

Air Contaminant	Averaging Period	Regulatory Standard ($\mu g/m^3$)	Estimated Background	Maximum Predicted Concentration ($\mu g/m^3$)	Predicted Concentration with	Percent of Criteria (%)
NO_2	1 hr	400	3.8	82.4	86	22%
	24 hr	200	3.8	15.3	19	10%
	ann	100	3.8	0.4	4	4%
SO_2	1 hr	900	5	22.3	27	3%
	3 hr	600	5	19.1	24	4%
	24 hr	300	5	4.0	9	3%
	ann	60	5	0.1	5	9%
TSP	1 hr	-	15	23.9	39	n/a
	24 hr	120	15	5.9	21	17%
	ann	60	15	0.2	15	25%
PM_{10}	1 hr	-	10	18.3	28	n/a
	24 hr	50	10	4.5	15	29%
$PM_{2.5}$	1 hr	-	5	6.0	11	n/a
	24 hr	25	5	1.4	6	26%
CO	1 hr	35,000	114	38.1	152	0%
	8 hr	15,000	114	14.3	128	1%

Table F-7- Summary of Maximum Predicted Ground-Level Concentrations at Cabin 6 - (642.233, 6068.097)

Air Contaminant	Averaging Period	Regulatory Standard ($\mu g/m^3$)	Estimated Background Concentration ($\mu g/m^3$)	Maximum Predicted Concentration ($\mu g/m^3$)	Predicted Concentration with Background ($\mu g/m^3$)	Percent of Criteria (%)
	1 hr	400	3.8	37.4	41	10%
	24 hr	200	3.8	6.6	10	5%
NO_2	ann	100	3.8	0.1	4	4%
	1 hr	900	5	9.6	15	2%
	3 hr	600	5	6.4	11	2%
	24 hr	300	5	1.8	7	2%
SO_2	ann	60	5	0.03	5	8%
	1 hr	-	15	11.9	27	n/a
	24 hr	120	15	2.0	17	14%
TSP	ann	60	15	0.04	15	25%
	1 hr	-	10	8.9	19	n/a
PM_{10}	24 hr	50	10	1.6	12	23%
	1 hr	-	5	3.0	8	n/a
$PM_{2.5}$	24 hr	25	5	0.5	6	22%
	1 hr	35,000	114	16.4	130	0%
CO	8 hr	15,000	114	6.7	121	1%

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Table F-8- Summary of Maximum Predicted Ground-Level Concentrations at Recreational Camp - (642.789, 6068.313)

Air Contaminant	Averaging Period	Regulatory Standard ($\mu g/m^3$)	Estimated Background Concentration ($\mu g/m^3$)	Maximum Predicted Concentration ($\mu g/m^3$)	Predicted Concentration with Background ($\mu g/m^3$)	Percent of Criteria (%)
	1 hr	400	3.8	26.7	30	8%
	24 hr	200	3.8	6.0	10	5%
NO_2	ann	100	3.8	0.1	4	4%
	1 hr	900	5	7.0	12	1%
	3 hr	600	5	5.8	11	2%
	24 hr	300	5	1.6	7	2%
SO_2	ann	60	5	0.03	5	8%
	1 hr	-	15	9.0	24	n/a
	24 hr	120	15	1.7	17	14%
TSP	ann	60	15	0.04	15	25%
	1 hr	-	10	7.0	17	n/a
PM_{10}	24 hr	50	10	1.4	11	23%
	1 hr	-	5	2.2	7	n/a
$PM_{2.5}$	24 hr	25	5	0.5	5	22%
	1 hr	35,000	114	11.7	126	0%
CO	8 hr	15,000	114	4.6	119	1%

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APPENDIX I

Water Quality (Groundwater and Surface Water)

Table 1
Water Analytical Results - Inorganics
Redmond Property, Labrador Iron Mines, Schefferville Project, Labrador

Parameter	Units	CWQG FWAL	GCDWQ	RDL+	RP1			RP2					RP3				RP4						RP5	
Sampling Date					4/1/2008	6/6/2008	9/16/2008	4/24/2007	9/23/2007	4/1/2008	6/6/2008	9/13/2008	4/24/2007	9/23/2007	6/6/2008	9/13/2008	9/15/2008	4/24/2007	9/23/2007	4/1/2008	4/1/2008	6/6/2008	3/31/2008	9/15/2008
INORGANICS																								
Total Alkalinity (Total as CaCO3)	mg/L	NG	NG	5	38	39	39	ND	ND	<10	<10	<10	87	15	87	84	87	180	63	120	110	73	71	94
Dissolved Chloride (Cl)	mg/L	NG	NG	1	3	2	<2	ND	ND	<2	<2	<2	1	ND	<2	<2	<2	ND	ND	<2	<2	<2	<2	<2
Colour	TCU	NG	≤15*	5	<1	2	1	ND	ND	<1	6	5	**39**	**15**	2	11	6	ND	7	**28**	**30**	5	1	7
Total Dissolved Solids	mg/L	NG	NG	10	60	70	110	12	NA	<20	<20	50	340	NA	110	130	130	190	NA	100	100	90	70	140
Hardness (CaCO3)	mg/L	NG	NG	1	67	55	50	3	8	18	9	9	120	50	102	95	100	180	72	137	123	85	110	106
Nitrate + Nitrite	mg/L	NG	NG	0.05	0.5	0.4	0.3	0.17	0.09	0.4	0.3	0.3	0.07	ND	0.3	0.2	0.2	ND	0.15	<0.2	<0.2	0.2	0.4	0.3
Nitrite (N)	mg/L	0.06	NG	0.01	<0.1	<0.1	0.3	ND	0.34	<0.1	<0.1	<0.1	ND	ND	<0.1	<0.1	<0.1	ND		<0.1	<0.1	<0.1	<0.1	<0.1
Nitrogen (Ammonia Nitrogen)	mg/L	NG	NG	0.05	<0.05	<0.05	0.08	ND	0.07	0.05	<0.05	0.09	0.6	ND	<0.05	0.14	0.10	0.09	0.07	0.12	0.12	<0.05	<0.05	0.13
Dissolved Organic Carbon (C)	mg/L	NG	NG	0.5	<1	<1	<1	0.6	0.5	<1	<1	<1	6.5	4.3	<1	<1	2	1.2	1.3	1	<1	1	<1	<1
Total Organic Carbon (C)	mg/L	NG	NG	0.5	NA	3	<1	0.8	0.8	NA	1	<1	10	3.7	19	2	2	3.7	1.2	NA	NA	17	NA	<1
Orthophosphate (P)	mg/L	NG	NG	0.01	<0.003	0.003	<0.003	ND	ND	<0.003	<0.003	<0.003	ND	ND	0.004	0.003	<0.003	ND	ND	<0.003	<0.003	0.003	0.004	0.003
pH	pH	6.5 - 9	6.5 - 8.5	N/A	7.92	7.84	7.89	**6.46**	6.51	6.87	6.9	6.93	7.52	7.23	8.09	8.04	8.17	7.57	7.79	7.68	7.7	8.04	8.09	8.03
Reactive Silica (SiO2)	mg/L	NG	NG	0.5	3.9	3.8	3.1	0.8	1.7	2.2	1.8	1.8	4	0.7	6.3	5.2	4.6	19	3.3	14	11.9	4	6.4	6.5
Dissolved Sulphate (SO4)	mg/L	NG	NG	2	9	9	9	ND	3	5	4	3	42	30	10	4	4	2	3	3	3	4	7	10
Turbidity	NTU	NG	NG	0.1	0.17	0.75	0.34	2.4	1.8	0.35	2.2	1.7	3.9	0.6	0.31	0.57	0.42	21	0.2	4.7	5.4	0.21	0.17	1.2
Conductivity	uS/cm	NG	NG	1	111	99.6	98	11	18	21.6	16.5	15.2	260	96	185	159	167	320	120	207	208	147	151	196
Bromide	mg/L	NG	NG	0.1	<0.1	<0.1	0.08	NA	NA	<0.1	<0.1	<0.1	NA	NA	<0.1	<0.1	<0.1	NA	NA	<0.1	<0.1	<0.1	<0.1	<0.1
Fluoride	mg/L	NG	1.5	0.1	<0.1	<0.1	<0.1	NA	NA	<0.1	<0.1	<0.1	NA	NA	<0.1	<0.1	<0.1	NA	NA	<0.1	<0.1	<0.1	<0.1	<0.1
RCAP CALCULATIONS																								
Nitrate (N)	mg/L	NG	45	N/A	0.5	0.4	0.03	NC	NA	0.4	0.3	0.3	8.16	NA	0.3	0.2	0.2	7.71	NA	<0.1	<0.1	0.2	0.4	0.3
Anion Sum	me/L	NG	NG	N/A	0.9	0.9	0.9	0.01	0.09	0.1	0.1	<0.1	2.64	0.92	1.7	1.5	1.5	3.63	1.34	2	1.9	1.3	1.4	1.8
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	NG	NG	1	38	39	39	ND	ND	<10	<10	<10	87	15	86	83	86	179	63	119	109	72	70	93
Calculated TDS	mg/L	NG	≤500*	1	50	55	51	3	9	13	8	8	145	57	96	86	89	191	69	120	109	76	88	102
Carb. Alkalinity (calc. as CaCO3)	mg/L	NG	NG	1	<10	<10	<10	ND	ND	<10	<10	<10	ND	ND	<10	<10	<10	ND	ND	<10	<10	<10	<10	<10
Cation - Anion Balance	%	NG	NG	N/A	19.5	Low EC	Low EC	NA	NA	Low EC	Low EC	Low EC	NA	NA	10.2	12.2	13.0	NA	NA	14.8	13.6	12.9	24.2	9.4
Cation Sum	me/L	NG	NG	N/A	1.4	1.2	1.0	0.08	0.17	0.4	0.2	0.2	2.62	1.04	2.1	1.9	2.0	3.67	1.46	2.7	2.5	1.7	2.2	2.2
Conductivity % Difference	%	NG	NG	N/A	6.9	5.4	-2.1	NA	NA	30	5.6	12.1	NA	NA	-4.5	0.2	-0.4	NA	NA	5.3	-4.5	-3.2	12.8	-5.2
Computed Conductivity	uS/cm	NG	NG	N/A	119	105	95.9	NA	NA	29.2	17.4	17.2	NA	NA	177	159	166	NA	NA	218	199	142	172	186
Ion Balance (% Difference)	%	NG	NG	N/A	148	Low EC	Low EC	77.8	30.8	Low EC	Low EC	Low EC	0.38	6.12	123	128	130	0.55	4.29	135	132	130	164	121
Langelier Index (@ 20C)	N/A	NG	NG	N/A	-0.7	-0.9	-0.8	NC	NC	-6.2	-6.5	-6.5	-0.393	-1.89	0	-0.1	0.0	0.107	-0.58	-0.1	-0.2	-0.2	0	0.0
Langelier Index (@ 4C)	N/A	NG	NG	N/A	NA	NA	NA	NC	NC	NA	NA	NA	-0.644	-2.15	NA	NA	NA	-0.143	-0.832	NA	NA	NA	NA	NA
Saturation pH (@ 20C)	N/A	NG	NG	N/A	8.59	8.69	8.74	NC	NC	13	13.4	13.4	7.91	9.12	8.13	8.15	8.13	7.46	8.37	7.82	7.91	8.23	8.1	8.08
Saturation pH (@ 4C)	N/A	NG	NG	N/A	NA	NA	NA	NC	NC	NA	NA	NA	8.16	9.38	NA	NA	NA	7.71	8.62	NA	NA	NA	NA	NA

All results expressed as indicated

RDL+ - Analytical Reportable Detection Limit

CWQG, FWAL = CCME Canadian Water Quality Guidelines for the Protection of Freshwater Aquatic Life (2006 Update)

GCDWQ = CCME Canadian Water Quality Guidelines for Drinking Water Quality

334 Exceeds CWQG FWAL Standards

334 Exceeds GCDWQ Standards

ND = Not detected

NC = Non-calculable

NG = No Guideline

NA = Not Analysed

N/A = Not Applicable

Table 2
Surface Water Analytical Results - Metals
Redmond Property, Labrador Iron Mines, Schefferville Project, Labrador

Parameter	Units	Criteria 1	Criteria 2	RDL+	RP1			RP2					RP3				RP4						RP5	
		CWQG FWAL	GCDWQ																					
Sampling Date					1-Apr-08	6-Jun-08	15-Sep-08	24-Apr-07	23-Sep-07	1-Apr-08	6-Jun-08	13-Sep-08	24-Apr-07	23-Sep-07	6-Jun-08	13-Sep-08	24-Apr-07	23-Sep-07	1-Apr-08	1-Apr-08	6-Jun-08	15-Sep-08	31-Mar-08	15-Sep-08
Total Metals																								
Total Aluminum (Al)	ug/L	5-100	100	10	<10	70	<10	32	NA	<10	20	20	42	NA	<10	<10	16	NA	<10	<10	<10	<10	50	0.02
Total Antimony (Sb)	ug/L	NG	6**	2	<5	<5	<5	ND	NA	<5	<5	<5	ND	NA	<5	<5	ND	NA	<5	<5	<5	<5	<5	<5
Total Arsenic (As)	ug/L	5	10	2	<1	<1	<1	ND	NA	<1	<1	<1	ND	NA	<1	<1	ND	NA	<1	<1	<1	<1	<1	<1
Total Barium (Ba)	ug/L	NG	1000	5	<10	<10	<10	ND	NA	<10	<10	<10	11	NA	<10	<10	ND	NA	<10	<10	<10	<10	<10	<10
Total Beryllium (Be)	ug/L	NG	NG	2	<1	<1	<1	ND	NA	<1	<1	<1	ND	NA	<1	<1	ND	NA	<1	<1	<1	<1	<1	<1
Total Bismuth (Bi)	ug/L	NG	NG	2	<1	<1	<1	ND	NA	<1	<1	<1	ND	NA	<1	<1	ND	NA	<1	<1	<1	<1	<1	<1
Total Boron (B)	ug/L	NG	5000**	5	<50	<50	<50	ND	NA	<50	<50	<50	ND	NA	<50	<50	ND	NA	<50	<50	<50	<50	<50	<50
Total Cadmium (Cd)	ug/L	0.017	5	0.3	<0.1	<0.1	<0.1	ND	NA	<0.1	<0.1	<0.1	ND	NA	<0.1	<0.1	ND	NA	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Total Calcium (Ca)	ug/L	NG	NG	100	14600	11000	9800	1200	1600	4100	2000	2300	33000	10000	19400	18700	47000	14000	29200	26000	17700	19000	25100	20300
Total Chromium (Cr)	ug/L	NG	50	2	<1	<1	<1	ND	NA	<1	<1	<1	ND	NA	<1	<1	ND	NA	<1	<1	<1	<1	<1	<1
Total Cobalt (Co)	ug/L	NG	NG	1	<0.5	<0.5	<0.5	ND	NA	<0.5	<0.5	<0.5	ND	NA	<0.5	<0.5	ND	NA	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Total Copper (Cu)	ug/L	2-4	≤1000*	2	<1	<1	<1	ND	ND	<1	<1	<1	ND	ND	<1	<1	ND	ND	<1	<1	<1	<1	<1	<1
Total Iron (Fe)	ug/L	300	≤300*	50	<50	180	<50	ND	30	<50	140	<50	**3300**	NA	100	120	320	**5800**	70	**2290**	**1720**	120	120	<50	240
Total Lead (Pb)	ug/L	1-7	10	0.5	<1	<1	<1	ND	NA	<1		<1	ND	NA	<1	<1	ND	NA	<1	<1	<1	<1	<1	<1
Total Magnesium (Mg)	ug/L	NG	NG	100	7300	6700	6100	600	900	1800	900	900	16000	5900	12900	11700	23000	8700	15600	14100	9.9	12800	11400	13500
Total Manganese (Mn)	ug/L	NG	≤50	2	3	13	12	10	ND	5	7	3	**780**	10	42	74	**160**	ND	**91**	**81**	14	3	**57**	**111**
Total Mercury (Hg)	ug/L	NG	1	0.01	<0.1	<0.1	<0.1	ND	NA	<0.1	<0.1	<0.1	ND	NA	<0.1	<0.1	ND	NA	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Total Molybdenum (Mo)	ug/L	73	NG	2	<1	<1	<1	ND	NA	<1	<1	<1	ND	NA	<1	<1	ND	NA	<1	<1	<1	<1	<1	<1
Total Nickel (Ni)	ug/L	25-150	NG	2	<2	<2	<2	ND	NA	<2	<2	<2	ND	NA	<2	<2	ND	NA	<2	<2	<2	<2	<2	<2
Total Phosphorus (P)	ug/L	NG	NG	100	<50	<30	<50	ND	NA	<50	<30	<50	ND	NA	<30	<50	ND	NA	<50	<50	<30	<50	<50	<50
Total Potassium (K)	ug/L	NG	NG	100	<1000	<1000	<1000	200	100	<1000	<1000	<1000	900	300	<1000	<1000	1100	300	<1000	<1000	<1	<1000	<1000	<1000
Total Selenium (Se)	ug/L	1	10	2	<5	<5	<5	ND	NA	<5	<5	<5	ND	NA	<5	<5	ND	NA	<5	<5	<5	<5	<5	<5
Total Silicon (Si)	ug/L	NG	NG	100	1800	1800	1500	NA	NA	1200	1000	900	NA	NA	2500	2400	NA	NA	6200	5700	1600	2200	3000	3100
Total Silver (Ag)	ug/L	NG	NG	0.5	<0.1	<0.1	<0.1	ND	NA	<0.1	<0.1	<0.1	NA	NA	<0.1	<0.1	ND	NA	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Total Sodium (Na)	ug/L	NG	≤200000*	100	1400	1200	1200	300	100	<500	<500	<500	600	500	600	<500	800	400	<500	<500	<500	<500	600	600
Total Strontium (Sr)	ug/L	NG	NG	5	9	9	7	ND	NA	5	3	3	19	NA	12	9	12	NA	18	12	9	9	13	11
Total Thallium (Tl)	ug/L	0.8	NG	0.1	<0.3	<0.3	<0.3	ND	NA	<0.3	<0.3	<0.3	ND	NA	<0.3	<0.3	ND	NA	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Total Tin (Sn)	ug/L	NG	NG	2	<1	<1	<1	ND	NA	<1	<1	<1	ND	NA	<1	<1	ND	NA	<1	<1	<1	<1	<1	<1
Total Titanium (Ti)	ug/L	NG	NG	2	<2	3	<2	ND	NA	<2	<2	<2	ND	NA	<2	<2	ND	NA	<2	<2	<2	<2	<2	<2
Tungsten (W)-Total	ug/L	NG	NG	10	<10	<10	<10	NA	NA	<10	<10	<10	NA	NA	<10	<10	NA	NA	<10	<10	<10	<10	<10	<10
Total Uranium (U)	ug/L	NG	20**	0.1	<5	<5	<5	ND	NA	<5	<5	<5	ND	NA	<5	<5	0.4	NA	<5	<5	<5	<5	<5	<5
Total Vanadium (V)	ug/L	NG	NG	2	<1	<1	<1	ND	NA	<1	<1	<1	ND	NA	<1	<1	ND	NA	<1	<1	<1	<1	<1	<1
Total Zinc (Zn)	ug/L	30	≤5000*	5	26	<3	<3	29	ND	20	<3	5	11	ND	3	<3	16	ND	28	5	3	<3	**153**	7
Zirconium (Zr)-Total	ug/L	NG	NG	4	<4	<4	<0.004	NA	NA	<4	<4	<0.004	NA	NA	<4	<0.004	NA	NA	<4	<4	<4	<4	<4	<4
Dissolved Metals																								
Dissolved Aluminum (Al)	ug/L	NG	NG	10	<10	<10	<10	ND	NA	<10	<10	<10	20	NA	<10	<10	ND	NA	<10	<10	<10	<10	<10	<10
Dissolved Antimony (Sb)	ug/L	NG	NG	2	<5	<5	<5	ND	NA	<5	<5	<5	ND	NA	<5	<5	ND	NA	<5	<5	<5	<5	<5	<5
Dissolved Arsenic (As)	ug/L	NG	NG	2	<1	<1	<1	ND	NA	<1	<1	<1	ND	NA	<1	<1	ND	NA	<1	<1	<1	<1	<1	<1
Dissolved Barium (Ba)	ug/L	NG	NG	5	<10	<10	<10	ND	NA	<10	<10	<10	10	NA	<10	<10	ND	NA	<10	<10	<10	<10	<10	<10
Dissolved Beryllium (Be)	ug/L	NG	NG	2	<1	<1	<1	ND	NA	<1	<1	<1	ND	NA	<1	<1	ND	NA	<1	<1	<1	<1	<1	<1
Dissolved Bismuth (Bi)	ug/L	NG	NG	2	<1	<1	<1	ND	NA	<1	<1	<1	ND	NA	<1	<1	ND	NA	<1	<1	<1	<1	<1	<1
Dissolved Boron (B)	ug/L	NG	NG	5	<50	<50	<50	ND	NA	<50	<50	<50	ND	NA	<50	<50	ND	NA	<50	<50	<50	<50	<50	<50
Dissolved Cadmium (Cd)	ug/L	NG	NG	0.3	<0.1	<0.1	<0.1	ND	NA	<0.1	<0.1	<0.1	ND	NA	<0.1	<0.1	ND	NA	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Dissolved Calcium (Ca)	ug/L	NG	NG	500	11200	10200	10400	NA	NA	2100	1600	1500	NA	NA	20500	18100	NA	NA	26300	25000	16700	19300	16000	20600
Dissolved Chromium (Cr)	ug/L	NG	NG	2	<1	<1	<1	ND	NA	<1	<1	<1	ND	NA	<1	<1	ND	NA	<1	<1	<1	<1	<1	<1
Dissolved Cobalt (Co)	ug/L	NG	NG	1	<0.5	<0.5	<0.5	ND	NA	<0.5	<0.5	<0.5	ND	NA	<0.5	<0.5	ND	NA	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Dissolved Copper (Cu)	ug/L	NG	NG	2	<1	<1	<1	ND	NA	<1	<1	<1	ND	NA	<1	<1	ND	NA	<1	<1	<1	<1	<1	<1
Dissolved Iron (Fe)	ug/L	NG	NG	50	<50	<50	<50	ND	NA	<50	<50	<50	**1800**	NA	<50	<50	220	NA	<50	<50	<50	<50	<50	<50
Dissolved Lead (Pb)	ug/L	NG	NG	0.5	<1	<1	<1	ND	NA	<1	<1	<1	ND	NA	<1	<1	ND	NA	<1	<1	<1	<1	<1	<1
Dissolved Magnesium (Mg)	ug/L	NG	NG	500	7200	6300	6100	NA	NA	120	900	1000	NA	NA	13000	10700	NA	NA	15000	14100	10100	11200	10700	12100
Dissolved Manganese (Mn)	ug/L	NG	NG	2	<1	6	<1	8	NA	2	6	<1	680	NA	42	60	120	NA	84	76	0.01	2	6	108
Mercury Dissolved (Hg)	ug/L	NG	NG	0.1	<0.1	<0.1	<0.1	NA	NA	<0.1	<0.1	<0.1	NA	NA	<0.1	<0.1	NA	NA	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Dissolved Molybdenum (Mo)	ug/L	NG	NG	2	<1	<1	<1	ND	NA	<1	<1	<1	ND	NA	<1	<1	ND	NA	<1	<1	<1	<1	<1	<1
Dissolved Nickel (Ni)	ug/L	NG	NG	2	<2	<2	<2	ND	NA	<2	<2	<2	ND	NA	<2	<2	ND	NA	<2	<2	<2	<2	<2	<2
Dissolved Phosphorus (P)	ug/L	NG	NG	50	<50	<50	<50	NA	NA	<50	<50	<50	NA	NA	<50	<50	NA	NA	<50	<50	<50	<50	<50	<50
Dissolved Potassium (K)	ug/L	NG	NG	1000	<1000	<1000	<1000	NA	NA	<1000	<1000	<1000	NA	NA	<1000	<1000	NA	NA	<1000	<1000	<1000	<1000	<1000	<1000
Dissolved Selenium (Se)	ug/L	NG	NG	2	<5	<5	<5	ND	NA	<5	<5	<5	ND	NA	<5	<5	ND	NA	<5	<5	<5	<5	<5	<5
Dissolved Silicon (Si)	ug/L	NG	NG	100	1800	1800	1600	NA	NA	1000	800	800	NA	NA	2900	2800	NA	NA	6500	5500	1900	2400	3000	3400
Dissolved Silver (Ag)	ug/L	NG	NG	0.5	<0.1	<0.1	<0.1	ND	NA	<0.1	<0.1	<0.1	ND	NA	<0.1	<0.1	ND	NA	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Dissolved Sodium (Na)	ug/L	NG	NG	500	1300	1100	1200	NA	NA	<500	<500	<500	NA	NA	600	<500	NA	NA	<500	<500	<500	<500	500	600
Dissolved Strontium (Sr)	ug/L	NG	NG	5	7	7	7	ND	NA	3	3	3	18	NA	0.011	9	11	NA	12	11	9	9	7	11
Dissolved Thallium (Tl)	ug/L	NG	NG	0.1	<0.3	<0.3	<0.3	ND	NA	<0.3	<0.3	<0.3	ND	NA	<0.3	<0.3	ND	NA	<0.3	<0.0003	<0.0003	<0.3	<0.3	<0.3
Dissolved Tin (Sn)	ug/L	NG	NG	2	<1	<1	<1	ND	NA	<1	<1	<1	ND	NA	<1	<1	ND	NA	<1	<1	<1	<1	<1	<1
Dissolved Titanium (Ti)	ug/L	NG	NG	2	<2	<2	<2	ND	NA	<2	<2	<2	ND	NA	<2	<2	ND	NA	<2	<2	<2	<2	<2	<2
Dissolved Tungsten (W)	ug/L	NG	NG	10	<10	<10	<10	NA	NA	<10	<10	<10	NA	NA	<10	<10	NA	NA	<10	<10	<10	<10	<10	<10
Dissolved Uranium (U)	ug/L	NG	NG	0.1	<5	<5	<5	ND	NA	<5	<5	<5	ND	NA	<5	<5	0.4	NA	<5	<5	<5	<5	<5	<5
Dissolved Vanadium (V)	ug/L	NG	NG	2	<1	<1	<1	ND	NA	<1	<1	<1	ND	NA	<1	<1	ND	NA	3	<1	<1	<1	1	<1
Dissolved Zinc (Zn)	ug/L	NG	NG	5	<6	6	<3	20	NA	3	7	<3	ND	NA	5	<3	5	NA	<3	<3	3	4	<3	3
Dissolved Zirconium (Zr)		NG	NG	4	<4	<4	<4	NA	NA	<4	<4	<4	NA	NA	<4	<4	NA	NA	<4	<4	<4	<4	<4	<4

All results expressed as indicated
RDL+ - Analytical Reportable Detection Limit
CWQG, FWAL = CCME Canadian Water Quality Guidelines for the Protection of Freshwater Aquatic Life (2006 Update)
GCDWQ = CCME Canadian Water Quality Guidelines for Drinking Water Quality

334	Exceeds CCME FWAL Standards
334	Exceeds GCDWQ Standards
ND = Not detected	N/A = Not Applicable
NA = Not Analyzed	
NG = No Guidelines	
* Aesthetic Objective	** Interim Maximum Acceptable Concentration

Table 3
Water Analytical Results - Inorganics
James Property, Labrador Iron Mines, Schefferville Project, Labrador

Parameter	Units	CCME FWAL	CCME DW	RDL+	JP1			JP2			JP3		JP4					JP5				JP6	
Sampling Date					*4/26/2007*	*9/23/2007*	*9/13/2008*	*4/26/2007*	*9/23/2007*	*9/13/2008*	*4/26/2007*	*9/13/2008*	*4/26/2007*	*9/23/2007*	*3/31/2008*	*6/9/2008*	*9/13/2008*	*4/26/2007*	*9/23/2007*	*3/31/2008*	9/14/2008	*6/9/2008*	*9/13/2008*
INORGANICS																							
Total Alkalinity (Total as CaCO3)	mg/L	NG	NG	5	76	71	73	73	74	74	81	23	10	11	14	<10	10	69	75	<10	70	13	22
Dissolved Chloride (Cl)	mg/L	NG	NG	1	1	ND	<2	1	ND	<2	1	<2	ND	ND	<2	<2	<2	ND	ND	<2	<2	<2	<2
Colour	TCU	NG	≤15*	5	ND	ND	5	ND	ND	4	ND	6	ND	ND	<1	<1	4	ND	ND	1	4	2	<1
Total Dissolved Solids	mg/L	NG	NG	10	88	NA	420	90	NA	80	89	90	39	NA	<20	<20	<20	91	NA	70	120	30	30
Hardness (CaCO3)	mg/L	NG	NG	1	77	81	83	75	89	88	87	31	14	12	23	11	13	78	86	110	73	19	28
Nitrate + Nitrite	mg/L	NG	NG	0.05	0.27	0.09	0.2	0.24	0.27	0.2	0.24	<0.2	0.24	0.24	0.2	0.3	0.2	0.33	0.27	0.4	0.2	0.2	0.2
Nitrite (N)	mg/L	0.06	NG	0.01	ND	NA	<0.1	ND	NA	<0.1	ND	<0.1	ND	NA	<0.1	<0.1	<0.1	ND	NA	<0.1	<0.1	<0.1	<0.1
Nitrogen (Ammonia Nitrogen)	mg/L	NG	NG	0.05	ND	0.06	0.06	ND	0.07	0.07	ND	0.05	ND	0.06	<0.05	<0.05	0.06	ND	0.07	<0.05	0.09	0.06	<0.05
Dissolved Organic Carbon (C)	mg/L	NG	NG	0.5	ND	ND	<1	ND	ND	2	0.6	<1	0.7	ND	<1	<1	1	ND	ND	<1	<1	<1	1
Total Organic Carbon (C)	mg/L	NG	NG	0.5	ND	0.5	<1	0.5	ND	3	0.5	<1	ND	ND	NA	<1	<1	0.9	ND	NA	<1	NA	<1
Orthophosphate (P)	mg/L	NG	NG	0.01	ND	ND	0.003	ND	ND	0.003	ND	<0.003	ND	ND	<0.003	0.003	<0.003	ND	ND	0.004	<0.003	<0.003	0.004
pH	pH	6.5 - 9	6.5 - 8.5	N/A	7.98	7.9	8.11	8.17	7.93	8.13	8.44	7.47	7.09	6.81	7.22	6.91	6.97	7.99	7.88	8.09	7.98	7.54	7.12
Reactive Silica (SiO2)	mg/L	NG	NG	0.5	5.9	4.7	6.8	5.4	5.4	7.1	5.6	5.9	4.9	4.2	5.1	4.1	5.9	5.4	5.3	6.4	6.5	3.9	6.4
Dissolved Sulphate (SO4)	mg/L	NG	NG	2	6	5	7	6	6	7	6	2	ND	ND	<2	2	<2	6	6	7	7	2	4
Turbidity	NTU	NG	NG	0.1	0.3	0.5	0.49	0.2	0.7	0.46	ND	0.31	ND	0.2	0.12	0.14	0.14	0.4	1.2	0.17	0.72	0.12	0.10
Conductivity	uS/cm	NG	NG	1	160	140	146	150	150	144	170	42.4	29	23	25.2	23	23.9	160	150	151	141	36.5	48.5
Bromide	mg/L	NG	NG	0.1	NA	NA	<0.1	NA	NA	<0.1	NA	<0.1	NA	NA	<0.1	<0.1	<0.1	NA	NA	<0.1	<0.1	<0.1	<0.1
Fluoride	mg/L	NG	1.5	0.1	NA	NA	<0.1	NA	NA	<0.1	NA	<0.1	NA	NA	<0.1	<0.1	<0.1	NA	NA	<0.1	<0.1	<0.1	<0.1
RCAP CALCULATIONS																							
Nitrate (N)	mg/L	NG	45	N/A	0.27	NA	0.2	0.24	NA	0.2	0.24	0.1	0.24	NA	0.2	0.3	0.2	0.33	NA	0.4	0.2	0.2	0.2
Anion Sum	me/L	NG	NG	N/A	1.7	1.54	1.4	1.63	1.61	1.4	1.79	0.4	0.22	0.23	0.2	<0.1	0.2	1.53	1.64	1.4	1.3	0.3	0.5
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	NG	NG	1	75	70	72	71	73	73	79	23	10	11	14	<10	<10	68	74	70	69	13	22
Calculated TDS	mg/L	NG	≤500*	1	86	80	78	82	86	81	91	26	17	16	17	7	11	81	86	88	73	17	27
Carb. Alkalinity (calc. as CaCO3)	mg/L	NG	NG	1	ND	ND	<10	ND	ND	<10	2	<10	ND	ND	<10	<10	<10	ND	ND	<10	<10	<10	<10
Cation - Anion Balance	%	NG	NG	N/A	NA	NA	9.7	NA	NA	12.6	NA	Low EC	NA	NA	Low EC	Low EC	Low EC	NA	NA	24.2	5.2	Low EC	Low EC
Cation Sum	me/L	NG	NG	N/A	1.57	1.65	1.7	1.53	1.82	1.8	1.76	0.6	0.29	0.25	0.5	0.2	0.3	1.59	1.75	2.2	1.5	0.4	0.6
Conductivity % Difference	%	NG	NG	N/A	NA	NA	-0.5	NA	NA	5.4	NA	21.0	NA	NA	33.2	-33.9	-5.8	NA	NA	12.8	-5.8	-6.2	7.4
Computed Conductivity	uS/cm	NG	NG	N/A	NA	NA	145	NA	NA	152	NA	52.4	NA	NA	35.2	16.3	22.6	NA	NA	172	133	34.3	52.2
Ion Balance (% Difference)	%	NG	NG	N/A	3.98	3.45	122	3.16	6.12	129	0.85	Low EC	13.7	4.17	Low EC	Low EC	Low EC	1.92	3.24	164	111	Low EC	Low EC
Langelier Index (@ 20C)	N/A	NG	NG	N/A	-0.245	-0.381	-0.2	-0.085	-0.295	-0.1	0.28	-1.6	-2.74	-3.06	-2.1	-6.5	-2.9	-0.269	-0.354	0	-0.4	-2	-2.1
Langelier Index (@ 4C)	N/A	NG	NG	N/A	-0.496	-0.633	NA	-0.336	-0.546	NA	0.029	NA	-2.99	-3.31	NA	NA	NA	-0.52	-0.605	NA	NA	NA	NA
Saturation pH (@ 20C)	N/A	NG	NG	N/A	8.23	8.28	8.28	8.26	8.23	8.23	8.16	9.09	9.83	9.78	9.37	13.4	9.87	8.26	8.23	8.1	8.36	9.59	9.23
Saturation pH (@ 4C)	N/A	NG	NG	N/A	8.48	8.53	NA	8.51	8.48	NA	8.41	NA	10.1	10.1	NA	NA	NA	8.51	8.49	NA	NA	NA	NA

All results expressed as indicated

RDL+ - Analytical Reportable Detection Limit

CWQG, FWAL = CCME Canadian Water Quality Guidelines for the Protection of Freshwater Aquatic Life (2006 Update)

GCDWQ DW = CCME Canadian Water Quality Guidelines for Drinking Water Quality

334 Exceeds CWQG FWAL Standards

334 Exceeds GCDWQ Standards

ND = Not detected

NC = Non-calculable

NG = No Guideline

NA = Not Analysed

N/A = Not Applicable

Table 4
Surface Water Analytical Results - Metals
James Property, Labrador Iron Mines, Schefferville Project, Labrador

