Fish and Fish Habitat Investigation for the Direct-Shipping Ore Project, New Millennium Capital Corp.

Prepared for
Groupe Hémisphères

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Executive Summary

Select fish and fish habitat within two mine sites (DSO2 & DSO3) of the proposed New Millennium Direct Shipping Ore Project (DSOP) were surveyed, classified and quantified under the federal Department of Fisheries and Oceans' quantification guidelines in order to characterize fish habitat within the proposed mine sites and to determine the potential HADD (habitat alteration, disruption or destruction) from proposed construction, operation and processing activities associated with the Project. This field investigation is follow-up from a preliminary reconnaissance survey in July 2008. The assessment and classification of habitat included five field-sampled waterbodies and twelve field-sampled stream sections within the Project footprint. Each waterbody was surveyed for fish species presence and subsequent habitat quantification as per Bradbury et al. (2001). Streams previously surveyed for habitat in July 2008 were sampled for fish species presence using index electrofishing. Table E1 provides a brief summary of the surveyed waterbodies and stream sections which contained fish.

All stream sections sampled within the proposed DSO2 footprint contained fish, primarily brook trout (*Salvelinus fontinalis*). Stream DSO2-01 yielded the most fish in site DSO2 with 30 brook trout. Within the proposed DSO3 footprint, three of the eight sites contained fish. Stream DS03-15 had the most brook trout captured (20). No fish were caught in streams DSO3-03, DSO3-06 and DSO3-14. Streams DSO3-10 and DSO3-11, which flowed during the July survey, were dried up on the September trip and could not be sampled. Two streams yielded species other than brook trout, DSO2-04 (burbot) (*Lota lota*) and DSO3-13 (lake chub) (*Couesius plumbeus*).

Of the five ponds and lakes sampled, two contained fish (brook trout): Star Lake and Timmins 1. Sampling for fish presence consisted of gill netting, the use of baited minnow traps and, in one case, index electrofishing in a very shallow pond (Triangle Pond, DSO3-05).

Star Lake is located within the proposed DSO2 mine site footprint. This pond contains brook trout and has a maximum depth of 1.5 m. The substrate composition of Star Lake consisted of mostly fines (sand and silt) with some rubble, cobble and gravel around the inflow and outflow. Total Habitat Equivalent Units have been calculated for brook trout at 0.1 ha.

Timmins 1 is located in the proposed DSO3 mine site footprint. This pond is the remains of previous mining operations, a pit now filled with water from spring freshet, runoff and precipitation in unknown proportions. Timmins 1 contains brook trout and has a total area of 23.78 ha, with the deepest location in the pond measuring 75 m. The substrate composition is comprised of rubble, gravel, sand and silt. Total Habitat Equivalent Units have been calculated for brook trout at 5.8 ha.

Table E.1. Summary of fish habitat quantification, DSO Project.

Site	Species Present	Total Area/Units	Total Area/Units by Habitat Type
Proposed Mining Site DSO2			
STREAMS			
DSO2-01	Brook trout	-	Riffle/Run
DSO2-02	Brook trout	-	Riffle/Run
DSO2-03	Brook trout	-	Riffle/Run
DSO2-04	Brook trout Burbot	-	Riffle/Run
LAKE			
Star Lake	Brook trout	10.1 ha	Littoral 10.1 ha
Proposed Mining Site DSO3			
STREAMS			
DSO3-03	-	-	Steady
DSO3-06	-	-	Steady
DSO3-08	Brook trout	-	Run / Riffle
DSO3-10	-	-	Dry (contained water in July)
DSO3-11	-	-	Dry (contained water in July)
DSO3-13	Brook trout Lake chub	-	Run / Riffle / Steady / Pool
DSO3-14	-	-	Steady
DSO3-15	Brook trout	-	Riffle
LAKE			
DSO-7 (Inukshuk Lake) (Upstream control)	-		Littoral 4.5 ha
DSO3-5 (Triangle Pond) (Downstream impact)	-		Littoral 0.2 ha
Timmins 1 Pit	Brook trout	23.8 ha	Littoral 2.5 ha Profundal 21.3 ha
Timmins 2 Pit	-		-

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1.0 INTRODUCTION

New Millennium Capital Corp. is exploring options for the location of mines northwest of the community of Schefferville, Quebec. There are currently two sites generally located just west of the community. The two proposed sites are named DSO2 and DSO3. To gather more information on the potential fish habitat in the area, a baseline survey of streams and waterbodies was carried out within the two options as required under schedule 2 of the Metal Mining Effluent Regulations (MMER) pursuant to subsections 36(5) (a) to (e) of the *Fisheries Act*.

2.0 OBJECTIVES

The aquatic survey provides New Millennium Capital Corp. with support for ongoing feasibility studies as well as information on the freshwater fish and fish habitat within the potential mining location options. It also addresses information requirements related to habitat characterization suitable for quantification in the context of DFO HADD requirements, as well as aquatic habitat characterization in compliance with general EA guidelines. The specific work scopes were as follows:

1. Collect baseline water quality parameters within selected watercourses and waterbodies;
2. Identify fish species present and, where possible, make population estimates in existing streams within both options;
3. Determine baseline habitat classification of streams and quantification of ponds to determine possible fish habitat within both options.

3.0 STUDY TEAM

The study team for the field project was a group that has extensive experience conducting fisheries surveys and habitat classification. Key team members are outlined below. Members of the study team have been involved in and have conducted fish and fish habitat studies during past projects.

Mr. Eugene M. Lee, M.Sc. is Project Manager and Senior Environmental/Aquatic Biologist with AMEC Earth and Environmental Ltd., St. John's. He has 22 years of experience as a consulting biologist and 15 years of experience in environmental site assessments in Canada and the United States. Mr. Lee was the project manager for this work scope.

Mr. James McCarthy, M.Sc. is a Senior Biologist with the St. John's office who has over sixteen years of experience in fisheries research and environmental assessment. Mr. McCarthy has acted as senior biologist and assessor for numerous projects throughout Newfoundland and Labrador and North America. Mr. McCarthy acted as senior technical biologist and co-project manager for this work scope.

Mr. Derm Kenny, NRT is an Environmental Technician with over ten years of experience in the environmental field involving baseline data collection directly related to the scope of work for this project. Mr. Kenny has a strong background in marine and freshwater studies, and conducted field data collection, data analysis, and interpretation for this project.

Ms. Suzanne Gouveia, B.Env. Studies (Honours) is an Environmental Biologist with the St. John's office. Ms. Gouveia has over seven years of experience in field sampling and environmental studies pertaining to fish and fish habitat studies. She has been involved in various baseline and environmental monitoring projects throughout Newfoundland and Labrador, Ontario and Washington State, USA. Ms. Gouveia conducted data analysis and interpretation and co-authored the project report.

Ms. Maureen Cameron-MacMillan, M.Sc. is an Intermediate Biologist with the Sydney, Nova Scotia, office. She has over four years of experience in fish habitat investigations and environmental assessments. Ms. Cameron-MacMillan has worked as a field biologist on fish habitat assessment projects throughout Atlantic Canada and acted as field team leader and field data manager for this project.

Mr. Aaron Wood, B.Sc. (Environmental Science) is an Environmental Scientist with the Dartmouth, Nova Scotia, office. Mr. Wood has 4 years of experience in Environmental Monitoring and Wildlife Inventories. He is experienced in data collection and report writing. He has a strong academic and field background in wildlife biology, marine and freshwater biology, ecology, and species at risk as well as experience in conservation. Mr. Wood acted as a field team member for this project.

Mr. Cassidy Pottle, NRT is an Environmental Technician with the Goose Bay office and has four years of experience in the collection of soil, water, sediment and fish samples for a variety of projects including contaminated site investigations and environmental effects monitoring. Mr. Pottle is experienced with working in remote locations throughout Labrador. Mr. Pottle's role on this project was field technician.

Mr. David McGinnis, CET is an Environmental Technologist with the Dartmouth, Nova Scotia, office who has five years of experience in various environmental fields. Mr. McGinnis has acted as field technologist for numerous projects throughout Nova Scotia and Newfoundland and Labrador. Mr. McGinnis acted as field technologist for this project.

4.0 QUALITY ASSURANCE

Standard Operating Procedures (SOPs) developed by AMEC Earth & Environmental for conducting studies were implemented during the current program. These included:

- Water, Sediment, Fish and Macro-invertebrate Sampling
- Electrofishing
- Bathymetry
- Fyke Net and Gill Net Use
- Stream Surveys
- Pond Surveys
- Field Data Management and Transfer

SOPs serve as established plans and procedures for conducting a series of tasks, ensuring that the work is completed to an acceptable standard and in a prescribed manner. The SOPs used by AMEC are on file. SOPs were reviewed in the field by all team members to ensure consistency of sample collection. In addition, a part of each team's Job-Safety Assessment (JSA) was a list of contact numbers for senior biologists and a call-in procedure to ensure that each day's data collection was consistent and accurate. This was referred to if any confusion arose in the field.

In addition to SOPs, QA/QC forms were completed and tracked for all data transfer from field to digital form and any aspect of the project where data validation was deemed necessary. These forms are an integral part of AMEC's QA/QC for data entry.

5.0 HEALTH AND SAFETY

Safety, health and environment (SHE) is an important part of every participant's overall job performance. Although AMEC has made great efforts in reducing the accident and injury rate, the goal is to have zero accidents and injuries. Obtaining this goal requires developing and maintaining an effective safety, health and environment management system and a safety culture among all employees. Managers continue to make safety their number one priority by promoting programs that are effective in identifying and reducing hazards in the workplace, providing ongoing training and making safety the primary consideration in all operations. As part of this program, field operations require job health and safety assessments (JSA) to be completed prior to remote activities. JSA documents are working documents that are brought to the work site and reviewed by all participants. Any outstanding issues are identified, documented and addressed as they arise. JSA reports are kept on file upon completion of the program.

6.0 DATA COLLECTION

The field data manager (Cameron-MacMillan) was responsible for ensuring that SOPs were followed during the collection of data and also for the daily transcription of field data onto data forms for subsequent computer data entry. For data requiring laboratory analysis, chain of custody forms were completed including documentation of preservation and storage methods. At least weekly, all data transcribed to data forms was reviewed by the data manager and cross-referenced with field note books. Any discrepancies were noted on field data forms and a review of procedure was conducted.

6.1. Technical Reporting

Technical quality assurance extending from field data collection to data review and reporting was provided by field supervisors and senior scientists. Their role included reviewing the data entered for computer analysis and all subsequent reports for accuracy. A Data Validation, QA/QC Form was completed each time data was transferred (e.g., from field data forms to digital spreadsheets). These forms suggest QA procedures and, when filled out, outline what QA reviews and corrective actions, if required, were completed on the data.

6.2. Nomenclature

The naming of streams, ponds and landmarks was provided by the client and utilized for consistency and referencing purposes. Each pond and stream has been labeled by a unique identification number or name as identified on the 1:50,000 topographic maps. Ponds and streams labeled and sampled in past programs retained their label designation to allow direct comparison of results. All names are provided in the appropriate sections of the report.

6.3. Geo-referencing

All sample locations were geo-referenced using handheld Global Positioning Systems (GPS). The position of each set was recorded on an internal SD chip and also recorded in field notebooks. All field positions were gathered using WGS84 datum unless sample locations from previous reports were used. In these circumstances, the original datum was used and is clearly shown. Where greater accuracy was required (i.e. during bathymetric surveys), Differential Global Positioning Systems (DGPS) were used. These systems used one of two methods to correct for position accuracy: integration of Canadian Coast Guard differential correction data or integration of OMNIstar differential correction data. Tests on both systems prior to deployment indicated accuracies of 1 m or less.

7.0 SAMPLING PROGRAM

The stream sampling program for this project followed the stream sampling Standard Methods Guide for Freshwater Fish and Fish Habitat Surveys in Newfoundland and Labrador: Rivers and Streams (Sooley et al. 1998 and McCarthy et al. 2007). Similarly, Standard Methods Guide for the Classification/Quantification of Lacustrine Habitat in Newfoundland and Labrador (Bradbury et al. 2001) was followed for all sampled ponds.

The work comprised a set of clearly defined tasks, which were carried out in accordance with the scope of work provided in the Request for Proposal. Sample locations are provided in Table 7.1, with a map of the general location provided in Figure 1. The existing 1:50,000 scale mapping doesn’t provide the detailed stream locations in and around the project site. Air photos taken in 1973 from the Department of Natural Resources and Wildlife of Quebec as well as aerial photography completed in Sept and Oct 2008 were used to provide more accurate delineation of habitat (Figures 2 and 3).

Table 7.1. Summary of sample sites, type of sampling and coordinates of DSO Project.

Sample Site ID	WGS 84 UTM		Sampling type
	N	E	
Proposed Mining Site DSO2			
DSO2-01	6079173	631981	Stream survey Index Electrofishing
DSO2-02	6079486	631340	Stream survey Index Electrofishing
DSO2-03	6079913	631512	Stream survey Index Electrofishing Sediment and Invertebrate samples
DSO2-04	6079693	630843	Stream survey Index Electrofishing
Star Lake	6079724	631689	Fish Presence, Bathymetry and Habitat Quantification
Proposed Mining Site DSO3			
DSO3-03	6083555	624887	Stream survey Index Electrofishing
Triangle Pond DSO3-05	6084610	623300	Fish Presence and Bathymetry
DSO3-06	6084138	624393	Stream survey Index Electrofishing
Inukshuk Lake DSO3-07	6086016	623471	Fish Presence and Bathymetry
DSO3-08	6088875	620814	Stream survey Index Electrofishing
DSO3-10	6088278	622497	Stream survey
DSO3-11	6086401	621667	Stream survey
DSO3-13	6084944	620381	Stream survey Index Electrofishing
DSO3-14	6086422	620277	Stream survey Index Electrofishing
DSO3-15	6083929	622501	Stream survey Index Electrofishing
Timmins 1 Pit	6083939	622599	Fish Presence, Bathymetry and Habitat Quantification
Timmins 2 Pit	6084494	622589	Fish Presence

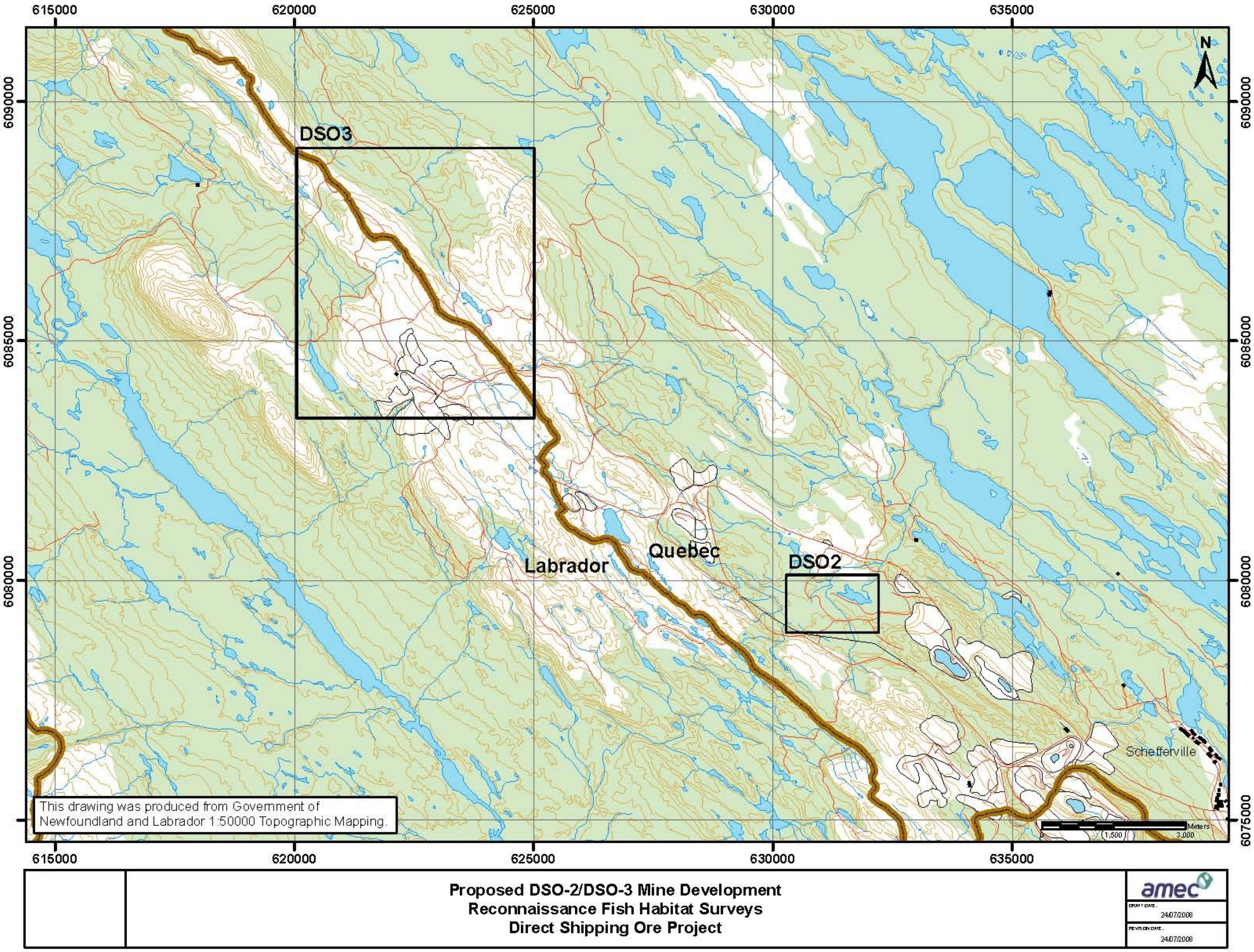

Figure 7.1. An overview of DSO2 and DSO3 locations.

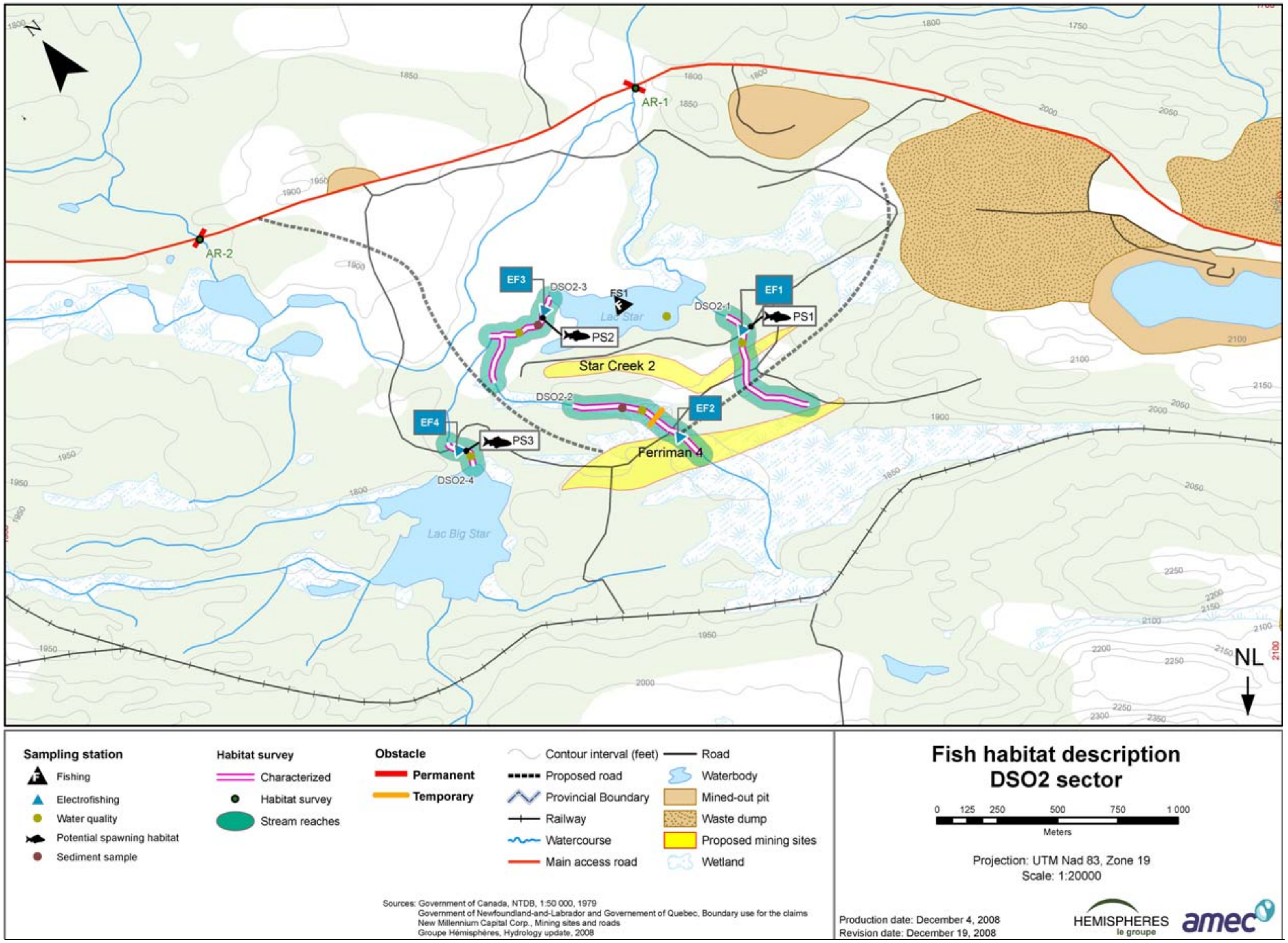

Figure 7.2. DSO2 stream and waterbody sites.

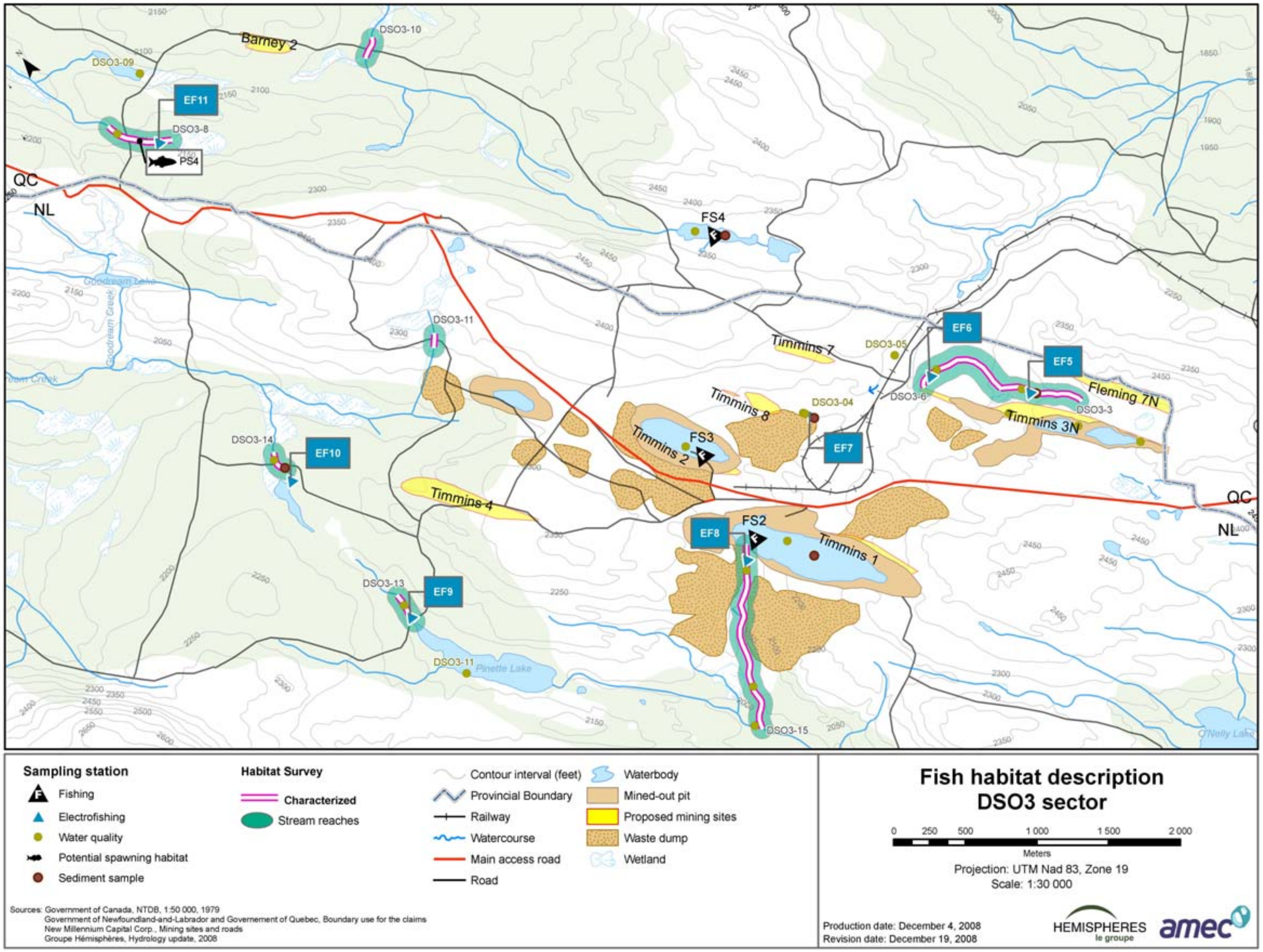

Figure 7.3.DSO3 stream and waterbody site.