Parameter	Units	Criteria 1	Criteria 2	RDL+	JP1			JP2			JP3		JP4					JP5				JP6	
		CCME FWAL	CCME DW																				
Sampling Date					*26-Apr-07*	*9/23/2007*	*9/13/2008*	*26-Apr-07*	*9/23/2007*	*9/13/2008*	*26-Apr-07*	*9/13/2008*	*26-Apr-07*	*9/23/2007*	*31-Mar-08*	*9-Jun-08*	*9/13/2008*	*26-Apr-07*	*9/23/2007*	*31-Mar-08*	*14-Sep-08*	*9-Jun-08*	*9/13/2008*
Total Metals																							
Total Aluminum (Al)	ug/L	5-100	100	10	ND	NA	<10	ND	NA	<10	ND	20	ND	NA	20	<10	<10	ND	NA	50	<10	<10	<10
Total Antimony (Sb)	ug/L	NG	6**	2	ND	NA	<5	ND	NA	<5	ND	<5	ND	NA	<5	<5	<5	ND	NA	<5	<5	<5	<5
Total Arsenic (As)	ug/L	5	10	2	ND	NA	<1	ND	NA	<1	ND	<1	ND	NA	<1	<1	<1	ND	NA	<1	<1	<1	<1
Total Barium (Ba)	ug/L	NG	1000	5	ND	NA	<10	ND	NA	<10	ND	<10	ND	NA	<10	<10	<10	ND	NA	<10	<10	<10	<10
Total Beryllium (Be)	ug/L	NG	NG	2	ND	NA	<1	ND	NA	<1	ND	<1	ND	NA	<1	<1	<1	ND	NA	<1	<1	<1	<1
Total Bismuth (Bi)	ug/L	NG	NG	2	ND	NA	<1	ND	NA	<1	ND	<1	ND	NA	<1	<1	<1	ND	NA	<1	<1	<1	<1
Total Boron (B)	ug/L	NG	5000**	5	ND	NA	<50	ND	NA	<50	ND	<50	ND	NA	<50	<50	<50	ND	NA	<50	<50	<50	<50
Total Cadmium (Cd)	ug/L	0.017	5	0.3	ND	NA	<0.1	ND	NA	<0.1	ND	<0.1	ND	NA	<0.1	<0.1	<0.1	ND	NA	<0.1	<0.1	<0.1	<0.1
Total Calcium (Ca)	ug/L	NG	NG	100	17000	16000	15900	17000	18000	17600	19000	7000	2900	2400	5900	2000	2500	17000	17000	25100	15000	3800	5300
Total Chromium (Cr)	ug/L	NG	50	2	ND	NA	<1	ND	NA	<1	ND	<1	ND	NA	<1	<1	<1	ND	NA	<1	<1	<1	<1
Total Cobalt (Co)	ug/L	NG	NG	1	ND	NA	<0.5	ND	NA	<0.5	ND	<0.5	ND	NA	<0.5	<0.5	<0.5	ND	NA	<0.5	<0.5	<0.5	<0.5
Total Copper (Cu)	ug/L	2-4	≤1000*	2	ND	ND	<1	ND	ND	<1	ND	<1	ND	ND	<1	<1	<1	ND	ND	<1	<1	<1	<1
Total Iron (Fe)	ug/L	300	≤300*	50	ND	40	80	ND	30	80	ND	110	ND	ND	<50	<50	50	ND	30	<50	110	<50	<50
Total Lead (Pb)	ug/L	1-7	10	0.5	ND	NA	<1	ND	NA	<1	ND	<1	ND	NA	<1	<1	<1	ND	NA	<1	<1	<1	<1
Total Magnesium (Mg)	ug/L	NG	NG	100	11000	9900	10600	11000	11000	10800	12000	3200	1900	1600	1900	1400	1700	11000	11000	11400	10200	2400	3700
Total Manganese (Mn)	ug/L	NG	≤50	2	10	ND	21	7	NA	13	ND	36	8	ND	15	4	16	21	10	**57**	20	9	2
Total Mercury (Hg)	ug/L	NG	1	0.01	ND	NA	<0.1	ND	NA	<0.1	ND	<0.1	ND	NA	<0.1	<0.1	<0.1	ND	NA	<0.1	<0.1	<0.1	<0.1
Total Molybdenum (Mo)	ug/L	73	NG	2	ND	NA	<1	ND	NA	<1	ND	<1	ND	NA	<1	<1	<1	ND	NA	<1	<1	<1	<1
Total Nickel (Ni)	ug/L	25-150	NG	2	ND	NA	<2	ND	NA	<2	ND	<2	ND	NA	<2	<2	<2	ND	NA	<2	<2	<2	<2
Total Phosphorus (P)	ug/L	NG	NG	100	ND	NA	<50	ND	NA	<50	ND	<50	ND	NA	<50	30	<50	ND	NA	<50	<50	30	<50
Total Potassium (K)	ug/L	NG	NG	100	500	400	<1000	500	500	<1000	400	<1000	200	100	<1000	<1000	<1000	500	400	<1000	<1000	<1000	<1000
Total Selenium (Se)	ug/L	1	10	2	ND	NA	<5	ND	NA	<5	ND	<5	ND	NA	<5	<5	<5	ND	NA	<5	<5	<5	<5
Total Silicon (Si)	ug/L	NG	NG	100	NA	NA	3200	NA	NA	3300	NA	2800	NA	NA	2400	2000	2800	NA	NA	3000	3100	1800	3000
Total Silver (Ag)	ug/L	NG	NG	0.5	ND	NA	0.6	ND	NA	0.8	ND	0.8	ND	NA	<0.1	<0.1	0.7	ND	NA	<0.1	<0.1	<0.0001	0.9
Total Sodium (Na)	ug/L	NG	≤200000*	100	500	600	<500	600	400	<500	500	<500	200	ND	<500	<500	<500	600	400	600	<500	<500	<500
Total Strontium (Sr)	ug/L	NG	NG	5	7	NA	7	7	NA	9	7	4	ND	NA	4	2	2	7	NA	13	8	3	2
Total Thallium (Tl)	ug/L	0.8	NG	0.1	ND	NA	<0.3	ND	NA	<0.3	ND	<0.3	ND	NA	<0.3	<0.3	<0.3	ND	NA	<0.3	<0.3	<0.3	<0.3
Total Tin (Sn)	ug/L	NG	NG	2	ND	NA	<1	ND	NA	<1	ND	<1	ND	NA	<1	<1	<1	ND	NA	<1	<1	<1	<1
Total Titanium (Ti)	ug/L	NG	NG	2	ND	NA	<2	ND	NA	<2	ND	<2	ND	NA	<2	<2	<2	ND	NA	<2	<2	<2	<2
Tungsten (W)-Total	ug/L	NG	NG	10	NA	NA	<10	NA	NA	<10	NA	<10	NA	NA	<10	<10	<10	NA	NA	<10	<10	<10	<10
Total Uranium (U)	ug/L	NG	20**	0.1	0.2	NA	<5	0.2	NA	<5	0.2	<5	ND	NA	<5	<5	<5	0.1	NA	<5	<5	<5	<5
Total Vanadium (V)	ug/L	NG	NG	2	ND	NA	<1	ND	NA	<1	ND	<1	ND	NA	<1	<1	<1	ND	NA	<1	<1	<1	<1
Total Zinc (Zn)	ug/L	30	≤5000*	5	6	ND	7	8	ND	21	5	34	ND	ND	**41**	<3	<3	5	ND	**153**	<3	<3	7
Zirconium (Zr)-Total	ug/L	NG	NG	4	NA	NA	<4	NA	NA	<4	NA	<4	NA	NA	<4	<4	<4	NA	NA	<4	<4	<4	<4
Dissolved Metals																							
Dissolved Aluminum (Al)	ug/L	5-100	100	10	ND	NA	<10	ND	NA	<10	ND	<10	ND	NA	<10	<10	<10	ND	NA	<10	<10	<10	<10
Dissolved Antimony (Sb)	ug/L	NG	NG	2	ND	NA	<5	ND	NA	<5	ND	<5	ND	NA	<5	<5	<5	ND	NA	<5	<5	<5	<5
Dissolved Arsenic (As)	ug/L	5	25	2	ND	NA	<1	ND	NA	<1	ND	<1	ND	NA	<1	<1	<1	ND	NA	<1	<1	<1	<1
Dissolved Barium (Ba)	ug/L	NG	1000	5	ND	NA	<10	ND	NA	<10	ND	<10	ND	NA	<10	<10	<10	ND	NA	<10	<10	<10	<10
Dissolved Beryllium (Be)	ug/L	NG	NG	2	ND	NA	<1	ND	NA	<1	ND	<1	ND	NA	<1	<1	<1	ND	NA	<1	<1	<1	<1
Dissolved Bismuth (Bi)	ug/L	NG	NG	2	ND	NA	<1	ND	NA	<1	ND	<1	ND	NA	<1	<1	<1	ND	NA	<1	<1	<1	<1
Dissolved Boron (B)	ug/L	NG	5000	5	ND	NA	<50	ND	NA	<50	ND	<50	ND	NA	<50	<50	<50	ND	NA	<50	<50	<50	<50
Dissolved Cadmium (Cd)	ug/L	0.017	5	0.3	ND	NA	<0.1	ND	NA	<0.1	ND	<0.1	ND	NA	<0.1	<0.1	<0.1	ND	NA	<0.1	<0.1	<0.1	<0.1
Dissolved Calcium (Ca)	ug/L	NG	NG	500	NA	NA	14200	NA	NA	15100	NA	4100	NA	NA	2800	1900	2300	NA	NA	16000	13700	3800	4200
Dissolved Chromium (Cr)	ug/L	NG	50	2	ND	NA	<1	ND	NA	<1	ND	<1	ND	NA	<1	<1	<1	ND	NA	<1	<1	<1	<1
Dissolved Cobalt (Co)	ug/L	NG	NG	1	ND	NA	<0.5	ND	NA	<0.5	ND	<0.5	ND	NA	<0.5	<0.5	<0.5	ND	NA	<0.5	<0.5	<0.5	<0.5
Dissolved Copper (Cu)	ug/L	2.4	<1000	2	ND	NA	<1	ND	NA	<1	ND	<1	ND	NA	<1	<1	<1	ND	NA	<1	<1	<1	<1
Dissolved Iron (Fe)	ug/L	300	<300	50	ND	NA	<50	ND	NA	<50	ND	<50	ND	NA	<50	<50	<50	ND	NA	<50	<50	<50	<50
Dissolved Lead (Pb)	ug/L	1-7	10	0.5	ND	NA	<1	ND	NA	<1	ND	<1	ND	NA	<1	<1	<1	ND	NA	<1	<1	<1	<1
Dissolved Magnesium (Mg)	ug/L	NG	NG	500	NA	NA	10100	NA	NA	11400	NA	3100	NA	NA	1800	1300	1700	NA	NA	10700	9400	2600	3500
Dissolved Manganese (Mn)	ug/L	NG	NG	2	3	NA	<1	ND	NA	<1	ND	22	6	NA	<1	3	8	17	NA	6	<1	3	1
Mercury Dissolved (Hg)	ug/L		0.001	0.1	NA	NA	<0.1	NA	NA	<0.1	NA	<0.1	NA	NA	<0.1	<0.1	<0.1	NA	NA	<0.1	<0.1	<0.1	<0.1
Dissolved Molybdenum (Mo)	ug/L	73	NG	2	ND	NA	<1	ND	NA	<1	ND	<1	ND	NA	<1	<1	<1	ND	NA	<1	<1	<1	<1
Dissolved Nickel (Ni)	ug/L	25-150	NG	2	ND	NA	<2	ND	NA	<2	ND	<2	ND	NA	<2	<2	<2	ND	NA	<2	<2	<2	<2
Dissolved Phosphorus (P)	ug/L		NG	50	NA	NA	<50	NA	NA	<50	NA	<50	NA	NA	<50	<50	<50	NA	NA	<50	<50	<50	<50
Dissolved Potassium (K)	ug/L	NG	NG	1000	NA	NA	<1000	NA	NA	<1000	NA	<1000	NA	NA	<1000	<1000	<1000	NA	NA	<1000	<1000	<1000	<1000
Dissolved Selenium (Se)	ug/L	1	10	2	ND	NA	<5	ND	NA	<5	ND	<5	ND	NA	<5	<5	<5	ND	NA	<5	<5	<5	<5
Dissolved Silicon (Si)	ug/L	NG	NG	100	NA	NA	3700	NA	NA	3500	NA	2700	NA	NA	2400	1900	2800	NA	NA	3000	3100	1800	3100
Dissolved Silver (Ag)	ug/L	NG	NG	0.5	ND	NA	<0.1	ND	NA	<0.1	ND	<0.1	ND	NA	<0.1	<0.1	<0.1	ND	NA	<0.1	<0.1	<0.0001	<0.1
Dissolved Sodium (Na)	ug/L		<200	500	NA	NA	<500	NA	NA	<500	NA	<500	NA	NA	<500	<500	<500	NA	NA	500	<500	<500	<500
Dissolved Strontium (Sr)	ug/L	NG	NG	5	7	NA	7	6	NA	7	7	2	ND	NA	3	3	2	7	NA	7	8	2	2
Dissolved Thallium (Tl)	ug/L	0.8	NG	0.1	ND	NA	<0.3	ND	NA	<0.3	ND	<0.3	ND	NA	<0.3	<0.3	<0.3	ND	NA	<0.3	<0.3	<0.3	<0.3
Dissolved Tin (Sn)	ug/L	NG	NG	2	ND	NA	<1	ND	NA	<1	ND	<1	ND	NA	<1	<1	<1	ND	NA	<1	<1	<1	<1
Dissolved Titanium (Ti)	ug/L	NG	NG	2	ND	NA	<2	ND	NA	<2	ND	<2	ND	NA	<2	<2	<2	ND	NA	<2	<2	<2	<2
Dissolved Tungsten (W)	ug/L	NG	NG	10	NA	NA	<10	NA	NA	<10	NA	<10	NA	NA	<10	<10	<10	NA	NA	<10	<10	<10	<10
Dissolved Uranium (U)	ug/L	NG	NG	0.1	0.2	NA	<5	0.2	NA	<5	0.2	<5	ND	NA	<5	<5	<5	0.2	NA	<5	<5	<5	<5
Dissolved Vanadium (V)	ug/L	NG	NG	2	ND	NA	1	ND	NA	<1	ND	<1	ND	NA	<1	<1	<1	ND	NA	1	<1	<1	<1
Dissolved Zinc (Zn)	ug/L	30	<5000	5	ND	NA	3	ND	NA	<3	ND	<3	ND	NA	<3	4	<3	ND	NA	<3	<3	<3	3
Dissolved Zirconium (Zr)		NG	NG	4	NA	NA	<4	NA	NA	<4	NA	<4	NA	NA	<4	<4	<4	NA	NA	<4	<4	<4	<4

All results expressed as indicated

RDL+ - Analytical Reportable Detection Limit

CWQG, FWAL = CCME Canadian Water Quality Guidelines for the Protection of Freshwater Aquatic Life (2006 Update)

GCDWQ DW = CCME Canadian Water Quality Guidelines for Drinking Water Quality

334	Exceeds CWQG FWAL Standards
334	Exceeds GCDWQ Standards
ND = Not detected	N/A = Not Applicable
NA = Not Analyzed	NG = No Guideline
* Aesthetic Objective	** Interim Maximum Acceptable Concentration

Table 5
Water Analytical Results - Inorganics
Offsite Property Samples, Labrador Iron Mines, Schefferville Project, Labrador

Parameter	Units	CWQG FWAL	GCWDG	RDL+	Spring			Slimy L.		Bean L. Outlet		Bean L.		Ruth Outet			Ruth Pit
Sampling Date					3/31/2008	7/6/2008	9/15/2008	7/6/2008	9/15/2008	6/6/2008	*9/14/2008*	4/3/2008	*9/13/2008*	4/1/2008	6/10/2008	9/14/2008	9/14/2008
INORGANICS																	
Total Alkalinity (Total as CaCO3)	mg/L	NG	NG	5	78	75	67	66	71	63	74	57	70	59	55	55	53
Dissolved Chloride (Cl)	mg/L	NG	NG	1	<2	<2	<2	7	<2	<2	<2	<2	7	<2	2	<2	<2
Colour	TCU	NG	≤15*	5	<1	2	15	4	5	3	4	2	5	<1	4	2	3
Total Dissolved Solids	mg/L	NG	NG	10	70	90	120	80	120	80	110	50	120	50	30	110	100
Hardness (CaCO3)	mg/L	NG	NG	1	140	108	80	74	74	73	71	82	69	76	66	66	65
Nitrate + Nitrite	mg/L	NG	NG	0.05	0.4	0.4	0.2	0.3	0.2	0.2	<0.2	0.5	<0.2	0.3	0.3	0.2	0.2
Nitrite (N)	mg/L	0.06	NG	0.01	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Nitrogen (Ammonia Nitrogen)	mg/L	NG	NG	0.05	<0.05	0.07	0.10	0.06	0.07	0.07	0.08	<0.05	0.07	0.06	<0.05	0.07	0.18
Dissolved Organic Carbon (C)	mg/L	NG	NG	0.5	<1	<1	<1	<1	<1	6.3	<1	<1	1	<1	<1	<1	<1
Total Organic Carbon (C)	mg/L	NG	NG	0.5	NA	<1	6	<1	<1	8	<1	NA	<1	NA	<1	2	<1
Orthophosphate (P)	mg/L	NG	NG	0.01	0.01	0.005	<0.003	0.004	0.003	<0.003	<0.003	<0.003	<0.003	0.003	0.005	<0.003	<0.003
pH	pH	6.5 - 9	6.5 - 8.5	N/A	8.13	8.09	8.05	8.01	8.06	7.99	8.10	7.73	8.05	7.97	8.04	8.06	8.05
Reactive Silica (SiO2)	mg/L	NG	NG	0.5	7	6.2	6.1	4.8	6.6	5.8	6.5	6.3	6.2	6.2	5.5	5.0	5.2
Dissolved Sulphate (SO4)	mg/L	NG	NG	2	7	7	7	7	7	6	6	7	6	7	7	6	6
Turbidity	NTU	NG	NG	0.1	<0.1	0.28	3.8	0.69	0.85	0.42	0.58	0.52	0.59	0.19	1.9	0.44	0.62
Conductivity	uS/cm	NG	NG	1	160	154	137	145	144	134	139	127	136	131	119	117	118
Bromide	mg/L	NG	NG	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Fluoride	mg/L	NG	1.5	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
RCAP CALCULATIONS																	
Nitrate (N)	mg/L	NG	45	N/A	0.4	0.4	0.2	0.3	0.2	0.02	<0.1	0.4	<0.1	0.3	0.3	0.2	0.2
Anion Sum	me/L	NG	NG	N/A	1.5	1.4	1.3	1.5	1.3	1.2	1.4	1.1	1.5	1.1	1.1	1.1	1
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	NG	NG	1	77	74	66	65	70	2	73	57	69	58	55	54	52
Calculated TDS	mg/L	NG	≤500*	1	104	90	74	79	74	68	73	70	77	69	65	61	60
Carb. Alkalinity (calc. as CaCO3)	mg/L	NG	NG	1	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Cation - Anion Balance	%	NG	NG	N/A	31.4	20.7	12.5	1.1	4.9	10.9	2.8	19	-3.6	15.1	8.1	12.2	13.2
Cation Sum	me/L	NG	NG	N/A	2.8	2.2	1.6	1.5	1.5	1.5	1.4	1.6	1.4	1.6	1.3	1.3	1.3
Conductivity % Difference	%	NG	NG	N/A	24.9	11.1	1.8	0.8	-6.8	-4.8	1.4	6	1.4	-0.2	2.2	-0.5	-3.1
Computed Conductivity	uS/cm	NG	NG	N/A	205	172	139	146	135	128	132	135	140	131	122	116	114
Ion Balance (% Difference)	%	NG	NG	N/A	191	152	129	102	110	124	106	147	93.1	136	118	128	130
Langelier Index (@ 20C)	N/A	NG	NG	N/A	0.2	0	-0.3	-0.3	-0.3	-0.4	-0.2	-0.6	-0.3	-0.4	-0.5	-0.4	-0.5
Langelier Index (@ 4C)	N/A	NG	NG	N/A	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Saturation pH (@ 20C)	N/A	NG	NG	N/A	7.92	8.06	8.34	8.32	8.35	8.38	8.33	8.34	8.38	8.38	8.49	8.49	8.51
Saturation pH (@ 4C)	N/A	NG	NG	N/A	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

All results expressed as indicated
RDL+ - Analytical Reportable Detection Limit
CWQG, FWAL = CCME Canadian Water Quality Guidelines for the Protection of Freshwater Aquatic Life (2006 Update)
GCDWQ = CCME Canadian Water Quality Guidelines for Drinking Water Quality

334	Exceeds CWQG FWAL Standards
334	Exceeds GCDWQ Standards

ND = Not detected
NC = Non-calculable
NG = No Guideline
NA = Not Analysed
N/A = Not Applicable

Table 6
Surface Water Analytical Results - Metals
Offsite Property Samples, Labrador Iron Mines, Schefferville Project, Labrador

Parameter	Units	Criteria 1	Criteria 2	RDL+	Spring			Slimy L.		Bean L. Outlet		Bean L.		Ruth Outlet			Ruth Pit
		CWGQ FWAL	GCDWQ														
Sampling Date					*31-Mar-08*	*06-Jul-08*	*15-Sep-08*	*06-Jul-08*	*15-Sep-08*	*6-Jun-08*	*14-Sep-08*	*3-Apr-08*	*13-Sep-08*	*1-Apr-08*	*10-Jun-08*	*14-Sep-08*	*14-Sep-08*
Total Metals																	
Total Aluminum (Al)	ug/L	5-100	100	10	**160**	20	100	20	<10	<10	<10	30	<10	<10	30	<10	<10
Total Antimony (Sb)	ug/L	NG	6**	2	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Total Arsenic (As)	ug/L	5	10	2	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Total Barium (Ba)	ug/L	NG	1000	5	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Total Beryllium (Be)	ug/L	NG	NG	2	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Total Bismuth (Bi)	ug/L	NG	NG	2	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Total Boron (B)	ug/L	NG	5000**	5	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
Total Cadmium (Cd)	ug/L	0.017	5	0.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Total Calcium (Ca)	ug/L	NG	NG	100	36000	26200	14900	15800	15000	14400	14800	17700	14800	15400	12600	12500	12500
Total Chromium (Cr)	ug/L	NG	50	2	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Total Cobalt (Co)	ug/L	NG	NG	1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Total Copper (Cu)	ug/L	2-4	≤1000*	2	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Total Iron (Fe)	ug/L	300	≤300*	50	60	<50	170	<50	100	110	100	70	160	<50	60	<50	<50
Total Lead (Pb)	ug/L	1-7	10	0.5	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Total Magnesium (Mg)	ug/L	NG	NG	100	12100	10300	10500	8500	10200	9100	10200	9300	10300	9100	8300	8400	8100
Total Manganese (Mn)	ug/L	NG	≤50	2	**54**	14	42	33	24	17	17	**51**	28	3	2	1	1
Total Mercury (Hg)	ug/L	NG	1	0.01	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Total Molybdenum (Mo)	ug/L	73	NG	2	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Total Nickel (Ni)	ug/L	25-150	NG	2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Total Phosphorus (P)	ug/L	NG	NG	100	<50	<50	<50	<50	<50	40	<50	<50	<50	<50	30	<50	<50
Total Potassium (K)	ug/L	NG	NG	100	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000
Total Selenium (Se)	ug/L	1	10	2	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Total Silicon (Si)	ug/L	NG	NG	100	3100	2900	2800	2000	3100	2500	3100	2900	2900	2700	2600	2700	2400
Total Silver (Ag)	ug/L	NG	NG	0.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.0001	<0.1	<0.1
Total Sodium (Na)	ug/L	NG	≤200000*	100	600	<500	500	<500	<500	<500	<500	<500	<500	700	600	600	600
Total Strontium (Sr)	ug/L	NG	NG	5	19	13	8	8	8	8	8	9	9	8	7	8	8
Total Thallium (Tl)	ug/L	0.8	NG	0.1	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Total Tin (Sn)	ug/L	NG	NG	2	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Total Titanium (Ti)	ug/L	NG	NG	2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Tungsten (W)-Total	ug/L	NG	NG	10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Total Uranium (U)	ug/L	NG	20**	0.1	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Total Vanadium (V)	ug/L	NG	NG	2	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Total Zinc (Zn)	ug/L	30	≤5000*	5	**230**	85	<3	54	<3	<3	<3	**76**	<3	8	<3	<3	<3
Zirconium (Zr)-Total	ug/L	NG	NG	4	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4
Dissolved Metals																	
Dissolved Aluminum (Al)	ug/L	NG	NG	10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Dissolved Antimony (Sb)	ug/L	NG	NG	2	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Dissolved Arsenic (As)	ug/L	NG	NG	2	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Dissolved Barium (Ba)	ug/L	NG	NG	5	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Dissolved Beryllium (Be)	ug/L	NG	NG	2	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Dissolved Bismuth (Bi)	ug/L	NG	NG	2	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Dissolved Boron (B)	ug/L	NG	NG	5	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
Dissolved Cadmium (Cd)	ug/L	NG	NG	0.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Dissolved Calcium (Ca)	ug/L	NG	NG	500	18600	15700	14600	13800	13800	14600	13600	13900	12900	13800	12.2	11400	12200
Dissolved Chromium (Cr)	ug/L	NG	NG	2	<1	2	<1	2	<1	<1	<1	<1	<1	<1	<1	<1	<1
Dissolved Cobalt (Co)	ug/L	NG	NG	1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Dissolved Copper (Cu)	ug/L	NG	NG	2	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Dissolved Iron (Fe)	ug/L	NG	NG	50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
Dissolved Lead (Pb)	ug/L	NG	NG	0.5	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Dissolved Magnesium (Mg)	ug/L	NG	NG	500	11700	9500	9600	8100	9500	9000	9100	9100	8900	9000	8300	8000	8000
Dissolved Manganese (Mn)	ug/L	NG	NG	2	<1	<1	4	<1	<1	<1	<1	36	<1	<1	<1	<1	<1
Mercury Dissolved (Hg)	ug/L	NG	NG	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Dissolved Molybdenum (Mo)	ug/L	NG	NG	2	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Dissolved Nickel (Ni)	ug/L	NG	NG	2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Dissolved Phosphorus (P)	ug/L	NG	NG	50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
Dissolved Potassium (K)	ug/L	NG	NG	1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000
Dissolved Selenium (Se)	ug/L	NG	NG	2	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Dissolved Silicon (Si)	ug/L	NG	NG	100	3300	2900	2800	2200	3100	2700	3100	2900	2800	2900	2600	2500	2500
Dissolved Silver (Ag)	ug/L	NG	NG	0.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Dissolved Sodium (Na)	ug/L	NG	NG	500	500	<500	500	<500	<500	<500	<500	500	<500	700	<500	600	600
Dissolved Strontium (Sr)	ug/L	NG	NG	5	7	6	8	7	8	8	8	7	8	87	7	7	7
Dissolved Thallium (Tl)	ug/L	NG	NG	0.1	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Dissolved Tin (Sn)	ug/L	NG	NG	2	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Dissolved Titanium (Ti)	ug/L	NG	NG	2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Dissolved Tungsten (W)	ug/L	NG	NG	10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Dissolved Uranium (U)	ug/L	NG	NG	0.1	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Dissolved Vanadium (V)	ug/L	NG	NG	2	1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Dissolved Zinc (Zn)	ug/L	NG	NG	5	<3	<3	<3	<3	<3	8	5	<3	4	<3	3	<3	<3
Dissolved Zirconium (Zr)		NG	NG	4	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4

All results expressed as indicated

RDL+ - Analytical Reportable Detection Limit

CWQG, FWAL = CCME Canadian Water Quality Guidelines for the Protection of Freshwater Aquatic Life (2006 Update)

GCDWQ = CCME Canadian Water Quality Guidelines for Drinking Water Quality

334	Exceeds CWQG FWAL Standards
334	Exceeds GCDWQ Standards
ND = Not detected	N/A = Not Applicable
NA = Not Analyzed	NG = No Guidance
* Aesthetic Objective	** Interim Maximum Acceptable Concentration

APPENDIX J

Hydrological Field Study Methods

Hydrological Field Survey Methods

WESA conducted a field survey at the Project site to monitor stream flow. Methods used by WESA to monitor stream flow at the Project site in 2008 are described.

Water Balance Approach

James Creek and Bean Lake are the focal points for the water balance assessment of the James Property since these are the closest surface waters features and because shallow groundwater from the site flows to the east/southeast, toward the lake. The approach taken with respect to the water balance involved measuring surface water flow into and out of the lake, estimating groundwater discharge to the lake, and incorporating evaporation data from available meteorological data sources.

Methodology

Methodologies and data sources used in determining the surface water inputs to the water balance are described in this section.

Surface Water

Velocity-Area Method of Discharge Calculation

The Velocity-Area Method of calculating stream discharge (Q) estimates Q as the product of flow velocity (V) and cross-sectional area (A):

$$Q=(V)(A)$$

In order to calculate the discharge of a channel, the channel cross-section must first be divided into several subsections. A tag line was set up perpendicular to the flow direction at each pre-selected gauging station to ensure accurate measurements of each subsection width. The stream depth was measured at these specific intervals across the stream, which allowed a stream profile to be constructed. From this profile, the cross-sectional area of the stream at the gauging site was determined. The average velocity of the cross-section was measured using the FP101 Global Flow Probe. The methodology outlined in the probe manual (Global Water, 2004) was utilized whereby the probe is moved in a serpentine pattern across the stream cross-section yielding a single average flow velocity. This average velocity was then multiplied by the cross-sectional area to determine stream discharge.

Continuous Stream Depth Measurement

Water level dataloggers were installed at five locations (SG-1, 2, 4, 5, and 8) on June 7, 2008. One additional datalogger was installed at SG-4 on July 7, 2008 to measure barometric pressure. Solinst® Levelogger® Gold Model 3001 and Barologger Gold dataloggers were used. These loggers are equipped with the datalogger, battery, pressure transducer, and temperature sensor. All loggers were programmed to record real-time data every 15 minutes which could be downloaded from the loggers using direct read cables.

Loggers at SG-1, 2, and 8 were installed in natural stream cross-sections using a length of 1.5-inch diameter ABS pipe extended horizontally from one bank to the other, perpendicular to the direction of flow. This pipe not only anchored the Levelogger, but also served as the tag line

used for cross-section measurements. A second length of ABS pipe was bolted vertically to the horizontal piece such that it extended down to the streambed. This vertical ABS pipe had holes drilled through it to allow water to pass into and through the pipe in order for the water depth inside the ABS to reflect the water level of the stream. The vertical ABS acted as a sort of "stilling-well" in which the Levelogger was contained. The Levelogger was secured inside the vertical ABS by attaching the direct read cable to it with zip-ties. The direct read cable was attached to the Levelogger and run along the ABS pipe (secured using zip-ties) to the shore where the other end remained on a spool to allow for easier downloading of the Levelogger. Figures 1 and 2 show leveloggers set up in a stream.



Figure 1 SG2 Stream Gauge Levelogger Looking Southeast



Figure 2 SG1 Stream Gauge Levellogger

Sites SG-4 and 5 required Leveloggers to be mounted in culverts using threaded steel rods. A hole was drilled in the top of the culvert through which the steel rod was inserted until it came in contact with the bottom of the culvert (Figure 3).



Figure 3 SG4 Levellogger Looking West

Precipitation

Precipitation was estimated using the meteorological data collected at the Schefferville Airport weather station from May to November 2008. This weather station is located approximately 4 km from the site. Weather patterns in the area can be extremely localized; consequently, the precipitation data for the Schefferville airport do not necessarily reflect the precipitation at Bean Lake on a day-to-day basis. However, it is assumed that over the course of a season, the precipitation at Schefferville would be a reasonable approximation of the amount of rainfall at Bean Lake, given the proximity of the site to the weather station and the similar elevations of each. Furthermore, a comparison of the James Property stream gauge data with the Schefferville precipitation data shows a qualitative correlation between higher levels of precipitation at Schefferville, and higher water levels in the monitored streams (Figures 4 to 7).

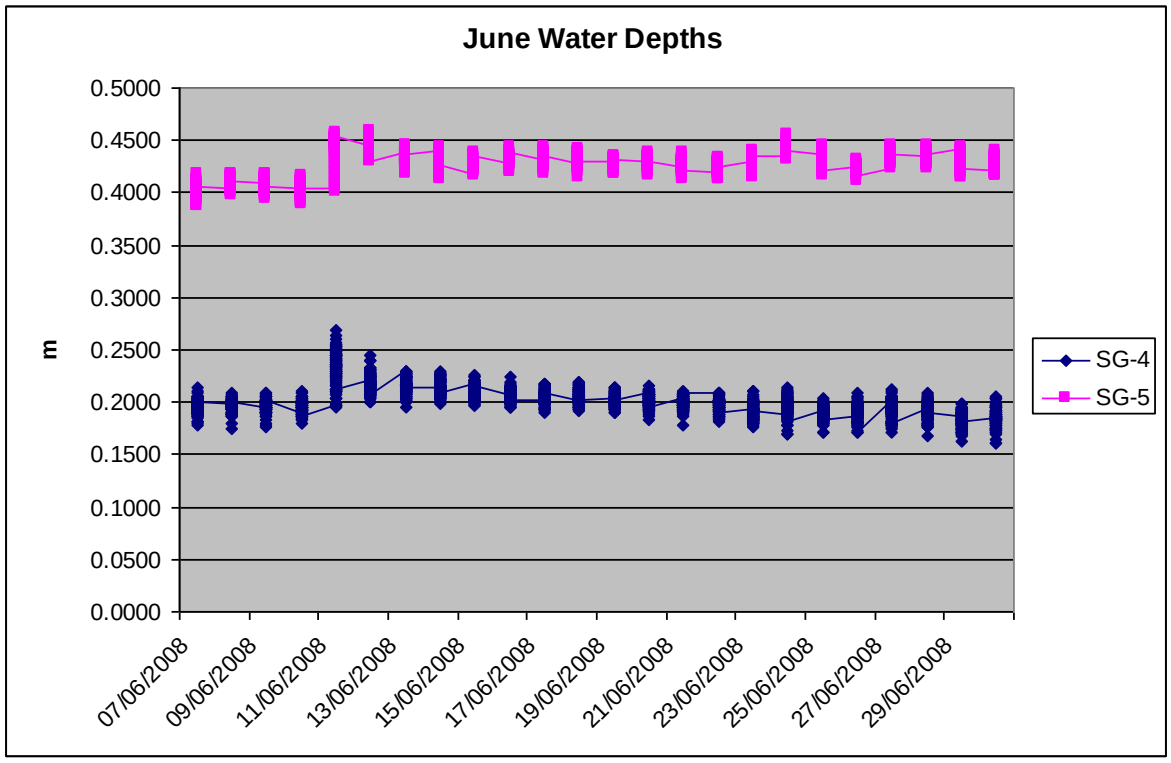


Figure 4 Stream Gauge Data, June 7 to 29

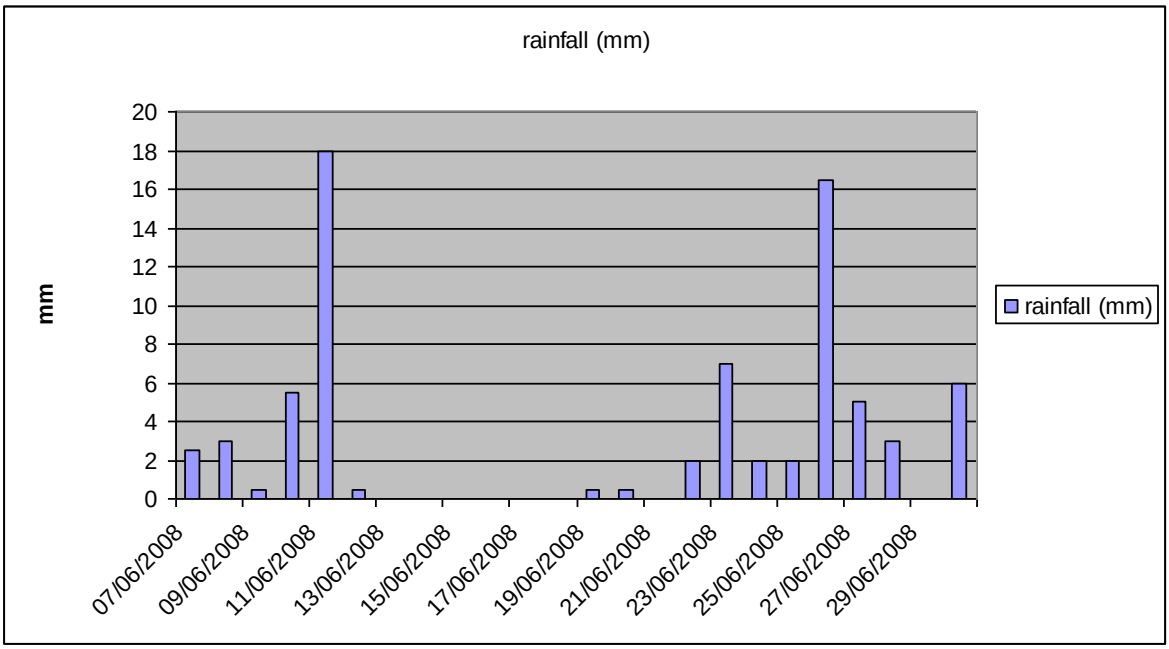


Figure 5 Rainfall Data, June 7 to 29

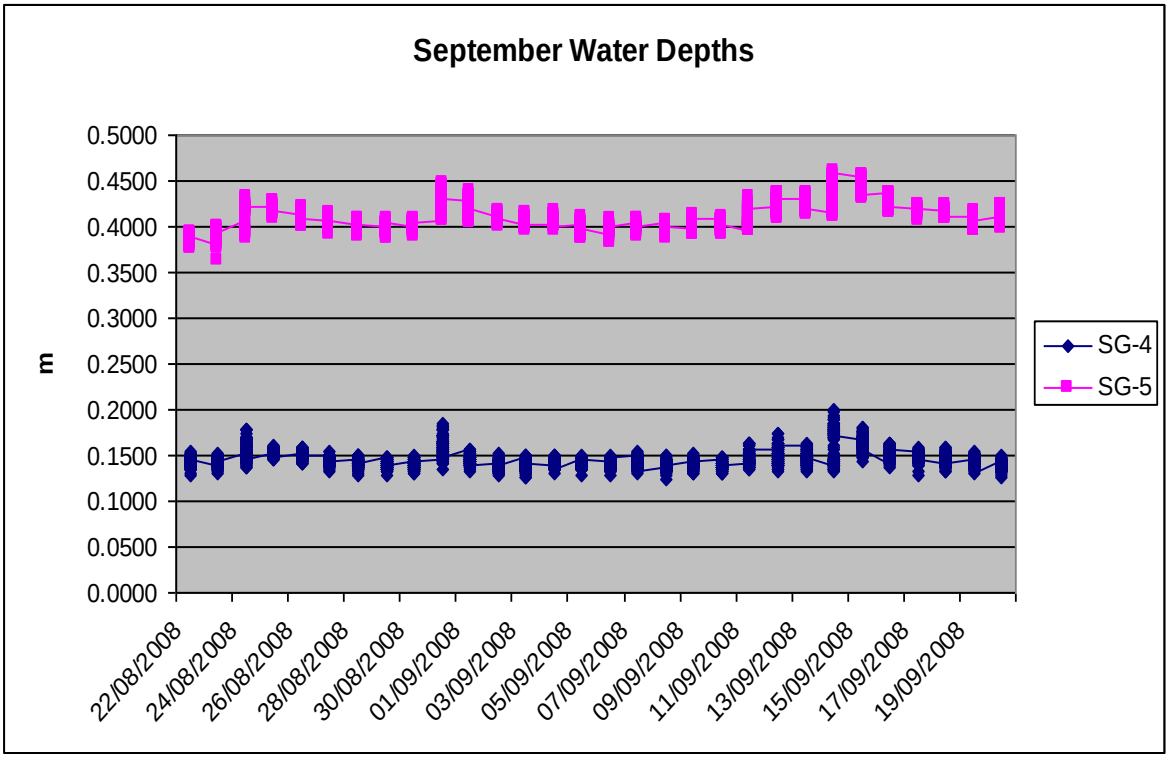


Figure 6 Stream Gauge Data, August 22 to September 19

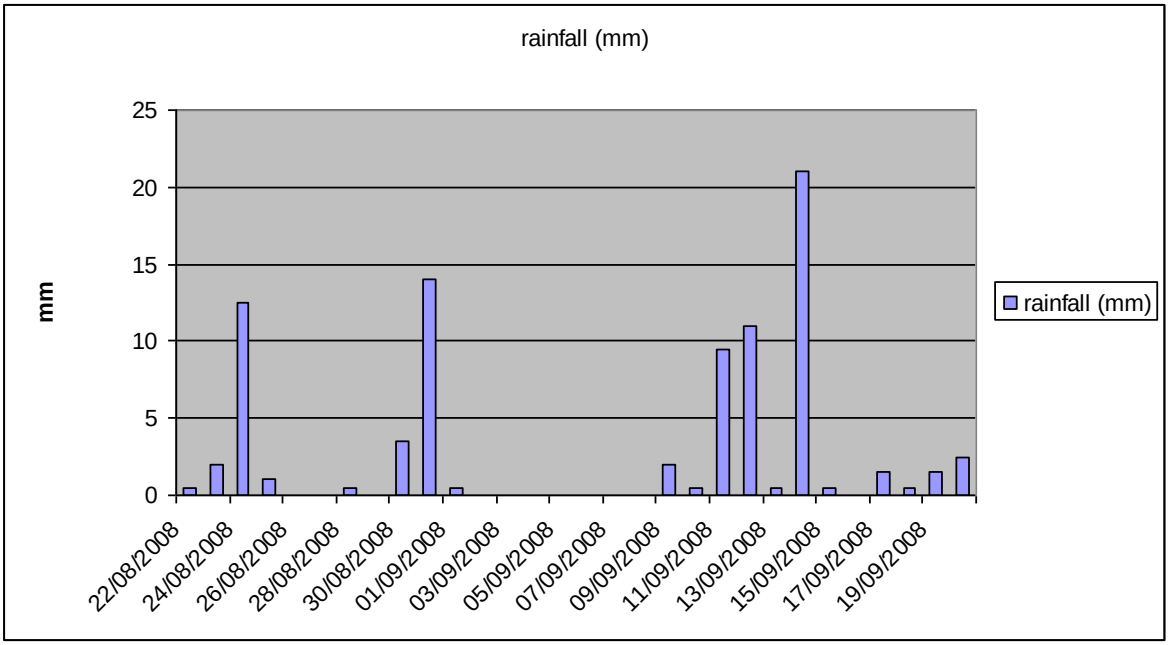


Figure 7 Rainfall Data, August 22 to September 19

Stream Gauges (James)

The stream gauges collected water level readings every 15 minutes. Water level readings were corrected for barometric pressure.

The locations of the stream gauges are described as follows:

SG-1: The northern of two springs in the proposed mine area (James North Spring). The stream gauge was installed in a stream about 3.3 m wide, with a depth of approximately 30 cm at its deepest point.

SG-2: The southern spring in the proposed mine area (James South Spring). This small stream is approximately 90 cm wide, with a depth of about 20 cm.

SG-4: The combined drainage of the two springs (unnamed tributary), just before it enters Bean Lake, passes through a culvert (formerly a 24" round culvert, now deformed such that the sides in the lower portion form a V-shape).

SG-8: The main inflow to Bean Lake (at the north end of the lake) is James Creek, a stream approximately 2.9 m wide and 30 cm deep.

SG-5: The outflow from Bean Lake passes through a 12 ft corrugated steel culvert.

The combined inflows to Bean Lake (surface and groundwater) and the combined outflows (surface water flow and evaporation) are presented in Figures 9 and 10.

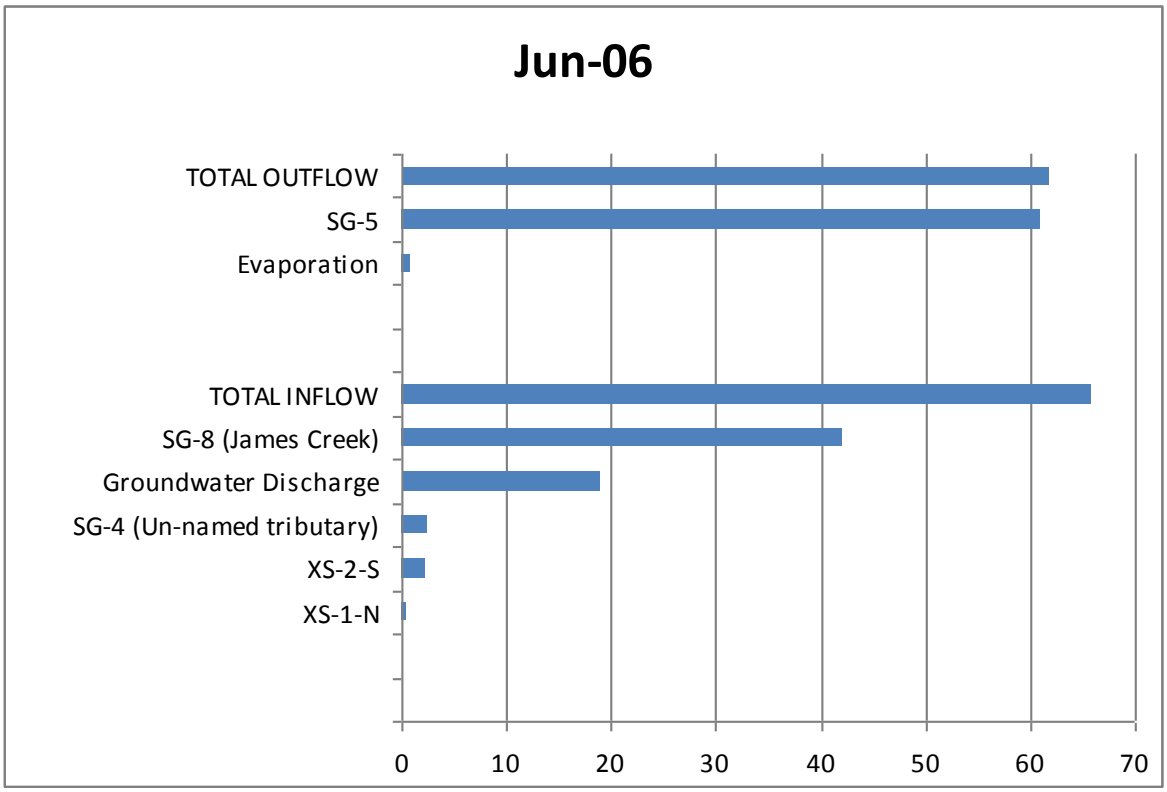


Figure 9 Components of the Water Balance for June 6

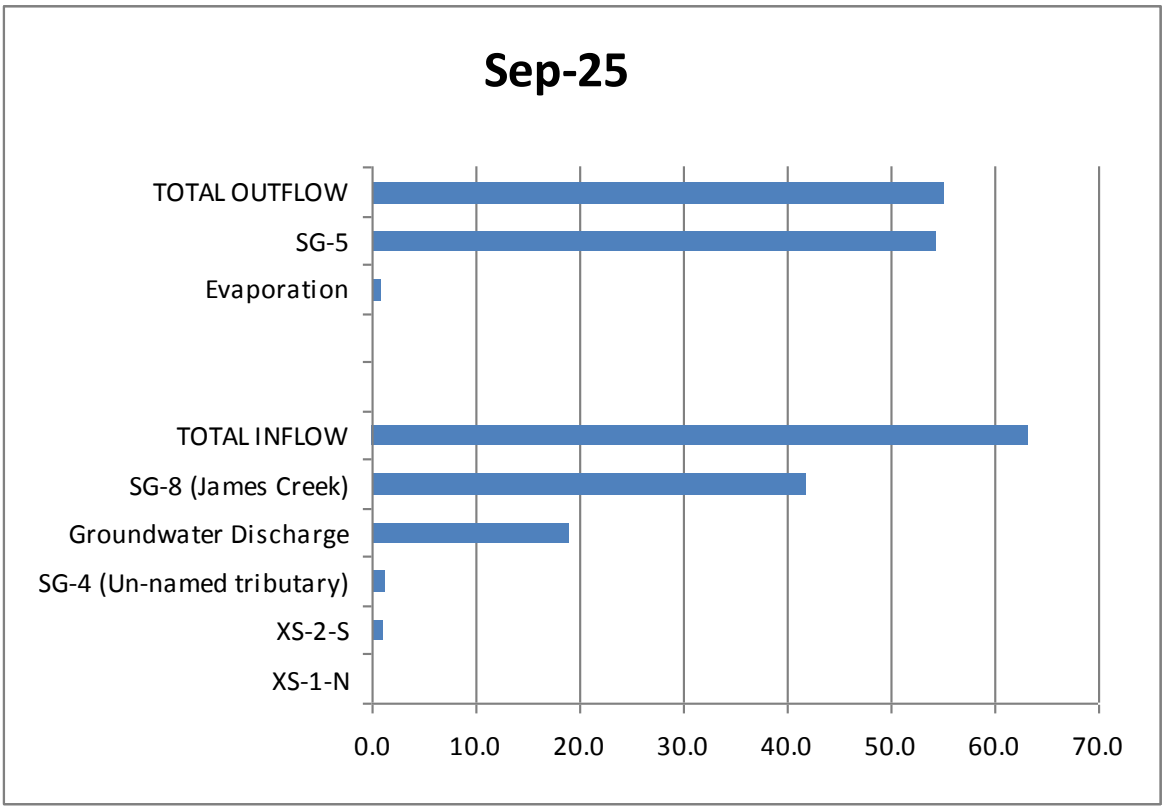


Figure 10 Components of the Water Balance for September 25

Comparison of Measured flow rates - for Theoretical Rates – James Creek and Bean Lake Watershed

Theoretical maximum runoff (R) estimates for the James Creek/Bean Lake watershed can be made by determining inputs to the watershed from precipitation (P) and subtracting the potential evapotranspiration (ET) based on the area of the watershed and published P and ET rates for the area. This approach assumes that any infiltration that occurs eventually discharges back to surface further along in the system.

The area of the watershed is estimated to be 1305 hectares. Precipitation data obtained from Environment Canada for the area for the period of 1949 to 2007 indicates average annual precipitation of 775 mm. A potential ET rate for the area of 375 mm was obtained from the Newfoundland and Labrador Water Atlas. Using these values yields an average annual runoff value of 5222504 m^3. This works out to 28230 m^3/day using a six month period as a basis and 14308 m^3/day over a twelve month period. These maximum theoretical values are considerably lower than the stream flow rates that were measured in James Creek from June to October 2008 if the measured flow rates are extrapolated over a full year.

The most likely explanation for this is that the stream flow measurements over the spring/summer/fall of 2008 represent well above average flow conditions and the flow rates drop substantially during the winter months. Longer term full season monitoring would be required to determine if this is the case.

Stream Gauges (Redmond)

The locations of the stream gauges are described as follows:

SG-3: Installed on June 6, removed on September 25. The stream gauge was installed in a stream about 2.5 m wide, with a depth of approximately 35 cm at its deepest point (Figure 11).

SG-7: Installed on July 30, removed on September 25. The gauge measured the combined drainage in the former railway turnaround north of the existing Redmond 2 pit and proposed Redmond 2B pit (Figure 12).



Figure 11 Stream Location SG3 Looking South



Figure 12 Stream Gauge Location SG7 Looking South

APPENDIX K

Vegetation Species List and Photographs

VASCULAR PLANT SPECIES LIST

Labrador Iron Mines Vegetation Assessment

SCIENTIFIC NAME	COMMON NAME	FAMILY
Achillea millefolium	Common Yarrow	ASTERACEAE
Alnus viridis ssp. crispa	Green Alder	BETULACEAE
Amelanchier arborea	Common Serviceberry	ROSACEAE
Andromeda sp.	Bog Rosemary	ERICACEAE
Aster sp.	Aster	ASTERACEAE
Betula glandulosa	Dwarf Birch	BETULACEAE
Betula papyrifera	Paper Birch	BETULACEAE
Betula pumila	Swamp Birch	BETULACEAE
Carex aquatilis	Water Sedge	CYPERACEAE
Carex sp.	… Sedge	CYPERACEAE
Chamaedaphne calyculata	Leatherleaf	ERICACEAE
Cornus canadensis	Bunchberry	CORNACEAE
Deschampsia flexuosa	Common Hairgrass	POACEAE
Empetrum sp.	Crowberry	ERICACEAE
Epilobium angustifolium	Fireweed	ONAGRACEAE
Epilobium sp.		ONAGRACEAE
Eriophorum sp.	Cottonrass	CYPERACEAE
Fragaria sp.	Strawberry	ROSACEAE
Geranium macrorrhizum	Bigroot cranesbill	GERANIACEAE
Heracleum sp.	Hogweed	APIACEA
Juncus sp.	Rush	JUNCACEAE
Larix laricina	Tamarack	PINACEAE
Ledum groenlandicum	Common Labrador Tea	ERICACEAE
Lonicera involucrata	Twinberry Honeysuckle	CAPRIFOLIACEAE
Lycopodium sp.	Clubmoss	LYCOPODIACEAE
Menyanthes trifoliata	Buckbean	MENYANTHACEAE
Picea glauca	White Spruce	PINACEAE
Picea mariana	Black Spruce	PINACEAE
Potentilla palustris	Silverweed	ROSACEAE
Pyrola sp.		PYROLACEAE
	Orchid	ORCHIDACEAE
Ribes glandulosum	Skunk Currant	GROSSULARIACEAE
Rubus chamaemorus	Cloudberry	ROSACEAE
Rubus idaeus	Raspberry	ROSACEAE
Salix arctophila	Arctic Willow	SALICACEAE
Salix bebbiana	Bebb's Willow	SALICACEAE
Salix reticulata	Net-leaved Willow	SALICACEAE
Salix sp.	Willow	SALICACEAE
Salix vestita	Rock Willow	SALICACEAE
Vaccinium angustifolium	Late Lowbush Blueberry	ERICACEAE
Vaccinium macrocarpon	Large Cranberry	ERICACEAE
Vaccinium uliginosum	Bog Bilberry	ERICACEAE
MOSSES		
Aulacomnium palustre	Ribbed Bog Moss	Aulacomniaceae
Dicranum spp.		Dicranaceae
Hylocomium splendens	Stair-Step Moss	Hylocomiaceae
Marchantia polymorpha	Green-Tongue Liverwort	Marchantiaceae
Mnium spp.	Mniums	Mniaceae
Pleurozium schreberi	Schreber's Moss	Hylocomiaceae
Polytrichum commune	Common Hair Cap Moss	Polytrichaceae
Polytrichum juniperinum	Juniper Moss	Polytrichaceae
Ptilium crista-castrensis	Plume Moss	Hypnaceae
Sphagnum angustifolium	Poor-Fen Peat Moss	Sphagnaceae
Sphagnum fuscum	Common Brown Peat Moss	Sphagnaceae
Sphagnum warnstorfii	Warnstorf's Peat Moss	Sphagnaceae
LICHENS		
Cladina rangiferina	Reindeer Lichen	Cladoniaceae
Cladina stellaris	Coral Lichen	Cladoniaceae
Cladonia cenotea	Powdered Funnel Cladonia	Cladoniaceae
Cladonia chlorophaea	False Pixie Cup	Cladoniaceae
Cladonia coniocraea	Powder Horn Lichen	Cladoniaceae
Cladonia cristatella	British Soldiers	Cladoniaceae



J-1 – Shrub/spruce over glacial till,



J-2 – Spruce/shrub over glacial till



J-3 – Sedge/open water Fen



J-4 – Mixed woods (birch/spruce) over gravel



J-5 – Alder stand over gravel



J-6 – Closed sedge/moss fen over slightly decomposed peat



J-7 – Spruce/moss stand over glacial till



J-8 – Spruce/shrub over glacial till



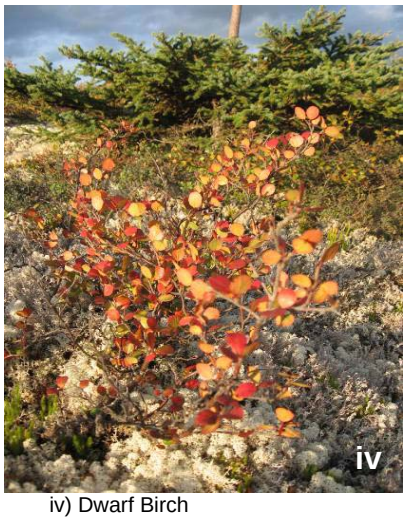
i) Crowberry



ii) Bunchberry



iii) Clubmoss



iv) Dwarf Birch



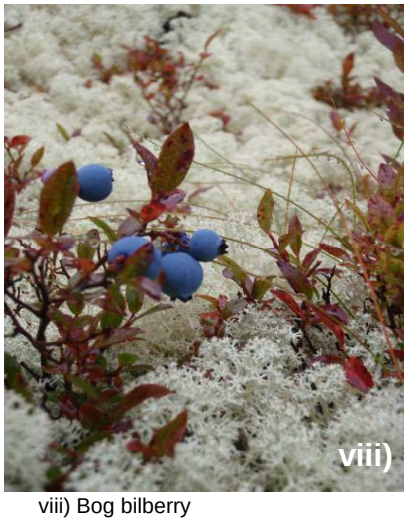
v) False Pixie Cup



vi) Bearberry



vii) British Soldiers



viii) Bog bilberry



ix) Pyrola sp



x) Bog laurel



SY-1 – Shrub/spruce over till



SY-2 – Alder stand over exposed till,



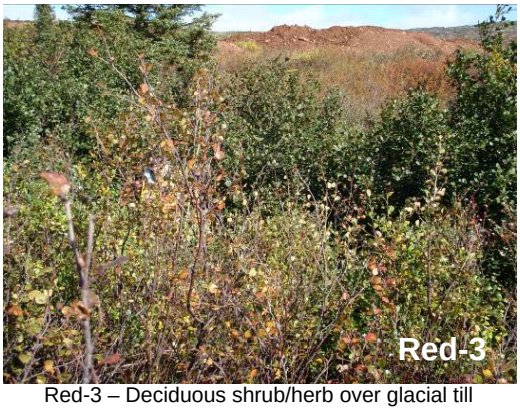
SY-3 – Shrub/herb over till



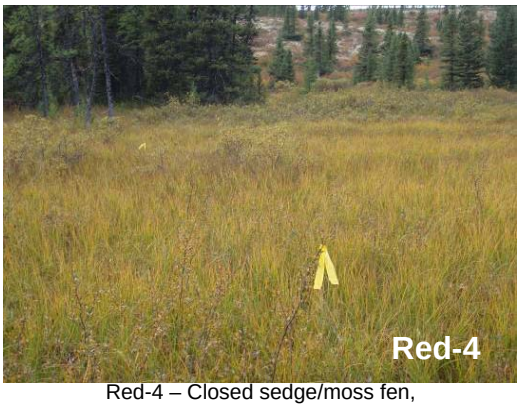
Red-1- Open lichen/shrub over bedrock



Red 2 - Open lichen/shrub/moss over bedrock



Red-3 – Deciduous shrub/herb over glacial till



Red-4 – Closed sedge/moss fen,



Red-5 – Spruce/tamarack/shrub over glacial till



Red-6 – Spruce/shrub over glacial till



Red-7 – Closed sedge/willow fen



Red-8 – Closed ribbed fen - hummocks



Red-9 – Closed ribbed fen - sedge/open water

APPENDIX L

Bird Species Observed During Survey

Avifauna Species List

Table 1 Avifauna Observations for the James Property (James Mine North and James Mine South)

Ring-neck Duck (*Aythya collaris*) – G5 Preferred Habitat: Habitat consists of small (<4 ha) wetlands with some surrounding woody vegetation, often in heavily forest areas; shallow swamps, marshes and bogs with emergent vegetation. May also be found near reedy lakes or rivers; during migration also rivers, larger lakes, and ponds with marshy edges. Observation: Probable breeding – Pair observed in breeding season in suitable habitat.
Osprey (*Pandion haliaetus*) – G5 Preferred Habitat: Habitat consists of lakes, rivers. Species nests in trees near water's edge or on large rocks. Species will use artificial structures as well such as transmission lines. Observation: Confirmed breeding – Adult carrying food for young.
Bald Eagle (*Haliaeetus leucocephalus*) – G4 Preferred Habitat: Habitat requires large continuous area of deciduous or mixed woods around large lakes, and rivers. Requires an area of 255 ha for nesting, shelter, feeding, and roosting. Species prefers open woods with 30 to 50% canopy cover, nests in tall trees 50 to 200m from shore. Species requires tall, dead, partially dead trees within 400 m of nest for perching. Observation: Possible breeding – Species observed in breeding season in suitable nesting habitat.
Short-billed Dowitcher (*Limnodromus griseus*) – G5 Preferred Habitat: Habitat consists of mudflats, estuaries, shallow marshes, pools, ponds, flooded fields and sandy beaches. Species prefers shallow salt water with soft muddy bottoms, but will visit various wetlands during migration. Species nests in grassy or mossy tundra and wet meadows, in muskeg. Observation: Possible breeding – Species observed in breeding season in suitable nesting habitat.
Herring Gull (*Larus argentatus*) – G5 Preferred Habitat: Habitat consists of undisturbed open, rocky islands, peninsulas or cliffs along lakes or rivers. May also be found on sand dunes or headlands with various types of shores and islands. Observation: Possible breeding – Species observed in breeding season in suitable

nesting habitat.

Northern Flicker (*Colaptes auratus*) –

Preferred Habitat: Habitat consists of open deciduous, coniferous or mixed woodlands; forest edges; suburbs, farm woodlots and wetlands. May also use dead or dying trees with a diameter at breast height (dbh) >30 cm. This species is adaptable and is not dependent on forest size.

Observation: Possible breeding – Species observed in breeding season in suitable nesting habitat.

Yellow-bellied Flycatcher (*Empidonax flaviventris*) – G5

Preferred Habitat: Habitat consists of coniferous forest of pine and spruce with dense shrubs. Species may also br found in shrubby swamps with spruce, and alder. Can be found in low, wet swampy thickets bordering ponds, streams, bogs, and talus slopes.

Observation: Possible breeding – Signing male present or breeding calls heard in breeding season in suitable habitat.

Gray Jay (*Perisoreus Canadensis*) – G5

Preferred Habitat: Habitat consists of coniferous, mixed wood forests; forest openings, and bogs. Species is highly territorial, common in Labrador.

Observation: Probable breeding – Agitated behavior or anxiety calls of adults

Common Raven (*Corvus corax*) – G5

Preferred Habitat: Habitat consists of relatively undisturbed habitat of boreal or mixed forest. May nest on steep cliffs or in tall trees, uses and builds onto same nest in consecutive years.

Observation: Possible breeding – Species observed in breeding season in suitable nesting habitat.

Boreal Chickadee (*Poecile hudsonicus*) – G5

Preferred Habitat: Habitat consists of conifers (spruce), wooded swamps, bogs, and thickets. Species nests in natural cavities, woodpecker holes, or their own excavation in decaying wood. Species territory is about 1-2 ha of woodland.

Observation: Possible breeding – Species observed in breeding season in suitable nesting habitat.

Winter Wren (*Troglodytes troglodytes*) – G5

Preferred Habitat: Habitat consists of coniferous forest with hemlock-pine communities; cedar swamps; spruce bogs and deep woods with dense undergrowth. May also be found near downed wood close to forest streams. Species nests in cavities of uprooted trees, old stumps, and brush piles, also nests in soft trees with dbh >10 cm. Species

appears to need at least 30 ha of forest and is considered an interior species.

Observation: Possible breeding – Signing male present or breeding calls heard in breeding season in suitable habitat.

Ruby-crowned Kinglet* (*Regulus calendula*) – G5

Preferred Habitat: Habitat consists of coniferous or mixed woodlands with stands of fir, spruce, tamarack or pine, evergreen stands in a variety of habitats. As well as, coniferous open or edge areas with thickets of brush, and bogs.

Observation: Possible breeding – Signing male present or breeding calls heard in breeding season in suitable habitat.

Gray-cheeked Thrush (*Catharus minimus*) – G5, S3S4

Preferred Habitat: Habitat consists of moist northern woodlands and riparian areas up to Arctic tundra.

Observation: Possible breeding – Signing male present or breeding calls heard in breeding season in suitable habitat.

Swainson's Thrush* (*Catharus ustulatus*) – G5

Preferred Habitat: Habitat consists of coniferous forest interiors (spruce, fir), with deciduous shrubs. May also be found in low, damp woods near water and riverbanks. The species may also be observed in young or mature stands and will also use mixed woods.

Observation: Probable breeding – Agitated behavior or anxiety calls of adults.

Hermit Thrush (*Catharus guttatus*) – G5

Preferred Habitat: Habitat consists of boreal forest or Great Lakes-St. Lawrence forest zones. Consisting of rocky, dry, jack pine forests, as well as dry sandy coniferous or deciduous woods with dense young undergrowth. Species may also be found in spruce bogs, borders of wooded swamps and damp forest, and brushy pasture. Species appears to need at least 100 ha of forest in south.

Observation: Possible breeding – Signing male present or breeding calls heard in breeding season in suitable habitat.

Tennessee Warbler (*Vermivora peregrine*) – G5

Preferred Habitat: Habitat consists of brushy, semi-open land including grassy openings in coniferous, deciduous or mixed woods with dense shrubs and scattered clumps of young deciduous trees. Species can also be found in treed fens or boggy areas, dry pine plantations and beach ridges.

Observation: Possible breeding – Signing male present or breeding calls heard in

breeding season in suitable habitat.

Orange-crowned Warbler (*Vermivora celata*) – G5

Preferred Habitat: Habitat consists of open deciduous or mixed woods with shrub undergrowth as well as second growth in clearings or burns, brushy thickets and tall stands of shrubbery

Observation: Possible breeding – Signing male present or breeding calls heard in breeding season in suitable habitat.

Nashville Warbler (*Vermivora ruficapilla*) – G5

Preferred Habitat: Habitat consists of wet, open coniferous, deciduous or mixed woods of young secondary growth. May also be found in cedar, spruce swamps; dry or moist overgrown pastures and old field with scattered trees and shrubs and edges. Species nests in depressions in ground under dead, dry bracken fern.

Observation: Possible breeding – Signing male present or breeding calls heard in breeding season in suitable habitat.

Yellow Warbler (*Dendroica petechia*) – G5

Preferred Habitat: Habitat: Habitat consists of open areas with dense scrub, shrubby wetland areas; stream and river banks or lakeshores with scattered small trees or dense shrubbery. May also be found in farmlands, orchards or suburban yards.

Observation: Possible breeding – Signing male present or breeding calls heard in breeding season in suitable habitat.

Wilson's Warbler (*Wilsonia pusilla*) – G5

Preferred Habitat: Habitat consists of boggy areas with cedar, tamarack or spruce. As well as swampy, brushy lands, streamside thickets and tangles. Species may also be found in wet, wooded high shrubs or low deciduous trees.

Observation: Possible breeding – Signing male present or breeding calls heard in breeding season in suitable habitat.

Fox Sparrow* (*Passerella iliaca*) – G5

Preferred Habitat: Habitat consists of thickets and edges of coniferous, mixed, or second-growth forests or chaparral.

Observation: Possible breeding – Signing male present or breeding calls heard in breeding season in suitable habitat.

Lincoln's Sparrow (*Melospiza lincolnii*) – G5

Preferred Habitat: Habitat consists of muskegs, bogs, swamps; regenerated stands following cutting or fires and hedgerows. Species may also be found in spruce forests with clearings; willow, alder thickets; low brushy growth with openings of grass or sedge, and edges of lakes, rivers.

Observation: Probable breeding – Agitated behavior or anxiety calls of adults.

White-throated Sparrow* (*Zonotrichia albicollis*) – G5

Preferred Habitat: Habitat consists of coniferous or mixed, semi-open forests with jack pine or spruce, balsam fir, aspen, and white birch. May also be found in old cut-overs or burns with forest regeneration and slash piles, brushy clearings, and borders of bogs. Species nests on the ground in brush piles or under logs.

Observation: Probable breeding – Agitated behavior or anxiety calls of adults.

White-crowned Sparrow (*Zonotrichia leucophrys*) – G5

Preferred Habitat: Species breeds in shrub growth in open areas such as woodland edge, forest burns, willow clumps on tundra, and stream edges. Species nests on ground; may winter in southern Ontario

Observation: Possible breeding – Signing male present or breeding calls heard in breeding season in suitable habitat.

White-wing Crossbill* (*Loxia leucoptera*)

Preferred Habitat: Habitat consists of boreal forest with tamarack, spruce, fir or hemlock.

Observation: Probable breeding – Pair observed in their breeding season in suitable habitat.

American Robin (*Turdus migratorius*) – G5

Preferred Habitat: Habitat consists of residential areas, lawns, gardens, ornamental trees, shrubberies. May also be found in forest edges and openings, burns, cut-over areas, as well as fens, bogs; lake or river shores.

Observation: Confirmed breeding – Recently fledged young or downy young.

Yellow-rumped Warbler* (*Dendroica coronata*) – G5

Preferred Habitat: Habitat consists of dry coniferous or mixed forests dominated by fir, spruce, pine, hemlock or cedar with scattered openings from logging, fire or abandoned fields. May also be found in evergreen plantations; young coniferous growth at woodland edges as well as wetter habitat of black spruce or tamarack. Species is

adaptable and opportunistic.

Observation: Confirmed breeding – Adult carrying food for young.

Blackpoll Warbler (*Dendroica striata*) – G5

Preferred Habitat: Habitat consists of coniferous forests during breeding season, and during migration found chiefly in tall trees.

Observation: Confirmed breeding – Adult carrying food for young.

Northern Waterthrush* (*Seiurus noveboracensis*) – G5

Preferred Habitat: Habitat consists of cool, shady, wet ground with open shallow pools of water; shrubby tangles, and fallen logs. May also be found in wooded swamps, bogs, creek, stream banks or swampy lakeshores. Species nests in banks, upturned tree roots or under mossy logs or stumps.

Observation: Confirmed breeding – Adult carrying food for young.

Dark-eye Junco* (*Junco hyemalis*) – G5

Preferred Habitat: Habitat consists of coniferous woodlands with aspen, birch and clearings; young jack pine stands; burned areas, and forest edges. Species may also be found in borders of streams or clearings. Nests in depression on ground, under roots, rocks or logs. Winters in conifers, hedgerows or brushy field borders.

Observation: Confirmed breeding – Adult carrying food for young.

Alder Flycatcher (*Empidonax alnorum*) – G5

Preferred Habitat: Habitat consists of open areas with alder, willow thickets bordering lakes or streams; low damp thickets in or near bogs, and swamps or marshes. Species prefers alders, willows, elders or sumacs.

Observation: Possible breeding – Signing male present or breeding calls heard in breeding season in suitable habitat.

* represents species most frequently observed within the site

Table 2 Avifauna Results for Silver Yards Property

Green-winged Teal (*Anas crecca*) – G5 Preferred Habitat: Habitat consists of marshes, rivers, lakes or ponds, and shorelines. Species nests in upland areas, dense stands of grass or brush from 36- 100 m from wetland edge. Species nests occasionally found far from water. Observation: Possible breeding – Species observed in breeding season in suitable nesting habitat.
Osprey (*Pandion haliaetus*) – G5 Preferred Habitat: Habitat consists of lakes, rivers. Species nests in trees near water's edge or on large rocks. Species will use artificial structures such as transmission lines. Observation: Possible breeding – Species observed in breeding season in suitable nesting habitat.
Spotted Sandpiper (*Actitis macularia*) – G5 Preferred Habitat: Habitat consists of a variety of habitat types near water. Species often forages on floating logs Observation: Possible breeding – Species observed in breeding season in suitable nesting habitat.
Alder Flycatcher (*Empidonax alnorum*) – G5 Preferred Habitat: Habitat consists of open areas with alder, willow thickets bordering lakes or streams; low damp thickets in or near bogs, and swamps or marshes. Species prefers alders, willows, elders or sumacs. Observation: Possible breeding – Signing male present or breeding calls heard in breeding season in suitable habitat.
Gray Jay (*Perisoreus Canadensis*) – G5 Preferred Habitat: Habitat consists of coniferous, mixed wood forests; forest openings, and bogs. Species is highly territorial, common in Labrador. Observation: Possible breeding – Species observed in breeding season in suitable nesting habitat.
Common Raven* (*Corvus corax*) – G5 Preferred Habitat: Habitat consists of relatively undisturbed habitat of boreal or mixed forest. May nest on steep cliffs or in tall trees, uses and builds onto same nest in consecutive years. Observation: Probable breeding – Agitated behavior or anxiety calls of adults.

Ruby-crowned Kinglet* (*Regulus calendula*) – G5

Preferred Habitat: Habitat consists of coniferous or mixed woodlands with stands of fir, spruce, tamarack or pine, evergreen stands in a variety of habitats. As well as, coniferous open or edge areas with thickets of brush, and bogs.

Observation: Possible breeding – Signing male present or breeding calls heard in breeding season in suitable habitat.

Gray-cheeked Thrush (*Catharus minimus*) – G5, S3S4

Preferred Habitat: Habitat consists of moist northern woodlands and riparian areas up to Arctic tundra.

Observation: Possible breeding – Signing male present or breeding calls heard in breeding season in suitable habitat.

Swainson's Thrush* (*Catharus ustulatus*) – G5

Preferred Habitat: Habitat consists of coniferous forest interiors (spruce, fir), with deciduous shrubs. May also be found in low, damp woods near water and riverbanks. The species may also be observed in young or mature stands and will also use mixed woods.

Observation: Possible breeding – Signing male present or breeding calls heard in breeding season in suitable habitat.

Hermit Thrush (*Catharus guttatus*) – G5

Preferred Habitat: Habitat consists of boreal forest or Great Lakes-St. Lawrence forest zones. Consisting of rocky, dry, jack pine forests, as well as dry sandy coniferous or deciduous woods with dense young undergrowth. Species may also be found in spruce bogs, borders of wooded swamps and damp forest, and brushy pasture. Species appears to need at least 100 ha of forest in south.

Observation: Possible breeding – Signing male present or breeding calls heard in breeding season in suitable habitat.

Tennessee Warbler (*Vermivora peregrine*) – G5

Preferred Habitat: Habitat consists of brushy, semi-open land including grassy openings in coniferous, deciduous or mixed woods with dense shrubs and scattered clumps of young deciduous trees. Species can also be found in treed fens or boggy areas, dry pine plantations and beach ridges.

Observation: Possible breeding – Signing male present or breeding calls heard in breeding season in suitable habitat.

Orange-crowned Warbler (*Vermivora celata*) – G5

Preferred Habitat: Habitat consists of open deciduous or mixed woods with shrub undergrowth as well as second growth in clearings or burns, brushy thickets and tall stands of shrubbery

Observation: Possible breeding – Species observed in breeding season in suitable nesting habitat.

Yellow Warbler (*Dendroica petechia*) – G5

Preferred Habitat: Habitat: Habitat consists of open areas with dense scrub, shrubby wetland areas; stream and river banks or lakeshores with scattered small trees or dense shrubbery. May also be found in farmlands, orchards or suburban yards.

Observation: Possible breeding – Signing male present or breeding calls heard in breeding season in suitable habitat.

Yellow-rumped Warbler (*Dendroica coronata*) – G5

Preferred Habitat: Habitat consists of dry coniferous or mixed forests dominated by fir, spruce, pine, hemlock or cedar with scattered openings from logging, fire or abandoned fields. May also be found in evergreen plantations; young coniferous growth at woodland edges as well as wetter habitat of black spruce or tamarack. Species is adaptable and opportunistic.

Observation: Possible breeding – Signing male present or breeding calls heard in breeding season in suitable habitat.

Blackpoll Warbler (*Dendroica striata*) – G5

Preferred Habitat: Habitat consists of coniferous forests during breeding season, and during migration found chiefly in tall trees.

Observation: Possible breeding – Signing male present or breeding calls heard in breeding season in suitable habitat.

Northern Waterthrush* (*Seiurus noveboracensis*) – G5

Preferred Habitat: Habitat consists of cool, shady, wet ground with open shallow pools of water; shrubby tangles, and fallen logs. May also be found in wooded swamps, bogs, creek, stream banks or swampy lakeshores. Species nests in banks, upturned tree roots or under mossy logs or stumps.

Observation: Confirmed breeding – Adult carrying food for young.

Wilson's Warbler (*Wilsonia pusilla*) – G5

Preferred Habitat: Habitat consists of boggy areas with cedar, tamarack or spruce. As well as swampy, brushy lands, streamside thickets and tangles. Species may also be found in wet, wooded high shrubs or low deciduous trees.

Observation: Possible breeding – Signing male present or breeding calls heard in breeding season in suitable habitat.

Fox Sparrow* (*Passerella iliaca*) – G5

Preferred Habitat: Habitat consists of thickets and edges of coniferous, mixed, or second-growth forests or chaparral.

Observation: Possible breeding – Signing male present or breeding calls heard in breeding season in suitable habitat.

Lincoln's Sparrow (*Melospiza lincolnii*) – G5

Preferred Habitat: Habitat consists of muskegs, bogs, swamps; regenerated stands following cutting or fires and hedgerows. Species may also be found in spruce forests with clearings; willow, alder thickets; low brushy growth with openings of grass or sedge, and edges of lakes, rivers.

Observation: Possible breeding – Signing male present or breeding calls heard in breeding season in suitable habitat.

White-throated Sparrow* (*Zonotrichia albicollis*) – G5

Preferred Habitat: Habitat consists of coniferous or mixed, semi-open forests with jack pine or spruce, balsam fir, aspen, and white birch. May also be found in old cut-overs or burns with forest regeneration and slash piles, brushy clearings, and borders of bogs. Species nests on the ground in brush piles or under logs.

Observation: Possible breeding – Signing male present or breeding calls heard in breeding season in suitable habitat.

White-crowned Sparrow * (*Zonotrichia leucophrys*) – G5

Preferred Habitat: Species breeds in shrub growth in open areas such as woodland edge, forest burns, willow clumps on tundra, and stream edges. Species nests on ground; may winter in southern Ontario

Observation: Confirmed breeding – Recently fledge young or downy young.

Dark-eye Junco* (*Junco hyemalis*) – G5

Preferred Habitat: Habitat consists of coniferous woodlands with aspen, birch and clearings; young jack pine stands; burned areas, and forest edges. Species may also be found in borders of streams or clearings. Nests in depression on ground, under roots, rocks or logs. Winters in conifers, hedgerows or brushy field borders.

Observation: Possible breeding – Species observed in breeding season in suitable nesting habitat.

White-wing Crossbill (*Loxia leucoptera*) – G5

Preferred Habitat: Habitat consists of boreal forest with tamarack, spruce, fir or hemlock.

Observation: Probable breeding – Pair observed in their breeding season in suitable

habitat.
Common Redpoll* (*Carduelis flammea*) – G5 Preferred Habitat: Habitat consists of low shrub tundra or barren-lands with patches of spruce, tamarack, alder, and willow thickets. Species winters near alder, birches in snow-covered weedy fields and frequents feeders. Observation: Confirmed breeding – Recently fledge young or downy young.
Pine Siskin (*Carduelis pinus*) – G5 Preferred Habitat: Habitat consists of coniferous, mixed woods; coniferous plantations; alder thickets, as well as weed patches next to forests. Observation: Possible breeding – Species observed in breeding season in suitable nesting habitat.

- represents species most frequently observed within the site

Table 3 Avifauna Results for Redmond Property

Greater Scaup (*Aythya marila*) – G5 Preferred Habitat: Habitat consists of pond, marshes and lakes. Observation: Probable – Pair observed in breeding season in suitable habitat.
Common Goldeneye (*Bucephala clangula*) – G5 Preferred Habitat: Habitat consists of wetlands, rivers or lakes with deep (~2 m) water; open lakes with nearby woodlands and marshy edges. May also be found in bulrush in water 1m deep Species breeding distribution depends on availability of trees >30 cm diameter at breast height (dbh). Observation: Possible breeding – Species observed in breeding season in suitable nesting habitat.
Osprey (*Pandion haliaetus*) – G5 Preferred Habitat: Habitat consists of lakes, rivers. Species nests in trees near water's edge or large rocks. Species will use artificial structures such as transmission lines. Observation: Probable breeding – Nest building or excavation of nest hole.
Spruce Grouse (*Falcipennis Canadensis*) – G5 Preferred Habitat: Habitat consists of dense stands of conifers, young jack pine, upland black spruce forests on stream borders, tamarack swamps, cedar bogs, and muskegs. Species nests on ground under woody debris. Observation: Confirmed breeding – recently fledge young or downy young.

Semipalmated Plover (*Charadrius semipalmatus*) – G5

Preferred Habitat: Breeding habitat consists of sandy or mossy tundra from Alaska to Newfoundland and Nova Scotia. Species winters on mudflats, salt marshes, and lakeshores along coastal California and the Carolinas south.

Observation: Possible breeding – Species observed in breeding season in suitable nesting habitat.

Greater Yellowlegs (*Tringa melanoleuca*) – G5

Preferred Habitat: Habitat consists of fens, bogs, sloughs, shallow ponds surrounded or interspersed with tree, shrub cover.

Observation: Possible breeding – Species observed in breeding season in suitable nesting habitat.

Solitary Sandpiper (*Tringa solitaria*) – G5

Preferred Habitat: Habitat consists of open, wet northern coniferous forest woodlands, wetlands, ponds, and lakes. Species nests in abandoned bird nests in trees.

Observation: Probable breeding – Nest building or excavation of nest hole.

Spotted Sandpiper (*Actitis macularia*) – G5

Preferred Habitat: Habitat consists of a variety of habitat types near water. Species often forages on floating logs

Observation: Probable breeding – Agitated behavior or anxiety calls of adults.

Wilson's Snipe (*Gallinago gallinago*) – G5

Preferred Habitat: Habitat consists of freshwater marshes and swamps. Species often frequents open landscapes.

Observation: Possible breeding – Species observed in breeding season in suitable nesting habitat.

American Three-toed woodpecker (*Picoides tridactylus*) – G5

Preferred Habitat: Habitat consists of moist, mature or old growth coniferous woodlands of cedar-balsam fir. Species may be found near burns with stands of dead timber, as well as riparian areas, bogs. Species is loosely colonial where nesting habitat is particularly suitable and food supply abundant, furthermore uses dead trees > 30 cm dbh, and needs extensive (40 ha) of forest.

Observation: Probable breeding – Courtship or display between male and female or two males including courtship feeding and copulation.

Northern Flicker (*Colaptes auratus)* – G5

Preferred Habitat: Habitat consists of open deciduous, coniferous or mixed woodlands; forest edges; suburbs, farm woodlots and wetlands. May also use dead or dying trees with a diameter at breast height (dbh) >30 cm. This species is very adaptable and is not dependent on forest size.

Observation: Possible breeding – Species observed in breeding season in suitable nesting habitat.

Yellow-bellied Flycatcher (*Empidonax flaviventris*) – G5

Preferred Habitat: Habitat consists of coniferous forest of pine and spruce with dense shrubs. Species may also br found in shrubby swamps with spruce, and alder. Can be found in low, wet swampy thickets bordering ponds, streams, bogs, and talus slopes.

Observation: Possible breeding – Signing male present or breeding calls heard in breeding season in suitable habitat.

Alder Flycatcher (*Empidonax alnorum*) – G5

Preferred Habitat: Habitat consists of open areas with alder, willow thickets bordering lakes or streams; low damp thickets in or near bogs, and swamps or marshes. Species prefers alders, willows, elders or sumacs.

Observation: Possible breeding – Signing male present or breeding calls heard in breeding season in suitable habitat.

Gray Jay* (*Perisoreus Canadensis*) – G5

Preferred Habitat: Habitat consists of coniferous, mixed wood forests; forest openings, and bogs. Species is highly territorial, common in Labrador.

Observation: Confirmed breeding – Recently fledged young or downy young.

Common Raven (*Corvus corax*) – G5

Preferred Habitat: Habitat consists of relatively undisturbed habitat of boreal or mixed forest. May nest on steep cliffs or in tall trees, uses and builds onto same nest in consecutive years.

Observation: Confirmed breeding – Recently fledge young or downy young.

Boreal Chickadee (*Poecile hudsonicus*) – G5

Preferred Habitat: Habitat consists of conifers (spruce), wooded swamps, bogs, and thickets. Species nests in natural cavities, woodpecker holes, or their own excavation in decaying wood. Species territory is about 1-2 ha of woodland.

Observation: Possible breeding – Species observed in breeding season in suitable nesting habitat.

Ruby-crowned Kinglet* (*Regulus calendula*) – G5

Preferred Habitat: Habitat consists of coniferous or mixed woodlands with stands of fir, spruce, tamarack or pine, evergreen stands in a variety of habitats. As well as, coniferous open or edge areas with thickets of brush, and bogs.

Observation: Confirmed breeding – Recently fledge young or downy young.

Gray-cheeked Thrush (*Catharus minimus*) – G5, S3S4

Preferred Habitat: Habitat consists of moist northern woodlands and riparian areas up to Arctic tundra.

Observation: Possible breeding – Signing male present or breeding calls heard in breeding season in suitable habitat.

Swainson's Thrush* (*Catharus ustulatus*) – G5

Preferred Habitat: Habitat consists of coniferous forest interiors (spruce, fir), with deciduous shrubs. May also be found in low, damp woods near water and riverbanks. The species may also be observed in young or mature stands and will also use mixed woods.

Observation: Possible breeding – Signing male present or breeding calls heard in breeding season in suitable habitat.

Hermit Thrush (*Catharus guttatus*) – G5

Preferred Habitat: Habitat consists of boreal forest or Great Lakes-St. Lawrence forest zones. Consisting of rocky, dry, jack pine forests, as well as dry sandy coniferous or deciduous woods with dense young undergrowth. Species may also be found in spruce bogs, borders of wooded swamps and damp forest, and brushy pasture. Species appears to need at least 100 ha of forest in south.

Observation: Possible breeding – Signing male present or breeding calls heard in breeding season in suitable habitat.

American Robin (*Turdus migratorius*) – G5

Preferred Habitat: Habitat consists of residential areas, lawns, gardens, ornamental trees, shrubberies. May also be found in forest edges and openings, burns, cut-over areas, as well as fens, bogs; lake or river shores.

Observation: Possible breeding – Signing male present or breeding calls heard in breeding season in suitable habitat.

American Pipit (*Anthus rubescens*) – G5

Preferred Habitat: Habitat consists of Arctic and alpine tundra, beaches, barren fields, agricultural lands, and golf courses.

Observation: Possible breeding – Species observed in breeding season in suitable

nesting habitat.

Tennessee Warbler (*Vermivora peregrine*) – G5

Preferred Habitat: Habitat consists of brushy, semi-open land including grassy openings in coniferous, deciduous or mixed woods with dense shrubs and scattered clumps of young deciduous trees. Species can also be found in treed fens or boggy areas, dry pine plantations and beach ridges.

Observation: Probable breeding – Agitated behavior or anxiety calls of adults.

Orange-crowned Warbler (*Vermivora celata*) – G5

Preferred Habitat: Habitat consists of open deciduous or mixed woods with shrub undergrowth as well as second growth in clearings or burns, brushy thickets and tall stands of shrubbery.

Observation: Confirmed breeding – Adult carrying food for young**.**

Yellow Warbler (*Dendroica petechia*) – G5

Preferred Habitat: Habitat: Habitat consists of open areas with dense scrub, shrubby wetland areas; stream and river banks or lakeshores with scattered small trees or dense shrubbery. May also be found in farmlands, orchards or suburban yards.

Observation: Possible breeding – Signing male present or breeding calls heard in breeding season in suitable habitat.

Yellow-rumped Warbler* (*Dendroica coronata*) – G5

Preferred Habitat: Habitat consists of dry coniferous or mixed forests dominated by fir, spruce, pine, hemlock or cedar with scattered openings from logging, fire or abandoned fields. May also be found in evergreen plantations; young coniferous growth at woodland edges as well as wetter habitat of black spruce or tamarack. Species is adaptable and opportunistic.

Observation: Confirmed breeding – Adult carrying food for young.

Blackpoll Warbler (*Dendroica striata*) – G5

Preferred Habitat: Habitat consists of coniferous forests during breeding season, and during migration found chiefly in tall trees.

Observation: Probable breeding – Agitated behavior or anxiety calls of adults.

Northern Waterthrush (*Seiurus noveboracensis*) – G5

Preferred Habitat: Habitat consists of cool, shady, wet ground with open shallow pools of water; shrubby tangles, and fallen logs. May also be found in wooded swamps, bogs, creek, stream banks or swampy lakeshores. Species nests in banks, upturned tree roots or under mossy logs or stumps.

Observation: Probable breeding – Agitated behavior or anxiety calls of adults.

Wilson's Warbler (*Wilsonia pusilla*) – G5

Preferred Habitat: Habitat consists of boggy areas with cedar, tamarack or spruce. As well as swampy, brushy lands, streamside thickets and tangles. Species may also be found in wet, wooded high shrubs or low deciduous trees.

Observation: Possible breeding – Signing male present or breeding calls heard in breeding season in suitable habitat.

American Tree Sparrow (*Spizella arborea*) – G5

Preferred Habitat: Habitat consists of open areas with scattered trees, brush; low-lying tundra with stands of shrubs, stunted trees, especially willow, birch, alder. During winter, species may be found in weedy, brushy fields, open country with groves of small trees, hedgerows, and marshes

Observation: Possible breeding – Species observed in breeding season in suitable nesting habitat.

Fox Sparrow* (*Passerella iliaca*) – G5

Preferred Habitat: Habitat consists of thickets and edges of coniferous, mixed, or second-growth forests or chaparral.

Observation: Possible breeding – Signing male present or breeding calls heard in breeding season in suitable habitat.

Lincoln's Sparrow* (*Melospiza lincolnii*) – G5

Preferred Habitat: Habitat consists of muskegs, bogs, swamps; regenerated stands following cutting or fires and hedgerows. Species may also be found in spruce forests with clearings; willow, alder thickets; low brushy growth with openings of grass or sedge, and edges of lakes, rivers.

Observation: Confirmed breeding – Adult carrying food for young.

White-throated Sparrow* (*Zonotrichia albicollis*) – G5

Preferred Habitat: Habitat consists of coniferous or mixed, semi-open forests with jack pine or spruce, balsam fir, aspen, and white birch. May also be found in old cut-overs or burns with forest regeneration and slash piles, brushy clearings, and borders of bogs. Species nests on the ground in brush piles or under logs.

Observation: Possible breeding – Signing male present or breeding calls heard in breeding season in suitable habitat.

White-crowned Sparrow (*Zonotrichia leucophrys*) – G5

Preferred Habitat: Species breeds in shrub growth in open areas such as woodland edge, forest burns, willow clumps on tundra, and stream edges. Species nests on

ground; may winter in southern Ontario Observation: Confirmed breeding – Recently fledge young or downy young.
Dark-eye Junco* (*Junco hyemalis*) – G5 Preferred Habitat: Habitat consists of coniferous woodlands with aspen, birch and clearings; young jack pine stands; burned areas, and forest edges. Species may also be found in borders of streams or clearings. Nests in depression on ground, under roots, rocks or logs. Winters in conifers, hedgerows or brushy field borders. Observation: Confirmed breeding – Recently fledge young or downy young.
Rusty Blackbird (Euphagus carolinus) – G5, Special Concern - COSEWIC Preferred Habitat: Habitat consists of openings in coniferous woodlands bordering bodies of water as well as tree- bordered marshes, beaver ponds, muskegs, bogs, and fens or wooded swamps. Species may also be found in stream borders with alder, willow; wooded islands on lakes. Observation: Possible breeding – Signing male present or breeding calls heard in breeding season in suitable habitat.
Pine Grosbeak (*Pinicola enucleator*) – G5 Preferred Habitat: Habitat consists of open coniferous forests with spruce or fir as well as forest edges, and clearings. Observation: Possible breeding – Signing male present or breeding calls heard in breeding season in suitable habitat.
White-wing Crossbill (*Loxia leucoptera*) – G5 Preferred Habitat: Habitat consists of boreal forest with tamarack, spruce, fir or hemlock. Observation: Probable breeding – Pair observed in their breeding season in suitable habitat.
Common Redpoll (*Carduelis flammea*) – G5 Preferred Habitat: Habitat consists of low shrub tundra or barren-lands with patches of spruce, tamarack, alder, and willow thickets. Species winters near alder, birches in snow-covered weedy fields and frequents feeders. Observation: Possible breeding – Species observed in breeding season in suitable nesting habitat.