8.0 METHODS

Preliminary field reconnaissance of streams near and within each proposed mine site (DSO2 and DSO3) took place July 17-19, 2008. Each stream site was accessed by vehicle and/or on foot and surveyed using standard stream measurement techniques as described in Sooley et al (1998) and Scruton et al. (1992) as well as AMEC Standard Operating Procedures. The preliminary reconnaissance identified areas that had potential as fish habitat. Sampling for fish presence was not included in the work scope for the reconnaissance survey.

The current study was initiated to determine fish presence and the quantity of lacustrine fish habitat in ponds containing fish populations. Streams determined in July to be potential fish habitat were sampled for fish presence from September 9 to 15, 2008. Surveying of selected ponds was also conducted.

8.1. Lacustrine Habitat Classification/Quantification

As per DFO guidelines, fish species presence is used to classify and quantify the fish habitat present in each pond. Sampling in each pond consisted of a depth profile of water quality parameters, Secchi depth determination, fish presence determination, and bathymetry using an integrated GPS and sonar mapping system. The field crew also conducted a shoreline survey of each pond for nearshore substrate classification.

8.1.1. Fish Presence

Baited minnow traps and gillnets were used to determine fish species presence in each of the ponds. Baited minnow traps were set along the littoral zone of the ponds to determine small-bodied fish presence. Monofilament gillnet gangs comprising a total of six panels of 12.7 mm, 25.4 mm, 38.1 mm, 76.2 mm, 101.6 mm, 127 mm mesh sizes were set throughout each pond. The nets and traps where set throughout the day and overnight to allow for fish movement throughout the pond and adequate time for the nets/traps to fish. Nets were generally set perpendicular to the shore.

Electrofishing was conducted in one sample pond (DSO3-05) as an alternative sampling means, because the water was too shallow to permit the use of nets or traps. The crew covered the entire area of the shallow pond. The total shocking time was recorded and later calculated to determine catch-per-unit-effort (CPUE). All captured fish were processed in the same way as those captured by electrofishing in streams.

8.1.2. Water Clarity

Water clarity, measured at the deepest location of the pond, was determined using a Secchi disc during the July site visit. The disc was lowered in the water column using a calibrated line on the shaded side of the boat. The depth when the disc disappeared from sight as it descended was recorded, as well as the depth when it re-appeared as it ascended. The average of the two was calculated and recorded as the littoral depth (depth of water which is penetrated by light).

8.1.3. Sediment Sampling

Sediment samples were collected from four open waterbodies and three stream locations with a Petit Ponar grab (model 1725-F10). The Petit Ponar was equipped with 500µm top screens, which assisted in reducing the loss of sediment on the surface substrates prior to recovery of the grab. The grab was brought to the surface and the appropriate amount extracted from the sampler using stainless steel instruments.

8.1.4. Bathymetric Profile

As part of lacustrine habitat quantification, a bathymetric profile of all identified ponds was completed using sonar equipment. The unit used to map the bathymetric profiles was linked to a GPS and external sonar; this allowed the correlation of pond depths and locations (differential GPS capable) with a set of digital maps. The unit collects a position and water depth every second. An aluminum boat was used with the digital sonar to appropriately traverse the pond habitat. The data was mapped upon completion of the surveys using existing mapping of the study area (1: 50,000) and contour mapping software. The pond boundary was extracted from existing digital base maps of the area provided by the Province of Newfoundland and Labrador and was used as the boundary for all contour modeling. Bathymetric plots were generated using the 3Dfield software package, which plots the data using simple linear equations with grid intervals of 1 m. All completed bathymetric contours were then exported to ARCGIS™ for analysis.

8.1.5. Habitat Quantification

In all ponds where fish were present, the number of hectares of productive lacustrine fish habitat was quantified. All fish species caught during sampling were considered to be using that habitat for part or all of their life-cycle. The approach used for the quantification of lacustrine habitat followed the Standard Methods Guide for the Classification/Quantification of Lacustrine Habitat in Newfoundland and Labrador (Bradbury et al. 2001). The approach involved the completion of both littoral and non-littoral habitat mapping and sampling for species presence and habitat utilization.

Secchi disc depth was used to discriminate between littoral and non-littoral habitat. Once determined, the crew conducted a habitat survey within the littoral zone recording the substrate composition, littoral depth and vegetation. This data was used to calculate the habitat suitability indices (HSI) of individual fish species at various life stages specific to the waterbody. Once habitat suitabilities are determined, habitat equivalent units (HEU's) are calculated for each fish species present.

8.2. Riverine Habitat Classification

All stream reaches were sampled on the ground and were identified and delineated with a series of habitat measurements completed within each stream reach (see Scruton et al. 1992 and Sooley et al. 1998). Habitat measurements included water velocity, water depth, substrate composition and quality, slope, vegetation (presence/absence), stream wetted width, channel width and general bank condition. Measurements of water depth and mean water column velocity were conducted at intervals of 1/3,1/2 and 2/3 of the stream wetted width. Water depth was recorded using a meter-stick, and mean water velocity was measured using a velocity meter (Global flow Probe model FP101) or equivalent field method as outlined in Sooley et al. (1998). The substrate composition of each reach was also recorded as the percentage of each substrate size classification. Based on these measurements, each reach was classified into various habitat types. Two habitat classification systems were used: the Beak (1980) and a new classification system soon to be implemented by DFO (McCarthy et al. 2007).

Riverine habitat classification was completed as part of the July site visit and is presented in Appendix A. Relevant results have been presented in this report where fish species were present.

8.2.1. Electrofishing

Index electrofishing surveys were completed at 12 sites throughout the study streams and at one standing body of shallow water to determine fish species presence. All sites were index electrofished for a minimum of 300 seconds (shocking time). Electrofishing was conducted in the same locations as the stream survey conducted in July.

Electrofishing procedures followed AMEC's Standard Operating Procedures (SOP's) for stream electrofishing as well as Scruton and Gibson (1995).

Electrofishing is the least selective method of fish sampling within a river system (Lagler 1978). A sampling site is selected based on the habitat type (e.g., riffle, run, pool) and the distance of the site allowing the crew to sample one discrete habitat type within a minimum of 300 seconds of electrofishing effort. The site must not be disturbed prior to sampling (e.g., walking through the selected site before sampling) as it is not enclosed with barrier nets. The site is sampled by a backpack-operated electrofisher and one or two dip-netters on either side of the electrofisher operator. The crew starts at the downstream end of the site and fishes moving upstream covering the entire width of the stream; moving up in a discontinuous fashion (turning on and off the power through the trigger on the anode) so as to not ‘push’ or herd fish continually upstream (Scruton and Gibson 1995). Each fish captured was placed in a bucket of stream water until the entire reach was completed. All observed missed fish were recorded for monitoring of fishing efficiency of the field crew. All captured fish were anaesthetized with a 10:1 mixture of ethanol alcohol and clove oil, identified to the species level, weighed, measured, a sub-set of scale samples taken (for purposes of age interpretation), and where possible sexed using external colouration. The fish were then released downstream of the sampling station.

8.2.2. Benthic Invertebrates

Benthic macroinvertebrates are known to be good indicators of habitat health (Reise and Wohlenberg 1993) and are typically included in long-term Environmental Effects Monitoring (EEM) Programs.

Benthic sampling was conducted during the September field sampling period. Samples were collected from four open waterbodies and three stream locations using either a Mini-Surber sampler or a Petit Ponar grab (model 1725-F10). Three separate samples were collected from each site.

The Mini-Surber has a sampling area of 0.023 m^2 and 500 μm mesh net for collection. Substrate within the square frame was cleaned thoroughly with a small, soft bristle brush. Samples were then stored in a glass sample jar preserved with 95% ethanol alcohol for later processing and identification.

The Ponar was used to collect samples from the ponds. The unit has a 232 cm^2 collection area (0.0024 m^3 volume) and is equipped with 500 µm top screens to reduce the loss of macroinvertebrates residing on the surface substrates prior to recovery of the grab. Each sample was field cleaned and stored in bottles with preservative (95% ethanol).

Each sample had all organisms identified to the lowest possible level (typically to Family) and enumerated. Due to the relatively low numbers of organisms, no splitting of the samples was conducted. Baseline diversity was assessed using standard methods with calculations of richness (total number of families), Shannon-Weiner Diversity Indices (H), Simpson’s Diversity Index and an estimate of Species Evenness (D).

Invertebrate Diversity Estimates

The mathematics of *information theory* is used to make calculations about groups of organisms and their *first-order diversity*, H_1, and divergence from equiprobability, D_1. For example, if there are n possible categories in a data set and their proportions are $p_i,.....,p_{n,}$ then the measure of diversity, for this system is defined to be:

$$H_i = \sum_{i=1}^{n} p_i \log_2 p_i$$

Since $\log_2 0$ is not defined, if $p_i = 0$ the conventional adoption is the expression $p_i \log_2 p_i = 0$. In a data set with n categories, $H_{1max}(n)$ is the maximum possible value of H_1.
The divergence from equiprobability is defined to be:

$$D_1 = H_{max} - H_1 = \log_2 n - H_1$$

A low D_1 value means H_1 is close to H_{1max}, that is, the system is nearly in a state of equiprobability; there is a high degree of diversity present. Conversely, a high D_1 value means that H_1 is small relative to H_{1max}, that is, the system has diverged substantially from equiprobability and is not very diverse. For example, for an H_1 of 1.5 and an H_{1max} of 2.0, the D_1 value would be 0.5. In this case 0.5 is a substantial divergence, since it represents 25% of H_{1max}.

9.0 WATER QUALITY

Water quality sampling was conducted at the locations listed in Table 9.1. Parameters analyzed were in accordance with the Metal Mining Effluent Regulations (MMER), with the exceptions of Radium 226 and Total Cyanide, which were not required by the client. All samples were analyzed by a CAEAL certified laboratory. Standard field duplicates of 10% of all samples were collected and sent to the laboratory for QA/QC. In addition, the laboratory results also identify all in-laboratory QA/QC measures (blanks and calibrations) as part of standard reporting (see Appendix C).

In addition to the collection of water samples, an in-situ physical analysis of the water quality in the study area was carried out concurrently with the stream surveys in July and the fish habitat surveys in September. Depth profiles of water quality parameters were recorded in-situ at each sample location. A Hydrolab Mini-Sonde probe was used to gather a profile of water temperature, pH, conductivity and dissolved oxygen at one-meter intervals (or at half-meter intervals if the pond was shallow) between the surface and bottom. Water quality parameters included temperature, pH, conductivity, dissolved oxygen, conductivity and turbidity. Data were collected with a hand-held water quality meter (YSI model 600 QS), a turbidity meter (La Motte model 2020e) and a Secchi disk. In some locations, a pocket pH meter and a conductivity meter (Hanna brand) were used. This information was collected during the July site visit.

Table 9.1. Summary of sampling sites in July and September, 2008.

Site I.D.	July Survey	September Survey
DSO2-01	17/07/2008	11/09/2008
DSO2-02	17/07/2008	11/09/2008
DSO2-03	17/07/2008	11/09/2008
DSO2-04	17/072008	11/09/2008
Star Lake	20/07/2012	11/09/2008
DSO3-02	17/07/2008	Not surveyed[1]
DSO3-03	17/07/2008	11/09/2008
DSO3-04	18/07/08	Not surveyed[1]
DSO3-05 Triangle Pond	20/07/2008	13/09/2008
DSO3-06	18/07/2008	10/09/2008
DSO3/-07 Inukshuk Lake	18/07/2008	13/09/2008
DSO3-08	18/07/2008	10/09/2008
DSO3-09	18/07/2008	Not surveyed[1]
DSO3-10	19/07/2008	Not surveyed[2]
DSO3-11	18/07/2008	Not surveyed[2]
DSO3-13	19/07/2008	10/09/2008
DSO3-14	19/07/2008	10/09/2008
DSO3-15	19/07/2008	12/09/2008
Timmins 1	19/07/2008	12/09/2008
Timmins 2	19/07/2008	11/09/2008

Notes:
1: July's survey determined that site contained no fish habitat
2 : July's survey quantified the site as fish habitat but was dried up in September

10.0 RESULTS

10.1. Lacustrine Habitat Classification/Quantification

Table 10.1 presents the CPUE of all fished waterbodies. Due to the shallow depth of site DSO3-05 (Triangle Pond), this site was sampled by electrofishing instead of netting. The entire pond was index electrofished but did not yield any fish. Only Timmins 1 and Star Lake were considered fish habitat, as only these had fish present. The habitat quantification and calculation of Habitat Equivalent Units for both Timmins 1 and Star Lake are provided below.

Table 10.1. CPUE of fishing effort, all ponds.

<table>
<tr><th colspan="7">CPUE Gill Nets</th></tr>
<tr><th>Site</th><th>Date (set)</th><th>Set Time</th><th>Date (lift)</th><th>Check Time</th><th>Total Catch</th><th>CPUE(catch/hr)</th></tr>
<tr><td>Inukshuk Lake</td><td>13/09/2008</td><td>15:30</td><td>14/09/2008</td><td>9:00</td><td>0</td><td>0.00</td></tr>
<tr><td>Timmins 1</td><td>12/09/2008</td><td>9:45</td><td>12/09/2008</td><td>11:40</td><td>6</td><td>3.13</td></tr>
<tr><td>Timmins 2</td><td>12/09/2008</td><td>15:40</td><td>13/09/2008</td><td>10:44</td><td>0</td><td>0.00</td></tr>
<tr><td>Star Lake</td><td>12/09/2008</td><td>11:00</td><td>12/09/2008</td><td>14:45</td><td>2</td><td>0.35</td></tr>
<tr><th colspan="7">CPUE Minnow Traps</th></tr>
<tr><th>Site</th><th>Date (set)</th><th>Set Time</th><th>Date (lift)</th><th>Check Time</th><th>Total Catch</th><th>CPUE(catch/hr)</th></tr>
<tr><td>Inukshuk Lake</td><td>13/09/2008</td><td>15:30</td><td>14/09/08</td><td>9:00</td><td>0</td><td>0.00</td></tr>
<tr><td>Star Lake</td><td>12/09/2008</td><td>11:00</td><td>12/09/2008</td><td>13:00</td><td>1</td><td>0.50</td></tr>
<tr><td>Star Lake</td><td>12/09/2008</td><td>13:00</td><td>12/09/2008</td><td>14:45</td><td>0</td><td>0.00</td></tr>
<tr><td>Timmins 1</td><td>12/09/2008</td><td>9:45</td><td>12/09/2008</td><td>11:35</td><td>0</td><td>0.00</td></tr>
<tr><td>Timmins 2</td><td>12/09/2008</td><td>15:40</td><td>13/09/2008</td><td>10:44</td><td>0</td><td>0.00</td></tr>
<tr><th colspan="7">Index Electrofishing CPUE</th></tr>
<tr><th>Site ID</th><th>Date</th><th>Effort (seconds)</th><th></th><th></th><th>Total Catch</th><th>CPUE (catch / 300 sec)</th></tr>
<tr><td>Triangle Pond DSO3-05</td><td>13/09/2008</td><td>300</td><td></td><td></td><td>0.00</td><td>0.00</td></tr>
</table>

10.1.1. DSO3-05 (Triangle Pond)

This pond contained no fish and is hence not considered fish habitat. The site consisted of a 0.2 ha (all littoral) water body located east of Timmins 2. It was sampled as a downstream impact monitoring site for water quality and fish presence. This pond was very shallow (all less than one metre deep) and contained a substrate composition of mostly silt and sand. There was no evidence of an inflow/outflow, and geologists stated that this water body is the result of rain runoff and spring freshet. See Photo B-56, Appendix B.

10.1.2. DSO3-07 (Inukshuk Lake)

This site also contained no fish and hence is not considered fish habitat. It is a 4.48 ha shallow lake (all littoral) with emergent vegetation. Inukshuk Lake contains a rocky bottom with an overall substrate composition of boulders and rubble, with lesser amounts of cobble, gravel and silt. This site may be considered as a control or reference site for water quality should development proceed. See Photo B-57, Appendix B. Figure 10.1 presents the bathymetric profile of Inukshuk Lake.

10.1.3. Timmins 2

Timmins 2 is an exhausted pit now filled with water, a result of rain, runoff and the spring freshet. It is located within the DSO3 proposed mine site. No inflow or outflow was observed. Gillnets and minnow traps were set but did not yield any fish; therefore no other surveys were conducted or samples collected (see Photo B-59, Appendix B).

10.1.4. Timmins 1

Brook trout were present in this former pit. Timmins 1 is an exhausted pit now filled with water, a result of rain, runoff and the spring freshet. Timmins 1 has a total area of 23.78 ha, with the deepest location measuring 75 m. The substrate composition consisted of rubble, gravel, sand and silt. It is located within the DSO3 proposed mine site. Water from this pond was found to be running through a gravel berm into stream DSO3-15 on the western shore (see Photo B-58, Appendix B). Figure 10.2 presents the bathymetric profile of Timmins 1.

Habitat Quantification

A DFO-generated spreadsheet was used for habitat quantification; the spreadsheet was used in conjunction with the habitat and species data collected in the field. Table 10.2 presents an overview of the habitat information used to determine habitat areas. Table 10.3 shows the habitat suitabilities of each habitat type for the species present (i.e., brook trout). The habitat suitabilities range from 0.00 (not suitable) to 1.00 (very high suitability). DFO spreadsheet calculations were used to determine final habitat equivalent units of each habitat type present (Table 10.4). Total HEUs (Table 10.4) have been calculated for brook trout at 5.8 ha and broken down as follows:

- 1.5 ha of Littoral Medium, no vegetation;
- 0.7 ha Littoral Fine, no vegetation;
- 3.6 ha Non-littoral Fine habitat.

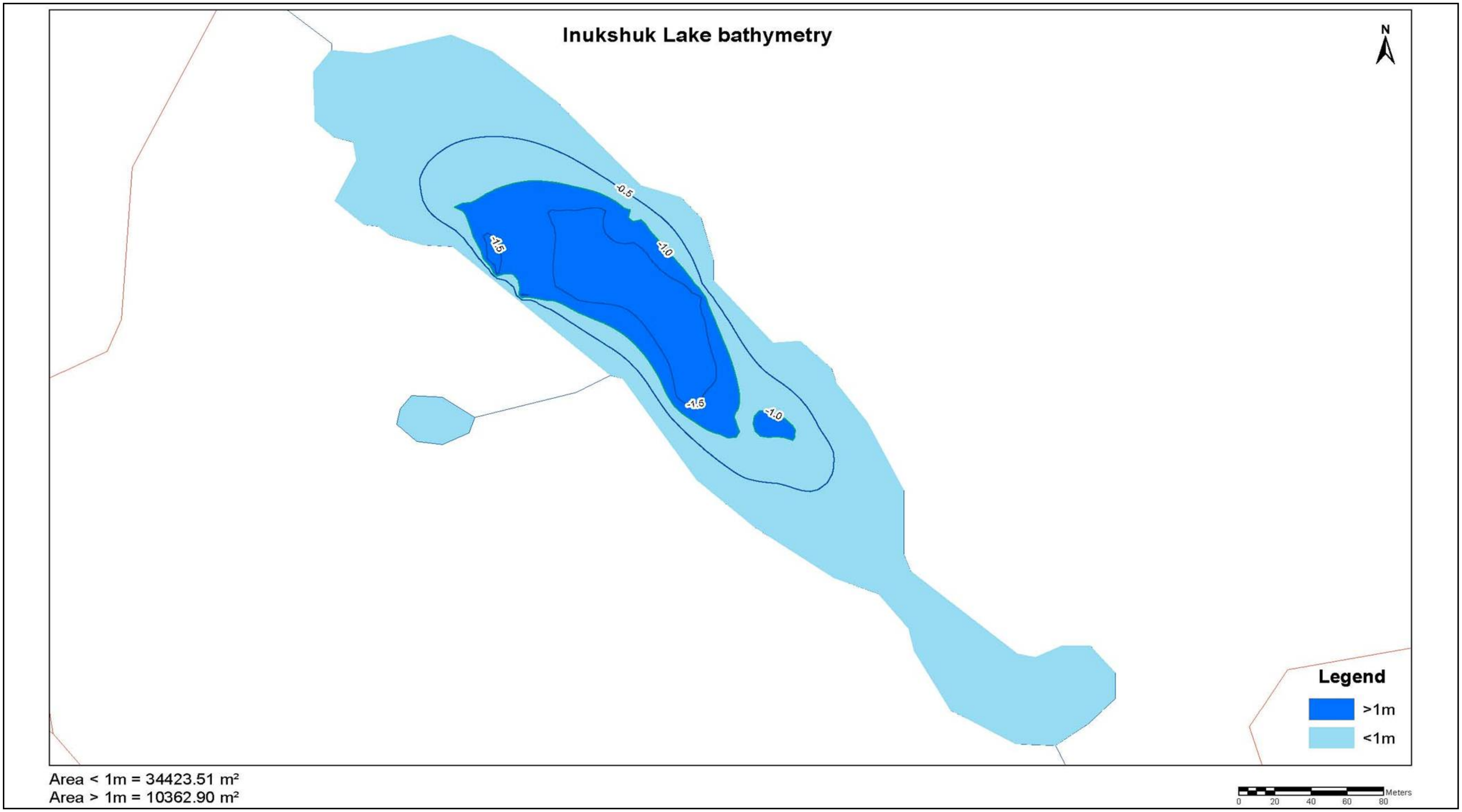

Figure 10.1. Bathymetric profile of Inukshuk Lake, September, 2008.

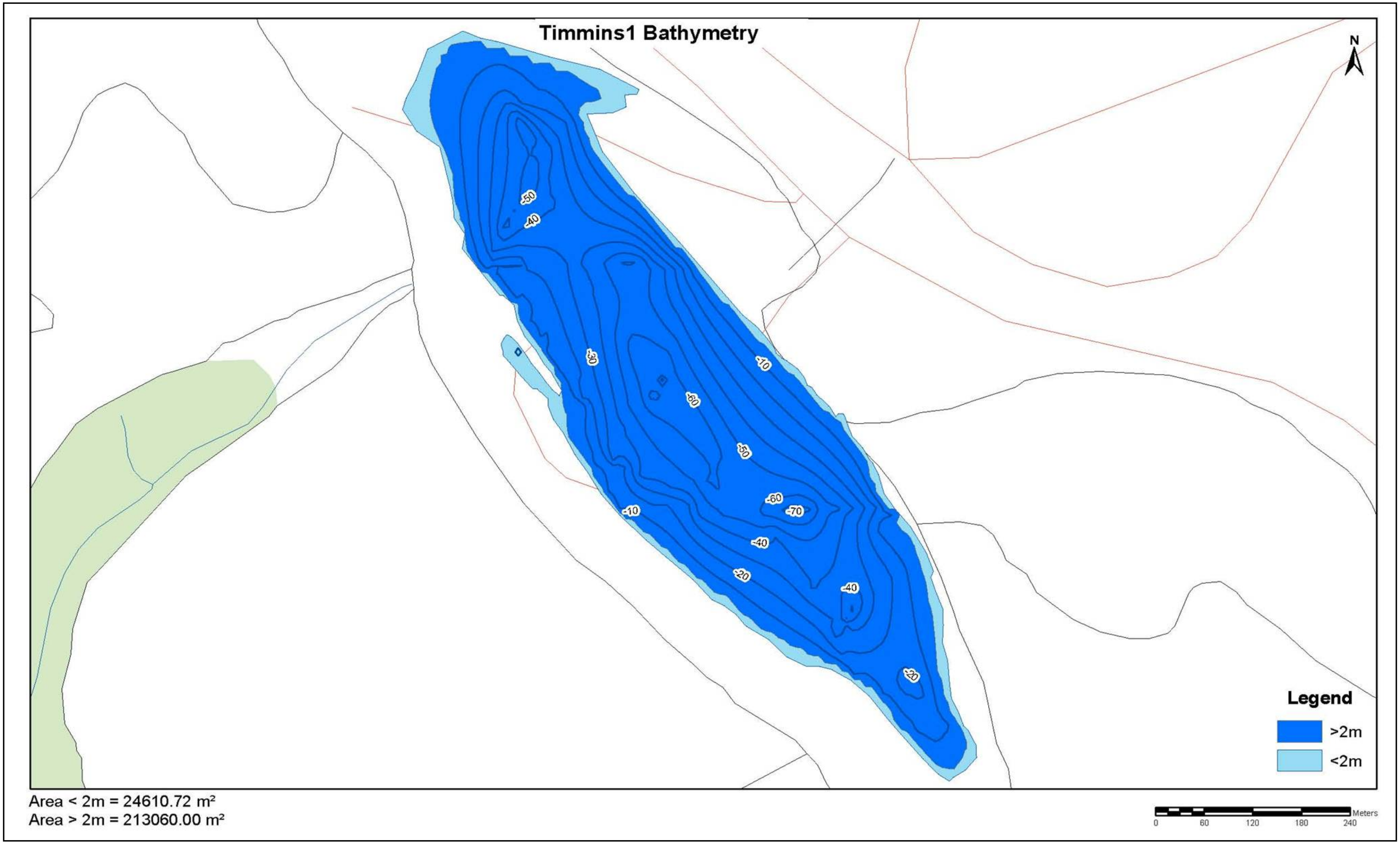

Figure 10.2. Bathymetric profile of Timmins 1, September, 2008.

Table 10.2. Summary of Timmins 1 habitat values used to calculate aerial extents

Enter Lake name: Timmins 1

Part 1 Entering Lake depth(s):

IF Lake Depth is less than or equal to 10 m:			**IF Lake Depth is greater than 10 m:**	
Path 1		**OR**	**Path 2**	
A Enter Depth of Littoral Zone:	0		**A-1 Enter mean depth of Non-Littoral Zone:**	17
B Enter Mean Depth of Lake:	0		**B-1 Enter depth of Benthic Zone:**	75

Path 2 (Continued…)

IF Lake Depth is greater than 10 m:	**Mean depth of Non-Littoral Zone:**		*(Reduced Value)*
	Depth of the Benthic Zone:		*(Reduced Value)*
	Benthic Pelagic ratio:		

Part 2 Enter the values for the estimated bottom surface area:

Littoral Zone (No vegetation):

Substrate:	**Coarse**	m^2	**Medium**	m^2	**Fine**	m^2
	Bedrock:	0.00	Rubble:	5,537.41	Sand:	5,537.41
	Boulder:	0.00	Cobble:	0.00	Silt:	4,306.88
			Gravel:	9,229.02	Muck:	0.00
					Clay:	0.00
	SubTotals:	0		14,766		9,844

Littoral Zone (Vegetation)

Substrate:	**Coarse**	m^2	**Medium**	m^2	**Fine**	m^2
	Bedrock:	0.00	Rubble:	0.00	Sand:	0.00
	Boulder:	0.00	Cobble:	0.00	Silt:	0.00
			Gravel:	0.00	Muck:	0.00
					Clay:	0.00
	SubTotals:	0		0		0

Non-Littoral Zone

Substrate:	**Coarse**	m^2	**Medium**	m^2	**Fine**	m^2
	Bedrock:	0.00	Rubble:	0.00	Sand:	0.00
	Boulder:	0.00	Cobble:	0.00	Silt:	0.00
			Gravel:	0.00	Muck:	213,060.00
					Clay:	0.00
	SubTotals:	0		0		213,060

Part 3 Summary Table for Bottom Surface Area Totals:

Habitat Types	**Bottom Surface area (m^2)**
Littoral Coarse/No vegetation	0
Littoral Medium/No vegetation	14,766
Littoral Fine/No vegetation	9,844
subtotal Littoral/No vegetation	**24,611**
Littoral Coarse/Vegetation	0
Littoral Medium/Vegetation	0
Littoral Fine/Vegetation	0
Subtotal Littoral/Vegetation	**0**
Subtotal Littoral	**24,611**
Non-littoral Coarse/Pelagic	0
Non-littoral Medium/Pelagic	0
Non-littoral Fine/Pelagic	213,060
Subtotal nonlittoral	**213,060**
Total Available Habitat	**237,671**

Table 10.3. Habitat suitabilities for species present (brook trout) within Timmins 1.

		Littoral Zone						Non-Littoral Zone		
Species	Life Stage	Coarse/No Vegetation	Medium/No Vegetation	Fine/No Vegetation	Coarse/Vegetation	Medium/Vegetation	Fine/Vegetation	Coarse/Pelagic	Medium/Pelagic	Fine/Pelagic
Brook Trout (freshwater resident)	Spawning	NA	0.84	0.76	NA	NA	NA	NA	NA	0.17
	YOY	NA	1.00	0.00	NA	NA	NA	NA	NA	0.00
	Juvenile	NA	1.00	0.00	NA	NA	NA	NA	NA	0.00
	Adult	NA	0.50	0.67	NA	NA	NA	NA	NA	0.00

YOY – Young of the Year

Table 10.4. Habitat equivalent units for species present (brook trout) within Timmins 1 measured in m^2.

	Littoral Zone						Non-Littoral Zone			
Species	Coarse/No Vegetation	Medium/No Vegetation	Fine/No Vegetation	Coarse/Vegetation	Medium/Vegetation	Fine/Vegetation	Coarse/Pelagic	Medium/Pelagic	Fine/Pelagic	Total Available Habitat
Brook Trout (freshwater resident)	0	14766	7482	0	0	0	0	0	36220	58468.4

10.1.5. Star Lake

This lake is located within the DSO2 proposed mine site. It has a total area of 10.1 ha, with the deepest point measuring 1.5 m. The substrate composition is comprised of fines, with gravel cobble and rubble located at the mouth of the inflow and outflow. Schools of large (approximately 200 mm in length) brook trout were observed near the outflow of the lake during the September field sampling. See Photo B-60, Appendix B. Figure 10.3 presents the bathymetric profile of Star Lake.

Habitat Quantification

A DFO-generated spreadsheet was used for habitat quantification; the spreadsheet was used in conjunction with the habitat and species data collected in the field. Table 10.5 presents an overview of the habitat information used to determine habitat areas. Table 10.6 shows the habitat suitabilities of each habitat type for the species present (i.e., brook trout). DFO spreadsheet calculations were used to determine final habitat equivalent units of each habitat type present (Table 10.7). Total HEUs (Table 10.7) have been calculated for brook trout at 0.055 ha and broken down as follows:

- 0.055 ha Littoral Fine, vegetation.

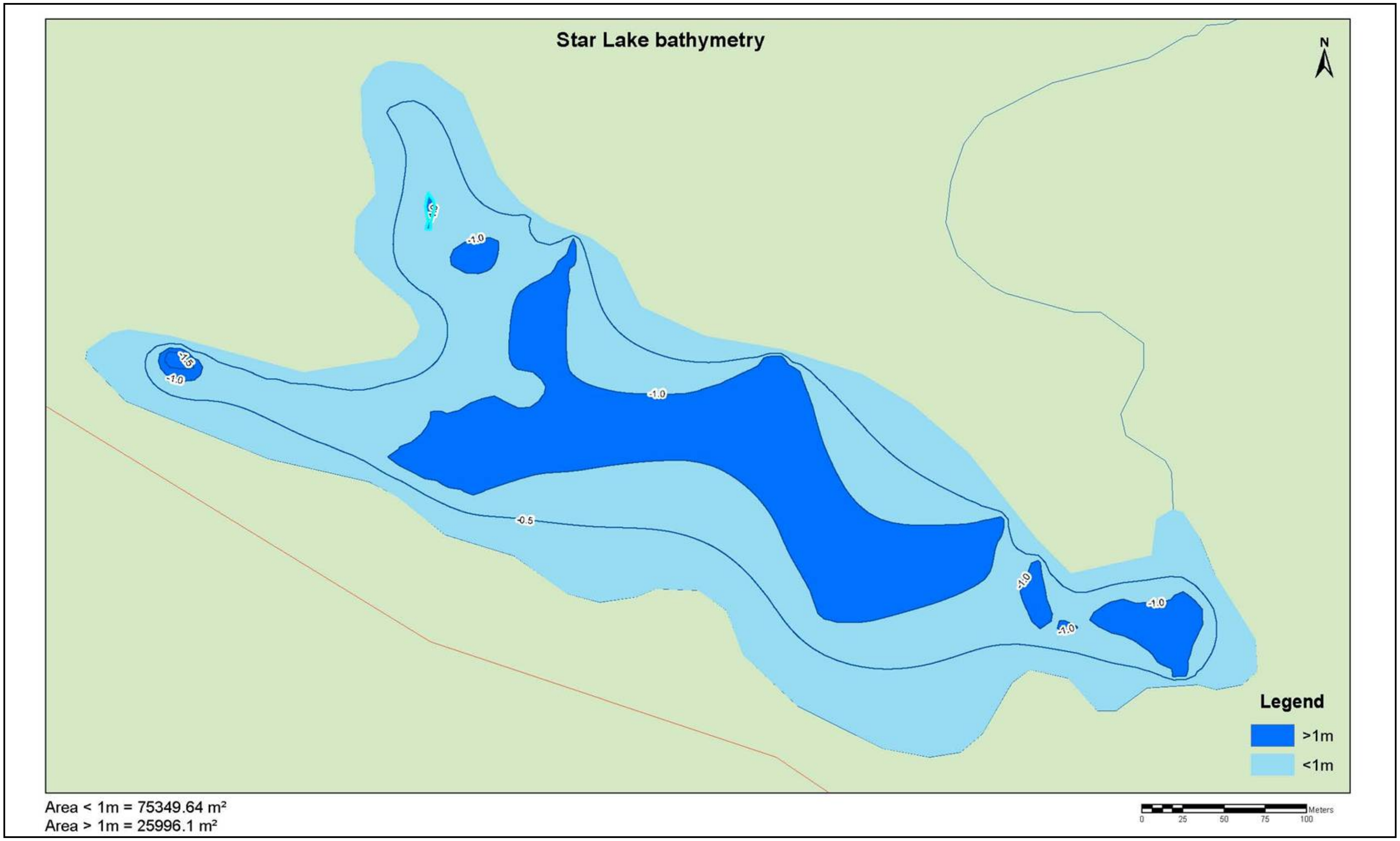

Figure 10.3. Bathymetric profile of Star Lake, September, 2008.

Table 10.5. Summary of Star Lake habitat values used to calculate aerial extents.

Step 1

Note: Only enter the values in the cells shaded blue, the subtotals, totals and ratios will be calculated autor

Enter Lake name: Star Lake

Part 1 Entering Lake depth(s):

IF Lake Depth is less than or equal to 10 m:

Path 1	
A Enter Depth of Littoral Zone:	1
B Enter Mean Depth of Lake:	1

OR

IF Lake Depth is greater than 10 m:

Path 2	
A-1 Enter mean depth of Non-Littoral Zone:	0
B-1 Enter depth of Benthic Zone:	0

Path 2 (Continued…)

IF Lake Depth is greater than 10 m:

Mean depth of Non-Littoral Zone:		*(Reduced Value)*
Depth of the Benthic Zone:		*(Reduced Value)*
Benthic Pelagic ratio:		

Part 2 Enter the values for the estimated bottom surface area:

Littoral Zone (No vegetation):						
Substrate:	**Coarse**	m^2	**Medium**	m^2	**Fine**	m^2
	Bedrock:	0.00	Rubble:	3,013.99	Sand:	30,139.86
	Boulder:	0.00	Cobble:	3,767.48	Silt:	30,139.86
			Gravel:	7,534.96	Muck:	0.00
					Clay:	0.00
	SubTotals:	0		14,316		60,280

Littoral Zone (Vegetation)						
Substrate:	**Coarse**	m^2	**Medium**	m^2	**Fine**	m^2
	Bedrock:	0.00	Rubble:	0.00	Sand:	0.00
	Boulder:	0.00	Cobble:	0.00	Silt:	0.00
			Gravel:	0.00	Muck:	753.50
					Clay:	0.00
	SubTotals:	0		0		754

Non-Littoral Zone						
Substrate:	**Coarse**	m^2	**Medium**	m^2	**Fine**	m^2
	Bedrock:	0.00	Rubble:	0.00	Sand:	0.00
	Boulder:	0.00	Cobble:	0.00	Silt:	0.00
			Gravel:	0.00	Muck:	25,996.10
					Clay:	0.00
	SubTotals:	0		0		25,996

Part 3 Summary Table for Bottom Surface Area Totals:

Habitat Types	**Bottom Surface area (m^2)**
Littoral Coarse/No vegetation	0
Littoral Medium/No vegetation	14,316
Littoral Fine/No vegetation	60,280
subtotal Littoral/No vegetation	**74,596**
Littoral Coarse/Vegetation	0
Littoral Medium/Vegetation	0
Littoral Fine/Vegetation	754
Subtotal Littoral/Vegetation	**754**
Subtotal Littoral	**75,350**
Non-littoral Coarse/Pelagic	0
Non-littoral Medium/Pelagic	0
Non-littoral Fine/Pelagic	25,996
Subtotal nonlittoral	**25,996**
Total Available Habitat	**101,346**

Table 10.6. Habitat suitabilities for species present (brook trout) within Star Lake.

		Littoral Zone						Non-Littoral Zone		
Species	Life Stage	Coarse/No Vegetation	Medium/No Vegetation	Fine/No Vegetation	Coarse/Vegetation	Medium/Vegetation	Fine/Vegetation	Coarse/Pelagic	Medium/Pelagic	Fine/Pelagic
Brook Trout (freshwater resident)	Spawning	0.00	0.84	0.71	0.00	0.84	0.71	0.00	0.42	0.30
	YOY	0.50	1.00	0.00	0.50	1.00	0.00	0.50	1.00	0.00
	Juvenile	0.50	1.00	0.00	0.50	1.00	0.00	0.50	1.00	0.07
	Adult	0.00	0.67	0.34	0.00	0.67	0.39	0.00	0.50	0.33

Table 10.7. Habitat equivalent units for species present (brook trout) within Star Lake measured in m^2

	Littoral Zone						Non-Littoral Zone			
Species	Coarse/No Vegetation	Medium/No Vegetation	Fine/No Vegetation	Coarse/Vegetation	Medium/Vegetation	Fine/Vegetation	Coarse/Pelagic	Medium/Pelagic	Fine/Pelagic	Total Available Habitat
Brook Trout (freshwater resident)	0	14316	43401	0	0	543	0	0	8839	67099.4

10.2. Riverine Habitat Classification

All streams that were surveyed and sampled are located within one of the two mining areas or adjacent to it with the likelihood of being affected by the proposed changes to the site. A summary of habitat information and classifications from July's survey is presented in Table 10.8. A more detailed summary can be found in Appendix A.

Table 10.8. A summary of habitat characteristics found during July survey

Survey ID	Predominant Habitat Type	Notes on Fish Habitat Potential
DSO2-01	Riffle / Run: All habitat parameters appear suitable	Potential Fish Habitat Present
DSO2-02	Riffle / Run: All habitat parameters appear suitable	Potential Fish Habitat Present
DSO2-03	Run / Riffle: All habitat parameters appear suitable	Potential Fish Habitat Present
DSO2-04	Run / Riffle: All habitat parameters appear suitable	Potential Fish Habitat Present
DSO3-02	Run / Riffle	No Potential Fish Habitat Present
DSO3-03	Steady: All habitat parameters appear suitable	Potential Fish Habitat Present
DSO3-04	Standing rain water: no inflow or outflow	No Potential Fish Habitat Present
DSO3-05	Standing rain water: no inflow or outflow	No Potential Fish Habitat Present
DSO3-06	Steady: All habitat parameters appear suitable	Potential Fish Habitat Present
DSO3-08	Run / Riffle: All habitat parameters appear suitable	Potential Fish Habitat Present
DSO3-09	No stream habitat present	No Potential Fish Habitat Present
DSO3-10	Run / Riffle: All habitat parameters appear suitable	Potential Fish Habitat Present
DSO3-11	Run / Riffle: All habitat parameters appear suitable	Potential Fish Habitat Present
DSO3-13	Run / Riffle/Steady/Pool: All habitat parameters appear suitable	Potential Fish Habitat Present
DSO3-14	Steady: All habitat parameters appear suitable	Potential Fish Habitat Present
DSO3-15	Riffle: All habitat parameters appear suitable	Potential Fish Habitat Present

10.2.1. Electrofishing

Table 10.9 summarizes each stream sampled for fish presence in September. An estimate of the catch per unit effort (CPUE) was calculated for all electrofished sites that yielded fish (Table 10.10). Stream DSO2-01 produced the highest CPUE while site DSO2-02 and DSO3-08 were the lowest. Streams DSO3-13 and DSO2-04 were the only two sites to capture a species other than brook trout (lake chub and burbot respectively).

Table 10.9. DSO2 and DSO3 habitat type and fish presence summary.

Survey ID	Predominant Habitat Type		Fish Presence
	New Classification	Beak	
DSO2-01	Riffle / Run	II (rearing, limited spawning)	30 Brook trout
DSO2-02	Riffle / Run	IV (shelter and feeding)	2 Brook trout
DSO2-03	Riffle / Run	I (spawning and rearing)	21 Brook trout
DSO2-04	Riffle / Run	II (rearing, limited spawning)	14 Brook trout and 1 Burbot
DSO3-03	Steady	IV (shelter and feeding)	No fish
DSO3-06	Steady	IV (shelter and feeding)	No fish
DSO3-08	Run / Riffle	IV (shelter and feeding)	2 Brook trout
DSO3-10	Dry		No fish; Channel was dry
DSO3-11	Dry		No fish; Channel was dry
DSO3-13	Run / Riffle/Steady/Pool	IV (shelter and feeding	3 Lake chub 1 Brook trout
DSO3-14	Steady	IV (shelter and feeding	No fish
DSO3-15	Riffle	II (rearing, limited spawning)	20 Brook trout

Table 10.10. Standardized Index electrofishing CPUE of all sites that yielded fish.

Index Electrofishing CPUE				
Site ID	**Species**	**Total Catch**	**Time (sec)**	**Catch/300sec**
DSO2				
DSO2-01	Brook trout	30	309	29.1
DSO2-02	Brook trout	2	305	2.0
DSO2-03	Brook trout	21	300	21.0
DSO2-04	Brook trout	14	309	13.6
	Burbot	1		1.0
DSO3				
DSO3-08	Brook trout	2	300	2.0
DSO3-13	Brook trout	1	306	1.0
	Lake chub	3		2.9
DSO3-15	Brook trout	20	300	20.0

DSO2-01

Stream DSO2-01 yielded a catch of 30 brook trout within an area dominated by instream cover and small pools. The fish ranged from young-of-the-year to 170 mm in length. This stream is confirmed as fish habitat due to the presence of fish there.

Approximately 370 m of stream was surveyed with most of the habitat being classified as riffle/run. The average stream wet width was 1.45 m. Mean water depth was 0.54 m with an average velocity of 0.17 m/s. Substrate consisted predominantly of cobble and rubble with sand and gravel intermixed. One pool was identified and measured at 3 m long by 6 m wide, had an average depth of 0.55 m and an average flow of 0.06 m/s. The pool contained substrate dominated by medium and fine substrate types. See Photos B-1 to B-3, Appendix B.

DSO2-02

Stream DSO2-02 yielded a catch of two brook trout within a narrow channel leading to open wetland. The fish ranged in length from 70 mm to 100 mm. The site consisted of partial instream cover. This stream is confirmed as fish habitat due to the presence of fish there.

Approximately 500 m of stream was surveyed, the majority of which was classified as run/riffle habitat. The average stream wet width was 0.9 m. Mean water depth was 0.39 m with an average velocity of 0.10 m/s. Substrate consisted of mostly muck and sand and partially medium-sized substrate such as cobble. One pool was identified and measured at 2.8 m long and 6 m wide, had an average depth of 0.54 m with no measurable velocity. The pool consisted of medium and fine sized substrate. The stream disappears into a fen at one point but emerges again approximately 100m away. This fen could be considered a temporary barrier during low flows. . See Photos B-4 to B-7 in Appendix B.

DSO2-03

Stream DSO2-03 yielded 21 brook trout ranging from 40 mm to 100 mm in length. Plenty of instream cover was present and a large deep pool at the mouth of the stream to Star Lake. This stream is confirmed as fish habitat due to the presence of fish there. Sediment samples were collected at this site.

Approximately 300 m of stream was surveyed and classified as predominantly run/riffle habitat. The average stream wet width was 3.12 m. Mean water depth was 0.28 m with an average velocity of 0.37 m/s. The majority of substrate consisted of sand and gravel, supplemented by medium-sized substrate such as cobble and rubble. One pool that was identified at the inflow of Star Lake measured 5.0 m long and 8.0 m wide. The pool had an average depth of 1.0 m. Velocity could not be measured due to the pool’s depth. The majority of substrate consisted of medium-sized rocks with fines settled along the sides of the pool. See Photos B-8 and B-9 in Appendix B.

DSO2-04

Stream DSO2-04 yielded 14 brook trout ranging from 80 mm to 250 mm in length and one burbot at 180 mm in length. The majority of brook trout caught were larger in size. The site was difficult to sample due to fast flowing water impairing visibility. This stream is confirmed as fish habitat due to the presence of fish there.

Approximately 120 m of stream was surveyed, the majority of which was classified as run/riffle habitat. The average stream wet width was 5.1 m. Mean water depth was 0.39 m with an average velocity of 0.34 m/s. Substrate consisted of medium-sized substrate with fines intermixed. See Photos B-10 and B-11, Appendix B.

DSO3-03

During July's survey this site was considered potential fish habitat but at the time of sampling the channel was dry in places, with very little cover. Electrofishing was conducted but did not yield any fish. Sediment samples were collected at this site as scheduled in the Work Task Order. This stream is not considered fish habitat.

DSO3-06

During July's survey this site was considered potential fish habitat but at the time of sampling the channel was dry in places, with very little cover. Electrofishing was conducted but did not yield any fish. This stream is not considered fish habitat.

DSO3-08

Stream DSO3-08 yielded a catch of two brook trout 120 mm and 240 mm in length respectively. The sample site consisted of ample overhang cover from vegetation along the banks of the stream. This stream is confirmed as fish habitat due to the presence of fish there.

Approximately 60 m of stream was surveyed and classified as run/riffle habitat. The average stream wet width was 1.38 m. Mean water depth was 0.11 m with an average velocity of 0.19 m/s. Substrate consisted predominantly of medium and fines with coarse substrate intermixed. See Photos B-28 and B-29, Appendix B.

DSO3-10

During July's survey this site was considered potential fish habitat but at the time of sampling, this stream was dry and is therefore not considered fish habitat.

DSO3-11

During July's survey this site was considered potential fish habitat but at the time of sampling, this stream was dry and is therefore not considered fish habitat.

DSO3-13

Stream DSO3-13 yielded three lake chub ranging from 40 mm to 80 mm in length and one brook trout 60 mm in length. A suitable sample site was found near the mouth of Lake Pinette as the upstream portion of this stream was dry in parts. This stream is confirmed as fish habitat due to the presence of fish there.

Approximately 150 m of stream was surveyed and classified as a combination of run/riffle, steady and pool habitats. The average stream wet width of the run/riffle habitat was 0.43 m with a mean water depth of 0.15 m and an average velocity of 0.52 m/s. Substrate consisted of a majority of medium substrate intermixed with coarse, fines and organics. The average stream wet width of the identified steady habitat was 2.2 m with a mean water depth of 0.26 m and an average velocity of 0.0 m/s. The average stream wet width of the identified pool habitat was 2.2 m with a mean water depth of 0.45 m and an average velocity of 0.04 m/s. Substrate in the steady and pool habitat consisted mostly of medium substrate intermixed with coarse, fines and organics. See Photos B-38 to B-41, Appendix B.

DSO3-14

During July's survey this site was considered potential fish habitat but did not yield any fish during sampling. Sediment samples were collected at this site as scheduled in the Work Task Order. This stream is not considered fish habitat.

DSO3-15

Stream DSO3-15 yielded 20 brook trout ranging from 45 mm to 150 mm in length. The site consisted of some moderately deep pools with overhanging vegetation providing cover for fish. The uppermost portions (outflow of Timmins 1) had little or no overhanging vegetation due to the large tailing piles on each side of the stream. This stream is confirmed as fish habitat due to the presence of fish there.

The outflow of Timmins 1 was surveyed between the pit and its confluence with the outflow of Lake Pinette (1.5 km). The stream was predominantly riffle habitat with an average stream wet width of 2.84 m. Mean water depth was 0.11 m with an average velocity of 0.21 m/s. Substrate consisted mostly of medium substrate intermixed with fine and coarse substrate. At the outflow from the pit, there were two steadies (6 m x 20 m and 15 m x 100 m). One small pool was also identified while surveying the stream. Its dimensions were 3.79 m x 3 m with an average depth of 0.32 m and an average velocity of 0.06 m/s. The substrate was classified as medium with coarse and fine substrates intermixed. See Photos B-49 to B-54, Appendix B.

10.2.2. Macroinvertebrates

Samples were collected from selected sites as outlined within the Work Task Order and identified to Family and Order. Table 10.11 presents a summary of species Richness, Evenness and Shannon-Weiner diversity indices from each pond sampled. Table 10.11 presents the macroinvertebrate results from each location and Table 10.12 presents the macroinvertebrates identified.

Table 10.11. Summary of species Richness (S), Shannon-Weiner (H) and Evenness (E) diversity indices for macroinvertebrates.

Sample ID	Aquatic Habitat Type	Number of Species (Richness - S)	Number of Individuals (n)	Shannon-Weiner (H)	H_{max}	Evenness (E) %	Simpson's Diversity Index
DSO2							
DSO2-03	Stream	9	24	1.921	3.2	60.0%	1.533
DSO2-03	Stream	8	28	1.810	3.3	54.9%	1.350
DSO2-03	Stream	9	30	1.867	3.4	54.9%	1.381
DSO3							
DSO3-03	Stream	0	0	-	0	-	-
DSO3-03	Stream	1	1	-	0	-	-
DSO3-03	Stream	1	1	-	0	-	-
DSO3-07	Stream	6	78	0.841	4.4	19.1%	1.069
DSO3-07	Stream	8	30	1.504	3.4	44.2%	1.318
DSO3-07	Stream	5	25	1.015	3.2	31.7%	1.111
DSO3-14	Stream	4	45	0.392	3.8	10.3%	1.073
DSO3-14	Stream	6	76	0.568	4.3	13.2%	1.071
DSO3-14	Stream	2	10	0.325	2.3	14.1%	1.125
Star	Lake	1	1	-	0	-	-
Star	Lake	1	1	-	0	-	-
Timmins 1	Pond	1	3	-	0	-	1
Timmins 1	Pond	1	2	-	0	-	1

Table 10.12. Macroinvertebrates identified, September 2008.