* represents species most frequently observed within the site

Table 4 Avifauna Species Observed in the Project Area

SPECIES	JAMES	REDMOND	SILVER YARDS/ BURNT AND RUTH PITS
Green-winged Teal			1 / H
Ring-necked Duck	4 / P		
Greater Scaup		2 / P	
White-winged Scoter		1 / X	
Common Goldeneye		1 / H	
Osprey	1 / CF	1 / N	1 / H
Bald Eagle	1 / H		
Spruce Grouse		6 / FY	
Semipalmated Plover		2 / H	
Greater Yellowlegs		1 / H	
Solitary Sandpiper		2 / N	
Spotted Sandpiper		2 / A	2 / H
Short-billed Dowitcher	1 / H		
Wilson's Snipe		1 / H	
Herring Gull	1 / H		65 / X
American Three-toed Woodpecker		1 / D	
Northern Flicker	1 / H	1 / H	
Yellow-bellied Flycatcher	1 / S	1 / S	
Alder Flycatcher	1 / S	1 / S	1 / S

Gray Jay	2 / A	3 / FY	1 / H
Common Raven	1 / H	3 / FY	3 / A
Boreal Chickadee	1 / H	1 / H	
Winter Wren	2 / S		
Ruby-crowned Kinglet	3 / S	3 / CF	2 / S
Gray-cheeked Thrush	1 / S	1 / S	3 / S
Swainson's Thrush	3 / A	2 / S	2 / S
Hermit Thrush	1 / S	2 / S	1 / S
American Robin	2 / FY	2 / S	
American Pipit		1 / H	
Tennessee Warbler	1 / S	2 / A	1 / S
Orange-crowned Warbler	1 / S	1 / CF	1 / H
Nashville Warbler	1 / S		
Yellow Warbler	1 / S	1 / S	1 / S
Yellow-rumped Warbler	3 / CF	6 / CF	4 / S
Blackpoll Warbler	5 / CF	2 / A	2 / S
Northern Waterthrush	3 / CF	2 / A	4 / CF
Wilson's Warbler	2 / S	1 / S	2 / S
American Tree Sparrow		1 / H	
Fox Sparrow	3 / S	3 / S	2 / S
Lincoln's Sparrow	2 / A	5 / CF	2 / S
White-throated Sparrow	6 / A	1 / S	2 / S

White-crowned Sparrow	2 / S	7 / FY	3 / FY
Dark-eyed Junco	3 / CF	6 / FY	2 / H
Rusty Blackbird		1 / S	
Pine Grosbeak		1 / S	
White-winged Crossbill	19 / P	45 / P	26 / P
Common Redpoll		2 / H	3 / FY
Pine Siskin			1 / H
Species Totals	**31**	**40**	**26**

APPENDIX M

Breeding and Migratory Birds of the Study Area

Table 1 Breeding and Migratory Birds of Labrador Iron Mines Study Area

Common Name	Scientific Name	Status*		Breeding**	Migratory	Other	
		Species at Risk (national)	Species at Risk (provincial)	Observed (O) or Possible (P)	Possible	Year-round or Over-wintering	Rare/ Unlikely to occur
Common Loon	*Gavia immer*			O			
Red-throated loon	*Gavia stellata*			O			
American Bittern	*Botaurus lentiginosus*			P			
Great Blue Heron	*Ardea herodias*				P		
Canada Goose	*Branta canadensis*			O			
Wood Duck	*Aix sponsa*				P		
Green-winged Teal	*Anas crecca*			O			
Ring-necked Duck	*Aythya collaris*			O			
American Black Duck	*Anas rubripes*			O			
Mallard	*Anas platyrhynchos*			P			
Northern Pintail	*Anas acuta*			P			
Northern Shoveler	*Anas clypeata*				P		
Blue-winged Teal	*Anas discors*				P		
Gadwall	*Anas strepera*						X
American Wigeon	*Anas americana*				P		
Greater Scaup	*Aythya marila*			O			
Lesser Scaup	*Aythya affinis*			P			
Harlequin Duck	*Histrionicus histrionicus*		Vulnerable	P			
Long-tailed Duck	*Clangula hyemalis*			P			
Surf Scoter	*Melanitta perspicillata*			P			
White-winged Scoter	*Melanitta fusca*			O			
Black Scoter	*Melanitta nigra*			P			
Common Goldeneye	*Bucephala clangula*			O			
Barrow's Goldeneye	*Bucephala islandica*	SC	Vulnerable	P			
Hooded Merganser	*Lophodytes cucullatus*			P			
Common Merganser	*Mergus merganser*			O			
Red-breasted Merganser	*Mergus serrator*			O			
Osprey	*Pandion haliaetus*			O			
Sharp-shinned Hawk	*Accipiter striatus*			P			
Northern Harrier	*Circus cyaneus*			P			
Bald Eagle	*Haliaeetus leucocephalus*			O			
Golden Eagle	*Aquila chrysaetos*			P			
Northern Goshawk	*Accipiter gentilis*			P			
Red-tailed Hawk	*Buteo jamaicensis*			P			
Rough-legged Hawk	*Buteo lagopus*			P			
American Kestrel	*Falco sparverius*			P			
Merlin	*Falco columbarius*			P			
Peregrine Falcon	*Falco peregrinus*	SC	Vulnerable		P		
Gyrfalcon	*Falco rusticolus*						X
Ruffed Grouse	*Bonasa umbellus*			P		year-round	
Spruce Grouse	*Falcipennis canadensis*			O		year-round	
Willow Ptarmigan	*Lagopus lagopus*			O		year-round	
Rock Ptarmigan	*Lagopus mutus*			P		year-round	
Black-bellied Plover	*Pluvialis squatarola*				P		

Common Name	Scientific Name	Status*		Breeding**	Migratory	Other	
		Species at Risk (national)	Species at Risk (provincial)	Observed (O) or Possible (P)	Possible	Year-round or Over-wintering	Rare/ Unlikely to occur
American Golden Plover	*Pluvialis dominica*				P		
Killdeer	*Charadrius vociferus*						X
Semipalmated Plover	*Charadrius semiplamatus*			O			
Greater Yellowlegs	*Tringa melanoleuca*			O			
Solitary Sandpiper	*Tringa solitaria*			O			
Spotted Sandpiper	*Actitis macularia*			O			
Ruddy Turnstone	*Arenaria interpres*						X
Sanderling	*Calidris alba*						X
Red Knot	*Calidris canutus*	END	Endangered				X
Dunlin	*Calidris alpina*				P		
White-rumped Sandpiper	*Calidris fuscicollis*				P		
Semipalmated Sandpiper	*Calidris pusilla*				P		
Least Sandpiper	*Calidris minutilla*			O			
Short-billed Dowitcher	*Limnodromus griseus*			O			
Wilson's Snipe	*Gallinago delicata*			O			
American Woodcock	*Scolopax minor*						X
Red-necked Phalarope	*Phalaropus lobatus*			P			
Black-legged Kittiwake	*Rissa tridactyla*						X
Sabine's Gull	*Xema sabini*						X
Herring Gull	*Larus argentatus*			O			
Iceland Gull	*Larus glaucoides*						X
Great Black-backed Gull	*Larus marinus*						X
Lesser Black-backed Gull	*Larus fuscus*						X
Glaucous Gull	*Larus hyperboreus*						X
Common Tern	*Sterna hirundo*			P			
Arctic Tern	*Sterna paradisaea*			P			
Mourning Dove	*Zenaida macroura*				P		
Great Horned Owl	*Bubo virginianus*			P		year-round	
Great Gray Owl	*Strix nebulosa*						X
Snowy Owl	*Bubo scandiaca*				P	over-winter	
Northern Hawk Owl	*Surnia ulula*			P		year-round	
Short-eared Owl	*Asio flammeus*	SC	Vulnerable	P			
Boreal Owl	*Aegolius funereus*			P		year-round	
Chimney Swift	*Chaetura pelagica*	THR	Threatened				X
Common Nighthawk	*Chordeiles minor*	THR	Threatened	P			
Belted Kingfisher	*Ceryle alcyon*			P			
Yellow-bellied Sapsucker	*Sphyrapicus varius*			P			
Hairy Woodpecker	*Picoides villosus*			P		year-round	
Three-toed Woodpecker	*Picoides tridactylus*			O		year-round	
Black-backed Woodpecker	*Picoides arcticus*			P		year-round	
Northern Flicker	*Colaptes auratus*			O			
Olive-sided Flycatcher	*Contopus cooperi*	THR		P			
Yellow-bellied Flycatcher	*Empidonax flaviventris*			O			
Alder Flycatcher	*Empidonax alnorum*			O			
Eastern Kingbird	*Tyrannus tyrannus*						X
Horned Lark	*Eremophila alpestris*			O			

Common Name	Scientific Name	Status*		Breeding**	Migratory	Other	
		Species at Risk (national)	Species at Risk (provincial)	Observed (O) or Possible (P)	Possible	Year-round or Over-wintering	Rare/ Unlikely to occur
Tree Swallow	*Tachycineta bicolor*			O			
Bank Swallow	*Riparia riparia*			P			
Gray Jay	*Perisoreus canadensis*			O		year-round	
American Crow	*Corvus brachyrhynchos*			P			
Common Raven	*Corvus corax*			O		year-round	
Boreal Chickadee	*Poecile hudsonica*			O		year-round	
Red-breasted Nuthatch	*Sitta canadensis*			P		Year-round	
Winter Wren	*Troglodytes troglodytes*			O			
Golden-crowned Kinglet	*Regulus satrapa*			P			
Ruby-crowned Kinglet	*Regulus calendula*			O			
Gray-cheeked Thrush	*Catharus minimus*		Vulnerable	O			
Swainson's Thrush	*Catharus ustulatus*			O			
Hermit Thrush	*Catharus guttatus*			O			
American Robin	*Turdus migratorius*			O			
American Pipit	*Anthus rubescens*			O	P		
Bohemian Waxwing	*Bombycilla garrulus*			P		year-round	
Cedar Waxwing	*Bombycilla cedrorum*						X
Philadelphia Vireo	*Vireo philadelphicus*			P			
Northern Shrike	*Lanius excubitor*			P			
European Starling	*Sturnus vulgaris*						X
Tennessee Warbler	*Vermivora peregrina*			O			
Orange-crowned Warbler	*Vermivora celata*			O			
Nashville Warbler	*Vermivora ruficapilla*			O			
Yellow Warbler	*Dendroica petechia*			O			
Black-throated Green Warbler	*Dendroica virens*			P			
Yellow-rumped Warbler	*Dendroica coronata*			O			
Palm Warbler	*Dendroica palmarum*			P			
Blackpoll Warbler	*Dendroica striata*			O			
Common Yellowthroat	*Geothlypis trichas*						X
Northern Waterthrush	*Seiurus noveboracensis*			O			
Wilson's Warbler	*Wilsonia pusilla*			O			
American Tree Sparrow	*Spizella arborea*			O			
Savannah Sparrow	*Passerculus sandwichensis*			P			
Lincoln's Sparrow	*Melospiza lincolnii*			O			
Swamp Sparrow	*Melospiza georgiana*			P			
Fox Sparrow	*Passerella iliaca*			O			
White-throated Sparrow	*Zonotrichia albicollis*			O			
White-crowned Sparrow	*Zonotrichia leucophrys*			O			
Dark-eyed Junco	*Junco hyemalis*			O			
Snow Bunting	*Plectrophenax nivalis*				P		
Lapland Longspur	*Calcarius lapponicus*				P		
Rusty Blackbird	*Euphagus carolinus*	SC	Vulnerable	O			
Hoary Redpoll	*Carduelis hornemanni*					over-winter	
Common Redpoll	*Carduelis flammea*			O		year-round	
Purple Finch	*Carpodacus purpureus*						X
Pine Grosbeak	*Pinicola enucleator*			O			

Common Name	Scientific Name	Status*		Breeding**	Migratory	Other	
		Species at Risk (national)	Species at Risk (provincial)	Observed (O) or Possible (P)	Possible	Year-round or Over-wintering	Rare/ Unlikely to occur
Pine Siskin	*Carduelis pinus*			O			
White-winged Crossbill	*Loxia leucoptera*			O		year-round	
Number of Species: 138							
Number of national Species at Risk: 8							
Number of provincial Species at Risk: 9							
*National Species at Risk are those listed by COSEWIC = Committee on the Status of Endangered Wildlife in Canada							
Provincial Species at Risk are those listed by Newfoundland and Labrador Regulation 57/02,							
Endangered Species List Regulations under the Endangered Species Act							
END = Endangered, THR = Threatened, SC = Special Concern							
**Observed (O): Observed during point-count surveys conducted July 2008							
**Possible (P): Though not observed during point counts, study area falls within or just north of their range of occurrence							
Data on 'Possible' species range of occurrence taken from range maps illustrated in:							
Sibley, D.A. 2003. The Sibley Field Guide to Birds of Eastern North America. Chanticleer Press, Inc. New York.							

APPENDIX N

Fish Habitat Assessment Report,

James Property Unnamed Tributary

AECOM

Labrador Iron Mines Limited

Fish Habitat Assessment Report – James Property Unnamed Tributary



Prepared by:

Earth Tech doing business as AECOM
702 – 101 Frederick Street, Floor 7, The Galleria, Kitchener, ON, Canada N2H 6R2
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Date:

December 2008

AECOM
702 – 101 Frederick Street, Floor 7, The Galleria, Kitchener, ON, Canada N2H 6R2
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December 6, 2008 Project Number:101931

Ms. Linda Wrong
Labrador Iron Mines Limited
220 Bay Street, Suite 700
Toronto, Ontario M5J 2W4

Dear Ms. Wrong:

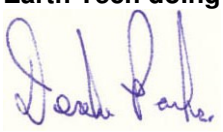
Re: Fish Habitat Assessment Report – James Property, Unnamed Tributary

Please find enclosed a Fish Habitat Assessment Report, prepared by AECOM, with hydrological support from WESA for the Unnamed Tributary located on the James Property. This assessment report contains extracted information from the Environmental Impact Statement currently being prepared on behalf of Labrador Iron Mines Ltd. for the West Central Labrador Iron Ore Project.

The conditions documented herein represent the existing fish habitat before the start of ore extraction at the James Property. Discussions on the potential impacts from mining operations and the proposed mitigation measures to offset any potential harmful alteration, disturbance or destruction (HADD) are discussed.

If you should have any questions with regards to this report, please feel free to contact us.

Sincerely,
Earth Tech doing business as AECOM



Derek Parks, B.Sc (Hon), M.Sc.
Senior Aquatic Ecologist
derek.parks@aecom

Encl.
cc: Byron O'Connor, WESA

Revision Log

Revision #	Revised By	Date	Issue / Revision Description
0	Derek Parks	November 28, 2008	Issued to Client for comments
1	Derek Parks	December 5, 2008	Revised report issued to Client for comments
2	Derek Parks	December 8, 2008	Final Report distributed to DFO
3	Derek Parks	December 19, 2008	Revisions to WESA 2008 Report (Appendix A)
4	Derek Parks	August 11, 2009	Revisions to Project Description

Signature Page

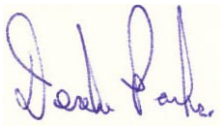
Report Prepared By:	Report Reviewed By:
	
Derek Parks, B.Sc. (Hon), M.Sc. Senior Aquatic Ecologist	Dean Fitzgerald, Ph. D. Senior Environmental Ecologist

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A. WESA 2008. James Property Hydrology and Water Balance, (Section 4.1.4) of the Environmental Impact Statement for Labrador Iron Mines Ltd. pp.19.

B. Appendix Site Photographs

1. Introduction

Labrador Iron Mines (LIM) plans to reactivate the mining of iron ore deposits in this location of western Labrador, an area of past intensive mining activities. Haematite iron ores will be mined from a number of known deposits where similar activities have previously taken place. Mining activities will be conducted in a sequential manner using conventional open pit mining methods. According to the Newfoundland and Labrador Mining Act (1999), a mill means " a facility in which a substance containing minerals may be concentrated by physical or chemical process or otherwise treated, except by simple washing or crushing. As the proposed beneficiation at the Silver Yard will be conducted using semi-mobile washer and crusher, the use of a mill is not required. Once the rock is mined, washed, crushed and sorted (beneficiated), it will be loaded onto rail cars, at the Silver Yards, located to the North of the James property in Labrador, for shipment south. No chemicals will be used in the beneficiation. The Silver Yards was historically operated as a rock storage, marshalling and loading yard by IOC and, although the former rail spur line was removed, the rail bed is still present in this area and is in good condition. As a result, the project will also included the re-establishment of the spur line rail along this existing rail bed.

The mines will produce lump and sinter ores for direct shipping to end users. As the deposit is a high-grade ore, no further processing aside from the proposed crushing and washing to be carried out in Labrador will be conducted in Canada Mining will initially be at a combined rate of one to two million tones per year at three mine sites at an estimated daily production rate less than 3000t/day per mine location. Rock beneficiation at the Silver Yard will occur during an estimated seven to eight month (approximately 250 days) working season and correspond to camp operations undertaken to complete the required excavation and processing. This process will take advantage of the existing infrastructure, such as the railway line between Schefferville and Sept-Iles, roads and electrical power and, as a result, no development work is proposed within the Province of Quebec. Although some local upgrading of roads and of the railway may be necessary, no major improvements are anticipated and work will be conducted along the existing rail-beds at the Silver Yard.

There is a small coldwater tributary immediately adjacent to the proposed James Mine South Pit (Figure 2) and, although it is outside the pit footprint, proposed dewatering activities have the potential to impact water levels further downstream.. Discussions with the Department of Fisheries and Oceans (DFO) at meetings conducted in St. John's Newfoundland and Labrador in September 2007, February and June 2008 indicated that a fish habitat assessment report would be required to determine whether a *Section 35(2) Harmful Alteration, Disturbance and Destruction* (HADD) *Authorization* would be required for the proposed mining operation. Two components for this fish habitat assessment report include; the actual physical fish habitat present and the role of groundwater contributions to the Unnamed Tributary (this report) as well as a water balance and hydrology report prepared by WESA (2008).(Appendix A). AECOM has been active on the sites, conducting environmental baseline work since 2005, and was retained by Labrador Iron Mines (LIM) to work cooperatively with WESA to complete this fish habitat assessment report for the James Property and provide potential mitigation/compensation strategies for DFO approval.

2. Study Team

The fish habitat assessment study team was lead by Mr. Derek Parks, with logistic support provided by Mr. David Praskey for the physical habitat mapping. Mr. Byron O'Connor (WESA) oversaw the hydrological and hydrogeological programs and provided the hydrological and water balance information for the Unnamed Tributary summarized within this document. Brief biographies are provided below:

Derek Parks, B.Sc. (Hon), M.Sc.

Mr Derek Parks is currently employed as a senior aquatic specialist within AECOM, and has been actively working on behalf of Labrador Iron Mines Ltd. in the Schefferville Area for the past three years. Mr. Parks has more than ten years of experience in fisheries and fish habitat, water-quality; environmental effects monitoring, bioengineering and habitat assessment and enhancement. He also has experience in the use of GIS to evaluate a range of fisheries issues. His previous employment includes AMEC Earth and Environmental, the Ontario Ministry of Natural Resources, the Township of Goulbourn and Niblett and Associates. He is also certified by MNR in the use of electrofishers and the Southern Ontario Rapid Stream Assessment Protocol and has extensive experience with a wide range of environmental studies. With a strong technical and academic background in fisheries resources, Mr Parks has applied this knowledge to plan, design and monitor a variety of projects to meet the needs of the client. He acted as a liaison for the client between regulatory agencies such as; Department of Fisheries and Ocean, Ontario Ministry of Natural Resources, and several Conservation Authorities, to provide the required information to be submitted to the appropriate agency. Once approvals have been granted, Mr. Parks has carried out over 15 monitoring programs to confirm work proposed and compensation and mitigation measures used were successful in protecting fish and fish habitat.

David Praskey, B.Sc.

Mr. Praskey is an aquatic ecologist with AECOM's Ecological Services group in Kitchener, Ontario. He has over six years experience in the aquatic biology field including lake and stream fisheries and habitat assessments, Lake Ontario wetland fish sampling, aquatic habitat mapping, Ontario Benthos Biomonitoring Network sampling, BC stream classification, and aquatic biological toxicity testing. Mr. Praskey's fish sampling experience includes index trapnetting and gillnetting, backpack and boat electrofishing, as well as seine and fyke netting. He also has more than 20 years of safe boating experience and has operated various sized boats for several professional and volunteer projects. He also has experience preparing project and client reports.

Byron O'Connor, P.Eng.

Mr. O'Connor, is a Principal with WESA Inc. and licensed professional engineer in the Provinces of Ontario, New Brunswick, the Northwest Territories and Nunavut, and Newfoundland and Labrador. He has worked in the mineral exploration and environmental fields since 1987. His technical expertise is in mining, hydrology, hydrogeology, contaminated site assessments and remedial assessments of surface water, groundwater and soil. He has conducted site assessments at mine sites and industrial facilities

across the Arctic, throughout Northern and Southern Ontario, New Brunswick, Prince Edward Island, in Labrador and Alberta. He has served as technical advisor on projects outside of Canada in Missouri, Delaware, Jamaica, Turks and Caicos, and St. Lucia. He is currently co-project project principal for a multi-site (15 sites) closure plan groundwater characterization study currently underway for a major mining company in the Sudbury area. His tailings experience includes installation and evaluation of data for inclinometers installed at Brunswick Mining and Smelting near Bathurst, NB, as well as groundwater studies at tailings facilities in Northern Ontario. He has appeared before the Environmental Assessment Board as a technical expert related to waste management systems expansion on several occasions. Mr. O'Connor has instructed groundwater and waste management courses and training sessions in Kingston and Sudbury, Ontario; Kuala Lumpur Malaysia, Kingston Jamaica, and St. Lucia (BWI).

3. Summary of Study Objectives

The study objective for this report is to provide DFO, in combination with the WESA Hydrology and Water Balance report, with sufficient information to determine whether a *Section 35(2) HADD Authorization* will be required for the proposed mining operations at the James Property. This report will outline the physical fish habitat that exists within the Unnamed Tributary on the James Property. The fish habitat assessment will define the existing aquatic habitats associated with the unnamed tributary, and identify historic alterations on the James Property. Anticipated impacts resulting from the proposed mining operations associated with the James North and James South Pits will also be assessed and discussed.

It is strongly believed that the information discussed within this report will enable DFO to make a determination, based on:

- The quantification of fish habitats, as defined by the DFO's McCarthy *et al.* 2007 DRAFT Interim Standard Methods Guide for the Classification and Quantification of Fish Habitat in Rivers of Newfoundland and Labrador, were completed,
- Provide sufficient information for a HADD determination by DFO, when read in conjunction with the WESA (2008) on hydrological interactions. (Appendix A)
- Mitigation measures to be implemented, to ensure no HADD occurs during the construction, operation and abandonment of the James North and South Pits.

4. Description of Study Area

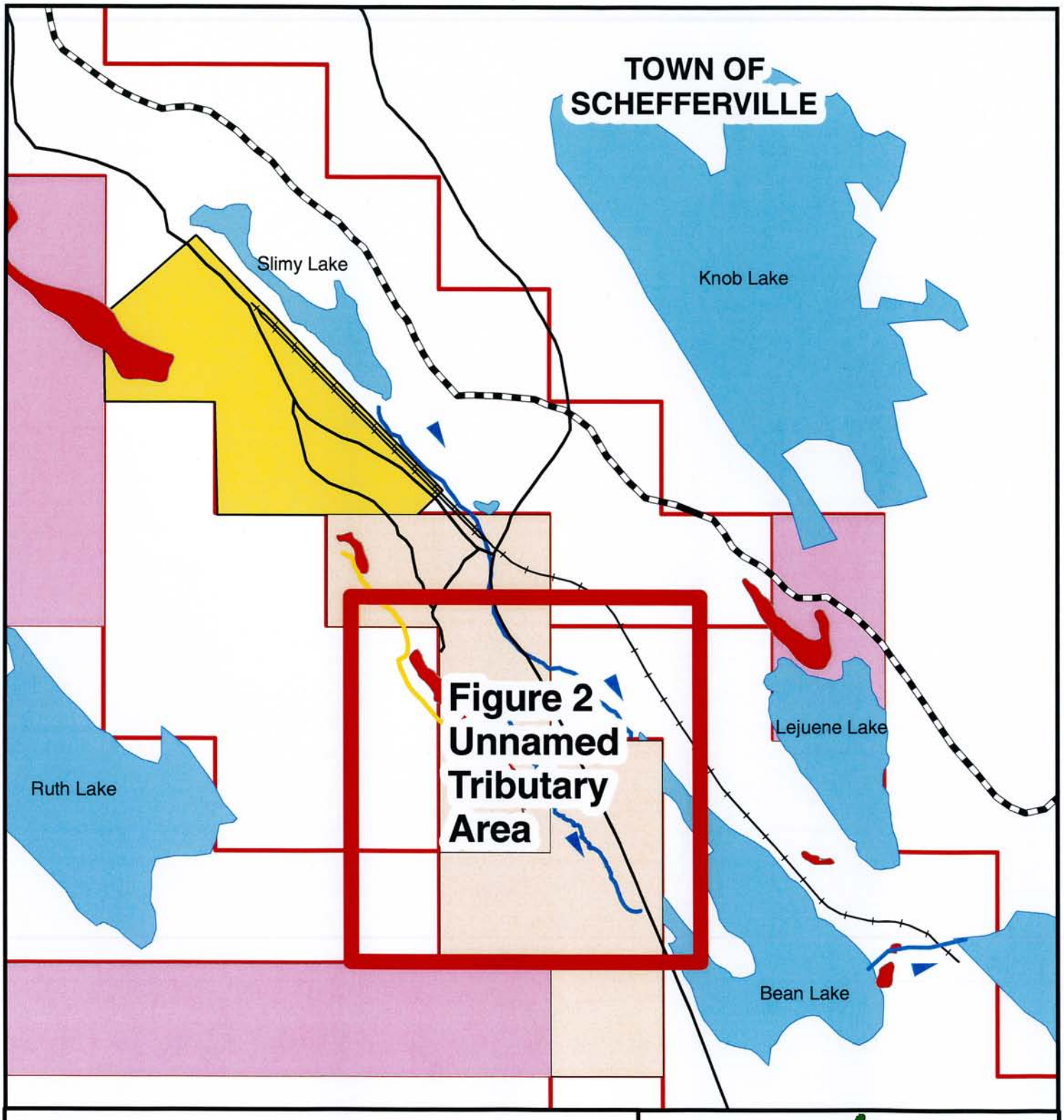
4.1 General

The James Property is located in western Labrador, at a distance of about 5 km from Schefferville, Quebec (Figure 1). The James Property has previous mining-related impacts as a result of historical IOC operations in the area. The James Property is bound by a high rock ridge to the southwest and an existing road connecting Schefferville with the Menihek Hydro Dam to the northeast. The terrain is comprised of parallel ridges and valleys, sparsely forested, trending northwest to southeast.

This area has been approximately 50% disturbed due to past mining activities. Two pits are planned for the area, the James North and James South pits.

4.2 Unnamed Tributary

Within the James Property, a small first order tributary originates from two artesian sources (James North Spring and James South Spring) that are situated between the James North and James South Pits (James North Spring) and at the southern edge of the James South Pit (James Spring South) (Figure 2). This tributary is approximately 1000 metres in length and flows in a south easterly direction and discharges into Bean Lake. Another small spring (James South Spring) originates from the southern end of the James South ore body and flows north easterly to the unnamed tributary, approximately half way between the tributary's origin and Bean Lake



Legend

- Spur Line
- Roads
- **James Watercourses**
- Permanent
- Intermittent
- Labrador-Quebec boundary_polyline
- James Property
- Beneficiation Area (Silver Yard)
- Lakes
- MapStakedClaims
- Estimated Extent of Ore Bodies
- LIM Claims
- Water Flow Direction

1:24,000

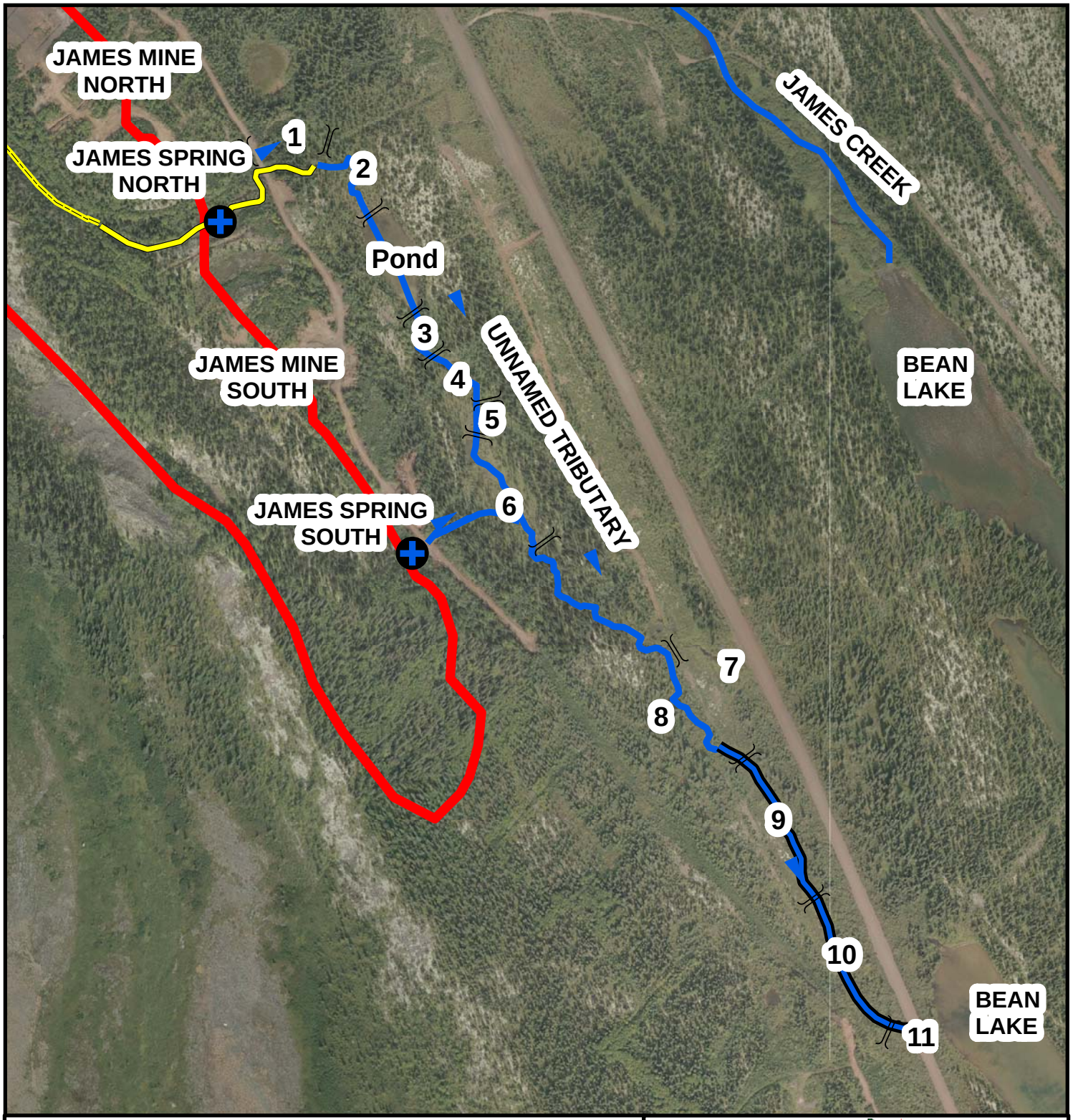
FIGURE 1

General Project Area
West Central Labrador Iron Ore Project

JANUARY 2009

Project #: 101931

AECOM



Legend

Habitat Classification

- Intermittent
- Permanent - No Fish
- Permanent - Fish Habitat
- Channelized - Fish habitat

- Water Flow Direction
- Habitat Reach Break (#) (Table 1)
- Maximum Pit Extent

FIGURE 2

Unnamed Tributary
James Property

DECEMBER 2008

Project #: 101931

AECOM

5. Methodology

5.1 Background

Information was sought from previous mining documents associated with the James Property. Provincial mapping data provided by the province indicated the origin of the unnamed tributary originated north of the James North Mine location. During winter baseline studies, conducted in late March 2007, spring locations were identified to assist in the summer physical habitat assessments. Seasonal environmental baseline studies ahve been conducted in the study area since 2005.

During the meeting with DFO staff in September 2007, and again in February and June 2008, DFO staff outlined that the fish habitat classification type values to be assessed were based on those described in Tables 4.2 (flow, current, depth and substrate parameters) and 4.2 (general habitat types) from the DRAFT Interim *Standard Methods Guide for Freshwater Fish and Fish Habitat Surveys in Newfoundland and Labrador: Rivers and Streams (2007)*.

5.2 Field Survey

5.2.1 September 2007

A physical habitat survey was conducted on September 21, 2007. Data collected included habitat type, mean wetted depth and width, substrate, % cover and type as well as additional comments including presence of redds, fish observations, etc. The stream was separated into reaches in the field when a typical reach break characteristic was observed. The lengths of the reaches were determined in a desk top exercise using ArcGIS.

Electrofishing was not conducted as young of year (YOY), juvenile and adult brook trout (*Salvelinus fontinalis*) were visually detected from the stream bank by the investigators during the September assessment located at the start of Reach 2 (Figure 2) and was outside of the timing window permitted by the DFO collection permit.

5.2.2 July 2008

On July 8, 2008, flow data were collected at 26 sites using a HydroQual flow meter. Velocity and depth measurements were recorded at distances of ¼, half and ¾ across the stream and a mean flow value of each was derived and follow the methodology outline in the guidance provided by DFO.

5.2.3 Winter 2007, 2008, and Spring 2008

Field sampling for the water quality program was completed in late March/early April 2007 and 2008. General habitat conditions for the tributary were noted during this field program.

6. Results

6.1 Physical Fish Habitat

6.1.1 General

The unnamed tributary consisted predominantly of flats and runs. Riffles and glides were also present but true pools were limited in number. One pool in Reach 8 had an approximated wetted width of 2 metres and maximum depth of 1.12 metres and occurred at an abrupt angular redirection of the stream.

The substrate in the riffles and runs was typically cobbles and gravels and in the flats, sand, silt and detritus dominated. In many flat sections however, gravels occurred under the fines and during the fall 2007 survey, redds that had been excavated down to the gravel were observed in some of these flat sections (Table 1).

Cover for fish in flat sections was dominated by undercut banks and overhanging grasses. In the runs, the dominant cover was typically overhanging alders and willows.

The smaller tributary that flows into the unnamed creek from the west was originally described as having a mean wetted width of 0.5 metres on the field sheets. This value was increased to 1 metre for calculations since the margins of the tributary were choked with watercress and therefore the actual wetted width was functionally a larger value than 0.5.

Available Habitat

The approximate areas of available spawning, rearing, migration and adult resident habitat types are 351 m², 1227 m², 0 m² and 5716 m², respectively (Table 1). We retained the use of glide as a habitat type from the BEAK 1980 and Sooley *et al* 1998, as the DRAFT classification does not identify slow moving water within a wide shallow channel with water velocities below <0.1 m/sec

Figures 3, 4 and 5 provide a representation of the fish habitat conditions noted during the study. Annotated text for each photograph can be found in Appendix B.

6.1.2 Other Observations

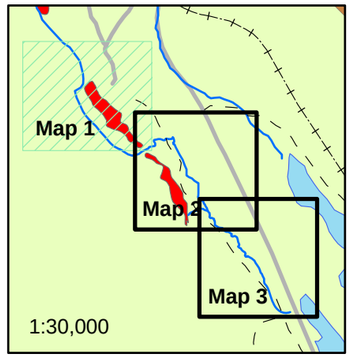
There appeared to be a significant decrease in the volumes of water flowing from the springs during the winter months. Sampling for the James North Spring indicated that flows were markedly reduced, as it took over one minute to fill a 1 litre bottle. Attempts to sample at pond locations along the tributary result in no water sample being collected, as the ponds were frozen solid to the substrate.

During the spring 2008 sampling program, it was noted the brook trout were actively swimming upstream from Bean Lake into the tributary. This observation was noted during the establishment of the hydrology monitoring station at the downstream perched culvert end along the road between the James and

Redmond Properties, as fish were jumping into the culvert during installation of water gauging devices (Figure 5, Photo H).

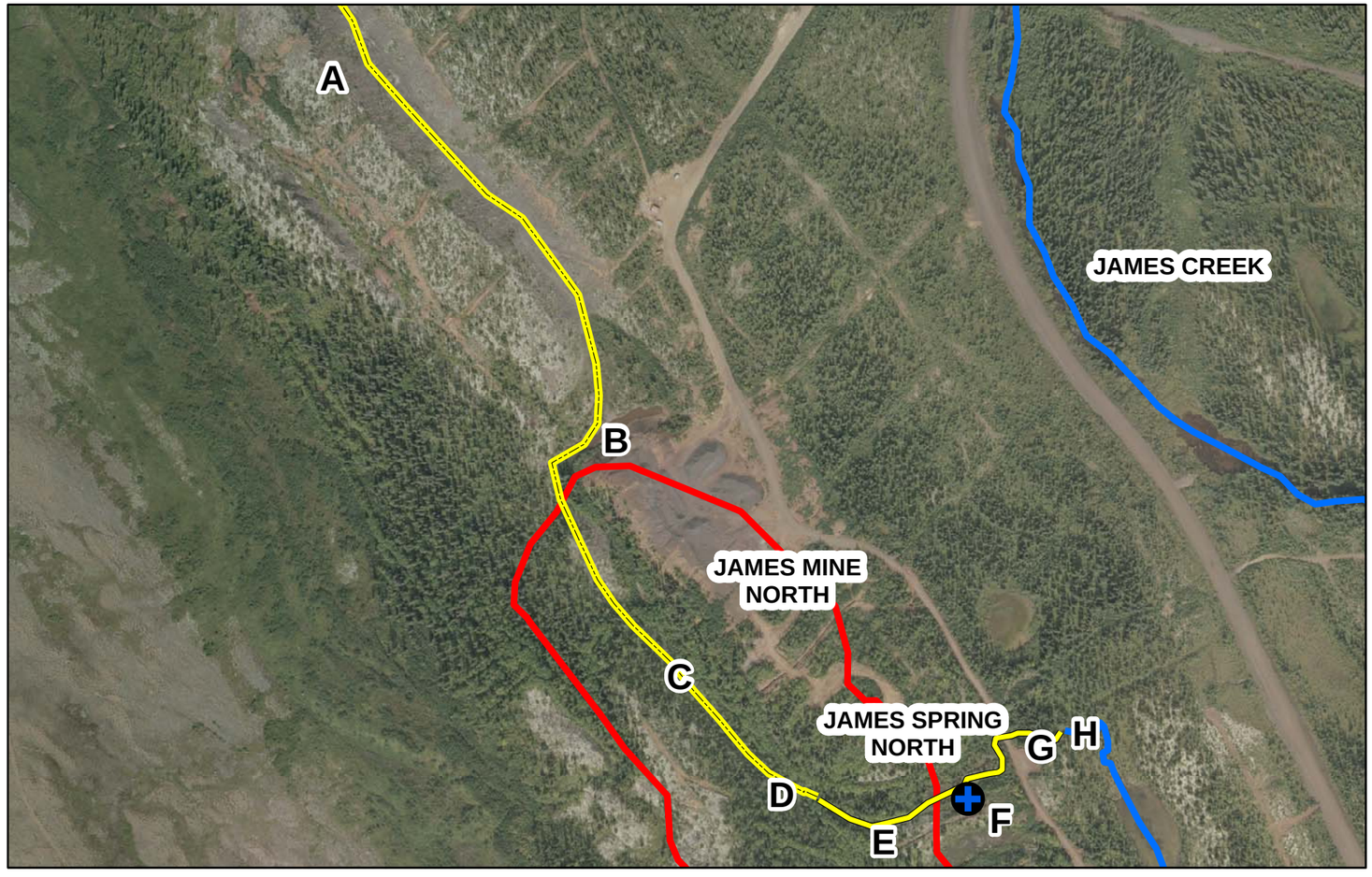
Table 1 Fish Habitat Classifications, Unnamed Tributary, James Property

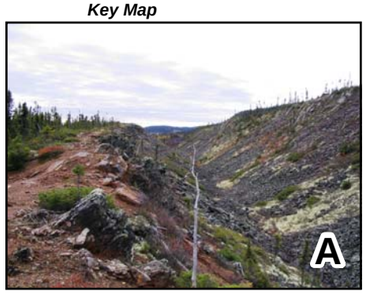
	Reach Number																																										Total Habitat Area
	1			2			pond			3			4			5	6			James S. Spring			7			8			9			10			11									
Habitat Type	Riffle	Flat	Pool	Glide	Flat	Pool				Riffle	Run	Pool	Riffle	Flat	Pool	Glide	Riffle	Flat	Pool	Run	Riffle	Pool	Run	Glide	Pool	Riffle	Run	Pool	Riffle	Run	Pool	Riffle	Run	Flat	Riffle	Flat	Pool							
% Habitat				85	15					20	70	10	5	50	45	100		100		100			20	60	20	20	60	20	50	50			100		100								
Reach Length (m)				92						47			53			53	100			105			231			353			104			230			14								
Habitat Type Length (m)				78	14					9	33	4.7	3	27	24	53		100		105			46	139	46	70	212	70	52	52			230		14								
Mean Wetted Width (m)				2.3	2.9					0.8	1.3	1.7	0.8	6.2	3.4	2.8		3.2		1			1.6	4	7	1.7	2.2	3.8	3.2	2.4			1.8		2.5								
Mean Wetted Depth (m)				0.1	0.4			< 0.5		0	0.1	0.2	0.1	0.1	0.2	0.3		0.2					0.1	0.2	0.2	0.1	0.1	0.5	0.1	0.1			0.2		0.1								
Approximate Area (m^2)				179	40			3522		12	43	6	19	167	149	148		320		105			74	556	322	119	466	266	166	125			414		35								
Mean Velocity at Flow Station (m/s)[1]					0.1									0.1				0		0.4						0.3	0.4	0.1	0.4			0.3										
Mean depth at Flow Station (m)					0.2									0.2				0.2		0						0.1	0.1	0.3	0.1			0.1										
Discharge m^3/s					0.1									0.1				0		0						0.1	0.1	0.1	0.1			0.1										
Spawning										12			19													119			166					35									**351**
Rearing											43									105			74				466			125			414									**1227**
Migration																																											**0**
Adult Resident				179	40			3522				6		167	149	148		320						556	322			266						41									**5716**
%Substrate	underground flow from road to start of Reach 2			80Sand 20Detritus	80sand 20detritus			10Detritus		80Gravels 20Cobbles	80Gravels 15Cobbles 5Sand	45Sand 45Gravels 10Detritus	100Gravels	95Detritus 4Gravels 1Boulder	100Gravels	100Detritus		100Detritus		70Gravels 20Cobbles 10Sand			100Detritus (over gravels/sand)	100Detritus (over gravels/sand)	100Detritus (over gravels/sand)	100Gravels	80Gravels 20Cobbles	80Gravels 20Detritus	80Gravels 20Cobbles	80Gravels 20Cobbles			50Gravels 50Sand		95Gravels 5Cobble								
Habitat types based on DRAFT Interim Riverine Habitat Classifications of Newfoundland Labrador																																										
[1] Flow data collected on July 8 2008; other physical habitat data collected on September 21 2007																																										