Macroinvertebrate Identification		Sample Location					
		DSO2-03			DSO3-03		
Order	Family	Sample 1	Sample 2	Sample 3	Sample 1	Sample 2	Sample 3
Ephemeroptera	Ephemerellidae	4	6	10			
	Unknown		1				
Tricoptera	Polycentropodidae		2	1			
	Lepidostomatidae	3					
	Glossosomatidae		2	1			
Diptera	Stratiomyidae	1					
	Chironomidae		2	3		1	
	Tipulidae	1		2			
Plecoptera	Chloroperlidae	3	10	7			
	Unknown	1		1			
Mollusca	bivalvia	8	3	3			
Crustacea	Amphipoda	1					
Oligochaetae	Unknown	2	2	2			
Homoptera	delphacidae						1

Macroinvertebrate Identification		Sample Location					
		DSO3-07			DSO3-14		
Order	Family	Sample 1	Sample 2	Sample 3	Sample 1	Sample 2	Sample 3
Ephemeroptera	Ephemerellidae			1			
	Unknown	2					
Tricoptera	Leptoceridae	1					
	Phryganeidae		1				
	Limnephilidae		1				
Diptera	Chironomidae	61	15	17	41	66	9
	Chaoboridae	5		4	1	5	
	Unknown					1	
Hemiptera	Corixidae		4	2			
Mollusca	bivalvia	6	6	1	2	2	1
Crustacea	Cladocera		1				
Coleoptera	Chrysomelidae				1		
	Dytiscidae		1			1	
Odonata	Libellulidae					1	
Arhynchobdellida	Erpodbellidae	3	1				

Macroinvertebrate Identification		Sample Location					
		Star Lake			Timmins 1		
Order	Family	Sample 1	Sample 2	Sample 3	Sample 1	Sample 2	Sample 3
Diptera	Chironomidae	1					
	Tipulidae				3		
Mollusca	Gastrapoda		1				
Coleoptera	Elmidae					2	

10.3. In-situ Water Quality and Laboratory Results

An *In-situ* physical analysis of the water quality in pond sample sites was carried out. Water quality parameters included temperature, pH, conductivity, dissolved oxygen conductivity and transparency. A summary of these results from July and September is presented in Table 10.13. Surface water samples were also collected and sent to AMEC's Mississauga Laboratory for analysis. Samples were analyzed for general chemistry and metals, plus hydrides, in compliance with the MMER. The laboratory results can be found in Appendix C.

Laboratory results were analyzed for exceedance of the Canadian Council of Ministers of the Environment Canadian Water Quality Guidelines for the Protection of Aquatic Life (2007). Aluminum was in exceedance at sites DSO3-03, DSO3-05, DSO3-06, DSO3-07, DSO3-13 and DSO3-14. Cadmium was in exceedance at sites DSO3-03, DSO3-05, DSO3-06, DSO3-07, DSO3-08, DSO3-13, DSO3-14, DSO3-15, DSO2-01, DSO2-02 and DSO2-03, DSO2-04, Star Lake, Timmins1, and Timmins 2. Copper was in exceedance at sites DSO3-06, DSO3-07, DSO3-14, and DSO3-15. Iron was in exceedance at sites DSO3-05, DSO3-06, DSO3-08, DSO3-13, DSO3-14 and DSO2-02. Lead was in exceedance at site DSO3-15. Mercury was in exceedance at site DSO3-06. Selenium was in exceedance at site DSO3-15. A summary of these results can be found in Table 10.14.

In the sediment results arsenic was in exceedance of ISQG guideline at sites DSO2-03 and DSO3-05. Cadmium was in exceedance of ISQG guideline at sites DSO2-03, DSO3-03, DSO3-05 and Timmins 1. None of the sites exceeded PEL levels. A summary of the results can be found in Table 10.15.

Table 10.13. Summary of water quality measurements at all sampled sites in July and September.

Site ID	July Sampling						September Sampling				
	Date	Temperature	Conductivity	pH	NTU	DO	Date	Temperature	Conductivity	pH	DO
DSO2-01	17/07/2008	-	-	-	0.49	-	11/09/2008	6.1	118	7.1	-
DSO2-02	17/07/2008	-	-	-	-	-	11/09/2008	8.8	54	6.36	-
DS02-03	17/07/2008	13.3	70	7.5	1.02	10.0	11/09/2008	9.3	58	6.63	-
DSO2-04	17/07/2008	14.7	70	7.5	1.02	10.0	11/09/2008	8.9	59	6.81	-
Star Lake	20/07/2008	14.3	72	7	0.34	11.5					
DSO3-03	17/07/2008	14.5	5	6.0	0.37	8.3	11/09/2008	10.9	0	4.81	-
DSO3-05 Triangle Pond	20/07/2008	14.1	7	5.7	210.00[2]	10.4	13/09/2008	10.6	0	5.21	-
DSO3-06	18/07/2008	13.8	6	6.2	0.27	9.9	10/09/2008	8.7	19	6.4	-
DSO3-07 Inukshuk Lake	18/07/2008	15.5	5	6.1	0.66	10.2	13/09/2008	12.5	0	5.73	-
DSO3-08	18/07/2008	14.8	22	6.0	0.52	9.6	10/09/2008	10.7	19	7.68	-
DSO3-10	19/07/2008	13.4	5	4.9	0.16	8.4	-	-	-	-	-
DSO3-11	18/07/2008	15.7	4	5.6	0.47	10.0	-	-	-	-	-
DSO3-13	19/07/2008	16.7	6	4.7	0.62	6.9	10/09/2008	8.8	-	-	-
DSO3-14	19/07/2008	14.1	16	7.2	13.10	-	10/09/2008	9.3	1	5.67	-
DSO3-15	19/07/2008	13.8	2	5.8	0.23	-	12/09/2008	9.7	11	7.78	-
Timmins 1	19/07/2008	8.8	21	6.5	4.89	12.1	12/09/2008	12.1	10	6.18	-
Timmins 2	19/07/2008	7.8	25	6.6	11.10	12.5	11/09/2008	11.7	13	6.33	-

[1] = Temperature in Degrees Celsius

[2] = Tailings pile was along one side of DSO3-05. This would cause heavy siltation during heavy rain events. This may have caused the high reading.

NTU = Nephelometric Turbidity Units. A measure of water turbidity.

DO = Dissolved Oxygen mg/L

Conductivity = µS/cm

Table 10.14. Summary of laboratory results of metals plus hydrides of water samples collected in September.

Lab Number **Sample ID** **Date Collected**			**S2008-12951** **DS03-06** **10-Sep-08**	**S2008-12952** **DS03-08** **10-Sep-08**	**S2008-12953** **DS03-13** **10-Sep-08**	**S2008-12954** **DS03-14** **10-Sep-08**	**S2008-12955** **DS02-01** **11-Sep-08**	**S2008-12956** **DS02-02** **11-Sep-08**	**S2008-12957** **DS02-03** **11-Sep-08**	**CCME Guidelines**
Parameters	**Unit**	**MDL**								
Aluminum	(µg/L)	1	36	32	118	57	10	17	8	5-100
Antimony	(µg/L)	1	<1	<1	<1	<1	<1	<1	<1	-
Arsenic	(µg/L)	1	<1	<1	<1	<1	<1	<1	<1	-
Barium	(µg/L)	0.5	7.9	2.2	3.3	1.6	1.2	3.7	0.9	-
Beryllium	(µg/L)	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-
Bismuth	(µg/L)	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-
Boron	(µg/L)	20	<20	<20	<20	<20	<20	<20	<20	-
Cadmium	(µg/L)	0.015	0.127	0.105	0.129	0.129	0.081	0.096	0.100	0.017
Calcium	(µg/L)	500	1500	1990	569	685	17400	7620	7800	-
Chromium	(µg/L)	1	<1	<1	<1	<1	<1	<1	<1	-
Cobalt	(µg/L)	1	1	<1	<1	<1	<1	<1	<1	-
Copper	(µg/L)	1	5	<1	1	4	<1	<1	1	2-4
Iron	(µg/L)	1	1570	826	1080	1640	66	2160	64	300
Lead	(µg/L)	1	<1	<1	<1	<1	<1	<1	<1	1-7
Magnesium	(µg/L)	20	693	2290	291	195	10400	4530	5400	-
Manganese	(µg/L)	1	135	53	104	64	6	111	6	-
Mercury	(µg/L)	0.02	0.04	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.026
Molybdenum	(µg/L)	2	<2	<2	<2	<2	<2	<2	<2	-
Nickel	(µg/L)	1	2	<1	<1	<1	<1	<1	<1	25-150
Phosphorus	(µg/L)	2	5	5	<2	14	7	7	8	-
Potassium	(µg/L)	20	67	331	56	20	187	210	337	-
Rubidium	(µg/L)	5	<5	<5	<5	<5	<5	<5	<5	-
Selenium	(µg/L)	1	<1	<1	<1	<1	<1	<1	<1	1
Silicon	(µg/L)	2	3450	1720	4280	405	1890	2570	2620	-
Silver	(µg/L)	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.1
Sodium	(µg/L)	500	1490	373	820	<500	<500	517	598	-
Strontium	(µg/L)	1	11	4	4	2	8	7	7	-
Sulphur	(µg/L)	2	205	1290	136	59	496	228	835	-
Tellerium	(µg/L)	5	<5	<5	<5	<5	<5	<5	<5	-
Thallium	(µg/L)	1	<1	<1	<1	<1	<1	<1	<1	1
Tin	(µg/L)	2	<2	<2	<2	<2	<2	<2	<2	-
Titanium	(µg/L)	2	<2	<2	<2	<2	<2	<2	<2	-
Uranium	(µg/L)	1	<1	<1	<1	<1	2	2	2	-
Vanadium	(µg/L)	5	<5	<5	<5	<5	<5	<5	<5	-
Zinc	(µg/L)	1	13	4	6	8	4	3	4	30

MDL: Method Detection Limit
CCME: Canadian Council of the Ministers of Environment
- : Value not established
Shaded area exceeds CCME Guidelines

Aluminum Guidelines: 5µg/L at a pH < 6.5
100µg/L at pH ≥6.5
Copper Guidelines: 2µg/L at $[CaCO_3]$ = 0-120mg/L
3µg/L at $[CaCO_3]$ = 120-180mg/L
4µg/L at $[CaCO_3]$ >180mg/L

Lead Guidelines: 1µg/L at $[CaCO_3]$ = 0-60mg/L
2µg/L at $[CaCO_3]$ = 60-120mg/L
4µg/L at $[CaCO_3]$ = 120-180mg/L
7µg/L at $[CaCO_3]$ >180mg/L
Nickel Guidelines: 25µg/L at $[CaCO_3]$ = 0-60mg/L
65µg/L at $[CaCO_3]$ = 60-120mg/L
110µg/L at $[CaCO_3]$ = 120-180mg/L
150µg/L at $[CaCO_3]$ >180mg/L

Table 10.14. (cont') Summary of laboratory results of metals plus hydrides of water samples collected in September.

Lab Number **Sample ID** **Date Collected**			**S2008-12958** **DS02-04** **11-Sep-08**	**S2008-12959** **Star 1** **11-Sep-08**	**S2008-13074** **Timmins 1** **12-Sep-08**	**S2008-13075** **Timmins 2** **12-Sep-08**	**S2008-13076** **DS03-15** **12-Sep-08**	**S2008-13077** **DS03-07** **13-Sep-08**	**S2008-13078** **DS03-03** **13-Sep-08**	**S2008-13079** **DS03-05** **13-Sep-08**	**CCME Guidelines**
Parameters	**Unit**	**MDL**									
Aluminum	(µg/L)	1	5	8	10	14	358	34	45	177	5-100
Antimony	(µg/L)	1	<1	<1	<1	<1	<1	<1	<1	<1	-
Arsenic	(µg/L)	1	<1	<1	<1	<1	<1	<1	<1	<1	-
Barium	(µg/L)	0.5	1.0	0.8	3.5	1.2	3.2	0.7	0.9	2.1	-
Beryllium	(µg/L)	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-
Bismuth	(µg/L)	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-
Boron	(µg/L)	20	<20	<20	<20	<20	<20	<20	<20	<20	-
Cadmium	(µg/L)	0.015	0.101	0.055	0.097	0.111	0.152	0.033	0.098	0.129	0.017
Calcium	(µg/L)	500	7910	8210	1070	1300	1100	<500	<500	<500	-
Chromium	(µg/L)	1	<1	<1	<1	<1	<1	<1	<1	<1	-
Cobalt	(µg/L)	1	<1	<1	<1	<1	<1	<1	<1	<1	-
Copper	(µg/L)	1	<1	<1	2	<1	9	3	1	1	2-4
Iron	(µg/L)	1	203	103	23	36	22	90	86	419	300
Lead	(µg/L)	1	<1	<1	<1	<1	2	<1	<1	1	1-7
Magnesium	(µg/L)	20	5540	5580	769	900	810	256	140	78	-
Manganese	(µg/L)	1	4	4	2	3	2	4	8	12	-
Mercury	(µg/L)	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.026
Molybdenum	(µg/L)	2	<2	<2	<2	<2	<2	<2	<2	<2	-
Nickel	(µg/L)	1	<1	<1	<1	<1	<1	<1	<1	<1	25-150
Phosphorus	(µg/L)	2	7	9	<2	<2	13	4	8	14	-
Potassium	(µg/L)	20	344	333	259	151	277	62	362	116	-
Rubidium	(µg/L)	5	<5	<5	<5	<1	<5	<5	<5	<5	-
Selenium	(µg/L)	1	<1	<1	<1	<1	2	<1	<1	<1	1
Silicon	(µg/L)	2	2630	2590	1330	2070	1650	1180	1750	241	-
Silver	(µg/L)	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.1
Sodium	(µg/L)	500	582	612	<500	710	<500	<500	715	<500	-
Strontium	(µg/L)	1	6	6	3	4	3	1	2	<1	-
Sulphur	(µg/L)	2	868	767	448	362	486	197	213	148	-
Tellerium	(µg/L)	5	<5	<5	<5	<5	<5	<5	<5	<5	-
Thallium	(µg/L)	1	<1	<1	<1	<1	<1	<1	<1	<1	1
Tin	(µg/L)	2	<2	<2	<2	<2	<2	<2	<2	<2	-
Titanium	(µg/L)	2	<2	<2	<2	<2	<2	<2	<2	4	-
Uranium	(µg/L)	1	2	2	<1	<1	<1	<1	<1	<1	-
Vanadium	(µg/L)	5	<5	<5	<5	<5	<5	<5	<5	<5	-
Zinc	(µg/L)	1	4	3	5	3	8	5	4	4	30

MDL: Method Detection Limit
CCME: Canadian Council of the Ministers of Environment
- : Value not established
Shaded area exceeds CCME Guidelines

Aluminum Guidelines: 5µg/L at a pH < 6.5
100µg/L at pH ≥6.5
Copper Guidelines: 2µg/L at [$CaCO_3$] = 0-120mg/L
3µg/L at [$CaCO_3$] = 120-180mg/L
4µg/L at [$CaCO_3$] >180mg/L

Lead Guidelines: 1µg/L at [$CaCO_3$] = 0-60mg/L
2µg/L at [$CaCO_3$] = 60-120mg/L
4µg/L at [$CaCO_3$] = 120-180mg/L
7µg/L at [$CaCO_3$] >180mg/L
Nickel Guidelines: 25µg/L at [$CaCO_3$] = 0-60mg/L
65µg/L at [$CaCO_3$] = 60-120mg/L
110µg/L at [$CaCO_3$] = 120-180mg/L
150µg/L at [$CaCO_3$] >180mg/L

Table 10.15. Summary of laboratory results of metals plus hydrides of sediment samples collected in September.

Lab Number **Sample ID** **Date Collected**			**S2008-13081** **DS03-14** **10-Sep-08**	**S2008-13082** **Star 1** **11-Sep-08**	**S2008-13083** **DS02-03** **11-Sep-08**	**S2008-13084** **Timmins 1** **12-Sep-08**	**S2008-13085** **DS03-05** **13-Sep-08**	**S2008-13086** **DS03-07** **13-Sep-08**	**S2008-13087** **DS03-03** **13-Sep-08**	**CCME Guideline**	
Parameters	**Unit**	**MDL**								**ISQG**	**PEL**
Aluminum	(µg/g)	5	7290	3150	4420	1510	7430	6110	6230	-	-
Antimony	(µg/g)	0.5	0.7	0.6	1.4	1.3	1.7	1.2	0.5	-	-
Arsenic	(µg/g)	0.5	5.3	4.4	10.2	3.0	9.2	2.9	3.9	5.9	17.0
Barium	(µg/g)	0.5	24.8	6.2	24.2	70.4	14.6	13.9	10.6	-	-
Beryllium	(µg/g)	0.2	0.2	0.3	0.4	0.3	0.3	0.4	0.3	-	-
Bismuth	(µg/g)	0.2	<0.2	<0.2	0.7	0.7	1.0	<0.2	<0.2	-	-
Boron	(µg/g)	1	13	8	37	42	33	19	38	-	-
Cadmium	(µg/g)	0.5	<0.5	<0.5	0.9	0.8	0.8	0.5	0.7	0.6	3.5
Calcium	(µg/g)	25	291	1750	2680	119	116	266	174	-	-
Chromium	(µg/g)	1	11	9	12	4	17	13	9	37.3	90.0
Cobalt	(µg/g)	1	1	2	7	19	5	5	1	-	-
Copper	(µg/g)	1	9	4	5	12	11	10	10	35.7	197.0
Iron	(µg/g)	5	16600	7620	40600	45000	38400	23000	16400	-	-
Lead	(µg/g)	5	9	<5	12	13	13	12	6	35.0	91.3
Magnesium	(µg/g)	10	1100	1030	2250	486	2030	2550	1150	-	-
Manganese	(µg/g)	1	71	70	1420	2800	228	136	36	-	-
Mercury	(µg/g)	0.01	0.10	0.04	0.03	0.16	0.06	0.04	0.05	0.17	0.49
Molybdenum	(µg/g)	2	<2	<2	<2	<2	<2	<2	<2	-	-
Nickel	(µg/g)	5	6	<5	9	5	10	14	6	-	-
Phosphorus	(µg/g)	5	739	781	565	116	310	427	397	-	-
Potassium	(µg/g)	10	860	562	457	173	380	436	390	-	-
Rubidium	(µg/g)	2	9	6	6	3	6	5	6	-	-
Selenium	(µg/g)	0.1	0.3	0.8	0.3	<0.1	0.1	<0.1	0.1	-	-
Silicon	(µg/g)	5	7	8	19	26	11	55	8	-	-
Silver	(µg/g)	0.25	0.36	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	-	-
Sodium	(µg/g)	25	168	131	141	104	139	131	107	-	-
Strontium	(µg/g)	2	2	<2	3	<2	<2	<2	<2	-	-
Sulphur	(µg/g)	5	1690	4690	458	23	114	292	1370	-	-
Tellerium	(µg/g)	2	<2	<2	5	5	5	3	3	-	-
Thallium	(µg/g)	0.5	<0.5	<0.5	<0.5	2.3	<0.5	<0.5	<0.5	-	-
Tin	(µg/g)	2	<2	<2	<2	<2	<2	<2	<2	-	-
Titanium	(µg/g)	2	97	37	91	68	59	54	36	-	-
Uranium	(µg/g)	0.5	22.7	10.4	55.1	65.3	59.5	34.5	24.2	-	-
Vanadium	(µg/g)	5	16	<5	11	<5	13	10	8	-	-
Zinc	(µg/g)	2	23	36	45	17	29	48	17	123.0	315.0

MDL: Method Detection Limit
CCME: Canadian Council of the Ministers of Environment
- : Value not established

ISQG: Interim Freshwater Sediment Quality Guidelines
PEL: Probable Effects Level
Shaded area exceeds CCME Guidelines

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Glossary

CPUE - Catch Per Unit Effort: The number of fish caught per unit of time or area and is often used as an estimate of relative fish abundance.

DSOP - Direct Shipping Ore Project.

Freshet - A flood resulting from heavy rain or a spring thaw.

HADD - Harmful Alteration, Disruption or Destruction of fish habitat, which reduces its capacity to support one or more life processes of fish.

ISQG – Interim Freshwater Sediment Quality Guidelines

Habitat Suitability Indices - The amount of habitat deemed viable for the life process of fish at different stages of life.

Lacustrine - Of or relating to lakes.

Littoral - The shallow, near shore region of a water body where adequate light can penetrate to the bottom to allow for the growth of rooted aquatic plants.

Non-littoral - The deeper region of a water body in which light does not penetrate to the bottom, resulting in the absence of aquatic plants.

PEL – Probable Effects Level. The concentration of a chemical in which adverse biological effects are expected to occur frequently.

Total Habitat Equivalent Units - A quantity (m^2 or ha) of a particular habitat type that offers equivalent utilization by a species (or life-cycle stage) to that of a standardized “preferred” habitat type.

YOY - Young of Year refers to the life stage of a fish during first year of life.

Appendix A

Summary of July 2008 Reconnaissance and Raw Data

DSO2-01

Approximately 370 m of stream was surveyed with most of the habitat being classified as riffle/run. The average stream wet width was 1.45m. Mean water depth was 0.54m with an average velocity of 0.17m/s. Substrate consisted predominantly of cobble and rubble with sand and gravel intermixed. One pool was identified and measured at 3m long by 6 m wide, had an average depth of 0.55m and an average flow of 0.06. The pool contained substrate dominated by medium and fine substrate-types. See Photos B-1 to B-3, Appendix B.

DSO2-02

Approximately 500m of stream was surveyed and classified as comprising a majority of run/riffle habitat. The average stream wet width was 0.9 m. Mean water depth was 0.39m with an average velocity of 0.10m/s. Substrate consisted of medium and fine substrates. One pool was identified and measured at 2.8m long and 6m wide, had an average depth of 0.54 m with no measurable velocity. The pool contained substrate consisting of medium and fine substrate. The pool consisted of medium and fine sized substrate. The stream disappears into a fen at one point but emerges again approximately 100m away. This fen could be considered a temporary barrier during low flows. See Photos B-4 to B-7 in Appendix B.

DSO2-03

Approximately 300m of stream was surveyed and classified as predominantly run/riffle habitat. The average stream wet width was 3.12 m. Mean water depth was 0.28m with an average velocity of 0.37m/s. Substrate consisted of medium and fine substrates. One pool that was identified at the inflow to Lac Star and measured at 5.0m long by 8.0m wide, had an average depth of 1.0 m. Velocity could not be measured due to the pools depth. The pool contained substrate consisting of a majority of medium substrates with fines settled along the sides of the pool. See Photos B-8 and B-9 in Appendix B.

DSO2-04

Approximately 120m of stream was surveyed and classified as comprising a majority of run/riffle habitat. The average stream wet width was 5.1m. Mean water depth was 0.39 m with an average velocity of 0.34m/s. Substrate consisted of medium substrate with fines intermixed. See Photos B-10 and B-11, Appendix B.

DSO3-01

This site is Timmins Pit 3N. No habitat survey of the pit was conducted due to its depth and size; however water quality samples were collected and measured. See Photo B-12, Appendix B.

DSO3-02

Approximately 200m of stream was surveyed and classified as predominantly run/riffle habitat. This stream flows between three existing mine pits (Timmins 3A, 3B, and 3C) with the stream terminating at pit 3C. The average stream wet width was 1.5m. Mean water depth was 0.1m with an average velocity of 0.24m/s. Substrate consisted mostly of medium substrate with fines intermixed. See Photos B-13 and B-14, Appendix B.

DSO3-03

Approximately 320m of stream was surveyed and classified as comprising a majority of steady with a portion of run/riffle habitat. The average stream wet width of the steadies was 2.3m with a mean depth of 0.27m and an average velocity of 0.01m/s. Substrate consisted primarily of organics. The average stream wet width of the run/riffle habitat was 0.58m with a mean water depth of 0.12m and an average velocity of 0.25m/s. Substrate in this habitat type consisted primarily of organics with medium and fine substrates intermixed. See Photos B-15 and B-16, Appendix B.

DSO3-04

This site consisted of a small body of water located just west of Timmins Pit 1 near the former railway track. The perimeter of the water body was surveyed and no inflows/outflows were located. Geologists working for New Millennium stated that this water body is a result of rain runoff and the spring freshet. See Photos B-17 and B-18, Appendix B.

DSO3-05

This site also consisted of a small water body located just to the east of DSO3-04. This water body was also surveyed around its entire perimeter with no evidence of an inflow/outflow identified. Geologists again stated that this water body is a result of rain runoff and spring freshet. See Photos B-19 and B-20, Appendix B.

DSO3-06

Approximately 500m of stream was surveyed and classified as steady habitat. The average stream wet width was 1.18m. Mean water depth was 0.15 m with an average velocity of 0.02m/s. Substrate consisted primarily of organics with medium and fines intermixed. See Photos B-22 to B25, Appendix B.

DSO3-07

This site consisted of a lake (Inukshuk Lake). No stream surveys were conducted; however water quality samples were collected and measured. This site may be considered as a control or reference site for water quality should development proceed. See Photos B-26 and B-27, Appendix B.

DSO3-08

Approximately 60m of stream was surveyed and classified as run/riffle habitat. The average stream wet width was 1.38m. Mean water depth was 0.11 m with an average velocity of 0.19m/s. Substrate consisted predominantly of medium and fines with coarse substrate intermixed. An access road is proposed to cross this stream. See Photos B-28 and B-29, Appendix B.

DSO3-09

This site has an existing road crossing between a bog and a lake; however no inflow or outflow were identified connecting the two bodies of water therefore no stream surveys were conducted. See Photos B-30 and B-31, Appendix B.

DSO3-10

Approximately 60m of stream was surveyed and classified as predominately run/riffle habitat. The average stream wet width was 3.37m. Mean water depth was 0.11m with an average velocity of 0.15m/s. Substrate consisted mostly of medium substrate intermixed with coarse and fines. An access road is proposed to cross this stream. See Photos B-32 to B-34, Appendix B.

DSO3-11

Approximately 60m of stream was surveyed and classified as predominately run/riffle habitat. The average stream wet width was 1.1m. Mean water depth was 0.20m with an average velocity of 0.06m/s. Substrate consisted predominately of medium substrate intermixed with coarse, fines and organics. An access road is proposed to cross this stream. See Photos B-35 and B-36, Appendix B.

DSO3-12

This site consisted of a lake (Lake Pinette). No stream surveys were conducted; however water quality samples were collected and measurements taken. See Photo B-37, Appendix B.

DSO3-13

Approximately 150m of stream was surveyed and classified as a combination of run/riffle, steady, and pool habitats. The average stream wet width of the run/riffle habitat was 0.43m with a mean water depth of 0.15m and an average velocity of 0.52m/s. Substrate consisted of a majority of medium substrate intermixed with coarse, fines and organics. The average stream wet width of the identified steady habitat was 2.2m with a mean water depth of 0.26m and an average velocity of 0.0m/s. The average stream wet width of the identified pool habitat was 2.2m with a mean water depth of 0.45m and an average velocity of 0.04m/s. Substrate in the steady and pool habitat consisted mostly of medium substrate intermixed with coarse, fines and organics. See Photos B-38 to B-41, Appendix B.

DSO3-14

Approximately 60m of stream was surveyed and was classified as steady habitat. The average stream wet width was 0.84m. Mean water depth was 0.22m with an average velocity of 0.13m/s. Substrate consisted predominately of organics intermixed with fine and medium substrate. See Photos B-42 to B-44, Appendix B.

DSO3-15

The outflow of Timmins Pit 1 was surveyed between the pit and where it joins the outflow of Lake Pinette (1.5km). The stream was predominately riffle habitat with an average stream wet width of 2.84m. Mean water depth was 0.11m with an average velocity of 0.21m/s. Substrate consisted mostly of medium substrate intermixed with fine and coarse substrate. At the outflow from the pit, there were two steadies (6m x 20m and 15m x100m). One small pool was also identified while surveying the stream. Its dimensions were 3.79m x 3m with an average depth of 0.32m and an average velocity of 0.06m/s. The substrate was classified as medium with coarse and fine substrates intermixed. See Photos B-49 to B-54, Appendix B

River: DSO2-1

Transect #	Reach Type	Width (m)	Av Width	Channel Width (m)	Depth			Average Depth	Velocity (m/s)			Average Velocity
					1/3	1/2	2/3		1/3	1/2	2/3	
1	Run/riffle	1.1		1.4	0.37	0.42	0.39		0.39	0.22	0.15	
2	pool	6			0.53	0.55	0.58		0.00	0.17	0	
3	Run/riffle	1.8		2.2	0.71	0.73	0.64		0.14	0.13	0	

Stream Habitat Survey Sheet

Substrate Compostion (%)								Reach Gradient (m/m)	Reach Gradient (degrees)	Average Gradient	0-50% Undercut Bank		0-50% Overhanging Veg.		0-100% Instream	0-100% Canopy	Comments
Organics	Fine		Medium			Coarse											
Detritus	Fines	Sand	Gravel	Cobble	Rubble	Boulder	Bedrock				L	R	L	R			
	35		15	30	10	10			**5.00**		10	10	50	50	10	40	
	45		15	30	10						20	40					Pool 3m x 6m
		40	25	20	10	5											

River: DSO2-2

Transect #	Type	Width (m)	Av Width	Channel Width (m)	Depth			Average Depth	Velocity (m/s)			Average Velocity
					1/3	1/2	2/3		1/3	1/2	2/3	
1	Run/riffle	0.9		1.2	0.41	0.26	0.17		0.11	0.00	0.00	
2	Run/riffle	0.77		0.89	0.33	0.21	0.28		0.18	0.11	0.00	
3	Run/riffle	1.3		1.6	0.25	0.25	0.25		0.00	0.05	0.05	
4	Run/riffle	0.76		0.8	0.37	0.40	0.40		0.00	0.13	0.11	
5	small pool	6		6.2	0.56	0.56	0.50		0.00	0.00	0.00	
6	Run/riffle	0.55		0.9	0.18	0.20	0.23		0.30	0.30	0.20	

Substrate Compostion (%)								Reach Gradient (m/m)	Reach Gradient (degrees)	Average Gradient	0-50% Undercut Bank		0-50% Overhanging Veg.		0-100% Instream	0-100% Canopy	Comments
Organics	Fine		Medium			Coarse											
Detritus	Fines	Sand	Gravel	Cobble	Rubble	Boulder	Bedrock				L	R	L	R			
	100								**2.00**		10	10	40	40	70	0	
	100										10	10	35	35	60	0	
		25	5	40	10	20							45	45	10	30	Stream dissappears into bog
																	Stream begins again
		60	20	10	10						10	5	40	40	60	0	small pool 2.8 x 6m
		30	10	40	10		10		1		20	30	30	30	30	0	

River: DSO2-3

Transect #	Type	Width (m)	Av Width	Channel Width (m)	Depth			Average Depth	Velocity (m/s)			Average Velocity
					1/3	1/2	2/3		1/3	1/2	2/3	
1	Pool	5.0		7.0	1.00	1.00	1.00					
2	Riffle/Run	2.1		2.8	0.37	0.49	0.58		0.17	0.66	0.47	
3	Riffle/Run	4.1		4.8	0.38	0.50	0.49		0.62	0.89	0.18	
4	Riffle/Run	4.9		5.1	0.47	0.55	0.40		0.09	0.56	0.05	
5	Riffle/Run	2.3		2.9	0.24	0.38	0.31		0.85	0.18	0.48	
6	Riffle/Run	2.2		3.1	0.27	0.21	0.20		0.10	0.11	0.07	

Stream Habitat Survey Sheet

Substrate Compostion (%)								Reach Gradient	Reach Gradient	Average Gradient	0-50% Undercut Bank		0-50% Overhanging Veg.		0-100% Instream	0-100% Canopy	Comments
Organics	Fine		Medium			Coarse											
Detritus	Fines	Sand	Gravel	Cobble	Rubble	Boulder	Bedrock	(m/m)	(degrees)		L	R	L	R			
	35		50	5	10												Pool too large to walk in. Depths estimated. 1 Brook Trout seen
		30	60	10	5	5					30	30	40	5	0	5	
		50	35	10	5								30	30	5	10	1 Brook trout 10cm observed. Another 6 to 8 @ 8cm
		30	25	30	15				1		20	30	40	40	0	75	
		10	5	25	20	30					20	25	30	35	0	45	Stream braids off into 3 different streams. Followed stream in centre
		20	30	10	10	30					35	20	40	40	10	70	

River: DSO2-4

Transect #	Type	Width (m)	Av Width	Channel Width (m)	Depth			Average Depth	Velocity (m/s)			Average Velocity
					1/3	1/2	2/3		1/3	1/2	2/3	
1	Riffle/Run	4.2		4.8	0.42	0.53	0.48		0.27	0.43	0.3	
2	Riffle/Run	6			0.33	0.38	0.18		0.84	0.18	0	

Stream Habitat Survey Sheet

Substrate Compostion (%)								Reach Gradient (m/m)	Reach Gradient (degrees)	Average Gradient	0-50% Undercut Bank		0-50% Overhanging Veg.		0-100% Instream	0-100% Canopy	Comments
Organics	Fine		Medium			Coarse											
Detritus	Fines	Sand	Gravel	Cobble	Rubble	Boulder	Bedrock				L	R	L	R			
									1.00								2 Brook trout about 14 cm observed
		10	15	30	30	15					15	25	20	25	5	50	

River: DSO3-2

Transect #	Type	Width (m)	Av Width	Channel Width (m)	Depth			Average Depth	Velocity (m/s)			Average Velocity
					1/3	1/2	2/3		1/3	1/2	2/3	
1	Riffle/Run	1.3		1.6	0.02	0.05	0.02		0.17	0.45	0.12	
2	Riffle/Run	1.7		1.9	0.40	0.05	0.03		0.32	0.36	0	

Stream Habitat Survey Sheet

Substrate Compostion (%)								Reach Gradient (m/m)	Reach Gradient (degrees)	Average Gradient	0-50% Undercut Bank		0-50% Overhanging Veg.		0-100% Instream	0-100% Canopy	Comments
Organics	Fine		Medium			Coarse											
Detritus	Fines	Sand	Gravel	Cobble	Rubble	Boulder	Bedrock				L	R	L	R			
		25	30	30	10	5		0.38/8									Stream runs into open pit (old mine)
		40	15	20	20	5					0	0	0	0	20	0	rocks covered in green algae

River: DSO3-03

Transect #	Type	Width (m)	Av Width	Channel Width (m)	Depth			Average Depth	Velocity (m/s)			Average Velocity
					1/3	1/2	2/3		1/3	1/2	2/3	
1	Steady	4.0		4.6	0.11	0.07	0.28		0.00	0.00	0	
2	Steady	1.5		2.6	0.41	0.48	0.25		0.00	0	0	
3	Steady	1.3		1.8	0.25	0.31	0.25		0.07	0	0	
4	Riffle/Run	0.58		0.8	0.10	0.14	0.13		0.26	0.49	0	

Stream Habitat Survey Sheet

Substrate Compostion (%)								Reach Gradient (m/m)	Reach Gradient (degrees)	Average Gradient	0-50% Undercut Bank		0-50% Overhanging Veg.		0-100% Instream	0-100% Canopy	Comments
Organics	Fine		Medium			Coarse											
Detritus	Fines	Sand	Gravel	Cobble	Rubble	Boulder	Bedrock				L	R	L	R			
100																	
95			2	1	1	1					5	5	50	50	70	0	mostly overland flow, no distinct streambed
100																	
80		5	10	5							5	15	50	50	20	0	

River: DSO3-06

Transect #	Type	Width (m)	Av Width	Channel Width (m)	Depth			Average Depth	Velocity (m/s)			Average Velocity
					1/3	1/2	2/3		1/3	1/2	2/3	
1	steady	0.66			0.10	0.21	0.12		0.00	0.00	0	
2	steady	0.69			0.23	0.24	0.23		0.00	0	0	
3	steady	0.51			0.10	0.10	0.07		0.15	0.19	0	
4	steady	3.00			0.07	0.12	0.13		0.00	0	0	
5	steady	0.88			0.10	0.16	0.08		0.00	0.1	0	
6	steady	1.35			0.26	0.26	0.17		0.00	0	0	

Stream Habitat Survey Sheet

Substrate Compostion (%)								Reach Gradient (m/m)	Reach Gradient (degrees)	Average Gradient	0-50% Undercut Bank		0-50% Overhanging Veg.		0-100% Instream	0-100% Canopy	Comments
Organics	Fine		Medium			Coarse											
Detritus	Fines	Sand	Gravel	Cobble	Rubble	Boulder	Bedrock				L	R	L	R			
100																	
40		20	15	15	10						5	15	10	15	5	0	
75		10	5	5	5			0.65/10					5	5	5	0	
35		15	10	10	10								10	5	5	1	some overland flow, meets small pond
50		10	10	20	10								20	15	5	0	

River: DSO3-08

Transect #	Type	Width (m)	Av Width	Channel Width (m)	Depth			Average Depth	Velocity (m/s)			Average Velocity
					1/3	1/2	2/3		1/3	1/2	2/3	
1	riffle/run	1.20		1.8	0.12	0.09	0.13		0.11	0.22	0.11	
2	riffle/run	2.30		2.9	0.05	0.04	0.04		0.40	0.25	0.24	
3	riffle/run	0.63		0.92	0.15	0.16	0.17		0.00	0.23	0.19	

Stream Habitat Survey Sheet

Substrate Compostion (%)								Reach Gradient (m/m)	Reach Gradient (degrees)	Average Gradient	0-50% Undercut Bank		0-50% Overhanging Veg.		0-100% Instream	0-100% Canopy	Comments
Organics	Fine		Medium			Coarse											
Detritus	Fines	Sand	Gravel	Cobble	Rubble	Boulder	Bedrock				L	R	L	R			
	30	24	5	20	10	11					7	5	20	15	15	5	
	25	10	20	30	10	5					5	7	20	15	5	10	

River: DSO3-09

Transect #	Type	Width (m)	Av Width	Channel Width (m)	Depth			Average Depth	Velocity (m/s)			Average Velocity
					1/3	1/2	2/3		1/3	1/2	2/3	
1	riffle/run	2.20		2.8	0.11	0.10	0.11		0.41	0.13	0.13	
2	riffle/run	4.20		6.1	0.14	0.13	0.09		0.24	0.09	0	
3	pool	10.00		10	0.10	0.66	0.64		0.00	0.02	0	
4	riffle/run	3.70		4.8	0.09	0.06	0.15		0.14	0	0.22	

Stream Habitat Survey Sheet

Substrate Compostion (%)								Reach Gradient (m/m)	Reach Gradient (degrees)	Average Gradient	0-50% Undercut Bank		0-50% Overhanging Veg.		0-100% Instream	0-100% Canopy	Comments
Organics	Fine		Medium			Coarse											
Detritus	Fines	Sand	Gravel	Cobble	Rubble	Boulder	Bedrock				L	R	L	R			
		10	15	50	20	5					5	10	35	30	5	10	
	20	30	30	20													Pool 10m x 3m
5		2	13	45	20	15					5	10	30	35	5	15	

River: DSO3-10

Transect #	Type	Width (m)	Av Width	Channel Width (m)	Depth			Average Depth	Velocity (m/s)			Average Velocity
					1/3	1/2	2/3		1/3	1/2	2/3	
1	steady	1.28		1.6	0.15	0.41	0.22		0.00	0.00	0	
2	steady	0.98		1.22	0.15	0.17	0.12		0.22	0.13	0.01	

Stream Habitat Survey Sheet

Substrate Compostion (%)								Reach Gradient (m/m)	Reach Gradient (degrees)	Average Gradient	0-50% Undercut Bank		0-50% Overhanging Veg.		0-100% Instream	0-100% Canopy	Comments
Organics	Fine		Medium			Coarse											
Detritus	Fines	Sand	Gravel	Cobble	Rubble	Boulder	Bedrock				L	R	L	R			
5		9	15	30	30	11			6.5		15	10	20	35	5	5	

River: DSO3-13

Transect #	Type	Width (m)	Av Width	Channel Width (m)	Depth			Average Depth	Velocity (m/s)			Average Velocity
					1/3	1/2	2/3		1/3	1/2	2/3	
1	steady	2.20		2.9	0.27	0.28	0.23		0.00	0.00	0	
2	pool	3.80		4.25	0.29	0.49	0.57		0.00	0.11	0	
3	riffle/run	0.43		0.58	0.14		0.15		0.51		0.53	

Stream Habitat Survey Sheet

Substrate Compostion (%)								Reach Gradient (m/m)	Reach Gradient (degrees)	Average Gradient	0-50% Undercut Bank		0-50% Overhanging Veg.		0-100% Instream	0-100% Canopy	Comments
Organics	Fine		Medium			Coarse											
Detritus	Fines	Sand	Gravel	Cobble	Rubble	Boulder	Bedrock				L	R	L	R			
																	stream disappears in sedge and goes underground after 10 m, reappears 20 m up
40		5	15	25	10	5					10	15	40	35	55	0	
30		10	15	30	10	5					7	15	40	35	40	5	

River: DSO3-14

Transect #	Type	Width (m)	Av Width	Channel Width (m)	Depth			Average Depth	Velocity (m/s)			Average Velocity
					1/3	1/2	2/3		1/3	1/2	2/3	
1	Steady	1.10		1.6	0.21	0.24	0.12		0.05	0.23	0	
2	Steady	0.62		0.87	0.15	0.15	0.14		0.27	0.21	0.11	
3	Steady	0.80		0.96	0.37	0.35	0.25		0.11	0.18	0	

Stream Habitat Survey Sheet

Substrate Compostion (%)								Reach Gradient (m/m)	Reach Gradient (degrees)	Average Gradient	0-50% Undercut Bank		0-50% Overhanging Veg.		0-100% Instream	0-100% Canopy	Comments
Organics	Fine		Medium			Coarse											
Detritus	Fines	Sand	Gravel	Cobble	Rubble	Boulder	Bedrock				L	R	L	R			
75		5	5	10	5				1.8		7	5	35	35	30	1	stream meets road, outflows from a small steady
75		10	5	5	5						15	10	40	40	25	0	

River: DSO3-15

Transect #	Type	Width (m)	Av Width	Channel Width (m)	Depth			Average Depth	Velocity (m/s)			Average Velocity
					1/3	1/2	2/3		1/3	1/2	2/3	
1	riffle/run	3.70		3.9	0.24	0.05	0.05		0.25	0.34	0	
2	riffle/run	2.86		3.4	0.06	0.12	0.05		0.20	0.35	0	
3	riffle/run	2.50		3.2	0.11	0.19	0.07		0.07	0.28	0.15	
4	riffle/run	3.40		4.6	0.10	0.20	0.15		0.45	0.34	0.13	
5	pool	3.79		4	0.31	0.41	0.23		0.00	0.18	0	
6	riffle/run	3.80		4.9	0.25	0.23	0.17		0.13	0.12	0.12	
7	steady	15.00										
8	riffle/run	2.37		15	0.06	0.05	0.12		0.33	0	0.62	
9	riffle/run	1.80		2.3	0.04	0.03	0.06		0.37	0.16	0.29	
10	steady	6.00										
11	riffle/run	2.30		3.4	0.05	0.06	0.08		0.10	0.2	0.09	

Stream Habitat Survey Sheet

Substrate Compostion (%)								Reach Gradient (m/m)	Reach Gradient (degrees)	Average Gradient	0-50% Undercut Bank		0-50% Overhanging Veg.		0-100% Instream	0-100% Canopy	Comments
Organics	Fine		Medium			Coarse											
Detritus	Fines	Sand	Gravel	Cobble	Rubble	Boulder	Bedrock				L	R	L	R			
																	1 Brook Trout about 15cm
		5	20	20	20	35		0.17/7			5	10	35	35	5	5	2 unidentified fish approximately 15 cm each
		5	20	15	30	30		0.43/8			5	5	40	40	0	10	leaving wooded area, tailing mounds on both sides of river
	2	10	13	25	10	40		0.61/8			30	7	35	25	5	5	2 Brook Trout seen between 10 and 15 cm
		5	15	15	15	55		0.44/9			15	2	25	35	5	0	small pool 3.79m x 3m, heavy bank erosion on both sides
	10	10	15	15	25	25					0	0	15	10	0	0	Tailings on both side of stream. Water has red tint
																	steady 15 m wide x 100m long. 1 Fish breached
		10	40	15	10	15	10				0	0	0	0	0	0	
																	Steady 6m long x 20m wide. Small waterfall (89 cm high) dumps into steady
		10	40	15	10	15	10				0	0	0	0	0	0	

Appendix B
Habitat Photos

Photo B-1. DSO2-01 looking upstream (pool)

Photo B-2. DSO2-01 substrate (pool)

Photo B-3. DSO2-01 upstream (riffle)

Photo B-4. DSO2-02 upstream

Photo B-5. DSO2-02 downstream

Photo B-6. DSO2-02 upstream

Photo B-7. DSO2-02 downstream

Photo B-8. DSO2-03 pool upstream

Photo B-9. DSO2-03 pool downstream

Photo B-10. DSO2-04 upstream

Photo B-11. DSO2-04 downstream

Photo B-12. Timmins 3N looking SE

Photo B-13. DSO3-2, Stream flowing into pit 3A

Photo B-14. DSO3-2, Stream flowing into pit 3A

Photo B-15. DSO3-3 upstream flowing from bog

Photo B-16. DSO3-3 downstream flowing into bog

Photo B-17. Dry streambed along side of DSO3-4

Photo B-18. Dry streambed along side of DSO3-4 (Stagnant body of water)

Photo B-19. Dry streambed along side of DSO3-5 (Stagnant body of water)

Photo B-20. Dry streambed along side of DSO3-5 (Stagnant body of water)

Photo B-21. DSO3-5 (Stagnant body of water) with no inflow

Photo B-22. DSO3-6 downstream view, stream is completely covered by sedge

Photo B-23. DSO3-6 upstream view, stream is completely covered by sedge

Photo B-24. DSO3-6 upstream view, stream outflow from a bog steady

Photo B-25. DSO3-6 downstream view, stream outflow from a bog steady

Photo B-26. DSO3-7 Lake Inukshuk

Photo B-27. DSO3-7 Lake Inukshuk outflow

Photo B-28. DSO3-8 downstream view (proposed road crossing)

Photo B-29. DSO3-8 upstream view (proposed road crossing)

Photo B-30. DSO3-9 road crosses wetland

Photo B-31. DSO3-9 road crosses by waterbody (no stream connection to wetland)

Photo B-32. DSO3-10 view of pool upstream of potential road crossing


Photo B-33. DSO3-10 view of pool inflow, upstream of potential road crossing


Photo B-34. DSO3-10 view of riffle, upstream of potential road crossing

Photo B-35. DSO3-11 upstream view of riffle (potential road crossing)

Photo B-36. DSO3-11 downstream view of riffle (potential road crossing)

Photo B-37. DSO3-12 Pinette Lake

Photo B-38. DSO3-13, upstream view of inflow to Pinette Lake

Photo B-39. DSO3-13, downstream view of inflow to Pinette Lake

Photo B-40. DSO3-13, upstream view of outflow from steady

Photo B-41. DSO3-13, downstream view of outflow from steady

Photo B-42. DSO3-14, upstream view of potential road crossing

Photo B-43. DSO3-14, downstream view of potential road crossing

Photo B-44. DSO3-14, view of potential road crossing

Photo B-45. Timmins 1 Ditch, downstream view from road which runs to Timmins 1

Photo B-46. Timmins 1 Ditch, upstream view from road which runs to Timmins 1
(could not find culvert inflow on other side of road)

Photo B-47. Timmins 1 Ditch, downstream view with Timmins 1 in background

Photo B-48. Timmins 1 Ditch, upstream view (a lot of debris such as wood and rubber conveyor belts in ditch)


Photo B-49. DSO3-15 upstream view of riffle


Photo B-50. DSO3-15 upstream view (inflow from Pinette Lake on left)

Photo B-51. DSO3-15 upstream view

Photo B-52. DSO3-15 downstream view

Photo B-53. DSO3-15 upstream view of inflow from Timmins 1

Photo B-54. DSO3-15 downstream view of steady (tailing piles on left and right causing heavy siltation)

Photo B-55. DSO3-1 5 downstream view of steady (tailing piles on left and right causing heavy siltation)

Photo B-56. DSO3-05. Triangle Pond

Photo B-57 DSO3-07. Inukshuk Lake

Photo B-58 Timmins 1.