Key Map

0 50 100 200 300 400 Meters



















JAMES PROPERTY

UNNAMED TRIBUTARY

Legend

Unnamed Tributary Classification

- Intermittent
- Permanent - No Fish
- Permanent - Fish Habitat
- Channelized - Fish Habitat
- Maximum Pit Extent

LHM

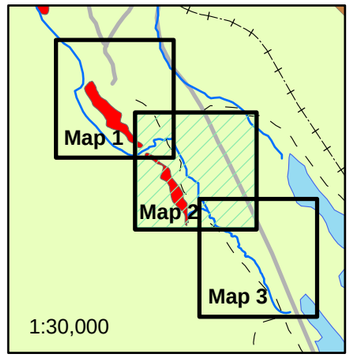
AECOM

FISH HABITAT CLASSIFICATION

FIGURE 3

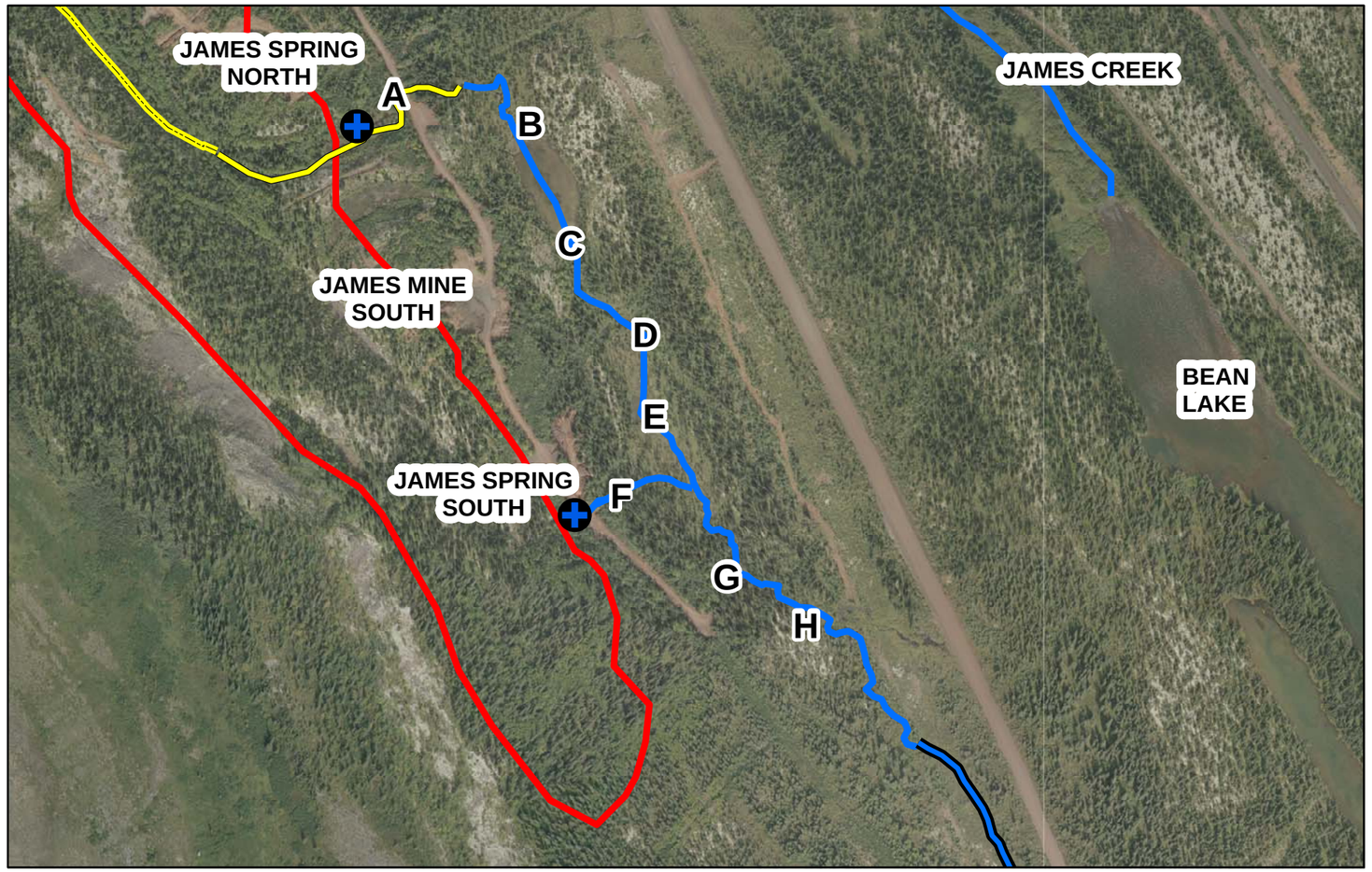
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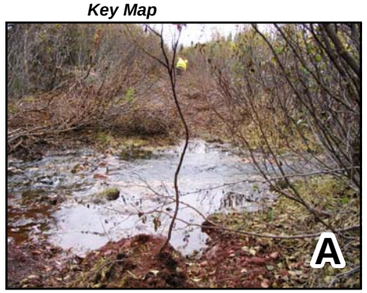
PROJECT NO.: 101931



Key Map

0 50 100 200 300 400 Meters



















JAMES PROPERTY

UNNAMED TRIBUTARY

Legend

Unnamed Tributary Classification

- Intermittent
- Permanent - No Fish
- Permanent - Fish Habitat
- Channelized - Fish Habitat
- Maximum Pit Extent

LIM

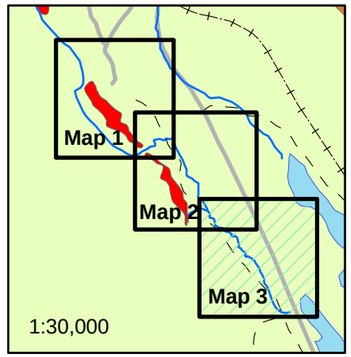
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FISH HABITAT CLASSIFICATION

FIGURE 4

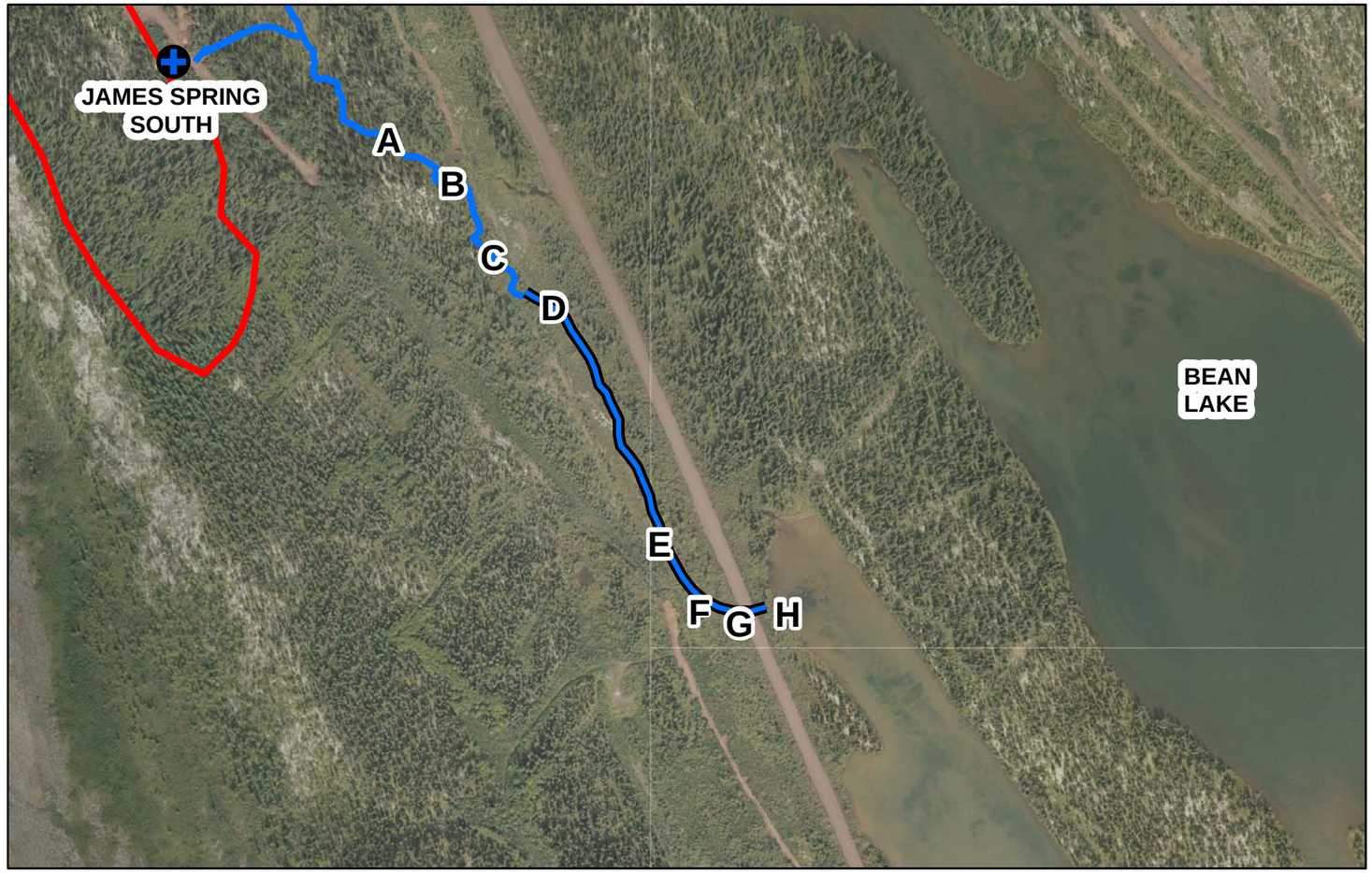
DATE: DECEMBER 2008

PROJECT N0.: 101931



Key Map

0 50 100 200 300 400 Meters



















JAMES PROPERTY

UNNAMED TRIBUTARY

Legend

Unnamed Tributary Classification

- Intermittent
- Permanent - No Fish
- Permanent - Fish Habitat
- Channelized - Fish Habitat
- Maximum Pit Extent

LHM

AECOM

FISH HABITAT CLASSIFICATION

FIGURE 5

DATE: DECEMBER 2008

PROJECT N0.: 101931

7. Discussion

Historic information (Drake, 1981) indicated that Bean Lake had been impacted by past mining activities. Habitat assessments made for the Unnamed Tributary indicate that past modifications (channel straightening) has occurred with the lower sections of the tributary, but sediment deposition noted in other historic mine impacted stream environments were not noted.

7.1 James North and South Mine Operations

Based on preliminary information provided by the LIM's engineering team and supporting information collected by WESA (2008) regarding the groundwater interactions with the Unnamed Tributary, the James North and South Springs are expected to be influenced by dewatering activities to facilitate ore extraction from both of the proposed mine sites.

The James North Pit and James South Pits have an estimated operating life of 5 years, with the first year of operation requiring active dewatering to commence late in 2009 to enable ore extraction in 2010. For this project, the mine design team allocated the required 15 m buffers, to satisfy DFO in mitigating active mining activities on the tributary.

7.2 Mitigation

LIM engineers, in combination with SNC Lavalin, have prepared preliminary pit designs and, as such, a mitigations option to maintain the viability of the Unnamed Tributary as viable fish habitat has been developed and includes the following mitigation measures to be implemented:

- Water pumped from groundwater dewatering wells for the James North and South Mine will be diverted into a 24 hour retention pond to allow particulate from the groundwater, if present, to precipitate out prior to maintaining flows in the Unnamed Tributary,
- Water quality from groundwater sampling indicates good water quality, with the exception of elevated total iron associated with suspended solids, as dissolved iron values are not considered to be elevated, based on CCME Guidelines (e.g., CCME, 2003, 2005, 2007) and presented in Section 4.1.5 of the EIS for the West Central Labrador Iron Ore Project
- Groundwater quality being diverted back into the stream will meet provincial water quality regulations and a regular water sample monitoring program will be developed and implemented;

- Should excess groundwater be present, it would be diverted into James Creek. It is also expected that a percentage of the groundwater can be redirected to the beneficiation area and/or used for general site use (dust suppression etc.);
- Pit dewatering and beneficiation area wash water will be directed to the Ruth Pit, an existing historical mining pit that has been tested to show that it is not fish habitat, to ensure that water that has come into contact with pit operations is not conveyed into areas of direct fish habitat,
- Upon closure, the pour point for the surface topography of the closed out mining areas will be directed back into the unnamed tributary to re-establish pre-development flows, and
- A monitoring program will be developed to assess the success of the mitigation outlined above (fish being present).

8. Conclusion

Based on the information provided by WESA 2008, the water that supplies the two springs (James Spring North and James Spring South) will be intercepted during dewatering activities and diverted back into the unnamed tributary, ensuring viable fish habitat during the operations of the mines. Past mining activities on the James Property has had no detectable impact on the unnamed tributary and thus no further detectable impacts to the unnamed tributary would be expected considering the proposed mining operation.

Mitigation measures to maintain viable fish habitat during and after mine operations will ensure that fish and fish habitat associated with the unnamed tributary will not be negatively impacted.

It is strongly believed that the information provided within this report and attached WESA 2008 report (Appendix A), will enable the DFO to determine their departments involvement during the EIS and permitting process.

9. References

Beak. 1980. Fisheries resources of tributaries of the lower Churchill River. Prepared by Beak Consultants Limited for the Lower Churchill Development Corporation, St. John's, Newfoundland and Labrador.

Canadian Council of Ministers of the Environment (CCME). 2007. Canadian Environmental Quality Guidelines for the Protection of Aquatic Life. Update 7.0. Canadian Council of Ministers of the Environment, Winnipeg, Manitoba. Available at: www.ccme.ca/publications/.

Canadian Council of Ministers of the Environment (CCME). 2005. Canadian Environmental Quality Guidelines. Update 5.0. Canadian Council of Ministers of the Environment, Winnipeg, Manitoba (www.ccme.ca/publications/).

Canadian Council of Ministers of the Environment (CCME). 2003. Canadian Water Quality Guidelines for Protection of Aquatic Life Guidance for Site-Specific Application of Water Quality Guidelines in Canada and Procedures for Deriving Numerical Water Quality Objectives. Canadian Council of Ministers of the Environment, Winnipeg, Manitoba.

Drake, John J. 1981. Effects of iron mining on surface water quality in the Schefferville Area. *Applied Geography,* 1: 287-296..

McCarthy, J.H, Grant. C and D. Scrutton. 2007. DRAFT Interim Standard Methoids Guide for the Classification and Quantification of Fish Habitat in Rivers of Newfoundland and Labrador.

Sooley, D.R., E.A. Luiker and M.A. Barnes. 1998. Standard methods guide for freshwater fish and fish habitat surveys in Newfoundland and Labrador: rivers and streams. Fisheries and Oceans, St. John's, NF. iii + 50p.

WESA. 2008. James Property Hydrology and Water Balance, submitted to LIM as Section 4.1.4 of the Environmental Impact Statement for the West Central Labrador Iron Ore Project.

Appendix A

WESA 2008, James Property Hydrology and Water Balance, (Section 4.1.4) of the Environmental Impact Statement for Labrador Iron Mines Ltd. pp.19.

JAMES PROPERTY HYDROLOGY and WATER BALANCE

Prepared for:

Labrador Iron Mines Limited

Prepared by:

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WESA File No. K-B6836

December 2008

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James Creek / Bean Lake Drainage Area
James Springs and Unnamed Tributary
Monitoring Wells and Stream Gauges Locations
Pproposed James Pit and Dewatering Wells

1.0 HYDROLOGY

This report is an excerpt from a section on hydrology that will be included in the Environmental Impact Statement (EIS) report currently being prepared by Labrador Iron Mines (LIM) for submission to the Department of Environment and Conservation, Government of Newfoundland and Labrador. Discussions with the Department of Fisheries and Oceans (DFO) at a meeting in St. John's Newfoundland and Labrador on September 5, 2007 indicated that a fish habitat assessment report would be required to determine whether a *Section 35(2) Harmful Alteration, Disturbance and Destruction* (HADD) *Authorization* would be required for the proposed mining operation. Two components for this fish habitat assessment report include; the actual physical fish habitat present and the role of groundwater contributions to the Unnamed Tributary as well as a water balance and hydrology report (this report).

This report describes the general hydrological conditions at the James Property and presents flow monitoring data from specific stream monitoring stations installed in June 2008 and monitored until the fall of 2008. A water balance for the James Creek/Bean Lake watershed is also presented, and an assessment is provided of potential impacts to the water balance from pit and beneficiation operations at the James site.

The drainage systems in the area are strongly influenced by the underlying geology. Streams and lakes tend to be oriented northwest/southeast to match the strike of the bedrock units. Watershed boundaries are generally quite clearly defined by exposed bedrock ridges that run in a northwest/southeast direction.

James Property:

The James Property is located at the base of an eastern slope of a significant northwest/southeast trending bedrock ridge (Figure "James Creek/Bean Lake Drainage Area"). Bean Lake is located to the east of the site and is the closest lake to the James Property. This lake is fed by James Creek which enters Bean Lake at its northern-most point. James Creek begins in the area east of Ruth Pit, flows southeast past the south end of Ruth Pit into Slimy Lake, then flows out of Slimy Lake continuing southeast to Bean Lake (Figure "James Creek/Bean Lake Drainage Area"). There are two springs on the James Property that are the source of an unnamed tributary that flows into Bean Lake (Figure "James Springs and Unnamed Tributary")). These springs (and tributary) figure prominently in the hydrological assessment of the James site and to the water balance of the system. Bean Lake outlets from the southeast and flows into a stream that outlets from Lejeune Lake.

WESA installed stream gauges and groundwater monitoring wells around the site in 2008. Stream gauges were installed to collect stream flows into and out of Bean Lake, which is the

main surface water feature near the James Property, and to collect flow data from the two springs located on the James Property. Data from the monitoring wells were used to estimate the groundwater component of the water balance for the site.

1.1 WATER BALANCE APPROACH

James Creek and Bean Lake are the focal points for the water balance assessment of the James Property since these are the closest surface water features and because shallow groundwater from the site flows to the east/southeast, toward the lake. The approach taken with respect to the water balance involved measuring surface water flow into and out of the lake, estimating groundwater discharge to the lake, and incorporating evaporation data from available meteorological data sources.

2.0 METHODOLOGY

Methodologies and data sources used in determining the surface water inputs to the water balance are described in this section.

2.1 SURFACE WATER

Velocity-Area Method of Discharge Calculation

The Velocity-Area Method of calculating stream discharge (Q) estimates Q as the product of flow velocity (V) and cross-sectional area (A):

$$Q=(V)(A)$$

In order to calculate the discharge of a channel, the channel cross-section must first be divided into several subsections. A tag line was set up perpendicular to the flow direction at each pre-selected gauging station to ensure accurate measurements of each subsection width. The stream depth was measured at these specific intervals across the stream, which allowed a stream profile to be constructed. From this profile, the cross-sectional area of the stream at the gauging site was determined. The average velocity of the cross-section was measured using the FP101 Global Flow Probe. The methodology outlined in the probe manual (Global Water, 2004) was utilized whereby the probe is moved in a serpentine pattern across the stream cross-section yielding a single average flow velocity. This average velocity was then multiplied by the cross-sectional area to determine stream discharge.

Continuous Stream Depth Measurement

Water level dataloggers were installed at five locations (SG-1, 2, 4, 5, and 8) on June 7, 2008. One additional datalogger was installed at SG-4 on July 7, 2008 to measure barometric pressure. Solinst® Levelogger® Gold Model 3001 and Barologger Gold dataloggers were used. These loggers are equipped with the datalogger, battery, pressure transducer, and temperature sensor. All loggers were programmed to record real-time data every 15 minutes which could be downloaded from the loggers using direct read cables.

Loggers at SG-1, 2, and 8 were installed in natural stream cross-sections using a length of 1.5-inch diameter ABS pipe extended horizontally from one bank to the other, perpendicular to the direction of flow. This pipe not only anchored the Levelogger, but also served as the tag line used for cross-section measurements. A second length of ABS pipe was bolted vertically to the horizontal piece such that it extended down to the streambed. This vertical ABS pipe had holes drilled through it to allow water to pass into and through the pipe in order for the water depth inside the ABS to reflect the water level of the stream. The vertical ABS acted as a sort of "stilling-well" in which the Levelogger was contained. The Levelogger was secured inside the vertical ABS by attaching the direct read cable to it with zip-ties. The direct read cable was attached to the Levelogger and run along the ABS pipe (secured using zip-ties) to the shore where the other end remained on a spool to allow for easier downloading of the Levelogger. Photographs 1 and 2 below show leveloggers set up in a stream.



Photograph 1: SG2 Stream Gauge Levelogger Looking Southeast



Photograph 2: SG1 Stream Gauge Levelogger

Sites SG-4 and 5 required Leveloggers to be mounted in culverts using threaded steel rods. A hole was drilled in the top of the culvert through which the steel rod was inserted until it came in contact with the bottom of the culvert.



Photograph 3: SG4 Levelogger Looking West

2.2 PRECIPITATION

Precipitation was estimated using the meteorological data collected at the Schefferville Airport weather station from May to November 2008. This weather station is located approximately 4 km from the site. A meteorological station was installed at the Houston Property by LIM. The data from the Schefferville station was used because that station is closer to the James Property. Although weather patterns in the area can be extremely localized, over the course of a season, the precipitation at Schefferville would be a reasonable approximation of the amount of rainfall at Bean Lake, given the proximity of the site to the weather station and the similar elevations of each. Furthermore, a comparison of the James Property stream gauge data with the Schefferville precipitation data shows a qualitative correlation between higher levels of precipitation at Schefferville, and higher water levels in the monitored streams (Charts 1-4, below).

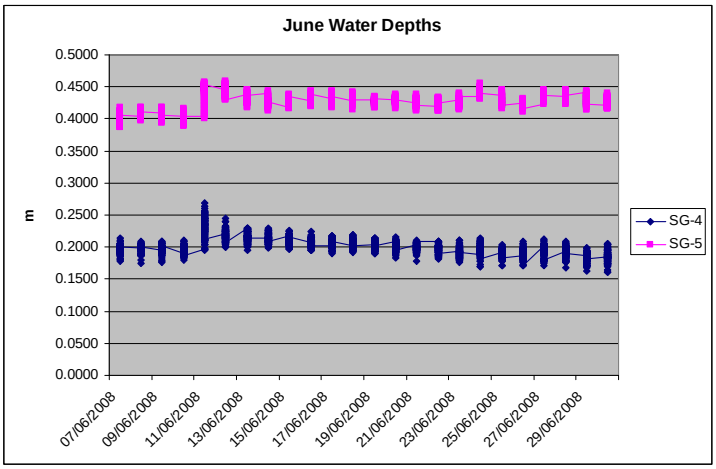


Chart 1: Stream Gauge Data, June 7 – 29

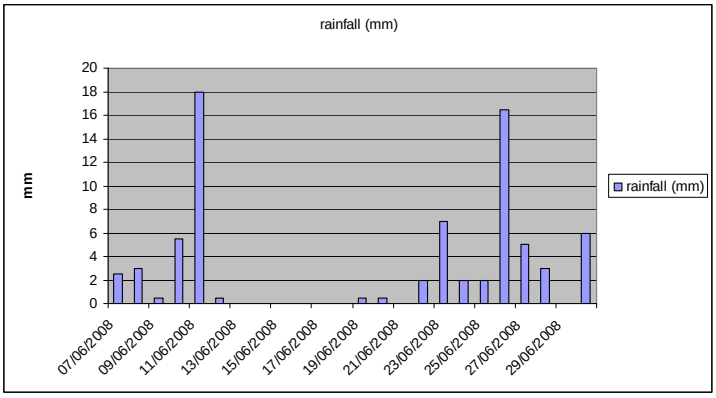


Chart 2: Rainfall Data, June 7- 29

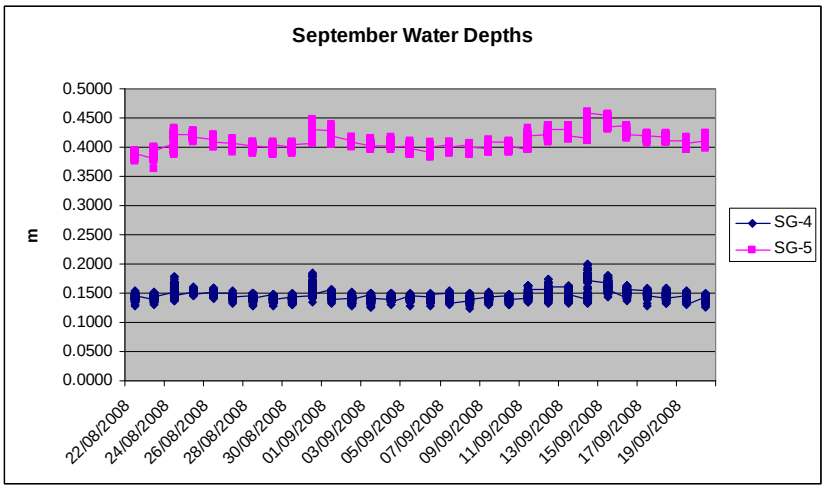


Chart 3: Stream Gauge Data, August 22 – September 19

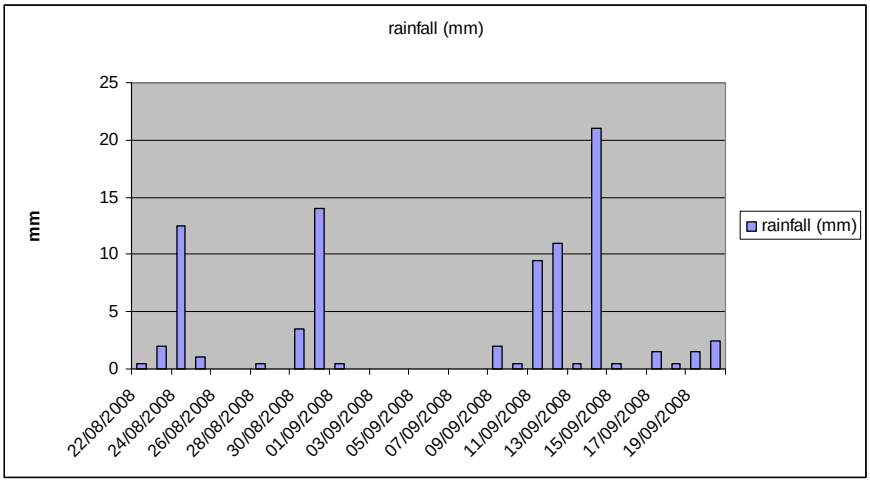


Chart 4: Rainfall Data, August 22 – September 19

3.0 WATER BALANCE

The water balance for Bean Lake can be described in terms of the contributions made by each of the following:

- Surface water inflow and outflow
- Groundwater discharge
- Evaporation

In addition to the continuous monitoring, the balance of flows into and out of the lake was examined as a kind of 'snapshot' at two points in time, one on a day in early spring (June 6) and the other on a day in late fall (Sep 25). These two sets of data were then compared to each other.

Precipitation was not included in the balance due to the fact that the week preceding each of these two days had been dry, as discussed below. Lake storage was also excluded from the balance based on the expectation that storage contribution would be minimal using the snapshot approach.

The components of the water balance are discussed in more detail below.

3.1 SURFACE WATER

Surface water inflow to Bean Lake is primarily through James Creek, which forms the main inlet at the north end, and from an inlet (unnamed tributary) along the west side of the lake that represents the combined flow of the two springs at the proposed mine site. In addition, there are some minor streams flowing into the lake near the south end. Extensive visual observation of the perimeter of the lake did not reveal any other significant inflows to the lake, and it is therefore assumed that the surface water input to the lake is captured by these inflow streams. All of the water in the area of the proposed mine site appears to drain into Bean Lake.

3.1.1 Stream Gauges

Stream gauges were placed in both of the two larger inlets (James Creek and the unnamed tributary) and the outlet, as well as the two springs near the proposed mine site. The stream gauges collected water level readings every 15 minutes. Water level readings were corrected for barometric pressure.

The locations of the stream gauges are shown on Figure "Monitoring Wells and Stream Gauges Locations" and are described as follows:

SG-1: The northern of two springs in the proposed mine area (James North Spring). The stream gauge was installed in a stream about 3.3 m wide, with a depth of approximately 30 cm at its deepest point.

SG-2: The southern spring in the proposed mine area (James South Spring). This small stream is approximately 90 cm wide, with a depth of about 20 cm.

SG-4: The combined drainage of the two springs (unnamed tributary), just before it enters Bean Lake, passes through a culvert (formerly a 24" round culvert, now deformed such that the sides in the lower portion form a V-shape).

SG-8: The main inflow to Bean Lake (at the north end of the lake) is James Creek, a stream approximately 2.9 m wide and 30 cm deep.

SG-5: The outflow from Bean Lake passes through a 12 ft corrugated steel culvert.

In addition, measurements of cross-sectional areas and stream velocities were made on July 30, 2008 at the two small streams near the south end of Bean Lake (XS-1-N and XS-2-S).

3.1.2 Stream Velocities

Stream velocities were measured during three field visits, on June 5 & 6, July 30 and September 25 & 26.

June measurements were collected during spring high levels following a period of little precipitation; July measurements followed a heavy rain; and late September measurements would be expected to represent the seasonal low. Despite these variations in conditions, measured flow velocities did not vary by more than 20% over the course of the season. The measured velocities are presented in Table 1, below.

Table 1: Measured Stream Velocities

Stream Gauge	Location	Jun-06	Jul-30	Sep-25	mean
		m/s	m/s	m/s	m/s
SG-1	James North spring	0.09	0.07	0.05	0.07
SG-2	James South spring	0.34	0.32	0.41	0.36
SG-4	Combined spring flow, unnamed tributary, at inlet to Bean Lake (culvert)	1.31	1.49	1.24	1.35
SG-8	James Creek, primary Bean Lake inlet	0.91	0.74	0.88	0.84
XS-1-N	Minor stream (culvert)		0.98		0.98
XS-2-S	Minor stream (culvert)		0.73		0.73
SG-5	Bean Lake outlet (culvert)	1.52	1.41	1.30	1.41

3.1.3 Stream Flows

Flow in the surface streams was calculated based on velocity measurements collected on June 5 & 6, July 30 and September 25 & 26. The measured flows in the streams are summarized in Table 2, below.

Table 2: Measured Flows

		June 6	July 30	Sep 25
Stream Gauge	Location	m^3/min	m^3/min	m^3/min
SG-1	James North spring	3.3	2.0	1.5
SG-2	James South spring	2.2	1.6	2.7
SG-4	combined spring flow, unnamed tributary, at inlet to Bean Lake (culvert)	2.4	2.4	1.2
SG-8	James Creek, primary Bean Lake inlet	42.1	32.1	41.8
SG-5	Bean Lake outlet (culvert)	61.0	56.1	54.4

Maximum, minimum and mean flows were calculated based on a combination of stream gauge data and measured values. The maximum flow was calculated using the highest water level (either measured or recorded by the stream gauge) and the maximum velocity. The minimum flow was similarly calculated using the lowest water level (either measured or recorded by the stream gauge) and the minimum velocity. Mean flows were calculated using the average depth recorded by the stream gauge or the average measured depth, and the average of the three measured velocities. These values are presented in Table 3, below.

Table 3: Maximum, Minimum and Mean Flows

Stream Gauge	Location	Max m³/min	Min m³/min	Mean m³/min
SG-1	James North spring	3.4	1.1	2.0
SG-2	James South spring	2.7	1.6	2.1
SG-4	combined spring flow, unnamed tributary, at inlet to Bean Lake (culvert)	3.2	0.9	1.6
SG-8	James Creek, primary Bean Lake inlet	48.6	19.7	26.3
SG-5	Bean Lake outlet (culvert)	72.8	41.5	55.9

3.1.4 Periods of Low Precipitation

Average rates of precipitation in the area, based on data collected from 1949 until 2007, falls in the range of 2.6 – 3.9 mm/day (or 19 - 27 mm/week), for the months of June through October (see Table 4).

Table 4: Meteorological Data - Daily Averages (1949 - 2007)

Month	Min Temp (C)	Max Temp (C)	Mean Temp (C)	Rain (mm)	Snow (mm)	Total Precipitation (mm)
Jun	3.4	14.0	8.73	2.41	0.24	2.65
Jul	7.8	17.5	12.65	3.20	0.01	3.21
Aug	6.8	15.7	11.25	2.97	0.07	3.04
Sep	2.1	9.6	5.83	2.98	0.56	3.53
Oct	-4.0	2.1	-0.96	2.44	1.49	3.93

In order to determine the water balance for Bean Lake, periods of very low precipitation have been examined. Without input from precipitation and runoff, the water balance consists of surface water inputs, groundwater inputs, and evaporation.

Stream measurements were collected on June 5 & 6, which was at the end of a relatively dry period (5 mm of precipitation in the week preceding June 5, and an additional 1.5 mm on June 6), as compared to the weekly average for June of approximately 19 mm/week. June 18 also marked the end of a seven-day period of very little precipitation (0.5 mm). The stream water levels at SG-4 were very similar on both June 6 and June 18, and stream velocities did not vary a great deal over the entire season; similarly for SG-5. Flows calculated for early June are therefore considered to represent a period of minimal precipitation in June.

Similarly, September 8 marked the end of a seven-day dry period (0 mm of precipitation). Stream measurements were taken on September 25 and 26, which also marked the end of a period of low precipitation (4.5 mm over the preceding seven days). The stream water levels at SG-4 were very similar on both September 8 and September 25/26 (Chart 5), and similarly at SG-5; flows calculated for late September are considered representative of a period of minimal precipitation in September.

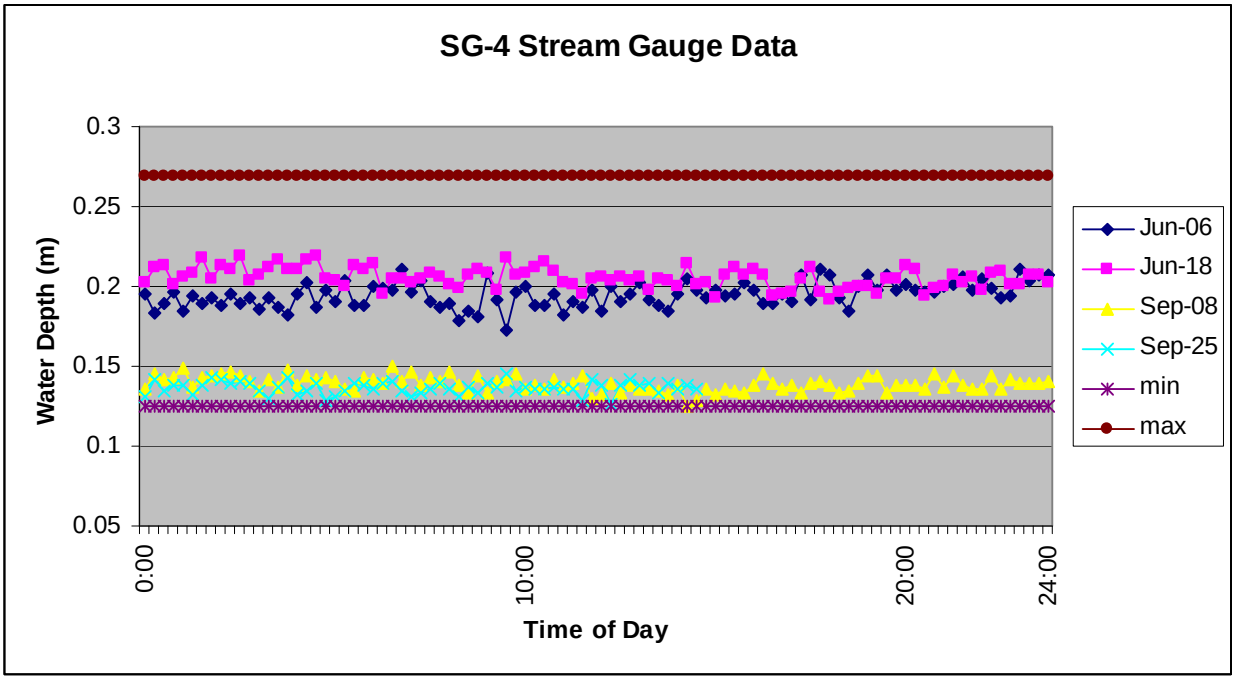


Chart 5: SG-4 Stream Gauge Data on June 6 & 18, Sep 8 & 25

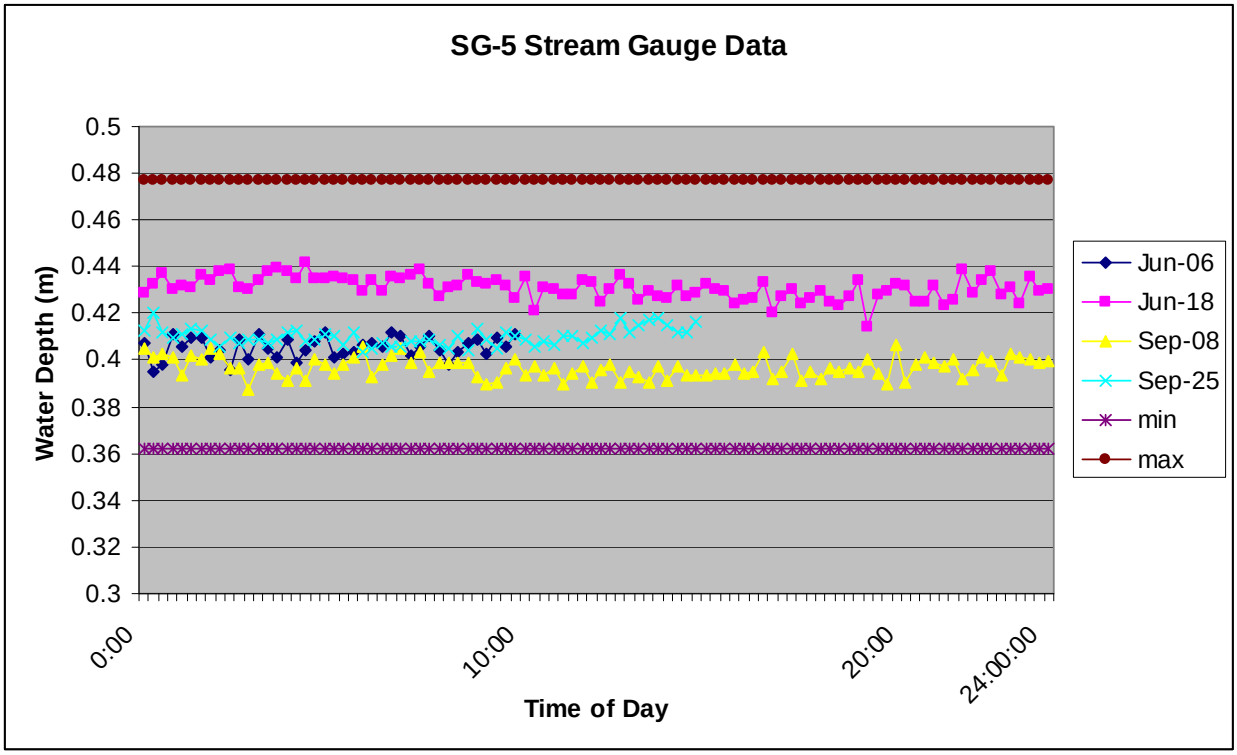


Chart 6: SG-5 Stream Gauge Data on June 6 & 18, Sep 8 & 25

3.2 GROUNDWATER FLOW

An estimate of the groundwater discharge to Bean Lake was made using information obtained during a hydrogeological assessment of the site. This assessment involved installing a total of 27 groundwater monitoring wells at 8 well nest locations across the property, conducting single well response testing to determine hydraulic conductivity, conducting a constant discharge pumping test as a further estimate of hydraulic conductivity, sampling the wells for chemical analysis, and measuring groundwater elevations to determine hydraulic gradients. The locations of the wells are shown on Figure "Monitoring Locations and Stream Gauges Locations".

Groundwater discharge to the west side of Bean Lake (from the James property side of the lake) was approximated using:

$$Q = kiA,$$

Where Q = Groundwater Flux
K = Hydraulic Conductivity
A = Cross sectional area of flowpath

The groundwater discharge estimate is an approximation and does not include any groundwater flow that may discharge to the lake from the north, south or east sides of the lake. Based on the topography, the groundwater contributions to the lake from these directions are thought to be much less than the flow from the west.

The mean hydraulic conductivity measured from single well response testing and from pumping tests conducted on pumping wells located southeast of the James North Spring was determined to be 2.69×10^{-4} m/sec. The estimated horizontal hydraulic gradient of groundwater monitoring wells installed in the shallower zone at the James site (the zone most likely to potentially discharge to Bean Lake) was determined to be 0.08. The cross sectional area of the groundwater flow path along the west side of Bean Lake was roughly estimated to be 15000 m^2. Based on these input values the groundwater discharge to the lake from the James Property side was estimated to be approximately 19 m^3/min.

3.3 EVAPORATION

Evaporation in this case includes all evaporation directly from the surface of Bean Lake.

According to the Water Resources Atlas of Newfoundland, the mean annual potential evapo-transpiration in the area falls in the range of 375 – 400 mm. Evaporation from lakes in Newfoundland and Labrador falls in the range of 300 – 600 mm. Based on this information, it was assumed that the evaporation from Bean Lake would occur at the rate of 400 mm/year.

It is also assumed that all of the evaporation takes place during the period when the lake is not frozen. There are approximately 185 ice-free days in the region.

The area of Bean Lake is 547,760 m^2. Based on this area and an evaporation rate of 400 mm in 185 days, the loss from Bean Lake due to evaporation is estimated to be 0.8 m^3/min.

4.0 JAMES CREEK/BEAN LAKE WATER BALANCE SUMMARY

The combined inflows to Bean Lake (surface and groundwater) and the combined outflows (surface water flow and evaporation) are presented in Table 5 and Charts 7 & 8, below.