Photo B-59 Timmins 2

Photo B-60 Inflow to Star Lake

Appendix C
Laboratory Results

Client:	AMEC Earth and Environmental, a division of AMEC Americas Limited 133 Crosbie Road, Suite 202, P.O. Box 13216 St. John's, Newfoundland A1B 4A5	Report Date: Received Date:	October 01, 2008 September 17, 2008
		Page:	1 of 7
Project Name:	DSOP West Labrador / East Quebec	Sample Type:	Water
Project Number:	TF 8165902	Lab Ref.:	F2008-1832
Contact:	Eugene Lee		Final

CERTIFICATE OF ANALYSIS

ICP Metals+Hydrides

Lab Number **Sample ID** **Date Collected**			**S2008-12950** **DS03-DUP** **10-Sep-08**	**S2008-12950** **DS03-DUP** **10-Sep-08**	**S2008-12951** **DS03-06** **10-Sep-08**	**S2008-12951** **DS03-06** **10-Sep-08**	**S2008-12952** **DS03-08** **10-Sep-08**	**S2008-12952** **DS03-08** **10-Sep-08**
Parameters	**Unit**	**MDL**	**(Total)**	**(Dissolved)**	**(Total)**	**(Dissolved)**	**(Total)**	**(Dissolved)**
Aluminum	(µg/L)	1	33	11	36	7	32	18
Antimony	(µg/L)	1	<1	<1	<1	<1	<1	<1
Arsenic	(µg/L)	1	<1	<1	<1	<1	<1	<1
Barium	(µg/L)	0.5	4.5	3.2	7.9	2.8	2.2	1.6
Beryllium	(µg/L)	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Bismuth	(µg/L)	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Boron	(µg/L)	20	<20	<20	<20	<20	<20	<20
Cadmium	(µg/L)	0.015	0.109	0.028	0.127	0.029	0.105	0.043
Calcium	(µg/L)	500	1350	1290	1500	1180	1990	1310
Chromium	(µg/L)	1	<1	<1	<1	<1	<1	<1
Cobalt	(µg/L)	1	<1	<1	1	<1	<1	<1
Copper	(µg/L)	1	1	<1	5	<1	<1	<1
Iron	(µg/L)	1	1070	20	1570	79	826	292
Lead	(µg/L)	1	<1	<1	<1	<1	<1	<1
Magnesium	(µg/L)	20	697	475	693	483	2290	1470
Manganese	(µg/L)	1	136	88	135	72	53	24
Mercury	(µg/L)	0.02	0.06	<0.02	0.04	<0.02	<0.02	<0.02
Molybdenum	(µg/L)	2	<2	<2	<2	<2	<2	<2
Nickel	(µg/L)	1	1	<1	2	<1	<1	<1
Phosphorus	(µg/L)	2	2	<2	5	<2	5	<2
Potassium	(µg/L)	20	58	39	67	43	331	213
Rubidium	(µg/L)	5	<5	<5	<5	<5	<5	<5
Selenium	(µg/L)	1	1	<1	<1	<1	<1	<1
Silicon	(µg/L)	2	3470	2370	3450	2420	1720	1120
Silver	(µg/L)	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Sodium	(µg/L)	500	1480	1010	1490	1040	373	243
Strontium	(µg/L)	1	11	8	11	7	4	3
Sulphur	(µg/L)	2	210	128	205	113	1290	871
Tellerium	(µg/L)	5	<5	<5	<5	<5	<5	<5
Thallium	(µg/L)	1	<1	<1	<1	<1	<1	<1
Tin	(µg/L)	2	<2	<2	<2	<2	<2	<2
Titanium	(µg/L)	2	<2	<2	<2	<2	<2	<2
Uranium	(µg/L)	1	<1	<1	<1	<1	<1	<1
Vanadium	(µg/L)	5	<5	<5	<5	<5	<5	<5
Zinc	(µg/L)	1	4	3	13	2	4	2

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Client:	AMEC Earth and Environmental, a division of AMEC Americas Limited 133 Crosbie Road, Suite 202, P.O. Box 13216 St. John's, Newfoundland A1B 4A5	Report Date: Received Date:	October 01, 2008 September 17, 2008
		Page:	2 of 7
Project Name:	DSOP West Labrador / East Quebec	Sample Type:	Water
Project Number:	TF 8165902	Lab Ref.:	F2008-1832
Contact:	Eugene Lee		Final

CERTIFICATE OF ANALYSIS

ICP Metals+Hydrides

Lab Number			S2008-12953	S2008-12953	S2008-12954	S2008-12954	S2008-12954	S2008-12955
Sample ID			DS03-13	DS03-13	DS03-14	DS03-14	DS03-14	DS02-01
Date Collected			10-Sep-08	10-Sep-08	10-Sep-08	10-Sep-08	10-Sep-08	11-Sep-08
Parameters	**Unit**	**MDL**	**(Total)**	**(Dissolved)**	**(Total)**	**(Total) (Replicate)**	**(Dissolved)**	**(Total)**
Aluminum	(µg/L)	1	118	4	57	NR	25	10
Antimony	(µg/L)	1	<1	<1	<1	NR	<1	<1
Arsenic	(µg/L)	1	<1	<1	<1	NR	<1	<1
Barium	(µg/L)	0.5	3.3	2.5	1.6	NR	1.6	1.2
Beryllium	(µg/L)	0.1	<0.1	<0.1	<0.1	NR	<0.1	<0.1
Bismuth	(µg/L)	0.5	<0.5	<0.5	<0.5	NR	<0.5	<0.5
Boron	(µg/L)	20	<20	<20	<20	NR	<20	<20
Cadmium	(µg/L)	0.015	0.129	0.025	0.129	NR	0.021	0.081
Calcium	(µg/L)	500	569	<500	685	NR	<500	17400
Chromium	(µg/L)	1	<1	<1	<1	NR	<1	<1
Cobalt	(µg/L)	1	<1	<1	<1	NR	<1	<1
Copper	(µg/L)	1	1	<1	4	NR	<1	<1
Iron	(µg/L)	1	1080	16	1640	NR	36	66
Lead	(µg/L)	1	<1	<1	<1	NR	<1	<1
Magnesium	(µg/L)	20	291	192	195	NR	136	10400
Manganese	(µg/L)	1	104	76	64	NR	48	6
Mercury	(µg/L)	0.02	<0.02	<0.02	<0.02	NR	<0.02	<0.02
Molybdenum	(µg/L)	2	<2	<2	<2	NR	<2	<2
Nickel	(µg/L)	1	<1	<1	<1	NR	<1	<1
Phosphorus	(µg/L)	2	<2	<2	14	NR	<2	7
Potassium	(µg/L)	20	56	31	20	NR	<20	187
Rubidium	(µg/L)	5	<5	<5	<5	NR	<5	<5
Selenium	(µg/L)	1	<1	<1	<1	<1	<1	<1
Silicon	(µg/L)	2	4280	1280	405	NR	442	1890
Silver	(µg/L)	0.1	<0.1	<0.1	<0.1	NR	<0.1	<0.1
Sodium	(µg/L)	500	820	535	<500	NR	<500	<500
Strontium	(µg/L)	1	4	3	2	NR	4	8
Sulphur	(µg/L)	2	136	103	59	NR	127	496
Tellerium	(µg/L)	5	<5	<5	<5	NR	<5	<5
Thallium	(µg/L)	1	<1	<1	<1	NR	1	<1
Tin	(µg/L)	2	<2	<2	<2	NR	<2	<2
Titanium	(µg/L)	2	<2	<2	<2	NR	<2	<2
Uranium	(µg/L)	1	<1	<1	<1	NR	<1	2
Vanadium	(µg/L)	5	<5	<5	<5	NR	<5	<5
Zinc	(µg/L)	1	6	2	8	NR	3	4

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Report Date: October 01, 2008
Received Date: September 17, 2008

Project Name: DSOP West Labrador / East Quebec

Sample Type: Water

Project Number: TF 8165902

Lab Ref.: F2008-1832

Contact: Eugene Lee

Final

CERTIFICATE OF ANALYSIS

ICP Metals+Hydrides

Lab Number Sample ID Date Collected			S2008-12955 DS02-01 11-Sep-08	S2008-12955 DS02-01 11-Sep-08	S2008-12956 DS02-02 11-Sep-08	S2008-12956 DS02-02 11-Sep-08	S2008-12957 DS02-03 11-Sep-08	S2008-12957 DS02-03 11-Sep-08
Parameters	**Unit**	**MDL**	**(Total) (Replicate)**	**(Dissolved)**	**(Total)**	**(Dissolved)**	**(Total)**	**(Dissolved)**
Aluminum	(µg/L)	1	NR	5	17	13	8	3
Antimony	(µg/L)	1	NR	<1	<1	<1	<1	<1
Arsenic	(µg/L)	1	NR	<1	<1	<1	<1	<1
Barium	(µg/L)	0.5	NR	0.9	3.7	2.4	0.9	0.7
Beryllium	(µg/L)	0.1	NR	<0.1	<0.1	<0.1	<0.1	<0.1
Bismuth	(µg/L)	0.5	NR	<0.5	<0.5	<0.5	<0.5	<0.5
Boron	(µg/L)	20	NR	<20	<20	<20	<20	<20
Cadmium	(µg/L)	0.015	NR	0.025	0.096	0.041	0.100	0.025
Calcium	(µg/L)	500	NR	11300	7620	4960	7800	5830
Chromium	(µg/L)	1	NR	<1	<1	<1	<1	<1
Cobalt	(µg/L)	1	NR	<1	<1	<1	<1	<1
Copper	(µg/L)	1	NR	<1	<1	<1	1	<1
Iron	(µg/L)	1	NR	34	2160	317	64	10
Lead	(µg/L)	1	NR	<1	<1	<1	<1	<1
Magnesium	(µg/L)	20	NR	6800	4530	2950	5400	4060
Manganese	(µg/L)	1	NR	2	111	64	6	<1
Mercury	(µg/L)	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Molybdenum	(µg/L)	2	NR	<2	<2	<2	<2	<2
Nickel	(µg/L)	1	NR	<1	<1	<1	<1	<1
Phosphorus	(µg/L)	2	NR	3	7	2	8	3
Potassium	(µg/L)	20	NR	116	210	132	337	253
Rubidium	(µg/L)	5	NR	<5	<5	<5	<5	<5
Selenium	(µg/L)	1	NR	<1	<1	<1	<1	<1
Silicon	(µg/L)	2	NR	1240	2570	1670	2620	1970
Silver	(µg/L)	0.1	NR	<0.1	<0.1	<0.1	<0.1	<0.1
Sodium	(µg/L)	500	NR	<500	517	<500	598	<500
Strontium	(µg/L)	1	NR	7	7	5	7	5
Sulphur	(µg/L)	2	NR	405	228	168	835	625
Tellerium	(µg/L)	5	NR	<5	<5	<5	<5	<5
Thallium	(µg/L)	1	NR	<1	<1	<1	<1	<1
Tin	(µg/L)	2	NR	<2	<2	<2	<2	<2
Titanium	(µg/L)	2	NR	<2	<2	<2	<2	<2
Uranium	(µg/L)	1	NR	<1	2	1	2	<1
Vanadium	(µg/L)	5	NR	<5	<5	<5	<5	<5
Zinc	(µg/L)	1	NR	<1	3	<1	4	3

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St. John's, Newfoundland A1B 4A5

Project Name: DSOP West Labrador / East Quebec

Project Number: TF 8165902

Contact: Eugene Lee

Report Date: October 01, 2008
Received Date: September 17, 2008

Page: 4 of 7

Sample Type: Water

Lab Ref.: F2008-1832

Final

CERTIFICATE OF ANALYSIS

ICP Metals+Hydrides

Lab Number **Sample ID** **Date Collected**			**S2008-12958** **DS02-04** **11-Sep-08**	**S2008-12958** **DS02-04** **11-Sep-08**	**S2008-12959** **Star 1** **11-Sep-08**	**S2008-12959** **Star 1** **11-Sep-08**	**S2008-12959** **Star 1** **11-Sep-08**
Parameters	**Unit**	**MDL**	**(Total)**	**(Dissolved)**	**(Total)**	**(Dissolved)**	**(Dissolved) (Replicate)**
Aluminum	(µg/L)	1	5	3	8	3	NR
Antimony	(µg/L)	1	<1	<1	<1	<1	<1
Arsenic	(µg/L)	1	<1	<1	<1	<1	<1
Barium	(µg/L)	0.5	1.0	0.7	0.8	0.6	NR
Beryllium	(µg/L)	0.1	<0.1	<0.1	<0.1	<0.1	NR
Bismuth	(µg/L)	0.5	<0.5	<0.5	<0.5	<0.5	NR
Boron	(µg/L)	20	<20	<20	<20	<20	NR
Cadmium	(µg/L)	0.015	0.101	0.017	0.055	0.049	NR
Calcium	(µg/L)	500	7910	5300	8210	5520	NR
Chromium	(µg/L)	1	<1	<1	<1	<1	NR
Cobalt	(µg/L)	1	<1	<1	<1	<1	NR
Copper	(µg/L)	1	<1	<1	<1	<1	NR
Iron	(µg/L)	1	203	9	103	29	NR
Lead	(µg/L)	1	<1	<1	<1	<1	NR
Magnesium	(µg/L)	20	5540	3720	5580	3760	NR
Manganese	(µg/L)	1	4	<1	4	<1	NR
Mercury	(µg/L)	0.02	<0.02	<0.02	<0.02	<0.02	NR
Molybdenum	(µg/L)	2	<2	<2	<2	<2	NR
Nickel	(µg/L)	1	<1	<1	<1	<1	NR
Phosphorus	(µg/L)	2	7	4	9	6	NR
Potassium	(µg/L)	20	344	229	333	222	NR
Rubidium	(µg/L)	5	<5	<5	<5	<5	NR
Selenium	(µg/L)	1	<1	<1	<1	<1	NR
Silicon	(µg/L)	2	2630	1770	2590	1730	NR
Silver	(µg/L)	0.1	<0.1	<0.1	<0.1	<0.1	NR
Sodium	(µg/L)	500	582	<500	612	<500	NR
Strontium	(µg/L)	1	6	5	6	5	NR
Sulphur	(µg/L)	2	868	582	767	525	NR
Tellerium	(µg/L)	5	<5	<5	<5	<5	NR
Thallium	(µg/L)	1	<1	<1	<1	<1	NR
Tin	(µg/L)	2	<2	<2	<2	<2	NR
Titanium	(µg/L)	2	<2	<2	<2	<2	NR
Uranium	(µg/L)	1	2	<1	2	<1	NR
Vanadium	(µg/L)	5	<5	<5	<5	<5	NR
Zinc	(µg/L)	1	4	<1	3	<1	NR

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Project Name: DSOP West Labrador / East Quebec

Sample Type: Water

Project Number: TF 8165902

Lab Ref.: F2008-1832

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CERTIFICATE OF ANALYSIS

ICP Metals+Hydrides

			Lab Blank	Q.C. Standards Actual	Q.C. Standards Expected	Date of Analysis
Parameters	**Unit**	**MDL**				
Aluminum	(µg/L)	1	<1	1030	1000	26-Sep-08
Antimony	(µg/L)	1	<1	3	3	22-Sep-08
Arsenic	(µg/L)	1	<1	3	3	24-Sep-08
Barium	(µg/L)	0.5	<0.5	504	500	26-Sep-08
Beryllium	(µg/L)	0.1	<0.1	496	500	26-Sep-08
Bismuth	(µg/L)	0.5	<0.5	1000	1000	26-Sep-08
Boron	(µg/L)	20	<20	908	1000	26-Sep-08
Cadmium	(µg/L)	0.015	<0.015	504	500	26-Sep-08
Calcium	(µg/L)	500	<500	9820	10000	26-Sep-08
Chromium	(µg/L)	1	<1	505	500	26-Sep-08
Cobalt	(µg/L)	1	<1	512	500	26-Sep-08
Copper	(µg/L)	1	<1	1010	1000	26-Sep-08
Iron	(µg/L)	1	<1	1020	1000	26-Sep-08
Lead	(µg/L)	1	<1	1010	1000	26-Sep-08
Magnesium	(µg/L)	20	<20	4070	4000	26-Sep-08
Manganese	(µg/L)	1	<1	519	500	26-Sep-08
Mercury	(µg/L)	0.02	<0.02	0.2	0.2	19-Sep-08
Molybdenum	(µg/L)	2	<2	1010	1000	26-Sep-08
Nickel	(µg/L)	1	<1	1030	1000	26-Sep-08
Phosphorus	(µg/L)	2	<2	2010	2000	26-Sep-08
Potassium	(µg/L)	20	<20	18800	20000	26-Sep-08
Rubidium	(µg/L)	5	<5	100	100	26-Sep-08
Selenium	(µg/L)	1	<1	3	3	23/26-Sep-08
Silicon	(µg/L)	2	<2	882	1000	26-Sep-08
Silver	(µg/L)	0.1	<0.1	992	1000	26-Sep-08
Sodium	(µg/L)	500	<500	20800	20000	26-Sep-08
Strontium	(µg/L)	1	<1	1030	1000	26-Sep-08
Sulphur	(µg/L)	2	<2	2010	2000	26-Sep-08
Tellerium	(µg/L)	5	<5	92	100	26-Sep-08
Thallium	(µg/L)	1	<1	1010	1000	26-Sep-08
Tin	(µg/L)	2	<2	1060	1000	26-Sep-08
Titanium	(µg/L)	2	<2	1000	1000	26-Sep-08
Uranium	(µg/L)	1	<1	97	100	26-Sep-08
Vanadium	(µg/L)	5	<5	503	500	26-Sep-08
Zinc	(µg/L)	1	<1	513	500	26-Sep-08

AMEC Earth & Environmental,
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Client:	AMEC Earth and Environmental, a division of AMEC Americas Limited 133 Crosbie Road, Suite 202, P.O. Box 13216 St. John's, Newfoundland A1B 4A5	Report Date: Received Date:	October 01, 2008 September 17, 2008
		Page:	6 of 7
Project Name:	DSOP West Labrador / East Quebec	Sample Type:	Water
Project Number:	TF 8165902	Lab Ref.:	F2008-1832
Contact:	Eugene Lee		Final

CERTIFICATE OF ANALYSIS

ICP Metals+Hydrides

			Method References
Parameters	**Unit**	**MDL**	
Aluminum	(µg/L)	1	APHA 3120, 3030 E
Antimony	(µg/L)	1	APHA 3114 C, VGA
Arsenic	(µg/L)	1	APHA 3114 C, VGA
Barium	(µg/L)	0.5	APHA 3120, 3030 E
Beryllium	(µg/L)	0.1	APHA 3120, 3030 E
Bismuth	(µg/L)	0.5	APHA 3120, 3030 E
Boron	(µg/L)	20	APHA 3120, 3030 E
Cadmium	(µg/L)	0.015	APHA 3120, 3030 E
Calcium	(µg/L)	500	APHA 3120, 3030 E
Chromium	(µg/L)	1	APHA 3120, 3030 E
Cobalt	(µg/L)	1	APHA 3120, 3030 E
Copper	(µg/L)	1	APHA 3120, 3030 E
Iron	(µg/L)	1	APHA 3120, 3030 E
Lead	(µg/L)	1	APHA 3120, 3030 E
Magnesium	(µg/L)	20	APHA 3120, 3030 E
Manganese	(µg/L)	1	APHA 3120, 3030 E
Mercury	(µg/L)	0.02	APHA 3112B, VGA
Molybdenum	(µg/L)	2	APHA 3120, 3030 E
Nickel	(µg/L)	1	APHA 3120, 3030 E
Phosphorus	(µg/L)	2	APHA 3120, 3030 E
Potassium	(µg/L)	20	APHA 3120, 3030 E
Rubidium	(µg/L)	5	APHA 3120, 3030 E
Selenium	(µg/L)	1	APHA 3114 C, VGA
Silicon	(µg/L)	2	APHA 3120, 3030 E
Silver	(µg/L)	0.1	APHA 3120, 3030 E
Sodium	(µg/L)	500	APHA 3120, 3030 E
Strontium	(µg/L)	1	APHA 3120, 3030 E
Sulphur	(µg/L)	2	APHA 3120, 3030 E
Tellerium	(µg/L)	5	APHA 3120, 3030 E
Thallium	(µg/L)	1	APHA 3120, 3030 E
Tin	(µg/L)	2	APHA 3120, 3030 E
Titanium	(µg/L)	2	APHA 3120, 3030 E
Uranium	(µg/L)	1	APHA 3120, 3030 E
Vanadium	(µg/L)	5	APHA 3120, 3030 E
Zinc	(µg/L)	1	APHA 3120, 3030 E

ASSOCIATION OF THE CHEMICAL PROFESSION OF ONTARIO
CHARTERED
Suman Punani
CHEMIST

Cynthia Ridge, C. Chem.
Q.A./Q.C. Officer

Suman Punani, C. Chem.
Laboratory Manager

~ GENERAL COMMENTS ~

MDL	Method Detection Limit
RDL	Reporting Detection Limit
ANR	Analysis not required
NA	Analysis not applicable
NP	Not Provided
NR	No Lab Replicate

Result in (brackets) represents Lab Replicate.

Results relate only to the items tested.

Client:	AMEC Earth and Environmental, a division of AMEC Americas Limited 133 Crosbie Road, Suite 202, P.O. Box 13216 St. John's, Newfoundland A1B 4A5	Report Date: Received Date: Page:	October 01, 2008 September 17, 2008 1 of 6
Project Name:	DSOP West Labrador / East Quebec	Sample Type:	Water
Project Number:	TF 8165902	Lab Ref.:	F2008-1832
Contact:	Eugene Lee		Final

CERTIFICATE OF ANALYSIS

General Chemistry + Cations

Lab Number **Sample ID** **Date Collected**			**S2008-12950** **DS03-DUP** **10-Sep-08**	**S2008-12950** **DS03-DUP** **10-Sep-08**	**S2008-12951** **DS03-06** **10-Sep-08**	**S2008-12952** **DS03-08** **10-Sep-08**	**S2008-12953** **DS03-13** **10-Sep-08**
Parameters	**Unit**	**MDL**		**(Replicate)**			
Ammonia as N	(µg/L)	10	<10	NR	<10	10	<10
Bicabornate	(µg/L)	6000	10200	NR	9540	11900	4440
Carbonate	(µg/L)	3000	<3000	NR	<3000	<3000	<3000
Chloride	(µg/L)	100	<100	<100	<100	<100	108
Colour	(TCU)	5	<5	NR	10	26	<5
Conductivity	(µS/cm)	5	21	NR	19	31	10
Dissolved Inorganic Carbon	(µg/L)	500	3850	NR	3740	2790	2190
Dissolved Organic Carbon	(µg/L)	500	1850	NR	1490	3080	995
Hardness as CaCO3	(µg/L)	300	6250	NR	6600	14400	2620
Nitrate as N	(µg/L)	50	132	124	<50	<50	<50
Nitrite as N	(µg/L)	15	<15	<15	<15	<15	<15
Nitrate + Nitrite	(µg/L)	65	<147	<139	<65	<65	<65
pH	-	-	6.12	NR	6.08	6.90	5.98
Reactive Silica	(µg/L)	10.7	7420	NR	7380	3680	4280
Sulphate	(µg/L)	100	521	527	532	3830	383
Total Alkalinity (CaCO3)	(µg/L)	5000	8350	NR	7820	9790	3640
Total Dissolved Solids (Theo)	(µg/L)	10000	13500	NR	12300	20100	<10000
Total Inorganic Carbon	(µg/L)	500	4240	NR	3880	2820	2240
Total Organic Carbon	(µg/L)	500	1900	1910	1670	3110	1040
Total Suspended Solids	(ug/L)	2000	2000	NR	2000	11000	3000
Turbidity	(NTU)	0.1	1.3	NR	1.3	3.2	2.0
Cations							
Calcium	(µg/L)	500	1350	NR	1500	1990	569
Magnesium	(µg/L)	20	697	NR	693	2290	291
Potassium	(µg/L)	20	58	NR	67	331	56
Sodium	(µg/L)	500	1480	NR	1490	<500	820

Client:
AMEC Earth and Environmental,
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Report Date: October 01, 2008
Received Date: September 17, 2008

Page: 2 of 6

Project Name: DSOP West Labrador / East Quebec

Sample Type: Water

Project Number: TF 8165902

Lab Ref.: F2008-1832

Contact: Eugene Lee

Final

CERTIFICATE OF ANALYSIS

General Chemistry + Cations

Lab Number **Sample ID** **Date Collected**			**S2008-12953** **DS03-13** **10-Sep-08**	**S2008-12954** **DS03-14** **10-Sep-08**	**S2008-12955** **DS02-01** **11-Sep-08**	**S2008-12955** **DS02-01** **11-Sep-08**	**S2008-12956** **DS02-02** **11-Sep-08**
Parameters	**Unit**	**MDL**	**(Replicate)**			**(Replicate)**	
Ammonia as N	(µg/L)	10	NR	<10	<10	NR	<10
Bicarbonate	(µg/L)	6000	NR	1700	103000	NR	46900
Carbonate	(µg/L)	3000	NR	<3000	<3000	NR	<3000
Chloride	(µg/L)	100	NR	<100	146	NR	155
Colour	(TCU)	5	NR	<5	<5	NR	20
Conductivity	(µS/cm)	5	NR	6	156	NR	72
Dissolved Inorganic Carbon	(µg/L)	500	2130	2120	20200	NR	9580
Dissolved Organic Carbon	(µg/L)	500	NR	3890	873	820	2260
Hardness as CaCO3	(µg/L)	300	NR	2510	86300	NR	37700
Nitrate as N	(µg/L)	50	NR	<50	<50	NR	<50
Nitrite as N	(µg/L)	15	NR	<15	<15	NR	<15
Nitrate + Nitrite	(µg/L)	65	NR	<65	<65	NR	<65
pH	-	-	NR	5.40	7.79	NR	7.03
Reactive Silica	(µg/L)	10.7	NR	866	4040	NR	5500
Sulphate	(µg/L)	100	NR	<100	1840	NR	648
Total Alkalinity (CaCO3)	(µg/L)	5000	NR	1390	84800	NR	38500
Total Dissolved Solids (Theo)	(µg/L)	10000	NR	<10000	10200	NR	46700
Total Inorganic Carbon	(µg/L)	500	NR	2590	20800	NR	10000
Total Organic Carbon	(µg/L)	500	NR	4420	1270	NR	2630
Total Suspended Solids	(ug/L)	2000	NR	5000	<2000	NR	3000
Turbidity	(NTU)	0.1	NR	1.6	0.1	NR	5.3
Cations							
Calcium	(µg/L)	500	NR	685	17400	NR	7620
Magnesium	(µg/L)	20	NR	195	10400	NR	4530
Potassium	(µg/L)	20	NR	20	187	NR	210
Sodium	(µg/L)	500	NR	<500	<500	NR	517

Client:	AMEC Earth and Environmental, a division of AMEC Americas Limited 133 Crosbie Road, Suite 202, P.O. Box 13216 St. John's, Newfoundland A1B 4A5	Report Date: Received Date: Page:	October 01, 2008 September 17, 2008 3 of 6
Project Name:	DSOP West Labrador / East Quebec	Sample Type:	Water
Project Number:	TF 8165902	Lab Ref.:	F2008-1832
Contact:	Eugene Lee		Final