Table 5: Water Balance Summary

Stream Gauge	June m3/min	Sep m3/min
XS-1-N	0.4	0.2
XS-2-S	2.2	1.1
SG-4 (Un-named tributary)	2.4	1.2
Groundwater Discharge	18.9	18.9
SG-8 (James Creek)	42.1	41.8
TOTAL INFLOW	66.0	63.2
Evaporation	0.8	0.8
SG-5	61.0	54.4
TOTAL OUTFLOW	61.8	55.2
Difference	4.2	8.0

The difference between the total inflow and outflow amounts is assumed to represent the cumulative error in the measurements and estimations that make up the components of the water balance. The June values balance very closely while the balance for September is not as close. The total inflow values to Bean Lake were very consistent between the June and September 2008 measurement periods. The component with the greatest unknown degree of accuracy is the groundwater flux, because the cross-sectional area of flow was determined based on an estimate of the width and depth of the groundwater flowpath that discharges to Bean Lake. In reality, the area of this flowpath may differ from the estimate. Notwithstanding this estimate, the overall water budget balanced quite closely giving a measure of confidence in the groundwater estimate. Additional groundwater assessment work will be conducted in 2009 to refine the dewatering requirements.

The outflow estimate from Bean Lake was lower in September than in June; it is possible that the groundwater discharge to Bean Lake decreased over the course of the summer and/or that water from the lake was lost to groundwater later in the season.

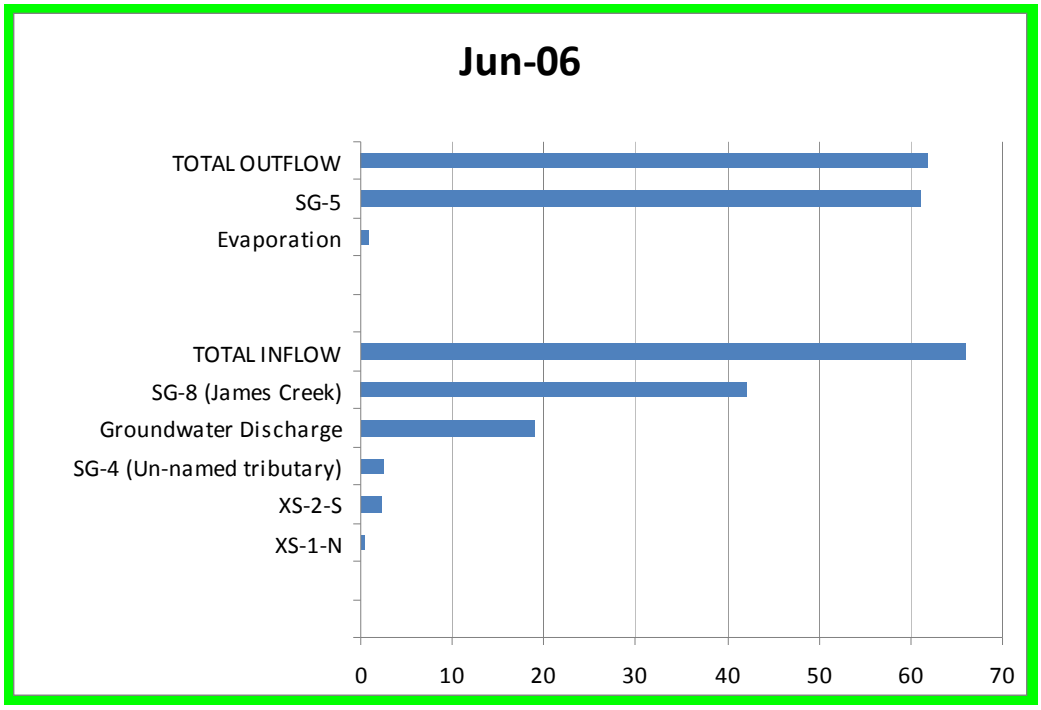


Chart 7: Components of the Water Balance for June 6

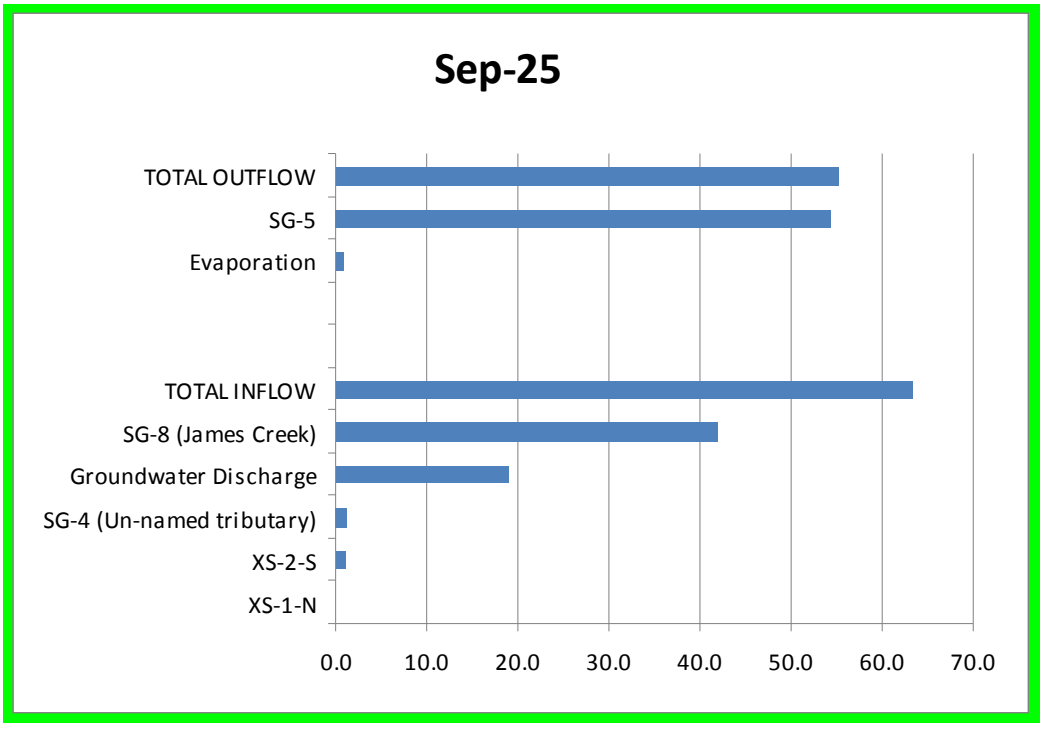


Chart 8: Components of the Water Balance for September 25

Overall, the June and September water balance 'snapshots' were quite similar: the flows were similar, and the relative contributions of the various components in the balance were similar. They are therefore considered to be representative of the entire ice-free season.

Comparison of Measured Flow Rates to Theoretical Rates – James Creek/Bean Lake Watershed:

Theoretical maximum runoff (R) estimates for the James Creek/Bean Lake watershed can be made by determining inputs to the watershed from precipitation (P) and subtracting the potential evapotranspiration (ET) based on the area of the watershed and published P and ET rates for the area. This approach assumes that any infiltration that occurs eventually discharges back to surface further along in the system.

The area of the watershed is estimated to be 1305 hectares. Precipitation data obtained from Environment Canada for the area for the period of 1949 to 2007 indicates average annual precipitation of 775 mm. A potential ET rate for the area of 375 mm was obtained from the Newfoundland and Labrador Water Atlas. Using these values yields an average annual runoff value of 5222504 m^3. This works out to 28230 m^3/day using a six month period as a basis and 14308 m^3/day over a twelve month period. These maximum theoretical values are considerably lower than the stream flow rates that were measured in James Creek from June to October 2008 if the measured flow rates are extrapolated over a full year.

Stream flow measurements over the spring/summer/fall of 2008 appear to represent seasonally above average flow conditions and the flow rates drop substantially during the winter months. Longer term full season monitoring will be undertaken in the future to confirm these conditions.

5.0 IMPACT OF JAMES PIT DEVELOPMENT ON WATER BALANCE

5.1 Pit Dewatering Impacts on James Springs and Unnamed Tributary:

The approximate locations of the proposed James Pits (North and South) are shown on Figure "Proposed James Pit and Dewatering Wells". Pit dewatering will be required to lower the water table in the immediate vicinity of the pits to allow mining to occur. Dewatering will be achieved using primarily perimeter dewatering wells and, as required, in pit sumps. Given the proximity of the springs to the pits (North Spring is between the two proposed pits and the south spring is within the proposed James South Pit), the lowering of the water table in response to pit dewatering is expected to impact the flow from the James North and James South Springs. Since the springs are the source of flow in the unnamed tributary, the interception of flow from the springs by pit dewatering will likely lead to a significant reduction and perhaps even complete

cessation of flow from the unnamed tributary unless steps are taken to replace the lost flow. The most appropriate way to manage this is to divert a portion of the water pumped from the groundwater dewatering back to the unnamed tributary to replace the groundwater that, under normal circumstances, would discharge from the two springs.

Based on current pumping test data, it is expected that water from the James Pit dewatering system will need to be directed to a sediment removal system or settling pond system to remove suspended solids before discharge to the natural environment. Anecdotal information (Don Hindy, former IOC engineer, December 2008) has indicated that historical groundwater observations were that the groundwater eventually became quite clear. However, a conservative approach will be taken to reduce TSS prior to the entrance of this water back into the nearby water systems.

The maximum, minimum, and mean flows from the James North and James South Springs over the June to October recording period are summarized below.

Flow	James North Spring – SG1	James South Spring – SG2
Maximum (m^3/min)	3.4	2.7
Minimum (m^3/min)	1.1	1.6
Mean (m^3/min)	2	2.1

Flow from the James North Spring forms the upper end of an unnamed tributary that flows southeast, accepts additional flow from the James South Spring, and ultimately discharges into Bean Lake (Figure 'James Springs and Unnamed Tributary"). Flow rates for the unnamed tributary were also recorded from June to mid October 2008 at a location just before it discharges to Bean Lake (SG4). The maximum, minimum, and mean flow rates for this location are summarized below.

Flow	Unnamed Tributary at Bean Lake – SG4
Maximum (m^3/min)	3.2
Minimum (m^3/min)	0.9
Mean (m^3/min)	1.6

The flow rate from SG4 (downstream end of the tributary) was always less than the combined flow from the two springs, indicating that water in the tributary infiltrates into the ground as it flows toward Bean Lake.

Based on the locations of the James North and James South Springs, the proposed outline of the James Pit, and the observations made during pumping tests at the site, it is highly probable that dewatering from the proposed pit will affect the flow rates from the springs, and in all probability the springs will stop flowing at some point during the development of the pit without the supplementation of water back into the fish habitat sections of the tributary. The mitigation

strategy will involve diverting a portion of the perimeter groundwater well water to the unnamed tributary after running the water through a settling/filter system to remove suspended solids. The targeted redirected water flow rate to the tributary during operations would be the maximum rate measured from the tributary (SG4 flow data) during the 2008 monitoring period, while the average flow rate measured would be used during winter shutdown periods.

Groundwater is the source of water that discharges from the springs, therefore replacing the spring water with water from the dewatering wells means that the same source of water will be feeding the unnamed tributary before, during and after site development.

5.2 Effects of Dewatering Water on Bean Lake:

SNC Lavalin is conducting engineering work for the proposed mine. They have estimated that the cumulative amount of groundwater pumped by the pit dewatering system will be 113 m^3/min. Approximately 8 m/min of this water will be diverted to the unnamed tributary to offset water lost from the springs by dewatering, therefore approximately 105 m^3/min of dewatering water will be sent to Bean Lake via the inlet from James Creek. The area of Bean Lake is approximately 54 ha, therefore a discharge rate of 113 m^3/min only adds about 0.02 cm/min to the hydraulic loading of Ruth Pit and Bean Lake. The hydraulic impact to Bean Lake is considered to be negligible.

5.3 Effects of Process Water Use:

An additional item in the James Creek/Bean Lake water balance includes process water used to wash the ore prior to shipment. It is estimated that 505 m^3 of water per hour will be required. The best source for this water is considered to be pit dewatering water that can be diverted from the James pit dewatering system. This process water (reject fines wash water) will contain approximately 21 % solids after washing, therefore it will be pumped to Ruth Pit, located north of the James Property for settling. This additional volume (505 m^3/hour) will have a negligible hydraulic impact on Ruth Pit, which has an area of 61 hectares and a depth of 120 m (hydraulic loading of 0.001 cm/min). Ruth Pit has more than adequate capacity to accommodate this additional flow and no hydraulic impacts to James Creek are anticipated.

6.0 REFERENCES

Department of Environment and Lands, Water Resources Division, Government of Newfoundland and Labrador. Water Resources Atlas of Newfoundland. 1992.

Environment Canada, 2008. National Climate Data and Information ArchiveEnvironment Canada, Meteorological data

Findlay, B.F. Precipitation in Northern Quebec and Labrador: An Evaluation of Measurement Techniques. 1967.

Global Water, 2004. FP101-FP102 Global Flow Probe User's Manual.

Nichols, Lee Clifford. Hydrologic Balance of a Complex Drainage Area in New Quebec. June 1967.

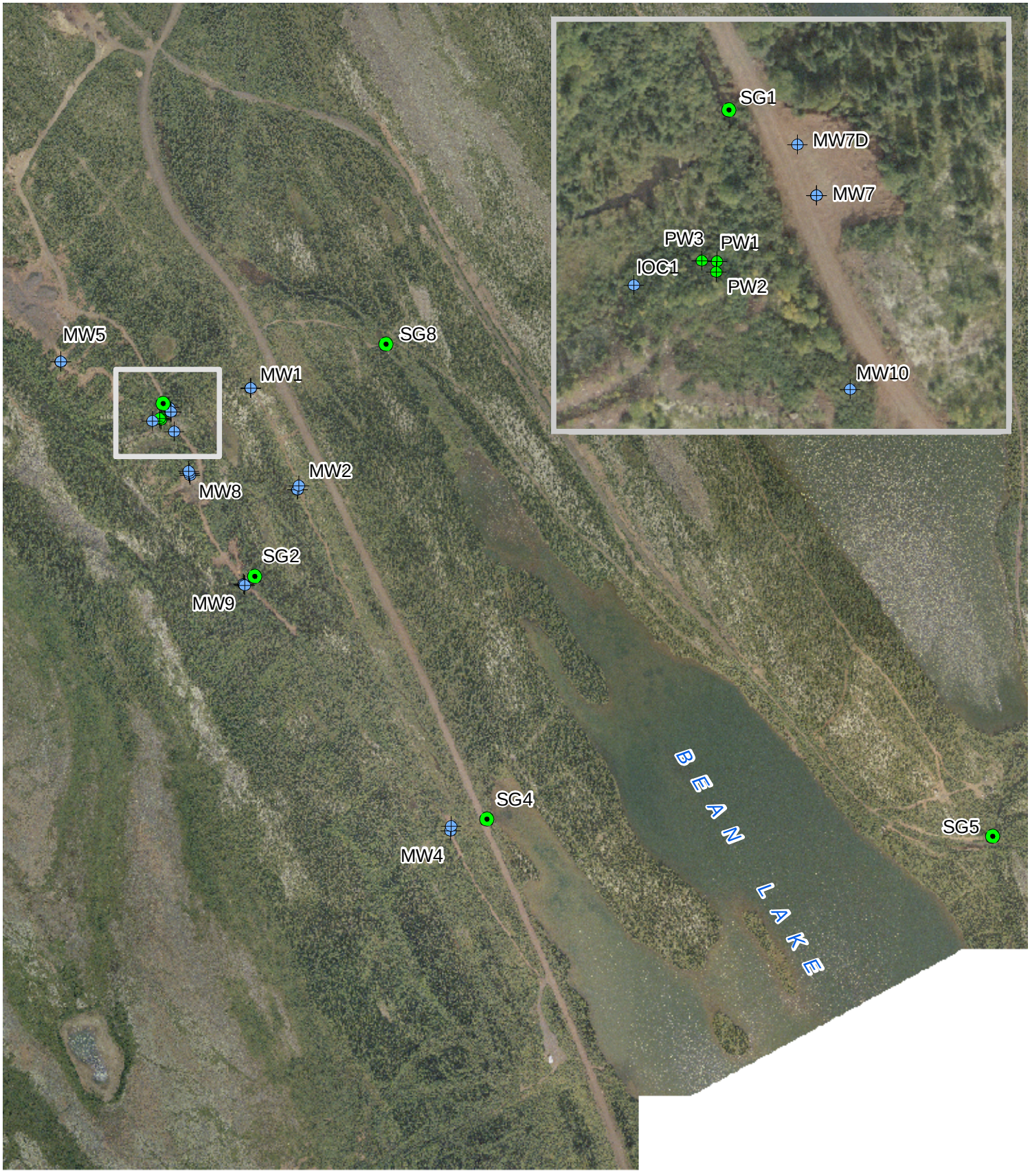


Figure xx: Monitoring Wells and Stream Gauges Locations

LEGEND:

- Bedrock Wells
- Pumping Wells
- Stream Gauges

Project Number:
K-B6836

Date: November 27, 2008

Data Source:
Eagle Mapping

WESA
A Better Environment For Business

N

0 25 50 100 150 200
Meters



LEGEND

- Flow Direction
- James Creek / Bean Lake Watershed Boundary

REFERENCE

Note:
Data Source : Geomatics Canada 1:50 000 NTS, Google Earth
Coordinate System : UTM NAD83 Zone 19 North

0 75 150 300 450 600
Meters

1:16,000

PROJECT

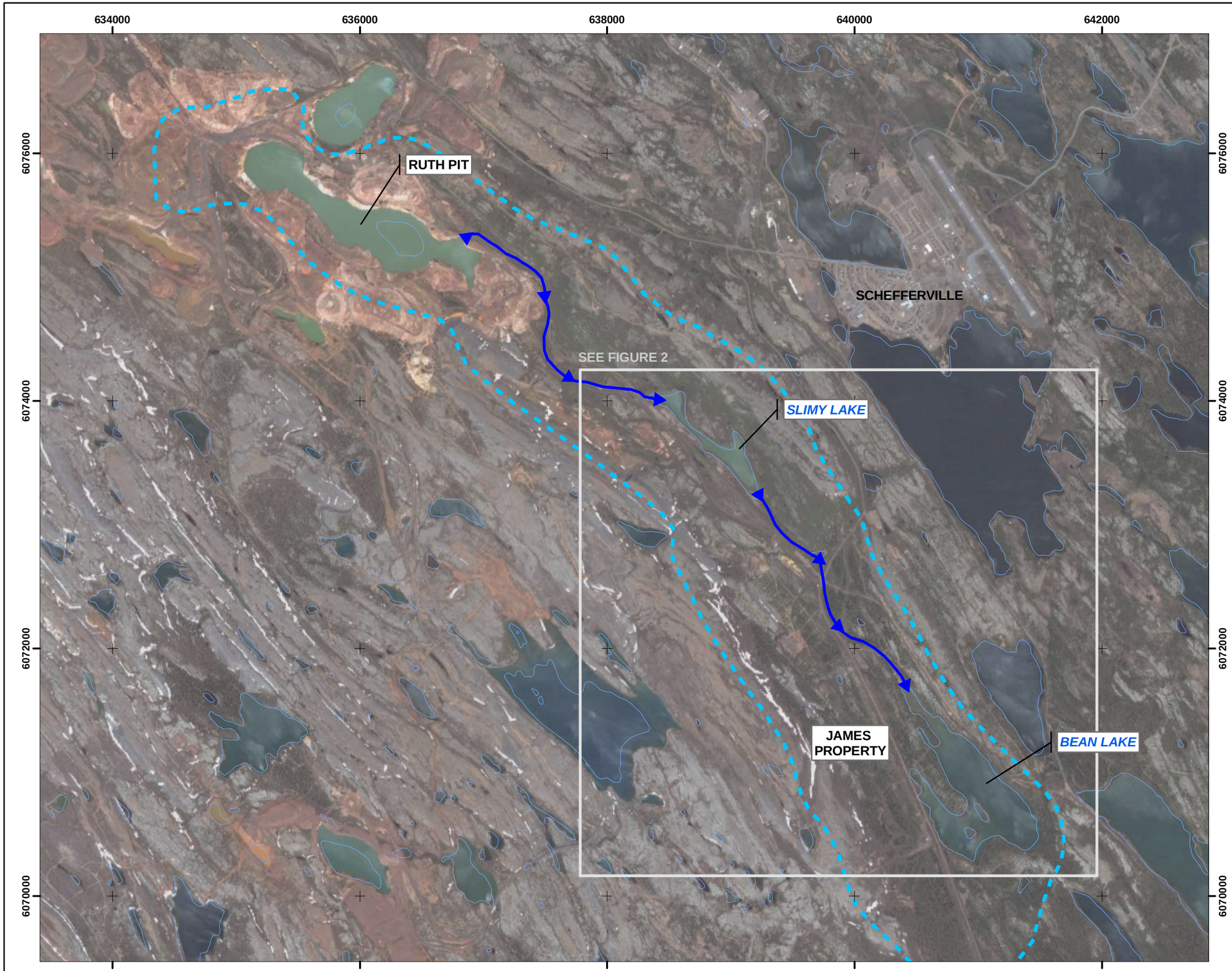
LIM SCHEFFERVILLE

TITLE

James Springs and Unnamed Tributary

WESA
A Better Environment For Business

PROJECT No. KB6832			FIGURE xx
DESIGN	JFD		
GIS	JFD	24/11/2008	
CHECK	BOC	24/11/2008	FIG2_LIM_DFO
REVIEW			



LEGEND

- Flow Direction
- James Creek / Bean Lake Watershed Boundary

REFERENCE

Note:
Data Source : Geomatics Canada 1:50 000 NTS, Google Earth
Coordinate System : UTM NAD83 Zone 19 North

0 100 200 400 600 800
Meters

1:30,000

PROJECT

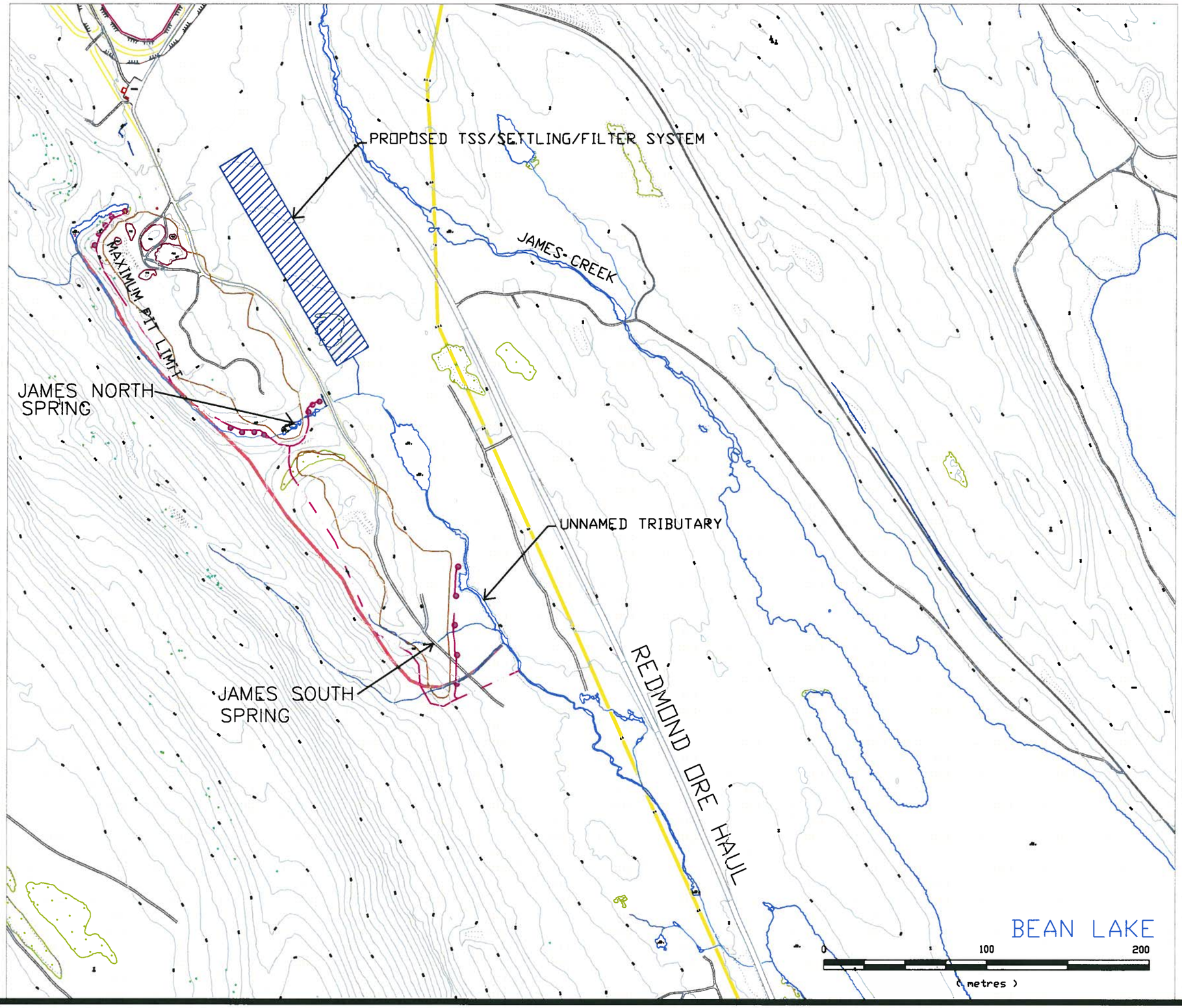
LIM SCHEFFERVILLE

TITLE

James Creek/Bean Lake
Drainage Area

WESA
A Better Environment For Business

PROJECT No. KB6832			FIGURE xx
DESIGN	JFD		
GIS	JFD	24/11/2008	
CHECK	BOC	24/11/2008	FIG1_LIM_DFO
REVIEW			



LEGEND

- PROPOSED DEWATERING WELL LOCATION

N

PROJECT NUMBER: B6836	DRAWN BY: C.M.R.	DESIGNED BY: B.D'C.
DATE: 05 DECEMBER 2008	CHECKED BY B.D'C.:	
SCALE: AS SHOWN	CAD FILE NO.: B6836-SP	

FIGURE:

PROPOSED JAMES PIT AND DEWATERING WELLS

WEST CENTRAL LABRADOR IRON ORE PROJECT

LIM

WESA
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Appendix B

SITE PHOTOGRAPHS DESCRIPTIONS

Photograph Descriptions for Figures 3, 4 and 5

Figure 3

- **A.** Intermittent section of tributary in historically excavated site
- **B.** Small area of pooled water on the northern margin of historical stockpile site – no fish occurrence in this section
- **C.** Stream flow in sections that are represented in photos C and D were alternating surface and subsurface in nature
- **D.** Same as C
- **E.** Section of wide flats. Electrofishing resulted in no fish captures.
- **F.** Active spring in upstream section of tributary
- **G.** High gradient area of surface and subsurface flow
- **H.** Origin of tributary at upwelling on east side of access road. Adult and juvenile brook trout were observed at this site.

Figure 4

- **A.** Flow station site east of James Spring North
- **B.** Large pond with maximum depth <0.5m
- **C.** Riffle section at south end of pond
- **D.** Section of flats
- **E.** Side section of flats where numerous adult brook trout and redds were observed in the fall of 2007
- **F.** Smaller tributary that originates at James Spring South. The channel was choked with mats of watercress and a few juvenile brook trout were observed in this section
- **G.** Sections G and H are meandering sections of flats with high occurrences of large woody debris and overhead cover
- **H.** Same as G

Figure 5

- **A.** Section of mainly flats with high occurrences of LWD and overhead cover
- **B.** Wide section of flats
- **C.** Side area of flats where numerous adult brook trout were observed in September, 2007
- **D.** Channelized reach that consisted mainly of flats and riffles
- **E.** Same as D
- **F.** Same as D
- **G.** Culvert inflow on west side of road
- **H.** Stream discharge from perched culvert on east side of road

APPENDIX O

Summary of Stakeholder Consultation

Labrador Iron Mines Ltd Stakeholder Consultation

Report Parameters:
Start Date: 1 Jan 2005
End Date: 15 Dec 2008

Community Visit 30 May 2005 Kawawachikamach	
Participants: Phillip Einish Chief – Naskapi Nation John Mameamskum Naskapi **Team Members:** Erick Chavez Gerry Gauthier John Kearney Terence McKillen	**Summary:** Introductory visit to Schefferville. Reviewed project proposal. No major issues raised. Do not want to see any new mining resulting in the visual “eyesore” left behind by IOC. Aboriginals effectively shut out by IOC operations.

Meeting 23 Sep 2005	
Participants: Uashat Band Council Gilbert Pilot Uashat **Team Members:** Joseph Lanzon Dan O'Rourke	**Summary:** Initial MOU discussion and project introduction. No significant issues other than jobs and economic benefits.

Meeting 21 Oct 2005 Uashat Meeting	
Participants: Richard Bell TSH **Team Members:** Joseph Lanzon Dan O'Rourke	**Summary:** TRT rail capacity discussion. Upgrade on a yearly approach.

Meeting 18 Nov 2005 Sept-Iles	
Participants: Normand Laprise Norma Lebri **Team Members:** Joseph Lanzon Dan O'Rourke	**Summary:** Meeting with Band officials in Sept-Iles and City Officials. Presentation of LIM project.

Meeting 1 Dec 2005	
Participants: Ben Michel Labrador Innu **Team Members:** Joseph Lanzon Dan O'Rourke	**Summary:** Meeting with Grand Chief - Innu of Labrador. Discussion on project and benefits for Labrador.

Phone Call 2 Dec 2005	
Participants: Gilbert Pilot Uashat **Team Members:** Terence McKillen	**Summary:** Reviewed Anglesey press release and discussed scope of project. Asked to set up a meeting with Development Corporation and Band Council.

Meeting 7 Mar 2006	
Participants: Innu Chiefs and Advisors **Team Members:** Joseph Lanzon Terence McKillen Dan O'Rourke	**Summary:** Meeting with aboriginal leaders. Project presentation and benefits.

Meeting 4 May 2006 Sept-Iles	
Participants: Chief Andree Chief - Uashat Gilbert Pilot - Uashat Daniel Ashini Labrador Innu Ben Michel Labrador Innu Dave Nuke Labrador Innu **Team Members:** John Kearney Joseph Lanzon Bill Hooley Veikko Koskella Terence McKillen Dan O'Rourke	**Summary:** LIM meets jointly with Labrador Innu Association and Uashat Innu Council. Review of project proposal. Aboriginal issues revolve around ensuring economic benefit accrues to their communities as they all felt they were abandoned by former IOC operations. Ben Michel outlined a vision for pan-provincial cooperation among the aboriginal groups and thought it should be possible to have a single negotiating table when it came time to negotiate the economic benefits from the project. Separate presentation made to the Uashat community. Issues raised related to jobs and protection of the environment with respect to ensuring that the communities can continue to “live off the land”.

Phone Call 8 May 2006	
Participants: Gilbert Pilot Uashat **Team Members:** Terence McKillen	**Summary:** To set up Wabash meeting with Ben Michel and Uashat Chief.

Meeting 10 May 2006 Wabush	
Participants: Daniel Ashini Labrador Innu Ben Michel Labrador Innu	**Summary:** Meeting with Labrador Innu Association. Review of project development and issues for LIA. Mr. Michel spoke of his vision for development of Labrador and the extension of a rail link from Labrador City to Goose Bay and further north to open up the country for development.

Meeting 10 May 2006 Wabush	
Team Members: John Kearney Joseph Lanzon Terence McKillen	

Meeting 18 May 2006 Montreal	
Participants: Daniel Ashini Labrador Innu Dave Nuke Labrador Innu Gilbert Pilot Uashat **Team Members:** Joseph Lanzon Terence McKillen Dan O'Rourke	**Summary:** Meeting to discuss project and Labrador based and Innu connected contractors. Uashat community anxious that LIM allow consultants and contractor with whom their Development Corporation has entered in to partnerships to have opportunity to bid on any contracts. LIM discussed the necessity of securing a qualified diamond drill company for a summer drill program. Mr. Nuke (LIA) was not in favour of LIM using Goose Bay-based Cartwright Diamond Drilling Co.

Phone Call 19 May 2006	
Participants: Dave Nuke Labrador Innu **Team Members:** Terence McKillen	**Summary:** Gave advice on potential drill contractors and other Labrador contractors.

Phone Call 23 Jun 2006	
Participants: Gilbert Pilot Uashat **Team Members:** Terence McKillen	**Summary:** Contractor for rail study.

Meeting 28 Jun 2006 **Ottawa**	
Participants: John Mameamskum – Director General Naskapi Nation **Team Members:** John Kearney Dan O'Rourke Joseph Lanzon	Project update. Discussion on TSH railway.

Meeting 28 Jun 2006 **Ottawa**	
Participants: Chief Andre – Matimekush Innu Real Mckenzie Gilbert Pilot – Uashat Innu **Team Members:** John Kearney Dan O'Rourke Joseph Lanzon	Project update. Issues for Matimekush community are jobs, sustainable economic development and ensuring that the community benefits from mine development this time. Discussion on the economic benefit for TSH railway.

Phone Call 5 Jul 2006	
Participants: Richard Bell TSH **Team Members:** Terence McKillen	**Summary:** Discussed TSH support for an independent Rail Study.

Meeting 30 Aug 2006 Montreal	
Participants: Daniel Ashini Labrador Innu Leo F Dillon Advisor - Labrador Innu Ben Michel Labrador Innu Dave Nuke Labrador Innu Gilbert Pilot Uashat **Team Members:** Joseph Lanzon Terence McKillen	**Summary:** Discussion on possibility of having single negotiating table. Mr. Michel reiterated his belief and desire to have a single negotiating table, however, it was still necessary for him to consult with the Naskapi and the Innu of Matimekush. No specific issues emerged other than economic development and jobs for the communities.

Meeting 5 Nov 2006 Montreal	
Participants: Chief Andree Chief - Uashat Gilbert Pilot Uashat **Team Members:** Joseph Lanzon Dan O'Rourke	**Summary:** Meetings with Band Members and Councilors. Project update.

Meeting 4 Jan 2007 Quebec City	
Participants:	**Summary:** Economic development initiatives to help Schefferville. Mining project

Meeting 4 Jan 2007 Quebec City	
Andre Cote Gilbert Pilot Uashat **Team Members:** Joseph Lanzon Dan O'Rourke	update.

Presentations 16 Jan 2007 Sept-Iles	
Participants: Uashat Band Council **Team Members:** Joseph Lanzon Terence McKillen Dan O'Rourke	**Summary:** Public presentation to new Council of Uashat. LIM review proposed project development and took the new council through the substantive consultation process already initiated with the former Chief and Council.

Meeting 18 Jan 2007 St.John's	
Participants: Norm Mercer Mines Richard Wardle Assistant Deputy Minister - Gov't of NL - Mines **Team Members:** John Kearney Joseph Lanzon Terence McKillen Dan O'Rourke	**Summary:** Introductory Meeting with Mines Ministry Representatives. Necessity to ensure benefits accruing to the province. Consult with Labrador Innu.

Meeting 12 Feb 2007 Schefferville	
Participants: Chief Andree Chief - Uashat Rodrigue Mckenzie **Team Members:** Joseph Lanzon Dan O'Rourke	**Summary:** MOU negotiations.

Meeting 13 Feb 2007 Kawa	
Participants: John Mameamskum Naskapi **Team Members:** Joseph Lanzon Dan O'Rourke	**Summary:** Review project development with Naskapi Leadership and Band members. Discussed economic stimulus from TSH railway.

Email 3 Apr 2007	
Participants: Chief Andree Chief - Uashat Daniel Ashini Labrador Innu **Team Members:** Bill Hooley Joseph Lanzon Terence McKillen	**Summary:** Set up meeting with Daniel Ashini.

Email 5 Apr 2007	
Participants: Marvin Barnes Regional Manager, EA and Major Projects - DFO Michael Cahill Gov't of NL - Environment and Conservation Bill Coulter CEAA **Team Members:** Terence McKillen	**Summary:** Conceptual project description draft.

Email 6 Apr 2007	
Participants: Schefferville Community Labrador Innu **Team Members:** Terence McKillen Dan O'Rourke	**Summary:** Project update.

Email 6 Apr 2007	
Participants: John Mameamskum Naskapi **Team Members:** Joseph Lanzon Terence McKillen Dan O'Rourke	**Summary:** Possible letter from John M. dated April 4.

Email 8 Apr 2007	
Participants: Chief Andree Chief - Uashat Labrador Innu William Johnson **Team Members:** Joseph Lanzon Dan O'Rourke	**Summary:** Band meeting April 11.

Meeting 11 Apr 2007 Schefferville	
Participants: Chief Andree Chief - Uashat William Johnson Chief - Innu Matimekush/Lac John First Nation Jean Marc Robert General Director - Societe de Gestion Innu **Team Members:** Matthew Coon Come Joseph Lanzon Rodrigue Mckenzie Dan O'Rourke	**Summary:** Schefferville negotiation meeting.

Email 29 Apr 2007	
Participants: Paul Wilkinson **Team Members:** Joseph Lanzon Terence McKillen Dan O'Rourke	**Summary:** Contact information for NL and Labrador Consultants.

Meeting 16 May 2007 Montreal	
Participants: Gilbert Pilot Uashat **Team Members:** Joseph Lanzon	**Summary:** Preparations for LIM's corporate presentations in Sept-Iles.

Email 20 Jun 2007	
Participants: John Mameamskum Naskapi **Team Members:** Bill Hooley John Kearney Joseph Lanzon Terence McKillen	**Summary:** TRT MOU.

Email 24 Jul 2007	
Participants: Daniel Ashini Labrador Innu Edgar Branton Leo F Dillon Advisor – Labrador Innu	**Summary:** MOU draft changes. No new issues. LIA is unlikely to participate in direct jobs on site but would participate through LIA businesses and through partnerships with contractors, etc.

Email 24 Jul 2007	
Labrador Innu John Olthuis Lawyer - Labrador Innu-Nation Maggie Wente **Team Members:** Joseph Lanzon Terence McKillen	

Meeting 5 Aug 2007 Schefferville	
Participants: Chief Real McKenzie Chief - Innu Matimekush/Lac John First Nation **Team Members:** Joseph Lanzon	**Summary:** Initial meeting sessions with newly elect Chief Real McKenzie. Review project proposal and importance of TSH railway. Chief recognized that jobs and sustainable economic development are important for his community. Young community with high unemployment. Despite importance of jobs and economy, the land must also be protected. They have to live with IOC's legacy.

Meeting 6 Aug 2007	
Participants: George Ernest Chief - Uashat **Team Members:** Joseph Lanzon	**Summary:** Meeting with newly elected Band Council members and Chief George Ernest.

Email 22 Aug 2007	
Participants: Schefferville Community **Team Members:** Joseph Lanzon Terence McKillen Dan O'Rourke	**Summary:** Meeting planning to Schefferville.

Email 27 Aug 2007	
Participants: Marvin Barnes Regional Manager, EA and Major Projects - DFO Roger Johnson Senior Habitat Biologist - DFO Sigrid Kuehnemund Senior Regional Habitat Biologist - Fisheries and Oceans Canada Shawna Powell Kevin Power Michelle Roberge Habitat Planning and	**Summary:** DFO HADD information package, DFO site visit in September and aquatic program.

Email 27 Aug 2007	
Operation - DFO **Team Members:** Gary Epp Terence McKillen Derek Parks	

Email 31 Aug 2007	
Participants: Jason Kelly Habitat Evaluation Section Assessor - DFO **Team Members:** Gary Epp Terence McKillen Derek Parks	**Summary:** Update on DFO site visit in September; Fish Habitat Compensation staff to attend; Presentation of project details.

Meeting 9 Sep 2007 Quebec City	
Participants: Chief Real McKenzie Chief - Innu Matimekush/Lac John First Nation **Team Members:** Joseph Lanzon	**Summary:** Meeting with Chief Real McKenzie and other Band Council members.

Email 14 Sep 2007	
Participants: Daniel Ashini Labrador Innu Labrador Innu John Olthuis Lawyer - Labrador Innu-Nation **Team Members:** Joseph Lanzon Terence McKillen	**Summary:** Revised MOU.

Email 22 Sep 2007	
Participants: Leo F Dillon Advisor - Labrador Innu Mark Nui Grand Chief Labrador Innu Peter Penashue Deputy Grand Chief - Labrador Innu **Team Members:** Terence McKillen	**Summary:** Election results.

Other 28 Sep 2007	
Participants: Chief Andree Chief - Uashat **Team Members:** Joseph Lanzon Dan O'Rourke	**Summary:** Participated in Youth Retreat organized by Band Councils for Uashat and Matimekush. Presentation of project.

Meeting 12 Oct 2007 **Toronto**	
Participants: Chief Philip Einish – Naskapi Paul Wilkinson **Team Members:** John Kearney Terence McKillen	**Summary:** Overview of project. Chief Einish indicated community need for jobs and development. Need to protect the environment.

Meeting 29 Oct 2007 Montreal	
Participants: J Pratt Legal Counsel - Paul Wilkinson **Team Members:** John Kearney Joseph Lanzon	**Summary:** Naskapi MOU discussion.

Email 19 Nov 2007	
Participants: Labrador Innu Chief Real McKenzie Chief - Innu Matimekush/Lac John First Nation **Team Members:** Joseph Lanzon Terence McKillen	**Summary:** Schefferville and Naskapi draft MOU and December 4th to 5th meeting.

Email 23 Nov 2007	
Participants: Labrador Innu Chief Real McKenzie Chief - Innu Matimekush/Lac John First Nation **Team Members:** Erick Chavez John Kearney Joseph Lanzon Terence McKillen	**Summary:** December 6th to 7th Schefferville travel arrangements and meeting with Labrador Innu.

Email 28 Nov 2007	
Participants: Peter Penashue Deputy Grand Chief - Labrador Innu **Team Members:** Matthew Coon Come Joseph Lanzon Terence McKillen	**Summary:** December meeting in Goose Bay.

Meeting 6 Dec 2007 Schefferville	
Participants: Council Matimekush Chief Real McKenzie Chief - Innu Matimekush/Lac John First Nation **Team Members:** Erick Chavez Matthew Coon Come John Kearney Joseph Lanzon Terence McKillen	**Summary:** Meeting with Matimekush - Council and Community. Review project update and use of TSH railway. Council members indicated support for LIM proposal and reiterated need to participate in economic benefit this time.

Meeting 7 Dec 2007 Goose Bay	
Participants: Mark Nui Grand Chief - Labrador Innu Peter Penashue Deputy Grand Chief - Labrador Innu Chief Anastasia Quepee Chief Prote Poker **Team Members:** Erick Chavez Matthew Coon Come John Kearney Joseph Lanzon Terence McKillen	**Summary:** Introduction to new council and Innu leadership. LIA introduced economic development corporation and the businesses associated with their community. They feel that it is unrealistic to assume that very many of their community would seek jobs in Schefferville area operations but their businesses would very definitely wish to bid on provision of goods and services. It was noted that the LIA partnership with SNC Lavalin for engineering work in the Province was nearing completion and that LIM had already engaged SNC to prepare a Technical Report and to continue with engineering design work.

Meeting 7 Dec 2007 Kawawachikamach	
Participants: Phillip Einish Chief - Naskapi **Team Members:** Erick Chavez Matthew Coon Come John Kearney Joseph Lanzon	**Summary:** Community Visit and Presentation to Chief and Administrators. MoU discussion.

Meeting 7 Dec 2007 Kawawachikamach	
Terence McKillen	

Meeting 11 Dec 2007 Ottawa	
Participants: Labrador Innu **Team Members:** Joseph Lanzon	**Summary:** Labrador Innu business opportunities IBA discussion. Partnership on procurement.

Meeting 9 Jan 2008 St. John's	
Participants: Chief Anastasia Quepee Labrador Innu Grand Chief Marc Innu Labrador Innu Peter Penashue Deputy Grand Chief - Labrador Innu Chief Prote Poker Paul Rich Innu Development Corp **Team Members:** Joseph Lanzon Terence McKillen	**Summary:** IBA process and final MoU negotiations. MoU provides for community support for the project and focuses on economic participation, opportunity for Innu businesses, community consultation on issues such as training, environmental, heritage and cultural protection, etc. MoU executed.

Meeting 21 Jan 2008 **Wabush**	
Participants: Mayor Wabush Mayor Labrador City **Team Members:** Joseph Lanzon Bill Hooley	Meeting with the mayors of Labrador City and Wabush. Provide project overview and update.

Meeting 4 Feb 2008 St. John's	
Participants: Labrador Innu **Team Members:** Matthew Coon Come Joseph Lanzon	**Summary:** Negotiating IBA.

Meeting 25 Feb 2008 **Quebec City**	
Participants: Innu Chiefs of Uashat and	**Summary:** Project update. Discussion on TSH Railway.

Meeting 25 Feb 2008 **Quebec City**	
Matimekush and council members **Team Members:** John Kearney Terence McKillen Joseph Lanzon	

Meeting 28 Feb 2008 Sept-Iles	
Participants: Representative New Millenium **Team Members:** Marc Duclos Joseph Lanzon Terence McKillen	**Summary:** LIM Project Presentation - TSH Board Meeting.

Meeting 29 Feb 2008 St. John's	
Participants: Vanessa Rodrigues CEAA Marvin Barnes DFO Randy Decker Transport Canada Alen Troke Environment & Conservation Bill Coulter CEAA Michael Cahill Gov't of NL - Environment and Conservation Carol Grant DFO **Team Members:** Linda Wrong Derek Parks	**Summary:** Joint Provincial/Federal Regulatory meeting with LIM to discuss the draft Project Registration document and to identify any issues. No serious identified.

Meeting 3 Mar 2008 PDAC Toronto	
Participants: Chief - Montagnais-Schefferville Chief - Montagnais - Sept-Iles **Team Members:** Marc Duclos	**Summary:** Chief of Montagnais - Sept-Iles and Chief of Montagnais Schefferville. Rail discussion.

Meeting 3 Mar 2008 PDAC Toronto	
Joseph Lanzon	

Meeting 4 Mar 2008	
Participants: Minister Dunderdale Dick Wardle **Team Members:** Linda Wrong Bill Hooley Joseph Lanzon John Kearney Terence McKillen Matthew Coon Come	**Summary:** Presentation to Minister Dunderdale and Dick Wardle.

Email 4 Mar 2008	
Participants: Michael Cahill Gov't of NL - Environment and Conservation Patrick Marrie Gov't of NL - Environment and Conservation Carl Strong Department of Environment and Conservation **Team Members:** Linda Wrong	**Summary:** St. John's meeting, Crown Land Referral, acceptability of bulk sample for metallurgical purposes.

Commitment 13 Mar 2008 Youth Centre	
Participants: Council Matimekush **Team Members:** Joseph Lanzon Terence McKillen John Kearney Linda Wrong Matthew Coon Come	**Summary:** Signing of MOU - with Matimekush. MoU provides for community support for the project and emphasizes job opportunities, business participation, development of the TSH railway, economic participation, and training as well as consultation with the community over environmental, cultural and heritage issues.

Meeting 14 Mar 2008 **Kawa**	
Participants: Chief Philp Einish **Team Members:**	Project update and presentation of final MOU for signature. MoU provides for community support for the project and emphasizes job opportunities, business participation, development of the TSH railway, economic participation, and training as well as consultation with the community over environmental, cultural and heritage issues.

Meeting 14 Mar 2008 **Kawa**	
John Kearney Terence McKillen Joseph Lanzon	

Email 19 Mar 2008	
Participants: Chantale Basque Principal - Schefferville School Schefferville Schools **Team Members:** Rodrigue Mckenzie Linda Wrong	**Summary:** Dates of the opening of Schefferville School and interest in catering.

Email 4 Apr 2008	
Participants: Daniel Andre Helper - Schefferville Community Benedict Mckenzie Helper - Schefferville Community **Team Members:** Rodrigue Mckenzie Derek Parks Linda Wrong	**Summary:** Resource/machinery and helpers discussions.

Email 4 Apr 2008	
Participants: Schefferville Community **Team Members:** Rodrigue Mckenzie Linda Wrong	**Summary:** Plans to attend conference and plans to meet with community elders.

Email 11 Apr 2008	
Participants: Marvin Barnes Regional Manager, EA and Major Projects - DFO Michael Cahill Gov't of NL - Environment and Conservation Bill Coulter CEAA Len Mandville Mineral Development Geologist - Gov't of NL - Mines	**Summary:** Confirmation of St. John's meeting location and time.

Email 11 Apr 2008	
Team Members: Terence McKillen Linda Wrong	

Email 14 Apr 2008	
Participants: Marvin Barnes Regional Manager, EA and Major Projects - DFO Jason Kelly Habitat Evaluation Section Assessor - DFO **Team Members:** Derek Parks Linda Wrong	**Summary:** Discussion to complete scientific fish collection activities, DFO fish collection permit.

Meeting 16 Apr 2008 Sept-Iles	
Participants: COPIC **Team Members:** Marc Duclos Joseph Lanzon	**Summary:** LIM Presentation to COPIC - Economic Development Corporation of Sept-Iles

Meeting 17 Apr 2008	
Participants: Pierre Gagnon Port of Sept-Iles Raynald Quellet Port of Sept-Iles **Team Members:** Marc Duclos	**Summary:** Meeting with Port of Sept-Iles

Meeting 17 Apr 2008 **Toronto**	
Participants: Grand Chief – Mark Nui (LIA) Deputy Grand Chief Peter Penashue Chief Anastasia Quepee Chief Prote Poker Simon Michel John Olthius **Team Members:** Joseph Lanzon Terence McKillen Matthew Coon Come	**Summary:** IBA schedule preparation.

Email 21 Apr 2008	
Participants: Schefferville Community **Team Members:** Rodrigue Mckenzie Terence McKillen Derek Parks Linda Wrong	**Summary:** Request for program helpers.

Meeting 22 Apr 2008	
Participants: Chief Georges Ernest Gregoire - Uashat **Team Members:** Joseph Lanzon	**Summary:** MOU schedule preparation.

Commitment: 22 Apr 2008	
Participants: Chief Philip Einish – Naskapi **Team Members:** John Kearney Terence McKillen	**Summary:** Sign MOU.

Email 27 Apr 2008	
Participants: John Mameamskum Naskapi **Team Members:** Terence McKillen Derek Parks Linda Wrong	**Summary:** Reimbursement and rental rates. Community helpers.

Meeting 30 Apr 2008 Ottawa	
Participants: Ministry of Indian Affairs Railway Association of Canada **Team Members:** Marc Duclos Joseph Lanzon	**Summary:** LIM Presentation to Ministry of Indian Affairs and The Railway Association of Canada (RAC).

Meeting 8 May 2008 **Halifax**	
Participants: Mark Nui – Labrador Innu Peter Penashue John Olthius	**Summary:** Negotiation table for IBA. No new issues.

Meeting 8 May 2008 **Halifax**	
Gerry Kerr Simon Michel **Team Members:** Terence McKillen Joseph Lanzon	

Phone Call 13 May 2008	
Participants: Paul Rich Innu Development Corp **Team Members:** Terence McKillen	**Summary:** Update on Innu-SNC JV.

Email 14 May 2008	
Participants: Schefferville Community **Team Members:** Rodrigue Mckenzie Linda Wrong	**Summary:** Community meeting reminder and details.

Meeting 20 May 2008 **Sept-Iles**	
Participants: Richard Bell TSH Team Members: Marc Duclos	Summary: LIM Operating Schedule Mid 2009.

Meeting 20 May 2008 **Sept-Iles**	
Participants: Richard Bell TSH **Team Members:** Gilles Blouin Marc Duclos	Summary: Technical Operating Meeting.

Meeting 26 May 2008 Montreal	
Participants: Council Matimekush Chief Real McKenzie Chief - Innu Matimekush/Lac John First Nation **Team Members:**	**Summary:** Review of LIM Project

Meeting 26 May 2008 Montreal	
Marc Duclos Joseph Lanzon	

Email 26 May 2008	
Participants: Schefferville Community Schefferville Schools **Team Members:** Rodrigue Mckenzie Linda Wrong	**Summary:** Clarification of LIM Schefferville visit and LIM's offer to provide graduation robes.

Email 28 May 2008	
Participants: Schefferville Schools **Team Members:** Rodrigue Mckenzie Linda Wrong	**Summary:** LIM buys and delivers graduation robes and caps to Shefferville graduates.

Email 28 May 2008	
Participants: Heather Cranford NL Human Resources John Davis Director, Mineral Resources Mines Branch - Newfoundland Government Randy Decker Senior Environmental Assessment Officer - Transport Canada Garry R. Gosse NL Transportation and Works Dan Gulliver NL Human Resources Michael Harvey NL Intergovernmental Affairs Cluney Mercer NL Transportation and Works Dan Michielsen NL Pollution Prevention Dexter Pitman NL Pollution Prevention Paul Rideout Environmental Scientist - Gov't of NL - EA Division, Dept. of Environment and Conservation NL Dept. of Justice NL Dept. of Aboriginal and	**Summary:** Date confirmation of screening committee meeting, St. John's, NL, and partial list of attendees.

Email 28 May 2008	
Labrador Affairs NRCAN (telecon) **Team Members:** Linda Wrong Joanne Robinson Derek Parks	

Email 29 May 2008	
Participants: John Davis Director, Mineral Resources Mines Branch - Newfoundland Government **Team Members:** Linda Wrong	**Summary:** Travel plans to St. Johns for a meeting with the Department of Environment and Conservation.

Email 30 May 2008	
Participants: Marvin Barnes Regional Manager, EA and Major Projects - DFO Bill Coulter CEAA Randy Decker Senior Environmental Assessment Officer - Transport Canada Garry R. Gosse NL Transportation and Works Len Mandville Mineral Development Geologist - Gov't of NL - Mines Kathy Martin Gov't of NL Bill Parrott Deputy Minister - Gov't of NL - Environment and Conservation Paul Rideout Environmental Scientist - Gov't of NL - EA Division, Dept. of Environment and Conservation Vanessa Rodrigues Senior Program Officer - CEA Agency **Team Members:** Derek Parks Linda Wrong	**Summary:** Meeting arrangements in St. John's concerning the registration document with Province and Federal Regulators.

Email 30 May 2008	
Participants: John Mameamskum Naskapi **Team Members:** John Kearney Linda Wrong	**Summary:** Discussion of education and dates of Schefferville visit.

Meeting 2 Jun 2008 Sept-Iles	
Participants: Uashat Band Council **Team Members:** Matthew Coon Come Marc Duclos Joseph Lanzon Terence McKillen	**Summary:** MOU Negotiation. The community is interested in jobs and business development. Families that hold trap line lots may need to be compensated.

Meeting 2 Jun 2008 St. John	
Participants: Vanessa Rodrigues Senior Program Officer - CEA Agency Annette Tobin NRCAN/MPMO **Team Members:** Linda Wrong Derek Parks Joanne Robinson	**Summary:** Meeting with MPMO and CEAA. Project not likely to trigger MPMO.

Meeting 2 Jun 2008 St. John's	
Participants: Heather Cranford NL Human Resources John Davis Director, Mineral Resources Mines Branch - Newfoundland Government Randy Decker Senior Environmental Assessment Officer - Transport Canada Garry R. Gosse NL Transportation and Works Dan Gulliver NL Human Resources Michael Harvey NL Intergovernmental Affairs Cluney Mercer NL Transportation and	**Summary:** Meeting with Provincial and Federal Regulators, LIM and Consultants.

Meeting 2 Jun 2008 St. John's	
Works Dan Michielsen NL Pollution Prevention Dexter Pitman NL Pollution Prevention Paul Rideout Environmental Scientist - Gov't of NL - EA Division, Dept. of Environment and Conservation NL Dept. of Justice NL Dept. of Aboriginal and Labrador Affairs NRCAN (telecon) **Team Members:** Linda Wrong Joanne Robinson Derek Parks	

Email 2 Jun 2008	
Participants: John Mameamskum Naskapi Curtis Tootoosis Principal - Jimmy Sandy Memorial School **Team Members:** John Kearney	**Summary:** Discussion of educational support from LIM for Kawa schools.

Meeting 3 Jun 2008 Sept-Iles	
Participants: Pierre Gagnon Port of Sept-Iles Carol Soucy Port of Sept-Iles **Team Members:** Matthew Coon Come Marc Duclos Joseph Lanzon Terence McKillen	**Summary:** Review and Update of LIM Project.

Meeting 4 Jun 2008 Happy Valley-Goose Bay	
Participants: Fred Hall Innu Development Ltd. Partnership Wayne Kelsie Innu Development Ltd. Partnership	**Summary:** Project Overview and discussion of environmental program.

Meeting 4 Jun 2008 Happy Valley-Goose Bay	
Paula Reid Innu Nation **Team Members:** Linda Wrong	

Meeting 4 Jun 2008 Happy Valley-Goose Bay	
Participants: Paul Aylward - Department of Crown Lands **Team Members:** Linda Wrong	**Summary:** Surface title application and confirmation that correct process being followed.

Meeting 4 Jun 2008 **Toronto**	
Participants: Nadir Andre – lawyer Matimekush Innu **Team Members:** Joseph Lanzon Terence McKillen	**Summary**: Discussion on commercial agreement arising from MoU.

Email 5 Jun 2008	
Participants: Paul Rideout Environmental Scientist - Gov't of NL - EA Division, Dept. of Environment and Conservation **Team Members:** Linda Wrong	**Summary:** Baseline water quality data to Province.

Email 9 Jun 2008	
Participants: Michael Cahill Gov't of NL - Environment and Conservation Deborah Clements Bill Coulter CEAA Livain Michaud Debra Myles CEAA Paul Rideout Environmental Scientist - Gov't of NL - EA Division, Dept. of Environment and Conservation	**Summary:** Federal coordination notice and Spring 2008 environmental baseline program to address outstanding information requirements.

Email 9 Jun 2008	
Vanessa Rodrigues Senior Program Officer - CEA Agency Annette Tobin NRCAN/MPMO Glenn Troke Julie Whiteway Jerry Wolchuck **Team Members:** Linda Wrong Joanne Robinson Derek Parks Bruce Bennett	

Email 10 Jun 2008	
Participants: Michael Cahill Gov't of NL - Environment and Conservation Randy Decker Senior Environmental Assessment Officer - Transport Canada Jason Kelly Habitat Evaluation Section Assessor - DFO Paul Rideout Environmental Scientist - Gov't of NL - EA Division, Dept. of Environment and Conservation Vanessa Rodrigues Senior Program Officer - CEA Agency **Team Members:** Marc Duclos Bill Hooley John Kearney Linda Wrong	**Summary:** Confirmation that no major undertakings are necessary for the rail line, need for a decision regarding culverts.

Email 11 Jun 2008	
Participants: Linda Poitras Naskapi Development Corporation Schefferville Schools Curtis Tootoosis Principal - Jimmy Sandy Memorial School **Team Members:** Bill Hooley John Kearney Joseph Lanzon Terence McKillen John Rogers	**Summary:** Schefferville Graduation. Linda Wrong attends and provides awards to graduates.

Email 11 Jun 2008	
Linda Wrong	

Email 14 Jun 2008	
Participants: Schefferville Community Linda Poitras Naskapi Development Corporation Jean Marc Robert General Director - Societe de Gestion Innu Schefferville Schools **Team Members:** Erick Chavez Rodrigue Mckenzie Terence McKillen Linda Wrong	**Summary:** Schefferville visit by Linda Wrong

Email 18 Jun 2008	
Participants: Schefferville Community **Team Members:** Rodrigue Mckenzie Linda Wrong	**Summary:** Program update.

Email 25 Jun 2008	
Participants: Team **Team Members:** Erick Chavez Bill Hooley Joseph Lanzon Rodrigue Mckenzie Terence McKillen Derek Parks Joanne Robinson Linda Wrong	**Summary:** Environmental monitoring hiring and training for all sites.

Email 25 Jun 2008	
Participants: Michael Cahill Gov't of NL - Environment and Conservation Labrador Innu Paul Rideout Environmental Scientist - Gov't of NL - EA Division, Dept. of Environment and Conservation **Team Members:** Joseph Lanzon	**Summary:** Update on IBA discussions with Labrador Innu.

Email 25 Jun 2008	
Linda Wrong	

Meeting 27 Jun 2008 Sept-Iles & Schefferville	
Participants: Tommy Volant President - TRT **Team Members:** Marc Duclos Bill Hooley	**Summary:** TRT train from Sept-Iles to Schefferville.

Meeting 28 Jun 2008 Schefferville	
Participants: Chief Real McKenzie Chief - Innu Matimekush/Lac John First Nation **Team Members:** Marc Duclos Bill Hooley Joseph Lanzon	**Summary:** Meeting with Chief Real McKenzie.

Meeting 4 Jul 2008	
Participants: Peter Penashue Labrador Innu Chief Georges Ernest Gregoire Uashat Chief Real McKenzie Chief - Innu Matimekush/Lac John First Nation **Team Members:** Joseph Lanzon	**Summary:** Project overview.

Meeting 8 Jul 2008	
Participants: Gerry Kerr – advisor to Labrador Innu **Team Members:** Joseph Lanzon Terence McKillen	**Summary:** Final amendments to IBA document. Ready for signature.

Email 9 Jul 2008	
Participants: Chantale Basque	**Summary:** Educational support

Email 9 Jul 2008	
Principal - Schefferville School Schefferville Schools **Team Members:** Joseph Lanzon Rodrigue Mckenzie Linda Wrong	

Email 9 Jul 2008	
Participants: Chantale Basque Principal - Schefferville School Schefferville Community Schefferville Schools Curtis Tootoosis Principal - Jimmy Sandy Memorial School **Team Members:** Joseph Lanzon Rodrigue Mckenzie Linda Wrong	**Summary:** Update on laptops; guidelines for community support next year. LIM waiting to organize meeting with trappers/traditional knowledge.

Phone Call 14 Jul 2008	
Participants: Fred Hall Business Manager - Innu Development Limited Partnership **Team Members:** Terence McKillen	**Summary:** Innu business opportunities. IDLP to provide updated list of qualified businesses and individuals in the communities.

Email 16 Jul 2008	
Participants: Schefferville Community **Team Members:** Erick Chavez Joseph Lanzon Rodrigue Mckenzie Terence McKillen Linda Wrong	**Summary:** Newsletters and appearances on local radio station to provide project updates.

Commitment: 17 Jul 2008 **Quebec City**	
Participants: Labrador Innu **Team Members:** Joseph Lanzon John Kearney Terence McKillen	**Summary:** Signing of Impact Benefit Agreement (IBA).

Email 18 Jul 2008	
Participants: Chief Real McKenzie Chief - Innu Matimekush/Lac John First Nation **Team Members:** Joseph Lanzon Linda Wrong	**Summary:** Project development.

Email 18 Jul 2008	
Participants: Chief Real McKenzie Chief - Innu Matimekush/Lac John First Nation **Team Members:** Joseph Lanzon Linda Wrong	**Summary:** Update to Chief Real

Email 21 Jul 2008	
Participants: Schefferville Community **Team Members:** Marc Duclos Bill Hooley John Kearney Joseph Lanzon Terence McKillen Linda Wrong	**Summary:** Information on Aboriginal-owned cell phone provider.

Email 21 Jul 2008	
Participants: Schefferville Community Schefferville Schools **Team Members:** Marc Duclos Joseph Lanzon Rodrigue Mckenzie Terence McKillen Linda Wrong	**Summary:** Project update.

Public Communication 31 Jul 2008	
Participants: Schefferville Community **Team Members:** Linda Wrong	**Summary:** First Nations Yearbook advertisement: plans in Schefferville.

Public Meeting 11 Aug 2008 Schefferville, Quebec	
Participants: Schefferville Community **Team Members:** Joseph Lanzon Rodrigue Mckenzie Derek Parks Linda Wrong	**Summary:** Project overview, traditional knowledge information review and sharing with Elders, discussion of all project issues particularly environmental and including presentation of baseline information, confirmation of wildlife, avifauna presence, caribou, etc.

Meeting 13 Aug 2008 Sept-Iles	
Participants: Port of Sept-Iles Authority Management - TRT **Team Members:** Marc Duclos	**Summary:** LIM Project Meeting.

Meeting 18 Aug 2008 Kawawachikamach	
Participants: Ruby Sandy Robinson Administrative Director - Naskapi Development Corporation **Team Members:** Rodrigue Mckenzie Paul Thibaudeau	**Summary:** Discussion with Ruby Sandy Robinson of Naskapi Development Corporation.

Meeting 19 Aug 2008 Kawawachikamach	
Participants: Phillip Einish Chief - Naskapi **Team Members:** Rodrigue Mckenzie Paul Thibaudeau	**Summary:** Met with Chief Phillip Einish.

Meeting 19 Aug 2008 Kawawachikamach	
Participants: Ruby Sandy Robinson Administrative Director - Naskapi Development Corporation **Team Members:** Rodrigue Mckenzie Paul Thibaudeau	**Summary:** Meeting with Ruby Sandy Robinson and Rodrigue McKenzie about community.

Meeting 19 Aug 2008 Jimmy Sandy Memorial School, Kawawachikamach	
Participants: Curtis Tootoosis Principal - Jimmy Sandy Memorial School **Team Members:** Rodrigue Mckenzie Paul Thibaudeau	**Summary:** Meeting with school.

Meeting 19 Aug 2008 Local Community Service Centre, Kawawachikamach	
Participants: Marcel Lortie Director General - CLSC Health Centre **Team Members:** Rodrigue Mckenzie Paul Thibaudeau	**Summary:** Discussion of CLSC operating capacity.

Meeting 19 Aug 2008 Kawawachikamach	
Participants: Theresa Chemaganish Training and Management Facilitator - Management Board, NDC **Team Members:** Rodrigue Mckenzie Paul Thibaudeau	**Summary:** Training and education.

Meeting 19 Aug 2008 Band Office, Kawawachikamach	
Participants: Sampson Einish **Team Members:** Rodrigue Mckenzie Paul Thibaudeau	**Summary:** Naskapi Nation employment.

Meeting 19 Aug 2008 Kawawachikamach	
Participants: Barry Einish Computer Technician - Naskapi Imuun Inc. **Team Members:** Rodrigue Mckenzie Paul Thibaudeau	**Summary:** Discussion with Barry Einish.

Meeting 19 Aug 2008 Sachidun Day Care, Kawawachikamach	
Participants: Myna Mameanskum Director - Sachidun Day Care **Team Members:** Rodrigue Mckenzie Paul Thibaudeau	**Summary:** Day care capacity discussions.

Meeting 20 Aug 2008 Innu Band Office	
Participants: Chief Real McKenzie Chief - Innu Matimekush/Lac John First Nation **Team Members:** Rodrigue Mckenzie John Rogers Paul Thibaudeau	**Summary:** Project update

Meeting 20 Aug 2008 Conseil de la Nation Innu Matimekush-Lac John	
Participants: Marc Jean Pierre Employment Officer - Conseil de la Nation Innu Matimekush-Lac John **Team Members:** Paul Thibaudeau	**Summary:** Discussions with Marc Jean Pierre.

Meeting 20 Aug 2008 LIM Schefferville Office	
Participants: Chantale Basque Principal - Schefferville School **Team Members:** Rodrigue Mckenzie Paul Thibaudeau	**Summary:** Schefferville school operating capacity.

Meeting 21 Aug 2008 Schefferville	
Participants: Marcella Beaudoin Administrator - Town of Schefferville **Team Members:** Paul Thibaudeau	**Summary:** Official contact with Administrator for Town of Schefferville.

Meeting 21 Aug 2008 Schefferville Airport	
Participants: Gervais Boudreau Fire Chief and Director of Transport - Town of Schefferville **Team Members:** Paul Thibaudeau	**Summary:** Fire fighting and airport capacity.

Meeting 21 Aug 2008 Schefferville Airport	
Participants: Sylvain Vollant Recreation Director - Nation Innu Matimekush-Lac John **Team Members:** Paul Thibaudeau	**Summary:** Policing service and recreation facilities for youth.

Meeting 21 Aug 2008 Northern Store, Schefferville	
Participants: M. Fortunat Manager - Northern Store **Team Members:** Rodrigue Mckenzie Paul Thibaudeau	**Summary:** Meeting with M. Fortunat of Northern Store.

Meeting 21 Aug 2008 Schefferville	
Participants: Gilles Porlier Businessman - Gestion Porlier Ltee **Team Members:** Rodrigue Mckenzie Paul Thibaudeau	**Summary:** Tour and information about Gestion Porlier Ltee.

Meeting 21 Aug 2008 Hotel Royal, Schefferville	
Participants: Sylvie Fortier Co-Owner with Albert Fortier - Hotel Royal Ltd. **Team Members:** Rodrigue Mckenzie Paul Thibaudeau	**Summary:** Details of accommodations and services offered by Mr. and Mrs. Fortier.

Meeting 21 Aug 2008 Schefferville	
Participants: Jean Marc Robert General Director - Societe de Gestion Innu **Team Members:** Rodrigue Mckenzie Paul Thibaudeau	**Summary:** Details of Societe Gestion Innu services and equipment.

Meeting 21 Aug 2008 Kawawachikamach	
Participants: Jimmy James Einish Deputy Chief and Director of Recreation - Band Council of Naskapi Nation of Kawawachikamach **Team Members:** Rodrigue Mckenzie Paul Thibaudeau	**Summary:** Meeting with Deputy Chief/Recreation Director.

Meeting 21 Aug 2008 Kawawachikamach	
Participants: Samuel Pien Director - Naskapi Police Force **Team Members:** Rodrigue Mckenzie Paul Thibaudeau	**Summary:** Discussion re: Naskapi Police Force.

Meeting 21 Aug 2008 Kawawachikamach	
Participants: Paul Mameanskum Councillor and Director - Naskapi Nation Band Council and Department of Public Works **Team Members:** Rodrigue Mckenzie Paul Thibaudeau	**Summary:** Description of some Public Works equipment and functional characteristics.

Meeting 22 Aug 2008 Kawawachikamach	
Participants: George Guanish Administrator - Hunter Support Programme Committee **Team Members:**	**Summary:** Hunting and training discussions.

Meeting 22 Aug 2008 Kawawachikamach	
Paul Thibaudeau	

Meeting 3 Sep 2008 Sept-Iles	
Participants: Port of Sept-Iles Authority Management - TRT **Team Members:** Marc Duclos	**Summary:** Review of Project Status.

Phone Call 29 Sep 2008	
Participants: Marcella Beaudoin Administrator - Town of Schefferville **Team Members:** John Kearney	**Summary:** Discussion on social services in Schefferville.

Meeting 7 Oct 2008 Sept-Iles	
Participants: Jean Marc Robert General Director - Societe de Gestion Innu **Team Members:** Marc Duclos	**Summary:** Bulk sample shipment discussion.

Meeting 7 Oct 2008 Sept-Iles	
Participants: Donald Gonthier Jean Marc Robert General Director - Societe de Gestion Innu Raoul Thibeault John Velis **Team Members:** Marc Duclos Joseph Lanzon	**Summary:** Contracts review and partnerships discussions.

Phone Call 8 Oct 2008	
Participants: Marcella Beaudoin Administrator - Town of Schefferville **Team Members:** Linda Wrong	**Summary:** Official contact with Administrator of Town of Schefferville.

Meeting 10 Oct 2008	
Participants: Chief Real McKenzie Chief - Innu Matimekush/Lac John First Nation **Team Members:** Marc Duclos Joseph Lanzon	**Summary:** Project update.

Meeting 13 Oct 2008 Sept-Iles	
Participants: Labrador Innu Chief Real McKenzie Chief - Innu Matimekush/Lac John First Nation Tommy Volant President - TRT **Team Members:** Marc Duclos Joseph Lanzon	**Summary:** Business opportunities.

Meeting 13 Oct 2008	
Participants: Council Matimekush **Team Members:** Joseph Lanzon	**Summary:** AGM Band members meeting in Matimekush. Project update.

Meeting 30 Oct 2008 Newfoundland Delta Hotel	
Participants: Jim Farrell Mayor - Wabush Graeme Letto Mayor - Labrador City **Team Members:** John Kearney Joseph Lanzon Terence McKillen	**Summary:** To pursue possibility of holding a joint meeting with their respective councils and to address the Labrador West Chamber of Commerce.

Meeting 30 Oct 2008 St. John	
Participants: Allison Dancey Policy and Prog. Development Specialist - Gov't of NL - Natural Resources Hon. Kathy Dunderdale	**Summary:** Meeting with Representatives Department of Education and Woman's Policy to increase training, education and leadership positions for women in the industry.

Meeting 30 Oct 2008 St. John	
Minister - Department of Education and Woman's Policy Heather MacLellan Assistant Deputy Minister - Ex. Council,Ex. Support - Gov't of NL - Women's Policy Office **Team Members:** Joseph Lanzon Joanne Robinson Linda Wrong	

Meeting 30 Oct 2008 St. John	
Participants: Hon. John Hickey Minister of Labrador Affairs - Lake Melville District - Gov't of NL - Labrador and Aboriginal Affairs Peter Penashue Deputy Grand Chief - Labrador Innu Hon. Patty Pottle Minister Aboriginal Affairs - Gov't of NL - Aboriginal Affairs **Team Members:** John Kearney Joseph Lanzon Terence McKillen Linda Wrong	**Summary:** Discussion of the entire project, job and commercial opportunities and the impact for the province as a whole, for Labrador and specifically for the Central and Northern part of Labrador.

Phone Call 31 Oct 2008 Schefferville	
Participants: Frances Duberco Director - Duberco, Inc. **Team Members:** Paul Thibaudeau	**Summary:** Information on services.

Phone Call 31 Oct 2008 Schefferville	
Participants: Jean-Pierre Ouellette Guide and Business Owner - Auberge Wedge Hills **Team Members:** Paul Thibaudeau	**Summary:** Details of local hunting guide outfit.

Phone Call 31 Oct 2008 Schefferville	
Participants: Joseph Dominique Caribou Hunter - Innu Nation **Team Members:** Paul Thibaudeau	**Summary:** Survey Calls for Hunting Camps in Schefferville.

Meeting 31 Oct 2008 St. John	
Participants: Greg Jones Senior Business Development Analyst - NL Hydro Derrick Sturge Vice-President Finance & CFO - NL Hydro Glenn Winsor Asset Manager - Menihek Generating Station - NL Hydro **Team Members:** John Kearney Joseph Lanzon Terence McKillen	**Summary:** Provision of electrical power supply.

Phone Call 3 Nov 2008 Jimmy Sandy Memorial School	
Participants: Fred Curtis Vice-Principal - Jimmy Sandy Memorial School **Team Members:** Paul Thibaudeau	**Summary:** Information about number of teachers and pupils at the school.

Phone Call 3 Nov 2008 Schefferville	
Participants: Marc Jean Pierre Employment Officer - Conseil de la Nation Innu Matimekush-Lac John **Team Members:** Paul Thibaudeau	**Summary:** Occupation discussions.

Phone Call 4 Nov 2008 Kawawachikamach	
Participants: James Pien Project Manager - Public	**Summary:** Details about Public Works Equipment and Staff.

Phone Call 4 Nov 2008 Kawawachikamach	
Works, Kawawachikamach **Team Members:** Paul Thibaudeau	

Phone Call 4 Nov 2008 Montreal	
Participants: Christopher Coggan Researcher - Atmacinta Consulting Inc. **Team Members:** Paul Thibaudeau	**Summary:** Consultation Services on Economic Development for EIS.

Phone Call 7 Nov 2008 Schefferville	
Participants: Marcella Beaudoin Administrator - Town of Schefferville **Team Members:** Paul Thibaudeau	**Summary:** Capacities of the Town of Schefferville

Meeting 20 Nov 2008 Wabush/Lab City	
Participants: Mayor - Council of Wabush Mayor Wabush **Team Members:** John Kearney Joseph Lanzon	**Summary:** Meeting with Mayors and Councils of Wabush and Labrador City- Project Overview and municipal procurement.

Meeting 21 Nov 2008 Goose-Bay	
Participants: Chief Anastasia Labrador Innu Brian King Manager, Business Development - Innu Business development Centre Mark Nui Labrador Innu Peter Penashue Deputy Grand Chief - Labrador Innu **Team Members:** John Kearney Joseph Lanzon	**Summary:** Meeting with Innu Development Corp. Aboriginal procurement discussion.

Public Meeting 26 Nov 2008 Hotel North 2 - Goose Bay	
Participants: Paul Rideout Environmental Scientist - Gov't of NL - EA Division, Dept. of Environment and Conservation **Team Members:** Joseph Lanzon Terence McKillen Linda Wrong	**Summary:** Public Meeting pursuant to the EIS process in Goose Bay. Participants very supportive. No environmental issues were raised. Communities interested in business opportunities and whether Goose Bay might be a fly-in point.

Public Meeting 27 Nov 2008 Wabush Hotel - Wabush, Labrador City	
Participants: Mayor Council of Wabush Paul Rideout Environmental Scientist - Gov't of NL - EA Division, Dept. of Environment and Conservation **Team Members:** Joseph Lanzon Terence McKillen Linda Wrong	**Summary:** Public Meeting pursuant to the EIS process in Wabush-Labrador City. Participants very supportive. No environmental concerns. People seemed interested in job opportunities. Administrator confirmed support.

Meeting 28 Nov 2008 Schefferville	
Participants: Marcella Beaudoin Administrator - Town of Schefferville **Team Members:** Joseph Lanzon Rodrigue Mckenzie Terence McKillen Linda Wrong	**Summary:** Potential demand for municipal services.

Meeting 28 Nov 2008 Schefferville	
Participants: Helen Littlejohn Board Member - Schefferville Health Dispensary **Team Members:** Joseph Lanzon Rodrigue Mckenzie Terence McKillen Linda Wrong	**Summary:** Discussion on availability of medical services.

Public Meeting 28 Nov 2008 Salle du Court Municipal - Schefferville	
Participants: Schefferville Community Marcella Beaudoin Administrator – Town of Schefferville Paul Rideout Environmental Scientist - Gov't of NL - EA Division, Dept. of Environment and Conservation **Team Members:** Joseph Lanzon Rodrigue Mckenzie Terence McKillen Linda Wrong	**Summary:** Public Meeting pursuant to the EIS process in Schefferville. Community seemed to be very supportive. The Administrator of Schefferville asked that she be consulted as far ahead of time as possible with respect to demands that might be placed on municipal services.

Email 2 Dec 2008	
Participants: Jean Madill President - College of The North Atlantic **Team Members:** Linda Wrong	**Summary:** Introduction letter re: commitment to training and educational programs and possibility of working together with College to identify any potential synergies.

APPENDIX P

Public Information Sessions Notice

PUBLIC NOTICE

Public Information Session on the Proposed

Labrador Iron Mines Limited

Schefferville Area Iron Ore Mine
West-Central Labrador

shall be held at

Hotel North Two
882 Hamilton River Road
Happy Valley – Goose Bay, NL
Conference Room 1

On Wednesday, November 26th 2008
at 7:00 p.m.

This session shall be conducted by the Proponent,

Labrador Iron Mines Limited
as part of the environmental assessment for this Project.

Contact +1 647-728-4125
for confirmation in case of bad weather or for general comment

The purpose of this session is to describe all aspects of the proposed Project, to describe the activities associated with it, and to provide an opportunity for all interested persons to request information or state their concerns.

ALL ARE WELCOME

PUBLIC NOTICE

Public Information Session on the Proposed

Labrador Iron Mines Limited

Schefferville Area Iron Ore Mine
West-Central Labrador

shall be held at
Wabush Hotel
9 Grenfell Drive
Wabush, NL
Conference Room

On Thursday, November 27th 2008
at 7:00 p.m.

This session shall be conducted by the Proponent,

Labrador Iron Mines Limited
as part of the environmental assessment for this Project.

Contact +1 647-728-4125
for confirmation in case of bad weather or for general comment

The purpose of this session is to describe all aspects of the proposed Project, to describe the activities associated with it, and to provide an opportunity for all interested persons to request information or state their concerns.

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The purpose of this session is to describe all aspects of the proposed Project, to describe the activities associated with it, and to provide an opportunity for all interested persons to request information or state their concerns.

ALL ARE WELCOME

L'AVIS PUBLIC

Session d'information publique sur le proposant

Labrador Iron Mines Limited
Schefferville Area Iron Ore Mine
West-Central Labrador

Aura lieu à
La Salle de Cour Municipale, 74 rue Atlantic
Schefferville, QC
Le vendredi, novembre 28, 2008
à 7:00 p.m.

Cette session sera conduite par la compagnie,

Labrador Iron Mines Limited
comme partie de l'estimation de l'environnement pour ce Projet.

Contactez +1 647-728-4125
En cas de mauvais temps ou pour tout commentaire

L'objectif de cette session est de décrire tous les aspects entourant ce Projet, décrire les activités connexes et offrir une occasion pour toutes personnes intéressées d'avoir de l'information sur ce projet.

TOUT SONT BIENVENUS

T.N. McKillen
Executive Vice-President

APPENDIX Q

Project Summary Handout

Newsletter November 2008
www.labradorironmines.ca

Labrador Iron Mines Limited

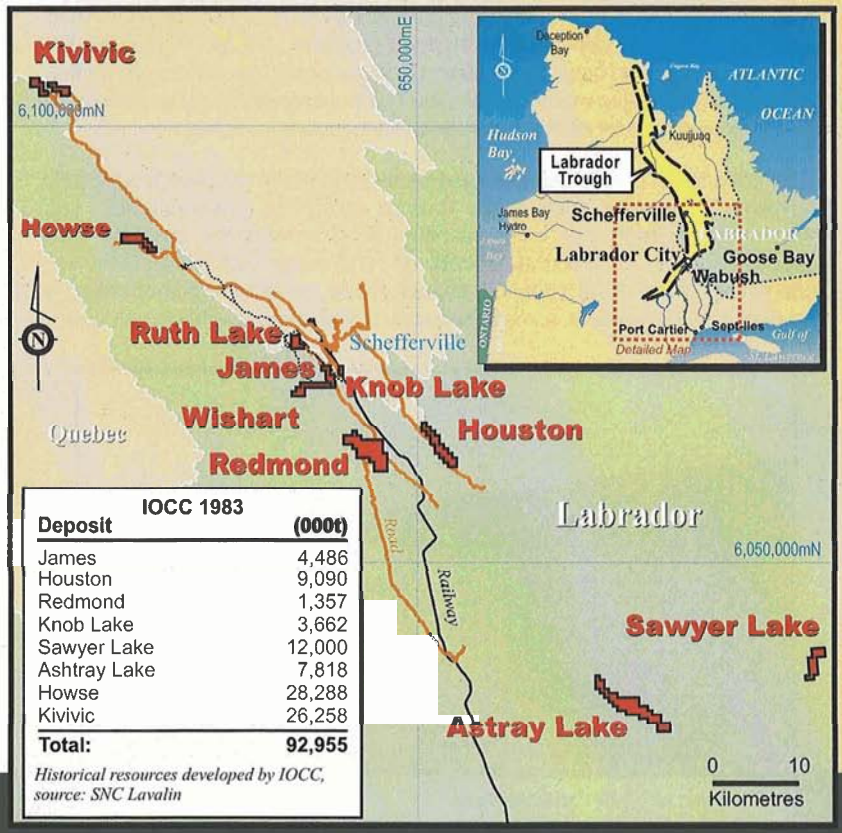
TSX - LIR

Direct Shipping Iron Ore Project
rejuvenation of an historic mining camp

The Schefferville Area Iron Ore Mine Project, West Central Labrador

Project Highlights, 2008

- Drilling, trenching and test pits to verify the historic resources as delineated by IOCC
- Bulk sampling - 6,500 tonnes (crushed and screened)
- Engineering and resource study (SNC Lavalin and Geostat)
- Rail Transportation studies (shipment of bulk samples)
- Incorporation of LabRail Inc. (ore transportation)
- Environmental Baseline Data and Traditional Knowledge programs
- Training programs
- Submission of Project Description and initiation of EA process
- Community consultations
- IBA with Innu of Labrador



IOCC 1983 Deposit	(000t)
James	4,486
Houston	9,090
Redmond	1,357
Knob Lake	3,662
Sawyer Lake	12,000
Ashtray Lake	7,818
Howse	28,288
Kivivic	26,258
Total:	**92,955**

Historical resources developed by IOCC, source: SNC Lavalin



Bulk sampling at James Deposit



Crushing



Lump ore products, James (left) and Houston (right)



Environmental Baseline Studies

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Newsletter November 2008
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Labrador Iron Mines Limited

TSX - LIR

Reopening Direct Shipping Iron Ore Operations in West Central Labrador

Highlights

- Phased development of direct shipping iron ore production
- Project is fully funded
- Planned construction of historical James and Redmond Mines in 2009
- Environmental Assessment and Permitting programs underway
- 20+ year project life
- Contract mining services and supplies from Labrador
- Direct and indirect job opportunities
- IBA with Innu of Labrador

MANAGEMENT TEAM

John Kearney - Chief Executive
Bill Hooley - President & COO
Terence McKillen - Executive Vice President
Marc Duclos - VP Transportation Services
Linda Wrong - VP Environment & Permitting
Danesh Varma - CFO
Joseph Lanzon - Manager of Gov't & Community Affairs

BOARD OF DIRECTORS

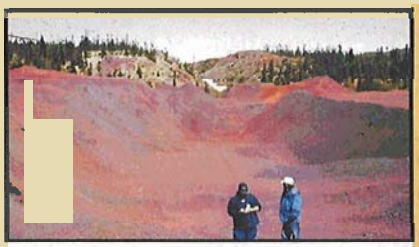
John Kearney - Chairman
Richard Lister - Lead Director
Bill Hooley
Terence McKillen
Matthew Coon Come
Gerald Gauthier
Eric Cunningham

Corporate Office:
220 Bay St. Suite 700
Toronto, Ontario, Canada M5J 2W4
Tel:647-728-4125 Fax: 416-368-5344
Email: info@labradorironmines.ca

Labrador Iron Mines Holdings Limited (TSX - LIR) through its wholly owned subsidiary **Labrador Iron Mines Limited (LIM)** has acquired interests in mineral claims and mineral licenses in the historical iron ore mining area of northwest Central Labrador

The project will be developed in phases with Phase 1 comprising the James and Redmond "brownfield" sites - having been stripped and partially prepared for development or partially mined by IOCC. LIM anticipates preliminary production will be achieved during the second half of 2009 from James and will ramp up to 3 million tonnes a year over time

LIM plans to produce lump and sinter fine direct shipping (**DSO**) iron ore products from eight deposits comprising approximately 90 million tons of historical resources at 56-58% Fe starting with the historically developed James and Redmond deposits.. LIM's operations will utilize much of the existing infrastructure constructed for the former Iron Ore Company of Canada (IOCC) operations. Available infrastructure includes access roads, the 585 km railway linking northwest Central Labrador to Sept-Iles, hydro-electric power and distribution lines, airport and other services, and proximity to the mining and service centres of Labrador West and Goose Bay.