CERTIFICATE OF ANALYSIS

General Chemistry + Cations

Lab Number **Sample ID** **Date Collected**			**S2008-12957** **DS02-03** **11-Sep-08**	**S2008-12958** **DS02-04** **11-Sep-08**	**S2008-12958** **DS02-04** **11-Sep-08**	**S2008-12959** **Star 1** **11-Sep-08**	**S2008-12959** **Star 1** **11-Sep-08**
Parameters	**Unit**	**MDL**			**(Replicate)**		**(Replicate)**
Ammonia as N	(µg/L)	10	<10	10	NR	<10	NR
Bicabornate	(µg/L)	6000	50100	50200	NR	51500	NR
Carbonate	(µg/L)	3000	<3000	<3000	NR	<3000	NR
Chloride	(µg/L)	100	302	294	NR	311	NR
Colour	(TCU)	5	<5	<5	NR	<5	<5
Conductivity	(µS/cm)	5	81	82	NR	83	NR
Dissolved Inorganic Carbon	(µg/L)	500	9590	9730	NR	10100	NR
Dissolved Organic Carbon	(µg/L)	500	675	659	NR	612	NR
Hardness as CaCO3	(µg/L)	300	41700	42600	NR	43500	NR
Nitrate as N	(µg/L)	50	<50	<50	NR	<50	NR
Nitrite as N	(µg/L)	15	<15	<15	NR	<15	NR
Nitrate + Nitrite	(µg/L)	65	<65	<65	NR	<65	NR
pH	-	-	7.60	7.62	NR	7.55	NR
Reactive Silica	(µg/L)	10.7	5600	5630	NR	5540	NR
Sulphate	(µg/L)	100	2540	2620	NR	2390	NR
Total Alkalinity (CaCO3)	(µg/L)	5000	41100	41100	NR	42200	NR
Total Dissolved Solids (Theo)	(µg/L)	10000	52900	53400	NR	54200	NR
Total Inorganic Carbon	(µg/L)	500	9860	9930	9930	10400	NR
Total Organic Carbon	(µg/L)	500	960	1080	NR	911	NR
Total Suspended Solids	(ug/L)	2000	<2000	<2000	NR	2000	2000
Turbidity	(NTU)	0.1	0.3	0.5	0.4	0.4	NR
Cations							
Calcium	(µg/L)	500	7800	7910	NR	8210	NR
Magnesium	(µg/L)	20	5400	5540	NR	5580	NR
Potassium	(µg/L)	20	337	344	NR	333	NR
Sodium	(µg/L)	500	598	582	NR	612	NR

Client: AMEC Earth and Environmental,
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133 Crosbie Road, Suite 202, P.O. Box 13216
St. John's, Newfoundland A1B 4A5

Report Date: October 01, 2008
Received Date: September 17, 2008

Page: 4 of 6

Project Name: DSOP West Labrador / East Quebec

Sample Type: Water

Project Number: TF 8165902

Lab Ref.: F2008-1832

Contact: Eugene Lee

Final

CERTIFICATE OF ANALYSIS

General Chemistry + Cations

Parameters	**Unit**	**MDL**	**Lab Blank**	**Q.C. Standard Actual**	**Q.C. Standard Expected**	**Date of Analysis**
Ammonia	(µg/L)	10	<10	395	400	19-Sep-08
Bicabornate	(µg/L)	6000	<6000	-	-	19-Sep-08
Carbonate	(µg/L)	3000	<3000	-	-	19-Sep-08
Chloride	(µg/L)	100	<100	4090	4200	20-Sep-08
Colour	(TCU)	5	<5	31	32.5	23-Sep-08
Conductivity	(µS/cm)	5	<5	107	100	19-Sep-08
Dissolved Inorganic Carbon	(µg/L)	500	<500	-	-	29-Sep-08
Dissolved Organic Carbon	(µg/L)	500	<500	15400	15000	23-Sep-08
Hardness as CaCO3	(µg/L)	300	<300	-	-	26-Sep-08
Nitrate as N	(µg/L)	50	<50	4130	4000	20-Sep-08
Nitrite as N	(µg/L)	15	<15	505	500	20-Sep-08
Nitrate + Nitrite	(µg/L)	65	<65	-	-	20-Sep-08
pH	-	-	6.68	5.99	6.00	19-Sep-08
Reactive Silica	(µg/L)	10.7	<10.7	882	1000	26-Sep-08
Sulphate	(µg/L)	100	<100	23900	24000	20-Sep-08
Total Alkalinity (CaCO3)	(µg/L)	5000	<5000	100	1000000	19-Sep-08
Total Dissolved Solids (Theo)	(µg/L)	10000	<10000	69000	65000	19-Sep-08
Total Inorganic Carbon	(µg/L)	500	<500	-	-	29-Sep-08
Total Organic Carbon	(µg/L)	500	<500	-	15000	23-Sep-08
Total Suspended Solids	(ug/L)	2000	<2000	97000	10000	22-Sep-08
Turbidity	(NTU)	0.1	<0.1	9.84	10.0	25-Sep-08
Cations						
Calcium	(µg/L)	500	<500	9820	10000	26-Sep-08
Magnesium	(µg/L)	20	<20	4070	4000	26-Sep-08
Potassium	(µg/L)	20	<20	18800	20000	26-Sep-08
Sodium	(µg/L)	500	<500	20800	20000	26-Sep-08

Client:	AMEC Earth and Environmental, a division of AMEC Americas Limited 133 Crosbie Road, Suite 202, P.O. Box 13216 St. John's, Newfoundland A1B 4A5	Report Date: Received Date: Page:	October 01, 2008 September 17, 2008 5 of 6
Project Name:	DSOP West Labrador / East Quebec	Sample Type:	Water
Project Number:	TF 8165902	Lab Ref.:	F2008-1832
Contact:	Eugene Lee		Final

CERTIFICATE OF ANALYSIS

General Chemistry + Cations

			Method References
Parameters	**Unit**	**MDL**	
Ammonia as N	(ug/L)	10	US EPA 1688, Skalar 155-318
Bicabornate	(µg/L)	6000	APHA 2320
Carbonate	(µg/L)	3000	APHA 2320
Chloride	(ug/L)	100	APHA 4110 C
Colour	(TCU)	5	APHA 2120 B
Conductivity	(µS/cm)	5	APHA 2510
Dissolved Organic Carbon	(µg/L)	500	APHA 5310
Hardness as CaCO3	(ug/L)	300	Calculated
Nitrate as N	(ug/L)	50	APHA 4110 C
Nitrite as N	(ug/L)	15	APHA 4110 C
Nitrate + Nitrite	(ug/L)	65	Calculated
pH	-	-	APHA 4500 H^+
Reactive Silica	(µg/L)	10.7	APHA 3120, 3030 E
Sulphate	(ug/L)	100	APHA 4110 C
Total Alkalinity (CaCO3)	(ug/L)	5000	APHA 2320
Total Dissolved Solids (Theo)	(ug/L)	10000	APHA 2510
Total Organic Carbon	(ug/L)	500	APHA 5310
Total Suspended Solids	(ug/L)	2000	APHA 2540 D
Turbidity	(NTU)	0.1	APHA 2130 B
Cations			
Calcium	(ug/L)	500	APHA 3120, 3030 E
Magnesium	(ug/L)	20	APHA 3120, 3030 E
Potassium	(ug/L)	20	APHA 3120, 3030 E
Sodium	(ug/L)	500	APHA 3120, 3030 E

Cynthia Ridge, C. Chem.
Q.A./Q.C. Officer

Suman Punani, C. Chem.
Laboratory Manager

CHARTERED
Suman Punani
CHEMIST

/gb

~ GENERAL COMMENTS ~

MDL	Method Detection Limit
RDL	Reporting Detection Limit
ANR	Analysis not required
NA	Analysis not applicable
NP	Not Provided
NR	No Lab Replicate
	Result in (brackets) represents Lab Replicate
	Results relate to only to the items tested.

Request for Analysis

AMEC EARTH AND ENVIRONMENTAL
a Division of AMEC Americas Ltd.
160 Traders Boulevard, Unit 4, Mississauga, Ont L4Z 3K7
Tel. (905) 890-0785 Fax: (905) 890-1141

The Work specified herein shall be performed in accordance with the terms and conditions on the reverse of this document; or, as may be applicable, in accordance with the terms and conditions of the Blanket Purchase Order Number ____________

LQ# ____________ AUTHORIZED SIGNATURE: ____________ DATE: ____________ TIME: ____________

DATE REQUIRED: ____________ RECEIVED AT LAB BY: ____________ DATE: ____________ TIME: ____________

LOGGED AT LAB BY: SS. DATE: Sept 17/08 TIME: 1:00

FILE #: 1832 BOX #: 41/42/39

(A) ARE THESE WATER SAMPLES FROM SOURCES IN ONTARIO - YES / [✓ NO]
(B) ARE THESE SAMPLES POTABLE or FOR HUMAN CONSUMPTION - YES / [✓ NO]
IF YES TO (A) and (B). CONTACT THE LAB BEFORE SHIPPING.

PROJECT # / P.O #: TF8165902
CONTACT: Eugene Lee
PROJECT NAME: DSOP West Labrador/East Quebec
COMPANY NAME: AMEC E&E
MAILING ADDRESS: 133 Crosbie Rd. St. John's, NL A1B 4A5
TELEPHONE NUMBER: 709-722-7023
FAX NUMBER: 709-722-7353

TURNAROUND BUSINESS DAY
☑ NORMAL (5-7) ☐ RUSH (3) ☐ SUPER (24Hrs)

Regulatory Requirements:
☐ Brownfields 153/04
☐ Table ___
☐ PWQO
☑ CCME
☐ ODWS
☐ TCLP
☐ Other
☐ uncertainty reported on C of A

separate request for Analysis Form required for Ontario Drinking water samples

note: unless stated otherwise, all water samples will be treated as non-potable and will not be subject to ODWS regulation requirements

Temperature 20.6/20.2 Sample Condition

ANALYSIS REQUESTED

LAB USE ONLY	SAMPLE ID	DATE	TYPE	AMOUNT COLLECTED	PRESERVATIVES in total metals only	LAB FILTRATION REQUIRED Dissolved metals	Gen Chem	Total metals	Dissolved metals	TSS	TOC				LEVEL OF CONTAMINATION (H, L, U)
S2008-12950	DS03-DUP	10Sept08	Surface water	1-1L 2-250mL 1-500mL 1-100mL	✓	✓	✓	✓	✓	✓	✓				
S2008-12951	DS03-06	↓	↓	↓	✓	✓	✓	✓	✓	✓	✓				
S2008-12952	DS03-08				✓	✓	✓	✓	✓	✓	✓				
S2008-12953	DS03-13				✓	✓	✓	✓	✓	✓	✓				
S2008-12954	DS03-14	10Sept08			✓	✓	✓	✓	✓	✓	✓				
S2008-12955	DS02-01	11Sept08			✓	✓	✓	✓	✓	✓	✓				
S2008-12956	DS02-02	↓			✓	✓	✓	✓	✓	✓	✓				
S2008-12957	DS02-03				✓	✓	✓	✓	✓	✓	✓				
S2008-12958	DS02-04				✓	✓	✓	✓	✓	✓	✓				
S2008-12959	Star1	11Sept08	surface water	1-1L 2-250mL 1-500mL 1-100mL	✓	✓	✓	✓	✓	✓	✓				
S2008-12960	Lab Blank No Sample.														

COMMENTS: Sent by Maureen Cameron-MacMillan
13 Sept 2008 @ 13:00.

Revision 2006 -2

Client:	AMEC Earth and Environmental, A Division of AMEC Americas Limited 133 Crosbie Road, Suite 202, P.O. Box 13216 St. John's, Newfoundland A1B 4A5	Report Date: Received Date: Page:	October 07, 2008 September 18, 2008 1 of 5
Project Name:	DSOP West Labrador / East Quebec	Sample Type:	Water
Project Number:	TF 8165902	Lab Ref.:	F2008-1848
Contact:	Eugene Lee		Final

CERTIFICATE OF ANALYSIS

General Chemistry

Lab Number **Sample ID** **Date Collected**			**S2008-13072** **Trip Blank** **04-Sep-08**	**S2008-13072** **Trip Blank** **04-Sep-08**	**S2008-13073** **DS03-Dup2** **12-Sep-08**	**S2008-13074** **Timmins 1** **12-Sep-08**	**S2008-13075** **Timmins 2** **12-Sep-08**
Parameters	**Unit**	**MDL**		**(Replicate)**			
Ammonia as N	(ug/L)	10	<1	NR	<10	<10	<10
Bicarbonate	(ug/L)	6000	<6000	NR	<6000	8920	7480
Carbonate	(ug/L)	3000	<3000	NR	<3000	<3000	<3000
Chloride	(ug/L)	100	<100	<100	<100	331	1230
Colour	(TCU)	5	<5	NR	<5	<5	<5
Conductivity	(uS/cm)	5	7	NR	<5	22	28
Dissolved Inorganic Carbon	(ug/L)	500	<500	NR	<500	2010	1530
Dissolved Organic Carbon	(ug/L)	500	<500	NR	<500	2300	1790
Nitrate as N	(ug/L)	50	<50	<50	<50	156	924
Nitrite as N	(ug/L)	15	<15	<15	<15	<15	<15
Nitrate + Nitrite	(ug/L)	65	<65	<65	<65	<171	<939
pH	-	-	7.35	NR	6.10	6.97	6.96
Reactive Silica	(ug/L)	10.7	1300	NR	1490	2850	4430
Sulphate	(ug/L)	100	<100	<100	<100	1540	1210
Total Alkalinity (CaCO3)	(ug/L)	5000	<5000	NR	<5000	7310	6130
Total Dissolved Solids (Theo)	(ug/L)	10000	<10000	NR	<10000	14000	18300
Total Hardness (CaCO$_3$)	(ug/L)	300	<300	NR	<300	5840	6950
Total Inorganic Carbon	(ug/L)	500	<500	NR	<500	2040	1580
Total Organic Carbon	(ug/L)	500	<500	NR	<500	2570	1900
Total Suspended Solids	(ug/L)	2000	<2000	NR	<2000	<2000	<2000
Turbidity	(NTU)	0.1	0.1	NR	<0.1	1.2	3.4
Cations							
Calcium	(µg/L)	500	<500	NR	<500	1070	1300
Magnesium	(µg/L)	20	<20	NR	<20	769	900
Potassium	(µg/L)	20	<20	NR	<20	259	151
Sodium	(µg/L)	500	<500	NR	<500	<500	710

Client: AMEC Earth and Environmental,
A Division of AMEC Americas Limited
133 Crosbie Road, Suite 202, P.O. Box 13216
St. John's, Newfoundland A1B 4A5

Report Date: October 07, 2008
Received Date: September 18, 2008

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Project Name: DSOP West Labrador / East Quebec

Sample Type: Water

Project Number: TF 8165902

Lab Ref.: F2008-1848

Contact: Eugene Lee

Final

CERTIFICATE OF ANALYSIS

General Chemistry

Lab Number			**S2008-13076**	**S2008-13076**	**S2008-13077**	**S2008-13077**	**S2008-13078**
Sample ID			**DS03-15**	**DS03-15**	**DS03-07**	**DS03-07**	**DS03-03**
Date Collected			**12-Sep-08**	**12-Sep-08**	**13-Sep-08**	**13-Sep-08**	**13-Sep-08**
Parameters	**Unit**	**MDL**		**(Replicate)**		**(Replicate)**	
Ammonia as N	(ug/L)	10	<10	NR	24	30	38
Bicarbonate	(ug/L)	6000	8930	NR	<6000	NR	<6000
Carbonate	(ug/L)	3000	<3000	NR	<3000	NR	<3000
Chloride	(ug/L)	100	342	NR	<100	NR	142
Colour	(TCU)	5	<5	NR	31	NR	<5
Conductivity	(uS/cm)	5	22	NR	7	NR	10
Dissolved Inorganic Carbon	(ug/L)	500	2080	NR	847	NR	1120
Dissolved Organic Carbon	(ug/L)	500	1840	NR	3190	NR	6350
Fluoride	(ug/L)	100	<100	NR	<100	NR	<100
Nitrate as N	(ug/L)	50	208	NR	<50	NR	<50
Nitrite as N	(ug/L)	15	<15	NR	<15	NR	<15
Nitrate + Nitrite	(ug/L)	65	<223	NR	<65	NR	<65
pH			6.81	NR	6.40	NR	6.02
Reactive Silica	(ug/L)	10.7	3530	NR	2530	NR	3750
Sulphate	(ug/L)	100	1560	NR	547	NR	586
Total Alkalinity (CaCO3)	(ug/L)	5000	7320	NR	<5000	NR	<5000
Total Dissolved Solids (Theo)	(ug/L)	10000	14600	NR	<10000	NR	<10000
Total Hardness (CaCO$_3$)	(ug/L)	300	6080	NR	1990	NR	1180
Total Inorganic Carbon	(ug/L)	500	2190	2140	879	NR	1150
Total Organic Carbon	(ug/L)	500	2270	NR	3560	3440	6740
Total Suspended Solids	(ug/L)	2000	<2000	NR	<2000	NR	<2000
Turbidity	(NTU)	0.1	4.2	NR	1.2	NR	1.2
Cations							
Calcium	(μg/L)	500	1100	NR	<500	NR	<500
Magnesium	(μg/L)	20	810	NR	256	NR	140
Potassium	(μg/L)	20	277	NR	62	NR	362
Sodium	(μg/L)	500	<500	NR	<500	NR	715

Client:	AMEC Earth and Environmental, A Division of AMEC Americas Limited 133 Crosbie Road, Suite 202, P.O. Box 13216 St. John's, Newfoundland A1B 4A5	Report Date: Received Date: Page:	October 07, 2008 September 18, 2008 2 of 5
Project Name:	DSOP West Labrador / East Quebec	Sample Type:	Water
Project Number:	TF 8165902	Lab Ref.:	F2008-1848
Contact:	Eugene Lee		Final

CERTIFICATE OF ANALYSIS

General Chemistry

Lab Number			**S2008-13079**	**S2008-13079**
Sample ID			**DS03-05**	**DS03-05**
Date Collected			**13-Sep-08**	**13-Sep-08**
Parameters	**Unit**	**MDL**		**(Replicate)**
Ammonia as N	(ug/L)	10	44	NR
Bicarbonate	(ug/L)	6000	<6000	NR
Carbonate	(ug/L)	3000	<3000	NR
Chloride	(ug/L)	100	<100	NR
Colour	(TCU)	5	<5	<5
Conductivity	(uS/cm)	5	<5	NR
Dissolved Inorganic Carbon	(ug/L)	500	<500	NR
Dissolved Organic Carbon	(ug/L)	500	2600	NR
Fluoride	(ug/L)	100	<100	NR
Nitrate as N	(ug/L)	50	<50	NR
Nitrite as N	(ug/L)	15	<15	NR
Nitrate + Nitrite	(ug/L)	65	<65	NR
pH	-	-	5.71	NR
Reactive Silica	(ug/L)	10.7	514	NR
Sulphate	(ug/L)	100	334	NR
Total Alkalinity (CaCO3)	(ug/L)	5000	<5000	NR
Total Dissolved Solids (Theo)	(ug/L)	10000	<10000	NR
Total Hardness (CaCO$_3$)	(ug/L)	300	704	NR
Total Inorganic Carbon	(ug/L)	500	520	NR
Total Organic Carbon	(ug/L)	500	3610	NR
Total Suspended Solids	(ug/L)	2000	13000	13000
Turbidity	(NTU)	0.1	33.3	34.1
Cations				
Calcium	(μg/L)	500	<500	NR
Magnesium	(μg/L)	20	78	NR
Potassium	(μg/L)	20	116	NR
Sodium	(μg/L)	500	123	NR

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Project Name: DSOP West Labrador / East Quebec

Sample Type: Water

Project Number: TF 8165902

Lab Ref.: F2008-1848

Contact: Eugene Lee

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CERTIFICATE OF ANALYSIS

General Chemistry

Parameters	Unit	MDL	Lab Blank	Q.C. Standard Actual	Q.C. Standard Expected	Date of Analysis
Ammonia as N	(ug/L)	10	<10	402	400	23-Sep / 06-Oct-08
Bicarbonate	(ug/L)	6000	<6000	-	-	23-Sep-08
Carbonate	(ug/L)	3000	<3000	-	-	23-Sep-08
Chloride	(ug/L)	100	<100	4100	4200	22-Sep-08
Colour	(TCU)	5	<5	31	32.5	23-Sep-08
Conductivity	(uS/cm)	5	<5	105	100	23-Sep-08
Dissolved Inorganic Carbon	(ug/L)	500	<500	-	-	29/30-Sep-08
Dissolved Organic Carbon	(ug/L)	500	<500	15400	15000	23/26-Sep-08
Fluoride	(ug/L)	100	<100	1850	1800	22-Sep-08
Nitrate as N	(ug/L)	50	<50	4160	4200	22-Sep-08
Nitrite as N	(ug/L)	15	<15	500	500	22-Sep-08
Nitrate + Nitrite	(ug/L)	65	<65	-	-	22-Sep-08
pH			6.81	5.99	6.00	23-Sep-08
Reactive Silica	(ug/L)	10.7	<10.7	915	1000	29-Sep-08
Sulphate	(ug/L)	100	<100	23800	24000	22-Sep-08
Total Alkalinity (CaCO3)	(ug/L)	5000	<5000	101000	100000	23-Sep-08
Total Dissolved Solids (Theo)	(ug/L)	10000	<10000	68100	65000	23-Sep-08
Total Hardness (CaCO$_3$)	(ug/L)	300	<300	-	-	29-Sep-08
Total Inorganic Carbon	(ug/L)	500	<500	-	-	29/30-Sep-08
Total Organic Carbon	(ug/L)	500	<500	15400	15000	23/26-Sep-08
Total Suspended Solids	(ug/L)	2000	<2000	97000	100000	22-Sep-08
Turbidity	(NTU)	0.1	<0.1	9.84	10.0	25-Sep-08
Cations						
Calcium	(μg/L)	500	<500	9500	10000	29-Sep-08
Magnesium	(μg/L)	20	<20	3750	4000	29-Sep-08
Potassium	(μg/L)	20	<20	18000	20000	29-Sep-08
Sodium	(μg/L)	500	<500	21000	20000	29-Sep-08

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Sample Type: Water

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CERTIFICATE OF ANALYSIS

General Chemistry + Sodium

			Method References
General Chemistry	**Unit**	**MDL**	
Ammonia as N	(ug/L)	10	US EPA 1688, Skalar 155-318
Bicarbonate	(ug/L)	6000	APHA 2320
Carbonate	(ug/L)	3000	APHA 2320
Chloride	(ug/L)	100	APHA 4110 C
Colour	(TCU)	5	APHA 2120 B
Conductivity	(uS/cm)	5	APHA 2510
Dissolved Inorganic Carbon	(ug/L)	500	APHA 5310 C
Dissolved Organic Carbon	(ug/L)	500	APHA 5310 C
Fluoride	(ug/L)	100	APHA 4110 C
Nitrate as N	(ug/L)	50	APHA 4110 C
Nitrite as N	(ug/L)	15	APHA 4110 C
Nitrate + Nitrite	(ug/L)	65	Calculated
pH			APHA 4500 H^+
Reactive Silica	(ug/L)	10.7	APHA 3120, 3030 E
Sulphate	(ug/L)	100	APHA 4110 C
Total Alkalinity (CaCO3)	(ug/L)	5000	APHA 2320
Total Dissolved Solids (Theo)	(ug/L)	10000	APHA 2510
Total Hardness ($CaCO_3$)	(ug/L)	300	Calculated
Total Inorganic Carbon	(ug/L)	500	APHA 5310 C
Total Organic Carbon	(ug/L)	500	APHA 5310 C
Total Suspended Solids	(ug/L)	2000	APHA 2540 D
Turbidity	(NTU)	0.1	APHA 2130 B
Cations			
Calcium	(µg/L)	500	APHA 3120, 3030 E
Magnesium	(µg/L)	20	APHA 3120, 3030 E
Potassium	(µg/L)	20	APHA 3120, 3030 E
Sodium	(µg/L)	500	APHA 3120, 3030 E

Cynthia Ridge, C. Chem.
Q.A./Q.C. Officer

ASSOCIATION OF THE CHEMICAL PROFESSIONS OF ONTARIO
Suman Punani

Suman Punani, C. Chem.
Laboratory Manager

~ GENERAL COMMENTS ~

MDL	Method Detection Limit
RDL	Reporting Detection Limit
ANR	Analysis not required
NA	Analysis not applicable
NP	Not Provided
NR	No Lab Replicate

Result in (brackets) represents Lab Replicate.

Results relate only to the items tested.