James Deposit

Mining will be by open pit methods and broken ore will be screened and washed to upgrade the iron content of the shipped products prior to rail loading. No chemicals will be used in the beneficiation process other than water and residual fines will be returned to existing open pits. The Environmental Assessment and Permitting programs for Phase 1 have been successfully launched.

LIM is committed to developing the James and Redmond deposits in a socially and environmentally sustainable manner and has demonstrated this commitment through the early initiation of environmental baseline data collection (2005 to present), traditional knowledge gathering program, undertaking of an Environmental Impact Study, development and training programs for local workers, and maximization of economic benefits to Labrador.



Bulk sample stockpiles at Silver Yard

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APPENDIX R

Public information Session Presentation

Labrador Iron Mines Limited

www.labradorironmines.ca

IRON ORE IN WEST-CENTRAL LABRADOR

The Re-establishment of Direct Shipping Iron Ore Production

Public Consultation Meetings

Wabush, Labrador City & Happy Valley-Goose Bay, NL - November 26-27, 2008

Agenda

TSX : LIR

- Who We Are:
  - Company
  - Team
  - Project
- Area History
- Existing Infrastructure
- Resource Estimate
- Details of Mining Phases
- Description of Mine Activities
- 2008 Activities
- Environment & Socio-Economic Studies
- Jobs & Business Opportunities
- Training, Education
- Summary

Who We Are

TSX : LIR

Labrador Iron Mines Limited ("LIM"):

- **A Canadian-based exploration and mine development company**
- **Interests in an estimated 90 million tonnes of high grade iron ore in west-central Labrador, formerly part of the iron ore reserves and resources established by the Iron Ore Company of Canada (IOCC)**
- **LIM has the necessary capital available to bring the project into initial production**
- **Subject to completion of permitting process, first production is targeted 2009**
- **LIM is managed by a team of experienced mining professionals and is working with qualified NL based contractors, consultants and suppliers**

Who We Are

TSX : LIR

Labrador Iron Mines Limited Team Presenters:

- **Terence McKillen, Executive Vice President**
- **Linda Wrong, P.Geo., Vice President, Environment and Permitting**
- **Joseph Lanzon, Manager, Government & Community Affairs**

- **LIM team members have prior experience in Newfoundland and Labrador, including the former IOCC operations**
- **Project is supported by Innu Nation of Labrador (IBA)**
- **LIM has contracted consultants, technical services and supplies from Labrador and will accelerate this with the start of construction/operations**
- **LIM has provided jobs and business opportunities for Labrador throughout the exploration and evaluation phases and will continue to do so with mine development**

Who We Are

TSX : LIR

The Project:

- **Re-establishing direct shipping iron ore (DSO) production in an area originally mined/assessed by IOCC**
- **There will be 3 phases to the project with expected 20+ years mine life:**
  - **Phase 1a: James North and South and Redmond deposits**
  - **Phase 1b: Knob Lake and Houston deposits**
  - **Phase 2: Sawyer and Astray deposits**
  - **Phase 3: Howse and Kivivik deposits**
- **Project is located in the heart of the "Labrador Trough" – a geological formation occurring in the Quebec-Labrador Peninsula that also hosts three of Canada's largest iron ore mines (at Lab West) comprising all Canadian iron ore production**
- **The project benefits from significant infrastructure remaining from the previous operations of IOCC**
- **LIM commenced exploration and environmental baseline work in this former IOCC area in 2005**
- **Full commercial production of 3 million tonnes/yr by 2012**

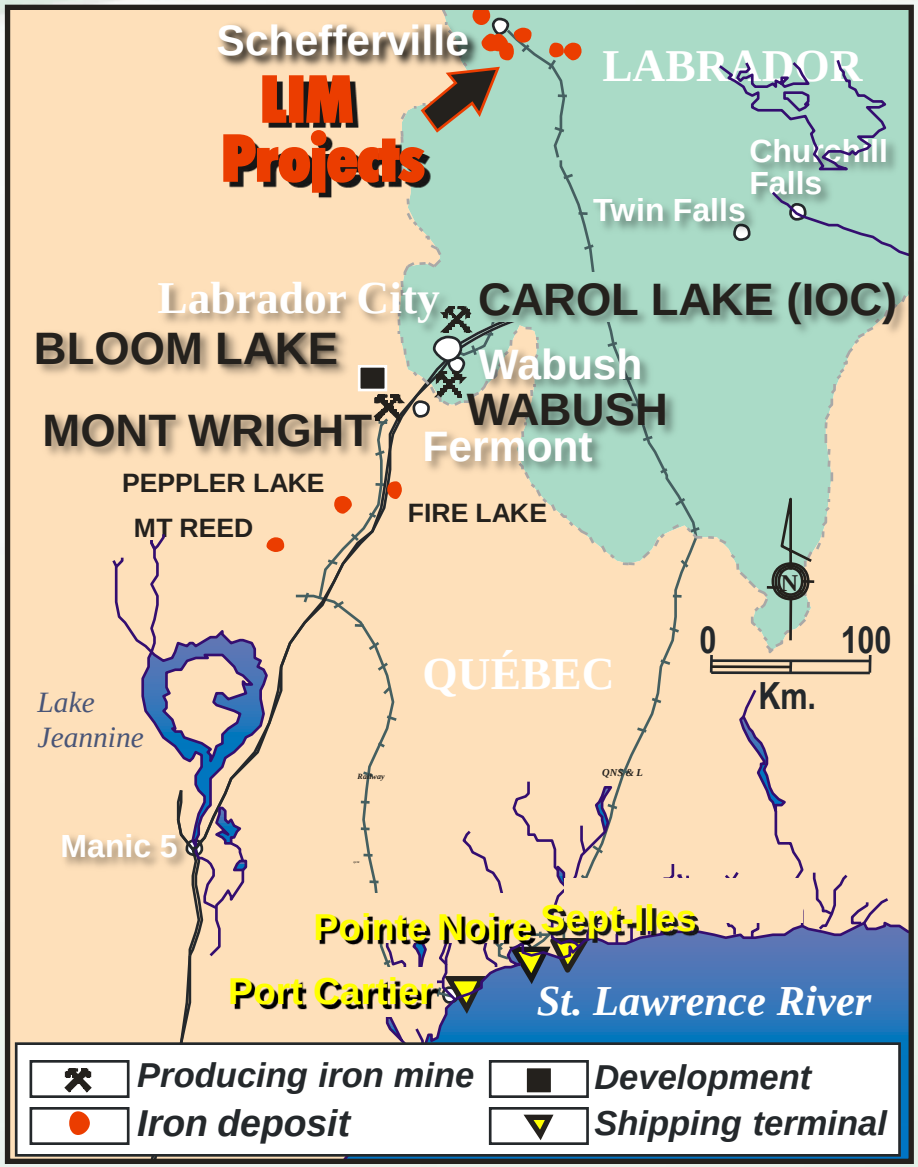
History of Iron Ore Development

TSX : LIR

- A major iron ore mining camp was developed in the Knob Lake Iron Range by IOCC and operated from 1954 to 1982
- Town of Schefferville, the Menihek power station, airport and the railway connection were built to service the iron ore industry in the region
- IOCC outlined 400 million tons of iron ore in the Knob Lake Iron Range but produced and shipped 150 million tons over the 28 year period
- LIM has acquired ~90 million tons of the remaining historical resources, located exclusively in west-central Labrador

Project Location

TSX : LIR







Location of Deposits & Infrastructure

TSX : LIR



Existing Infrastructure

TSX : LIR

Labrador Communities

1



Fuel Station

Near Processing Sites

2



NL Hydro Plant

Menihek Dam - 35km from the Project

3



4



Electricity

Power Lines crossing property

6



Port Facilities at Sept-Îles

Ship loading with existing installations

5



TSH Railway

Freight and Passengers from Sept-Îles to Schefferville

Resource Estimate

TSX : LIR

IOCC 1983	
Deposit	(000t)
James	4,486
Redmond	1,357
Knob Lake	3,662
Houston	9,090
Sawyer	12,000
Astray	7,818
Howse	28,288
Kivivik	26,258
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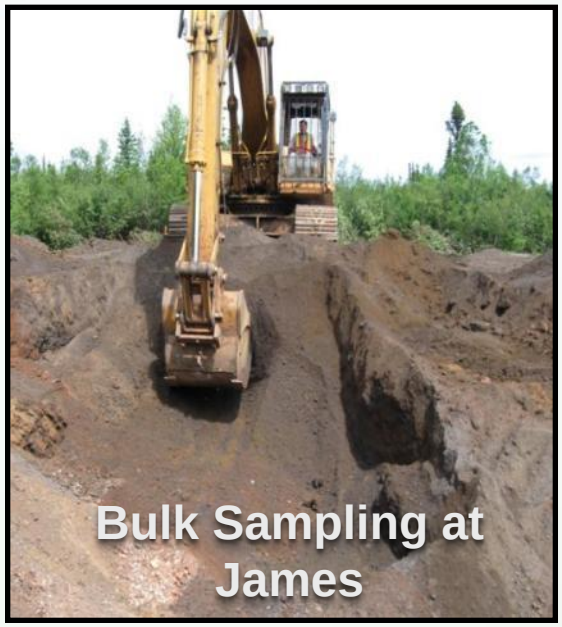
Source: SNC Lavalin Technical Report dated September 10, 2007

Historical resources are non NI 43-101 compliant

- Historical resources based on IOCC calculations
- Grade of ore mined is expected to be 56%-58% Fe based on IOCC's historical operations
- Screening and washing is expected to increase grade to 64-65% Fe
- This ore grade is higher than the Lab West iron deposits and therefore does not require concentration or pelletizing
- James North and South & Redmond deposits comprise Phase 1a development

Phase 1a Development

TSX : LIR


Bulk Sampling at James

Phase 1a – James North, James South & Redmond

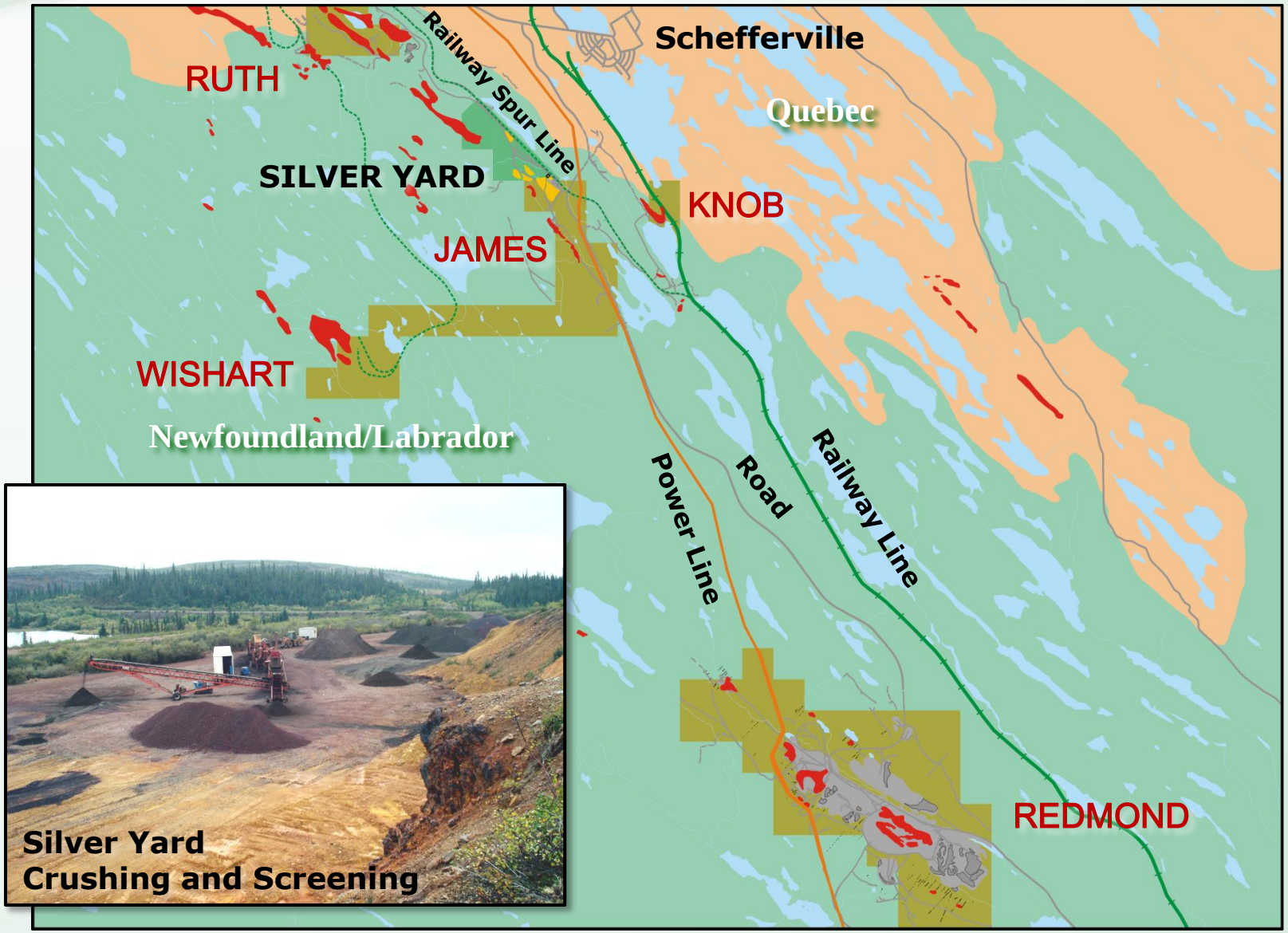
- 6 million tonnes, 4-5 year production schedule
- Brownfield sites
- James is within 1 km of the rail spur line
- Accessible by existing roads
- James and Redmond deposits are partially pre-stripped since the 1980s and are ready for development


James Deposit


Redmond Deposit

James & Redmond Mines and Plant

TSX : LIR

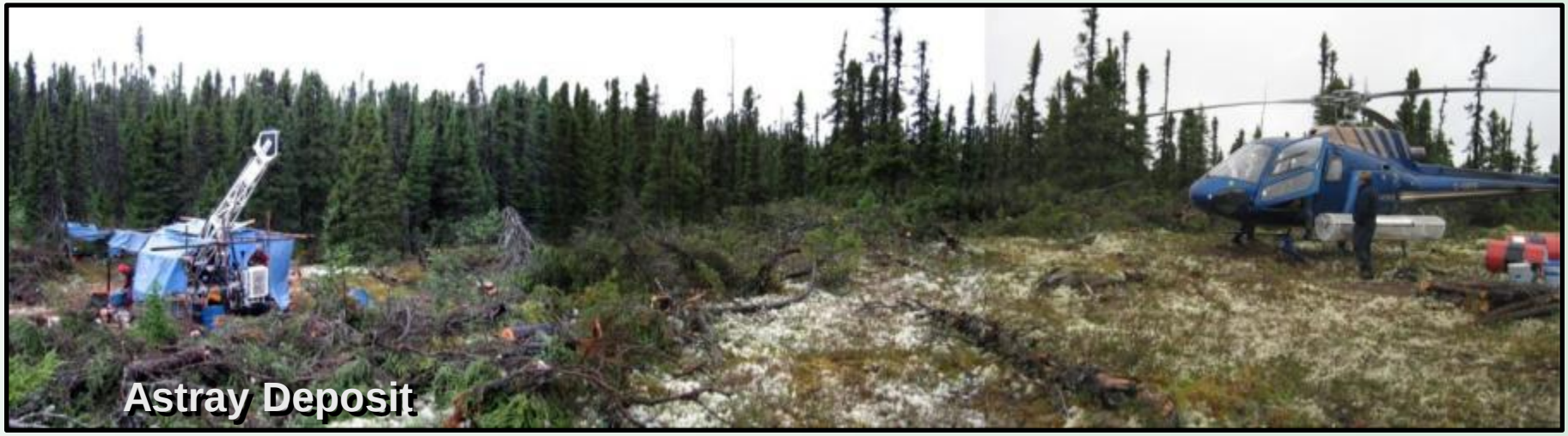


Phases 1b,2 & 3 - Future Development

TSX : LIR



- Not included in scope of current EIS
- 6 deposits - 80 million tons, 15-20 year production schedule
- Houston and Knob are close to the James deposit and existing infrastructure
- Astray and Sawyer approximately 60km southeast
- Howse & Kivivic are 20 & 50 kms respectively to northwest
- Accessible by existing roads (except Astray and Sawyer– require road access)
- Production may increase to 6 million tonnes/yr



Description of Mine Activities

TSX : LIR

- Open pit mining
- 2,000 tonnes per day (tpd) increasing to 9,000 tpd total for three deposits (over 8 month operating cycle)
- Drilling and blasting of ore
- Loading onto 65t trucks – delivery to plant
- Crushing to Lump product (gravel size & larger) & Sinter (fine product)
- Washing to remove silica and fines (no chemicals used in process)
- Water source mainly from historical pit and rock fines discharge to same
- Load on to 90 tonne gondola rail cars
- 3 trains per week – no negative impact to current rail operations
- Delivery to port
- Environmental monitoring of air and water during all phases of mine life
- Reclamation and closure

LIM's 2008 Activities

TSX : LIR



- Drilling
- Resource verification
- Bulk sampling
- Metallurgical testing
- Transportation studies
- Marketing
- Community consultation



- System flowsheet design
- Engineering designs and specifications
- Capital and Opex estimates
- Environmental Baseline studies
- Start of EA Process

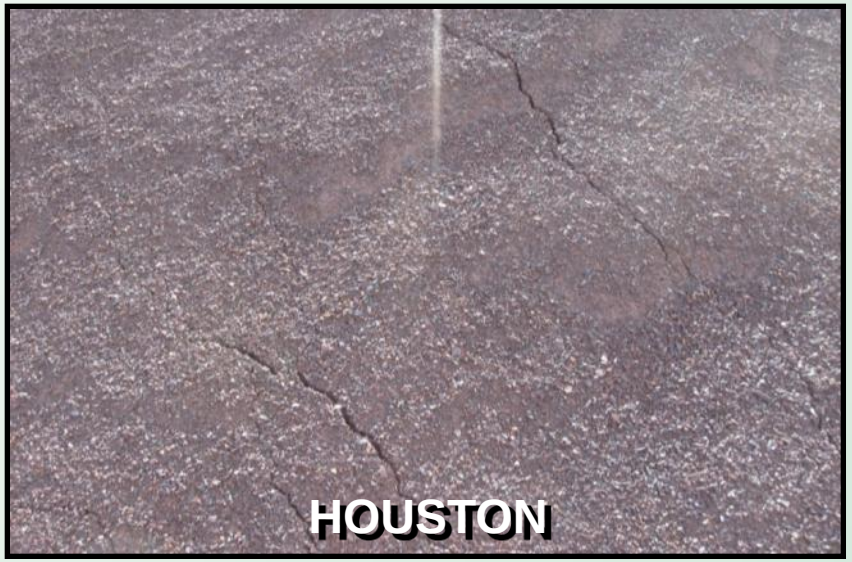
Products - Lump & Sinter Fine Ore

TSX : LIR









Environment & Socio-Economic Studies

TSX : LIR

- Environmental Baseline Data collection started during exploration (2005)
- Community Meetings, Outreach Programs & Consultation started 2005
  - Consultations and MOUs with local First Nations
- Traditional Knowledge and Trappers'/Elders' Committees
- Initiated training of Local Environmental Technicians
- Environmental Monitoring of work areas
- Socio-Economic Baseline Program
- Regional Economic Development:
  - Training
  - Educational Support
  - Regional Sourcing of Goods and Services
- Impact Benefit Agreement with Innu Nation of Labrador
  - Business opportunities and jobs through the Innu Development Corporation
  - Environmental protection & monitoring
  - Social, cultural and community support

Jobs & Business Opportunities

TSX : LIR

- **LIM is committed to Labrador-based employment and goods and services procurement**
- **Labrador based businesses will provide:**
  - **Mining, loading, haulage, crushing & washing, loading of rail cars**
  - **Supplies, equipment, fuel, accommodations/catering, road maintenance, equipment maintenance, air transport**
- **IBA with Innu Nation of Labrador:**
  - **Business opportunities and jobs through the Innu Development Corporation**
- **Commitment to maximizing economic benefit to Labrador**
- **LIM and its contractors plan to utilize a "commute system" providing air or rail transportation from hubs at Lab West and Goose Bay**

Training & Education

TSX : LIR

- **LIM is committed to maximizing the social and economic benefits to Labrador**
- **LIM is committed to ensuring adequate training is available:**
  - **Human Resources and Social Development Canada (HRSD)**
  - **Newfoundland & Labrador Department of Education (DOE)**
  - **College of the North Atlantic (CNA)**
  - **Women in Resource Development Committee (WRDC)**
  - **Apprenticeship opportunities**
- **LIM is committed to employment equity and affirmative action**
  - **Development and implementation of Employment Equity Plan**
  - **Ensure Full and Fair Opportunity and First Consideration for employment, contracting, procurement, education and training**
  - **Ensuring compliance from its contractors and suppliers for these commitments**
- **LIM is committed to the incorporation of traditional knowledge into the mine development:**
  - **LIM has conducted meetings with Elders to discuss and record Traditional Knowledge**
  - **LIM is in contact with the Innu Nation to work together to support their Traditional Knowledge initiatives**
  - **LIM has met with local trappers and hunters to discuss and record observations about the environment**

Summary

TSX : LIR

- **Modest-scale direct shipping iron ore production**
  - proposed operation at 25% of IOCC operation in 1982
  - LIM's production would add <10% to volume of rail traffic
- **The Phase 1a development has modest foot print**
  - is a "brownfield" site
  - utilizes existing infrastructure
  - Sources water and discharges to existing pits
- **Will provide sustainable jobs and business opportunities for Labrador**
- **Project is financed**
  - not subject to current financial markets
- **Project has support of Innu Nation of Labrador**
- **Targets for 2009**
  - approval, construction, marketing 1H 2009
  - production start up 2H 2009

Corporate Contacts

TSX : LIR

Labrador Iron Mines Limited

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Toronto, Ontario, Canada M5J 2W4
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Toll Free: +1 877-728-4125
E-mail: info@labradoriron mines.ca Website : www.labradoriron mines.ca

Contacts:

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Chairman and Chief Executive Officer
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Bill Hooley
President and Chief Operating Officer
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Terence N. McKillen
Executive Vice President
+1 647-728-4102

Thank-You

TSX : LIR

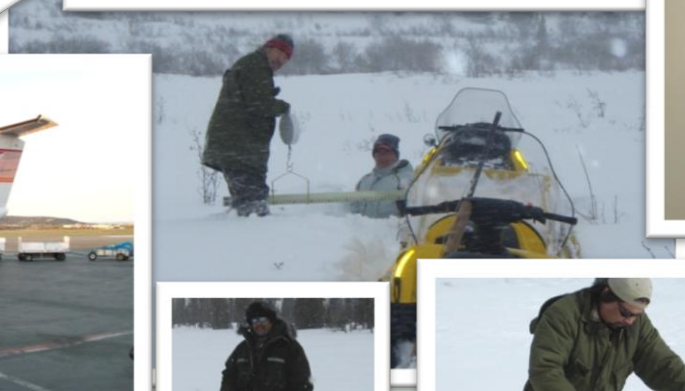




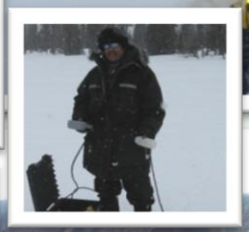


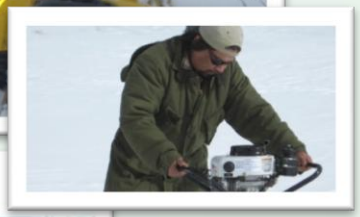




















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APPENDIX S

Environmental Assessment Methods

Environmental Assessment Methods

Environmental assessments generally focus on those components of the environment that are valued by society and that can serve as indicators of environmental change. These Valued Environmental Components (VECs) may include both biophysical and socioeconomic components.

The methods employed in this EA are therefore intended to:

- focus on issues of greatest concern;
- address regulatory requirements, including those identified through the project-specific Environmental Impact Statement Guidelines;
- address issues raised by the public and other stakeholders during project-specific consultation; and
- integrate engineering design, mitigation, and monitoring programs into a comprehensive environmental management planning process.

The approach and methods used for the EIS are based largely on the work of Beanlands and Duinker (1983), the CEA Agency (1994; 1999), and Barnes et al. (2000), as well as the study team's experience in conducting environmental assessments. The EA methods provide a systematic evaluation of the potential environmental effects that may arise from each Project phase (construction, operation, and abandonment/decommissioning) as well as malfunctions and accidents, with regard to each of the identified VECs. Project related effects are assessed within the context of temporal and spatial boundaries established for each VEC. The evaluation of potential cumulative effects includes past, present and likely future projects and activities that may interact with Project-related environmental effects within the spatial and temporal boundaries defined in the EIS.

This environmental assessment provides detailed effects analyses for each of the VECs. The specific steps involved in the assessment for each VEC include:

- determination of the assessment boundaries;
- description of the existing conditions for each VEC;
- identification of potential Project-VEC interactions;
- overview of existing knowledge and mitigation or effects management measures;
- definition of the significance criteria for residual environmental effects;
- assessment of the environmental effects and mitigations or effects management measures;
- determination of the significance of Project residual environmental effects.
- cumulative effects assessment; and,
- identification of any monitoring or follow-up requirements.

Each of these is described in more detail in the following sections.

Boundaries

The EIS considers the potential effects of the proposed Project within the spatial and temporal boundaries defined for each VEC. These boundaries may vary with each VEC but generally reflect a consideration of:

- the proposed schedule/timing of the construction, operation, maintenance, and abandonment phases;
- the natural variation of a VEC;
- the timing of sensitive life cycle phases in relation to the scheduling of proposed Project activities;
- interrelationships/interactions between and within VECs;
- the time required for recovery from an effect and/or return to a pre-effect condition, including the estimated proportion, level, or amount of recovery; and
- the area within which a VEC functions and within which a Project effect may be felt.

Spatial Boundaries

The Assessment will be limited to the development of the James and Redmond leases.. Spatial boundaries may be limited to the immediate Project area (e.g., project "footprint" or zone of influence) or may be regional or larger in extent in consideration of the distribution and/or movement of some VECs. The geographic limits and migration patterns of wildlife populations, for example, are important considerations in determining spatial boundaries and may influence the extent and distribution of an environmental effect. For this assessment, the area that could potentially be affected by Project activities and interact with VECs is referred to as the Assessment Area. The Assessment Area is also developed in consideration of the timing and type of Project activity being considered and the sensitivities within the particular VEC being assessed. The assessment of potential Project effects and determination of the significance of those effects occurs within the Assessment Area.

Temporal Boundary

Project effects for this EIS have been assessed from construction through to decommissioning and abandonment. With the exception of those activities which will occur seasonally, effects of Project activities have been assessed as "year round" for the period 2009-2029. The effects of decommissioning, abandonment and site rehabilitation will be assessed and are assumed to occur after 2029. Potential accidental events will be considered and could occur at any point during the life of the Project.

Administrative Boundaries and Technical Boundaries

Administrative boundaries refer to the spatial and temporal dimensions imposed on the environmental assessment for political, socio-cultural or economic reasons. Administrative boundaries can include such elements as the legislation, regulations, and government agencies that govern Project-related activities and the VECs selected for the EIS. Administrative boundaries can also include pertinent government guidelines and wildlife management zones and hunting/fishing seasons. These boundaries are defined for each VEC individually.

Technical Boundaries include and data and information gaps with a focus on data gaps important to environmental effects predictions and determination of significance or to satisfaction of the EIS guidelines. Such boundaries could include limits on availability of existing information and/or field surveys.

Existing Environment

The description of the existing environment (i.e., pre-Project or baseline conditions) for the Assessment Area (as specified in the EIS Guidelines) includes:

- Physical Environment;
    - Climate
    - Air Quality
    - Landscape
    - Hydrology
    - Ambient water quality
- Biological Environment;
    - Wetlands and Flora
    - Wildlife (including caribou and other species)
    - Avifauna (including osprey, eagles and other birds)
    - Fish and fish habitat
    - Fishing
- Socio-economic
    - Employment and business
    - Communities

The description of the existing environment is based primarily on:

- field programs undertaken for the project;
- historical project information for other developments in the area;
- previous environmental assessments for other projects in the area;
- baseline research on the socioeconomic environment in the Assessment Area;
- recent scientific publications and databases; and
- personal communications with local experts and scientific authorities.

The information available through the above sources is considered to be sufficient and acceptable for the purposes of this environmental assessment. While data gaps are always present when describing the natural environment, the gaps for this Project are not considered of sufficient scale and/or nature to affect the integrity of this assessment.

Potential Interactions and Existing Knowledge

A list of potential interactions between the Project activities and each VEC is presented in Table 1.These interactions represent the pathways/mechanisms through with the Project could have environmental effects on the VECs being considered in the EIS. Existing knowledge concerning these potential interactions is also reviewed and summarized.

Table 1 Potential Project-VEC Interactions (Example)

Project Activities and Physical Works	VEC			
	Fish and Fish Habitat	Caribou and Caribou Habitat	Employment and Business	Communities
Construction (Project activities in 2009)				
Site Preparation (grubbing, clearing, excavating)				
Placement of Infrastructure (reinstatement of rail spur, roads, utilities)				
Placement of Equipment and Buildings				
Construction (on-site power generation, solid waste, grey water, human presence, transportation)				
Employment and Expenditures				
Operation (Project activities starting in 2010)				
Iron Ore Extraction (excavation – mechanical, blasting)				
Iron Ore Beneficiation (crushing, washing, screening, stockpiling, hazardous and mining waste disposal)				
Stormwater and Wastewater Management				
Transportation (on-site trucking, rail loading)				
Operations (on-site power generation, solid waste, grey water, human presence)				
Employment and Expenditures				
Abandonment and Decommissioning				
Removal of Facilities and Equipment				
Site Reclamation (grading, re-vegetation)				

Residual Environmental Effects Significance Criteria

Significant adverse environmental effects are those effects that will cause a change that will alter the status or integrity of a VEC beyond an acceptable level. The significance of environmental effects is determined according to criteria defined in each of the VECs.

The definitions for significant adverse environmental effects are based primarily on key factors such as: magnitude (i.e., the portion of the VEC population affected); potential changes in VEC distribution and abundance; effect duration (i.e., the time required for the VEC to return to pre-project levels); frequency; and geographic extent (refer to Section 6.5 for a more detailed

definition of these criteria). They also include other important considerations such as interrelationships between populations and species, as well as any potential for changes in the overall integrity of affected populations. A positive effect is one that may enhance a population or socio-economic component.

Environmental Effects Assessment, Identification of Effects Management and Residual Effects Determination

This effects assessment analyses potential effects associated with Project components/activities and potential accidental events for each of the VECs under consideration. Effects are analyzed qualitatively and, where possible, quantitatively using existing knowledge, professional judgment and appropriate analytical tools. The assessment of accidental events and cumulative effects will be considered within each individual VEC chapter.

Some of the key factors that can be considered for determining adverse environmental effects, as per the Agency guidelines (CEA Agency 1994) include:

- negative environmental effects on the health of biota;
- loss of rare or endangered species;
- reductions in biological diversity;
- loss or avoidance 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;
- loss of, or detrimental change in, current use of lands and resources for traditional purposes;
- foreclosure of future resource use or production; and
- negative effects on human health or well-being.

Potential environmental effects on each VEC are characterized using the following five descriptors:

- Magnitude – the nature and degree of the predicted environmental effect. Rating depends on the nature of the VEC and the potential effect. For biophysical/ecological VECs the rating system is as follows:
    - Low - Affects a specific group or critical habitat for one generation or less; within natural variation;
    - Medium - Affects a portion of a population or critical habitat for one or two generations; temporarily outside the range of natural variability;
    - High - Affects a whole stock, population or critical habitat (may be due to the loss of an individual(s) in the case of a species at risk) outside the range of natural variability.

For socio-economic VECs the magnitude of potential effect is defined as:

  - Low - Does not have a measurable effect on valued socio-economic components;
  - Medium - Has a measurable effect on socio-economic components, but is temporary and/or is highly localized;
  - High - Has a measurable and sustained adverse effect on socio-economic components.

- Geographical Extent: describes the area within which an effect of a defined magnitude occurs;
- Frequency: the number of times during a project or a specific project phase that an effect may occur (i.e., one time, multiple);
- Duration: typically defined in terms of the period of time required until the VEC returns to its baseline condition or the effect can no longer be measured or otherwise perceived (defined specifically for each VEC, may be a specific period of time); at a minimum, it is divided into three timeframes: short-term, mid-term and long-term;
- Reversibility: the likelihood that a measurable parameter will recover from an effect, including through active management techniques such as habitat restoration works; and
- Ecological Context: the general characteristics of the area in which the project is located; typically defined as limited or no anthropogenic disturbance (i.e., not substantially affected by human activity) or anthropogenically developed (i.e., the area has been substantially disturbed by human development or human development is still present).

Based on the potential interactions identified for each VEC, technically and economically feasible mitigation measures will be identified to reduce or eliminate potentially significant adverse effects.

Where possible, a proactive approach to mitigating potential environmental effects has been taken by incorporating environmental management considerations directly into program design and planning; these are noted in the Project Description (Section 3.0). Additional mitigation measures are identified in the environmental assessment to further mitigate potential adverse effects where economically and technically feasible. These mitigation measures are identified and discussed within each individual VEC chapter. Residual environmental effects predictions are made taking into consideration these identified mitigation measures.

A summary of the environmental assessment for each VEC is presented for Project construction and operation as noted in Table 2.

Table 2 Template for Summary of Residual Environmental Effects for [VEC]: [Project Phase]

Mitigation	
Significance Determination	
Geographic extent	
Frequency of occurrence	
Duration of effect	
Magnitude of effect	
Permanence/reversibility	
Significance	
Confidence	
Likelihood of occurrence	
Follow-up and monitoring	

The evaluation of the significance of the predicted residual environmental effects is based on a review of relevant literature and professional judgment. In some instances, assessing and evaluating potential environmental effects is difficult due to limitations of available information. Ratings are therefore provided to indicate the level of confidence in each prediction. The level of confidence ratings provide a general indication of the confidence within which each environmental effects prediction is made based on professional judgment and the effects recorded from similar existing projects. The likelihood of the occurrence of any predicted significant adverse effects is also indicated, based on previous scientific research and experience.

Cumulative Environmental Effects

Environmental effects of individual projects operating in the same geographic region can overlap spatially and temporally resulting in cumulative environmental effects. This environmental assessment includes consideration of cumulative environmental effects for each VEC.

Cumulative effects are considered as part of the Project-specific environmental effects analyses described above (i.e., the overall effect of each project on a VEC). Other projects or activities that could interact cumulatively with the LIM Project include the New Millennium proposal for the Elross Lake area and increased railway traffic as a result of the proposed Bloom Lake Railway; these will be considered in the cumulative effects assessment (Table 3).

Table 3 Projects and Activities Considered in Cumulative Environmental Effects Analysis

Project	Status
Elross Lake Iron Ore Mine Proponent: New Millenium Capital Corporation • New Millenium Capital Corporation is planning to develop an iron ore mine at a previously mined site in Western Labrador, approximately 10 kilometres northwest of Schefferville, Quebec. • Ore will be transported via rail to a marshalling yard in Schefferville and then sent via rail to Sept-Îles , Quebec , for shipment to customers.	Reasonably Foreseeable Project
Bloom Lake Railway Proponent: Consolidated Thompson Iron Mines Ltd. • Consolidated Thompson Iron Mines proposes to construct and operate a new 31.5 kilometre long single-track railway line to connect the company's new load-out facilities within Labrador with the existing railway line between Wabush Mines and the Quebec North Shore & Labrador Railway.	Reasonably Foreseeable Project

As determined by the Guidelines, the assessment of cumulative environmental effects will involve consideration of the following:

- temporal and spatial boundaries;
- interactions among the Project's environmental effects;
- interactions between the Project's environmental effects and those of existing projects and activities;
- interactions between the project's environmental effects and those of planned projects and activities; and,
- mitigation measures employed toward a no-net-loss or net-gain outcome (e.g. recovery and restoration initiatives pertinent to a VEC that can offset predicted effects).

Accidental Events

Each VEC will discuss the potential environmental effects resulting from malfunctions or accidental events that may occur in connection with the Project. These shall be discussed with respect to risk, severity and significance. This discussion shall include (as required by the Guidelines):

- discussion of accidents and malfunctions that could occur related to the Project and the potential interactions with environmental features
- reference to the standards, codes and regulations applicable to governance of the project

Monitoring and Follow-up

The EIS Guidelines require the consideration of any monitoring and follow-up programs that might be required. The purpose of the follow-up program is to:

- verify the accuracy of the environmental assessment; and
- determine the effectiveness of mitigation measures.

As part of the environmental effects analysis, monitoring and follow-up programs are described where warranted. Monitoring and follow-up is considered where there are important Project-VEC interactions, where there is a high level of uncertainty, where significant environmental effects are predicted, or in areas of particular sensitivity.

Effects of the Environment on the Project

The EIS also assesses the effects of the environment on the mine. In particular the EIS will identify the vulnerability of the mine to climatic elements (including wind, weather and global climate change) and describe the provisions for minimizing any identified risk.

APPENDIX T

Methods to Control Ammonia and Nitrate Levels in Mine Waste Water

Methods to Control Ammonia and Nitrate Levels in Mine Waste Water

The main source of nitrogen in mine waste waters is from nitrogen components in explosives. Residues from mine blasting operations enter surface runoff water and depending on the form (nitrate, nitrite, ammonia) and concentration of nitrogen and the characteristics of the receiving stream, nitrogen compounds can have adverse effects to aquatic life.

Many mine operators have learned that there is a direct relationship between the ammonia and nitrate levels in mine waste water and the amount of undetonated explosives in the rock through which the water flows. Most commercial blasting agents contain 70% to 94% (by weight) ammonium nitrate. When some of the explosives end up in shot rock and ore, through either spillage or incomplete detonation, ammonia and nitrates can leach into the ground water. When a blast is completely detonated, there is no blast residue.

There are several ways that undetonated explosives end up on the ground or in shot rock:

- Sloppy handling, storage and loading practices may cause a significant amount of explosive spillage, particularly when bulk explosives are used.
- Poor drilling and loading practices can also cause significant amounts of explosives to remain undetonated.
- Drill patterns, stemming or collar length, explosive selection, priming methods and delay timing are the elements of blast design that can be adjusted to control charge cutoffs and failures

The objective of reducing ammonia and nitrate levels in mine waste water from blasting activities would be to implement actions that contribute to the complete detonation of a blast and reduce the amount of undetonated explosives. This can be achieved through the following approaches:

- Limiting the amount of explosives used.
    - Based on field investigations to-date, it is expected that only periodic blasting will be required during the initial benches, with mechanical means (example dozer with ripper) being used to break the rock. For those infrequent times and for the lower benches, where it is expected the rock is somewhat harder and less leached, packaged emulsion explosives are planned to be used. A relatively low powder factor is still expected for the lower benches.
- Controlling Explosive Losses through storage and handling controls
    - Bulk ANFO and bulk emulsion blasting agents are often spilled during storage, transfer or loading. Development of spill containment and clean-up procedures are integral.
    - Based on field investigations to-date, it is LIM's plan to use packaged explosives (and not bulk explosives) for their periodic blasting requirements. The use of packaged explosives is expected to reduce the amount of explosive spillage due to handling and loading practices.
    - Development of an ongoing explosive management program (as either part of an Operations Manual or Environmental Protection Plan) that outlines proper storage, handling, and loading controls.

- Selection of Blasting Agent

    - The type of explosive used can have a dramatic effect on overall explosive losses. For example, if bulk explosives are used instead of packaged explosives, spillage losses will be relatively high. If bulk ANFO is used in wet holes, losses caused by complete failure or partial detonation will be high.

    - As stated above, it is LIM's intention to use packaged emulsion explosive. These typically consist of 70% ammonium nitrate liquor, 15% water, and 15% mix of diesel oil and surfactant. (ANFO, the most commonly used blasting agent, is usually a mixture of 6% fuel oil and 94% ammonium nitrate).

    - The rate at which nitrates leach from different explosives varies dramatically, based on the explosive's composition. It has been reported that Emulsions did not release nitrates as readily as the ANFO or watergel explosives (the ammonium nitrate is contained in an aqueous phase that is surrounded by an oil (or oil and wax) fuel phase).

- Implementing engineered blasting practices that minimize to the extent possible, the amount of blasting material used and residue produced

    - For many reasons, including safety, environmental, and economic, blast designs should include measures that ensure complete detonation of all explosives.

    - Incomplete detonation can occur as a result of a cutoff. Drill pattern design, explosive loads, and initiation methods can be adjusted to reduce/eliminate the potentiality of a cutoff.

    - This can be accomplished by the use of multiple in-hole delay primers, using appropriate delay time between holes,

    - Stemming heights, stemming material, burden and spacing sizing are other blast pattern design variables that can be adjusted to optimize the complete detonation of explosives and reduce the potential of undetonated explosives from entering the mine waste water.

    - Incomplete detonation can also occur when using a non-water resistant product (ex. ANFO) in wet holes. The planned use of packaged emulsion explosives (which is water resistant) is an attempt to avoid incomplete detonation.

- Minimizing surface runoff that can enter a blasting area

    - For example, the use of a diversion ditch that would divert surface runoff away from the blasting area.

- Properly designed and operated settling pond

    - Settling ponds are considered to represent best practicable technology for treating mine wastewater.

    - In LIM's case, the in-pit sump which is the first stage of mine waste water collection and management, could offer an initial pre-settling and retention time depending on the capacity of the sump.

Summarized in part from "Practical Methods to Control Explosive Losses and Reduce Ammonia and Nitrate Levels in Mine Water", G.F. Revey, Mining Engineering (SME), July 1996