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Project Name: DSOP West Labrador / East Quebec

Sample Type: Water

Project Number: TF 8165902

Lab Ref.: F2008-1848

Contact: Eugene Lee

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CERTIFICATE OF ANALYSIS

ICP Metals+Hydrides

Lab Number			**S2008-13072**	**S2008-13072**	**S2008-13073**	**S2008-13073**	**S2008-13074**	**S2008-13074**
Sample ID			**Trip Blank**	**Trip Blank**	**DS03-Dup2**	**DS03-Dup2**	**Timmins 1**	**Timmins 1**
Date Collected			**04-Sep-08**	**04-Sep-08**	**12-Sep-08**	**12-Sep-08**	**12-Sep-08**	**12-Sep-08**
Parameters	**Unit**	**MDL**	**(Total)**	**(Dissolved)**	**(Total)**	**(Dissolved)**	**(Total)**	**(Dissolved)**
Aluminum	(μg/L)	1	<1	<1	13	5	10	8
Antimony	(μg/L)	1	<1	<1	<1	<1	<1	<1
Arsenic	(μg/L)	1	<1	<1	<1	<1	<1	<1
Barium	(μg/L)	0.5	<0.5	<0.5	<0.5	<0.5	3.5	2.4
Beryllium	(μg/L)	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Bismuth	(μg/L)	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Boron	(μg/L)	20	<20	<20	<20	<20	<20	<20
Cadmium	(μg/L)	0.015	<0.015	<0.015	0.054	<0.015	0.097	<0.015
Calcium	(μg/L)	500	<500	<500	<500	<500	1070	709
Chromium	(μg/L)	1	<1	<1	<1	<1	<1	<1
Cobalt	(μg/L)	1	<1	<1	<1	<1	<1	<1
Copper	(μg/L)	1	1	<1	1	<1	2	<1
Iron	(μg/L)	1	<1	<1	31	16	23	18
Lead	(μg/L)	1	<1	<1	2	<1	<1	<1
Magnesium	(μg/L)	20	<20	<20	<20	<20	769	517
Manganese	(μg/L)	1	<1	<1	<1	<1	2	<1
Mercury	(μg/L)	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Molybdenum	(μg/L)	2	<2	<2	<2	<2	<2	<2
Nickel	(μg/L)	1	<1	<1	<1	<1	<1	<1
Phosphorus	(μg/L)	2	<2	<2	<2	<2	<2	<2
Potassium	(μg/L)	20	<20	<20	<20	<20	259	163
Rubidium	(μg/L)	5	<5	<5	<5	<5	<5	<5
Selenium	(μg/L)	1	<1	<1	<1	<1	<1	<1
Silicon	(μg/L)	2	607	576	694	626	1330	1220
Silver	(μg/L)	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Sodium	(μg/L)	500	<500	<500	<500	<500	<500	<500
Strontium	(μg/L)	1	<1	<1	<1	<1	3	2
Sulphur	(μg/L)	2	3	4	<2	<2	448	305
Tellerium	(μg/L)	5	<5	<5	<5	<5	<5	<5
Thallium	(μg/L)	1	<1	<1	<1	<1	<1	<1
Tin	(μg/L)	2	<2	<2	<2	<2	<2	<2
Titanium	(μg/L)	2	<2	<2	<2	<2	<2	<2
Uranium	(μg/L)	1	<1	<1	<1	<1	<1	<1
Vanadium	(μg/L)	5	<5	<5	<5	<5	<5	<5
Zinc	(μg/L)	1	2	2	3	1	5	2

Client:	AMEC Earth and Environmental, A Division of AMEC Americas Limited 133 Crosbie Road, Suite 202, P.O. Box 13216 St. John's, Newfoundland A1B 4A5	Report Date: Received Date:	October 07, 2008 September 18, 2008
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Project Name:	DSOP West Labrador / East Quebec	Sample Type:	Water
Project Number:	TF 8165902	Lab Ref.:	F2008-1848
Contact:	Eugene Lee		Final

CERTIFICATE OF ANALYSIS

ICP Metals+Hydrides

Lab Number **Sample ID** **Date Collected**			**S2008-13075** **Timmins 2** **12-Sep-08**	**S2008-13075** **Timmins 2** **12-Sep-08**	**S2008-13075** **Timmins 2** **12-Sep-08**	**S2008-13076** **DS03-15** **12-Sep-08**	**S2008-13076** **DS03-15** **12-Sep-08**	**S2008-13076** **DS03-15** **12-Sep-08**
Parameters	**Unit**	**MDL**	**(Total)**	**(Total) (Replicate)**	**(Dissolved)**	**(Total)**	**(Total) (Replicate)**	**(Dissolved)**
Aluminum	(µg/L)	1	14	NR	2	358	NR	146
Antimony	(µg/L)	1	<1	<1	<1	<1	NR	<1
Arsenic	(µg/L)	1	<1	<1	<1	<1	NR	<1
Barium	(µg/L)	0.5	1.2	NR	0.7	3.2	NR	2.1
Beryllium	(µg/L)	0.1	<0.1	NR	<0.1	<0.1	NR	<0.1
Bismuth	(µg/L)	0.5	<0.5	NR	<0.5	<0.5	NR	<0.5
Boron	(µg/L)	20	<20	NR	<20	<20	NR	<20
Cadmium	(µg/L)	0.015	0.111	NR	0.098	0.152	NR	<0.015
Calcium	(µg/L)	500	1300	NR	910	1100	NR	839
Chromium	(µg/L)	1	<1	NR	<1	<1	NR	<1
Cobalt	(µg/L)	1	<1	NR	<1	<1	NR	<1
Copper	(µg/L)	1	<1	NR	<1	9	NR	<1
Iron	(µg/L)	1	36	NR	12	22	NR	14
Lead	(µg/L)	1	<1	NR	<1	2	NR	<1
Magnesium	(µg/L)	20	900	NR	589	810	NR	579
Manganese	(µg/L)	1	3	NR	2	2	NR	1
Mercury	(µg/L)	0.02	<0.02	NR	<0.02	<0.02	<0.02	<0.02
Molybdenum	(µg/L)	2	<2	NR	<2	<2	NR	<2
Nickel	(µg/L)	1	<1	NR	<1	<1	NR	<1
Phosphorus	(µg/L)	2	<2	NR	<2	13	NR	<2
Potassium	(µg/L)	20	151	NR	99	277	NR	184
Rubidium	(µg/L)	5	<1	NR	<5	<5	NR	<1
Selenium	(µg/L)	1	<1	<1	<1	2	NR	1
Silicon	(µg/L)	2	2070	NR	1930	1650	NR	1490
Silver	(µg/L)	0.1	<0.1	NR	<0.1	<0.1	NR	<0.1
Sodium	(µg/L)	500	710	NR	<500	<500	NR	<500
Strontium	(µg/L)	1	4	NR	3	3	NR	2
Sulphur	(µg/L)	2	362	NR	245	486	NR	340
Tellerium	(µg/L)	5	<5	NR	<5	<5	NR	<5
Thallium	(µg/L)	1	<1	NR	<1	<1	NR	<1
Tin	(µg/L)	2	<2	NR	<2	<2	NR	<2
Titanium	(µg/L)	2	<2	NR	<2	<2	NR	<2
Uranium	(µg/L)	1	<1	NR	<1	<1	NR	<1
Vanadium	(µg/L)	5	<5	NR	<5	<5	NR	<5
Zinc	(µg/L)	1	3	NR	2	8	NR	2

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CERTIFICATE OF ANALYSIS

ICP Metals+Hydrides

Lab Number **Sample ID** **Date Collected**			**S2008-13077** **DS03-07** **13-Sep-08**	**S2008-13077** **DS03-07** **13-Sep-08**	**S2008-13078** **DS03-03** **13-Sep-08**	**S2008-13078** **DS03-03** **13-Sep-08**	**S2008-13079** **DS03-05** **13-Sep-08**	**S2008-13079** **DS03-05** **13-Sep-08**
Parameters	**Unit**	**MDL**	**(Total)**	**(Dissolved)**	**(Total)**	**(Dissolved)**	**(Total)**	**(Dissolved)**
Aluminum	(µg/L)	1	34	14	45	37	177	30
Antimony	(µg/L)	1	<1	<1	<1	<1	<1	<1
Arsenic	(µg/L)	1	<1	<1	<1	<1	<1	<1
Barium	(µg/L)	0.5	0.7	<0.5	0.9	0.7	2.1	0.9
Beryllium	(µg/L)	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Bismuth	(µg/L)	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.5
Boron	(µg/L)	20	<20	<20	<20	<20	<20	<20
Cadmium	(µg/L)	0.015	0.033	<0.015	0.098	<0.015	0.129	0.085
Calcium	(µg/L)	500	<500	<500	<500	<500	<500	<500
Chromium	(µg/L)	1	<1	<1	<1	<1	<1	<1
Cobalt	(µg/L)	1	<1	<1	<1	<1	<1	<1
Copper	(µg/L)	1	3	<1	1	1	1	<1
Iron	(µg/L)	1	90	56	86	46	419	9
Lead	(µg/L)	1	<1	<1	<1	<1	1	<1
Magnesium	(µg/L)	20	256	180	140	115	78	38
Manganese	(µg/L)	1	4	2	8	5	12	4
Mercury	(µg/L)	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Molybdenum	(µg/L)	2	<2	<2	<2	<2	<2	<2
Nickel	(µg/L)	1	<1	<1	<1	<1	<1	<1
Phosphorus	(µg/L)	2	4	<2	8	<2	14	<2
Potassium	(µg/L)	20	62	33	362	285	116	39
Rubidium	(µg/L)	5	<5	<5	<5	<5	<5	<5
Selenium	(µg/L)	1	<1	<1	<1	<1	<1	<1
Silicon	(µg/L)	2	1180	1080	1750	1730	241	41
Silver	(µg/L)	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Sodium	(µg/L)	500	<500	<500	715	553	<500	<500
Strontium	(µg/L)	1	1	<1	2	1	<1	<1
Sulphur	(µg/L)	2	197	137	213	167	148	72
Tellerium	(µg/L)	5	<5	<5	<5	<5	<5	<5
Thallium	(µg/L)	1	<1	<1	<1	<1	<1	<1
Tin	(µg/L)	2	<2	<2	<2	<2	<2	<2
Titanium	(µg/L)	2	<2	<2	<2	<2	4	<2
Uranium	(µg/L)	1	<1	<1	<1	<1	<1	<1
Vanadium	(µg/L)	5	<5	<5	<5	<5	<5	<5
Zinc	(µg/L)	1	5	<1	4	2	4	1

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Sample Type:	Water
Lab Ref.:	F2008-1848
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CERTIFICATE OF ANALYSIS

ICP Metals+Hydrides

Lab Number			**S2008-13079**
Sample ID			**DS03-05**
Date Collected			**13-Sep-08**
Parameters	**Unit**	**MDL**	**(Dissolved) (Replicate)**
Aluminum	(µg/L)	1	NR
Antimony	(µg/L)	1	NR
Arsenic	(µg/L)	1	<1
Barium	(µg/L)	0.5	NR
Beryllium	(µg/L)	0.1	NR
Bismuth	(µg/L)	0.5	NR
Boron	(µg/L)	20	NR
Cadmium	(µg/L)	0.015	NR
Calcium	(µg/L)	500	NR
Chromium	(µg/L)	1	NR
Cobalt	(µg/L)	1	NR
Copper	(µg/L)	1	NR
Iron	(µg/L)	1	NR
Lead	(µg/L)	1	NR
Magnesium	(µg/L)	20	NR
Manganese	(µg/L)	1	NR
Mercury	(µg/L)	0.02	NR
Molybdenum	(µg/L)	2	NR
Nickel	(µg/L)	1	NR
Phosphorus	(µg/L)	2	NR
Potassium	(µg/L)	20	NR
Rubidium	(µg/L)	5	NR
Selenium	(µg/L)	1	<1
Silicon	(µg/L)	2	NR
Silver	(µg/L)	0.1	NR
Sodium	(µg/L)	500	NR
Strontium	(µg/L)	1	NR
Sulphur	(µg/L)	2	NR
Tellerium	(µg/L)	5	NR
Thallium	(µg/L)	1	NR
Tin	(µg/L)	2	NR
Titanium	(µg/L)	2	NR
Uranium	(µg/L)	1	NR
Vanadium	(µg/L)	5	NR
Zinc	(µg/L)	1	NR

Client:	AMEC Earth and Environmental, A Division of AMEC Americas Limited 133 Crosbie Road, Suite 202, P.O. Box 13216 St. John's, Newfoundland A1B 4A5	Report Date: Received Date: Page:	October 07, 2008 September 18, 2008 5 of 7
Project Name:	DSOP West Labrador / East Quebec	Sample Type:	Water
Project Number:	TF 8165902	Lab Ref.:	F2008-1848
Contact:	Eugene Lee		Final

CERTIFICATE OF ANALYSIS

ICP Metals+Hydrides

			Lab Blank	Q.C. Standards Actual	Q.C. Standards Expected	Date of Analysis
Parameters	**Unit**	**MDL**				
Aluminum	(µg/L)	1	<1	1040	1000	29-Sep-08
Antimony	(µg/L)	1	<1	3	3	25/26-Sep-08
Arsenic	(µg/L)	1	<1	3	3	25-Sep-08
Barium	(µg/L)	0.5	<0.5	451	500	29-Sep-08
Beryllium	(µg/L)	0.1	<0.1	494	500	29-Sep-08
Bismuth	(µg/L)	0.5	<0.5	960	1000	29-Sep-08
Boron	(µg/L)	20	<20	986	1000	29-Sep-08
Cadmium	(µg/L)	0.015	<0.015	493	500	29-Sep-08
Calcium	(µg/L)	500	<500	9500	10000	29-Sep-08
Chromium	(µg/L)	1	<1	481	500	29-Sep-08
Cobalt	(µg/L)	1	<1	482	500	29-Sep-08
Copper	(µg/L)	1	<1	985	1000	29-Sep-08
Iron	(µg/L)	1	<1	966	1000	29-Sep-08
Lead	(µg/L)	1	<1	946	1000	29-Sep-08
Magnesium	(µg/L)	20	<20	3750	4000	29-Sep-08
Manganese	(µg/L)	1	<1	479	500	29-Sep-08
Mercury	(µg/L)	0.02	<0.02	0.2	0.2	23-Sep-08
Molybdenum	(µg/L)	2	<2	947	1000	29-Sep-08
Nickel	(µg/L)	1	<1	970	1000	29-Sep-08
Phosphorus	(µg/L)	2	<2	2000	2000	29-Sep-08
Potassium	(µg/L)	20	<20	18000	20000	29-Sep-08
Rubidium	(µg/L)	5	<5	106	100	29-Sep-08
Selenium	(µg/L)	1	<1	3	3	24-Sep-08
Silicon	(µg/L)	2	<2	915	1000	29-Sep-08
Silver	(µg/L)	0.1	<0.1	929	1000	29-Sep-08
Sodium	(µg/L)	500	<500	21000	20000	29-Sep-08
Strontium	(µg/L)	1	<1	918	1000	29-Sep-08
Sulphur	(µg/L)	2	<2	2010	2000	29-Sep-08
Tellerium	(µg/L)	5	<5	84	100	29-Sep-08
Thallium	(µg/L)	1	<1	994	1000	29-Sep-08
Tin	(µg/L)	2	<2	993	1000	29-Sep-08
Titanium	(µg/L)	2	<2	945	1000	29-Sep-08
Uranium	(µg/L)	1	<1	95	100	29-Sep-08
Vanadium	(µg/L)	5	<5	482	500	29-Sep-08
Zinc	(µg/L)	1	<1	493	500	29-Sep-08

amec

Client: AMEC Earth and Environmental,
A Division of AMEC Americas Limited
133 Crosbie Road, Suite 202, P.O. Box 13216
St. John's, Newfoundland A1B 4A5

Report Date: October 07, 2008
Received Date: September 18, 2008

Page: 6 of 7

Project Name: DSOP West Labrador / East Quebec

Sample Type: Water

Project Number: TF 8165902

Lab Ref.: F2008-1848

Contact: Eugene Lee

Final

CERTIFICATE OF ANALYSIS

ICP Metals+Hydrides

			Method References
Parameters	**Unit**	**MDL**	
Aluminum	(µg/L)	1	APHA 3120, 3030 E
Antimony	(µg/L)	1	APHA 3114 C, VGA
Arsenic	(µg/L)	1	APHA 3114 C, VGA
Barium	(µg/L)	0.5	APHA 3120, 3030 E
Beryllium	(µg/L)	0.1	APHA 3120, 3030 E
Bismuth	(µg/L)	0.5	APHA 3120, 3030 E
Boron	(µg/L)	20	APHA 3120, 3030 E
Cadmium	(µg/L)	0.015	APHA 3120, 3030 E
Calcium	(µg/L)	500	APHA 3120, 3030 E
Chromium	(µg/L)	1	APHA 3120, 3030 E
Cobalt	(µg/L)	1	APHA 3120, 3030 E
Copper	(µg/L)	1	APHA 3120, 3030 E
Iron	(µg/L)	1	APHA 3120, 3030 E
Lead	(µg/L)	1	APHA 3120, 3030 E
Magnesium	(µg/L)	20	APHA 3120, 3030 E
Manganese	(µg/L)	1	APHA 3120, 3030 E
Mercury	(µg/L)	0.02	APHA 3112B, VGA
Molybdenum	(µg/L)	2	APHA 3120, 3030 E
Nickel	(µg/L)	1	APHA 3120, 3030 E
Phosphorus	(µg/L)	2	APHA 3120, 3030 E
Potassium	(µg/L)	20	APHA 3120, 3030 E
Rubidium	(µg/L)	5	APHA 3120, 3030 E
Selenium	(µg/L)	1	APHA 3114 C, VGA
Silicon	(µg/L)	2	APHA 3120, 3030 E
Silver	(µg/L)	0.1	APHA 3120, 3030 E
Sodium	(µg/L)	500	APHA 3120, 3030 E
Strontium	(µg/L)	1	APHA 3120, 3030 E
Sulphur	(µg/L)	2	APHA 3120, 3030 E
Tellerium	(µg/L)	5	APHA 3120, 3030 E
Thallium	(µg/L)	1	APHA 3120, 3030 E
Tin	(µg/L)	2	APHA 3120, 3030 E
Titanium	(µg/L)	2	APHA 3120, 3030 E
Uranium	(µg/L)	1	APHA 3120, 3030 E
Vanadium	(µg/L)	5	APHA 3120, 3030 E
Zinc	(µg/L)	1	APHA 3120, 3030 E

ASSOCIATION OF THE CHEMICAL PROFESSION OF ONTARIO
CHARTERED
Suman Punani
CHEMIST

Cynthia Ridge, C. Chem.
Q.A./Q.C. Officer

Suman Punani, C. Chem.
Laboratory Manager

/bpj

~ GENERAL COMMENTS ~

MDL	Method Detection Limit .
RDL	Reporting Detection Limit
ANR	Analysis not required
NA	Analysis not applicable
NP	Not Provided
NR	No Lab Replicate

Result in (brackets) represents Lab Replicate.

Results relate only to the items tested.

Request for Analysis

AMEC EARTH AND ENVIRONMENTAL
a Division of AMEC Americas Ltd.
160 Traders Boulevard, Unit 4, Mississauga, Ont L4Z 3K7
Tel. (905) 890-0785 Fax: (905) 890-1141

The Work specified herein shall be performed in accordance with the terms and conditions on the reverse of this document; or, as may be applicable, in accordance with the terms and conditions of the Blanket Purchase Order Number ______

LQ# ______ AUTHORIZED SIGNATURE: ______ DATE: ______ TIME: ______

DATE REQUIRED: ______ RECEIVED AT LAB BY: ______ DATE: ______ TIME: ______

LOGGED AT LAB BY: SS DATE: Sept 18/08 TIME: 2:45

FILE #: 1848 BOX #: 44/45/38

(A) ARE THESE WATER SAMPLES FROM SOURCES IN ONTARIO - YES / [✓ NO]
(B) ARE THESE SAMPLES POTABLE or FOR HUMAN CONSUMPTION - YES / [✓ NO]
IF YES TO (A) and (B). CONTACT THE LAB BEFORE SHIPPING.

PROJECT # / P.O #: TF 8165902
CONTACT: Eugene Lee
PROJECT NAME: D50p West Labrador/East Quebec
COMPANY NAME: AMEC E&E
MAILING ADDRESS: 133 Crosbie Rd. St. John's, NL A1B 4A5
TELEPHONE NUMBER: 709-722-7023
FAX NUMBER: 709-722-7353

TURNAROUND BUSINESS DAY
☒ NORMAL (5-7) ☐ RUSH (3) ☐ SUPER (24Hrs)

Regulatory Requirements:
- ☐ Brownfields 153/04
- ☐ Table ___
- ☐ PWQO
- ☒ CCME FWAL
- ☐ ODWS
- ☐ TCLP

separate request for Analysis Form required for Ontario Drinking water samples
- ☐ Other
- ☐ uncertainty reported on C of A

note: unless stated otherwise, all water samples will be treated as non-potable and will not be subject to ODWS regulation requirements

Temperature: 17.2/20.0
Sample Condition

							ANALYSIS REQUESTED								
LAB USE ONLY	SAMPLE ID	DATE	TYPE	AMOUNT COLLECTED	PRESERVATIVES in Total Metals only	LAB FILTRATION REQUIRED for Dissolved Metals	Gen Chem	Total Metals	Dissolved Metals	TSS	TOC				LEVEL OF CONTAMINATION (H, L, U)
S2008-13072	Trip Blank	4 Sept 08	Surface water	1-1L 2-250mL 1-500mL 1-100mL	✓	✓	✓	✓	✓	✓	✓				
S2008-13073	D503-Dup2	12 Sept 08	↓	↓	✓	✓	✓	✓	✓	✓	✓				
S2008-13074	Timmins 1	↓	↓	↓	✓	✓	✓	✓	✓	✓	✓				
S2008-13075	Timmins 2	↓	↓	↓	✓	✓	✓	✓	✓	✓	✓				
S2008-13076	D503-15	12 Sept 08	↓	↓	✓	✓	✓	✓	✓	✓	✓				
S2008-13077	D503-07	13 Sept 08	↓	↓	✓	✓	✓	✓	✓	✓	✓				
S2008-13078	D503-03	↓	↓	↓	✓	✓	✓	✓	✓	✓	✓				
S2008-13079	D503-05	13 Sept 08	Surface water	1-1L 2-250mL 1-500mL 1-100mL	✓	✓	✓	✓	✓	✓	✓				
S2008-13080	Lab Blank No Sample														

COMMENTS: Sent by Maureen Cameron-McMillan 15 Sept 2008 at 12:00

Revision 2006-2

Client:	AMEC Earth and Environmental, A Division of AMEC Americas Limited 133 Crosbie Road, Suite 202, P.O. Box 13216 St. John's, Newfoundland A1B 4A5	Report Date: Received Date: Page:	October 06, 2008 September 18, 2008 1 of 3
Project Name:	DSOP West Labrador / East Quebec	Sample Type:	Sediment
Project Number:	TF 8165902	Lab Ref.:	F2008-1849
Contact:	Eugene Lee		Final

CERTIFICATE OF ANALYSIS

General Chemistry

Lab Number **Sample ID** **Date Collected**			**S2008-13081** **DS03-14** **10-Sep-08**	**S2008-13082** **Star 1** **11-Sep-08**	**S2008-13083** **DS02-03** **11-Sep-08**	**S2008-13084** **Timmins 1** **12-Sep-08**	**S2008-13085** **DS03-05** **13-Sep-08**
Parameters	**Unit**	**MDL**					
Ammonia as N	(ug/g)	10	62	179	24	<10	<10
Chloride	(ug/g)	1	8	4	4	2	<1
Conductivity	(uS/cm)	10	110	445	185	21	18
Nitrate as N	(ug/g)	1	<1	<1	<1	<1	<1
Nitrite as N	(ug/g)	1	<1	<1	<1	<1	<1
pH	-	-	4.2	5.9	6.6	6.5	4.5
Sulphate	(ug/g)	1	69	140	10	1	3

Lab Number **Sample ID** **Date Collected**			**S2008-13086** **DS03-07** **13-Sep-08**	**S2008-13086** **DS03-07** **13-Sep-08**	**S2008-13087** **DS03-03** **13-Sep-08**	**S2008-13087** **DS03-03** **13-Sep-08**
Parameters	**Unit**	**MDL**		**(Replicate)**		**(Replicate)**
Ammonia as N	(ug/g)	10	<10	<10	29	NR
Chloride	(ug/g)	1	2	NR	5	NR
Conductivity	(uS/cm)	10	49	NR	67	68
Nitrate as N	(ug/g)	1	<1	NR	<1	NR
Nitrite as N	(ug/g)	1	<1	NR	<1	NR
pH	-	-	4.7	NR	4.3	NR
Sulphate	(ug/g)	1	17	NR	44	NR

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Client:	AMEC Earth and Environmental, A Division of AMEC Americas Limited 133 Crosbie Road, Suite 202, P.O. Box 13216 St. John's, Newfoundland A1B 4A5	Report Date: Received Date: Page:	October 06, 2008 September 18, 2008 2 of 3
Project Name:	DSOP West Labrador / East Quebec	Sample Type:	Sediment
Project Number:	TF 8165902	Lab Ref.:	F2008-1849
Contact:	Eugene Lee		Final

CERTIFICATE OF ANALYSIS

General Chemistry

			Lab Blank (µg/g)	Q.C. Standard Actual (mg/L)	Q.C. Standard Expected (mg/L)	Date of Analysis
Parameters	**Unit**	**MDL**				
Ammonia as N	(ug/g)	10	<10	0.43	0.40	26-Sep-08
Chloride	(ug/g)	1	<1	4.1	4.2	22-Sep-08
Conductivity	(uS/cm)	10	<10	104	100	24-Sep-08
Nitrate as N	(ug/g)	1	<1	4.2	4.2	22-Sep-08
Nitrite as N	(ug/g)	1	<1	0.5	0.5	22-Sep-08
pH	-	-	6.5	6.0	6.0	24-Sep-08
Sulphate	(ug/g)	1	<1	23.8	24.0	22-Sep-08

			Method References
General Chemistry	**Unit**	**MDL**	
Ammonia as N	(ug/g)	10	Water Ext., Skalar Method 155-318
Chloride	(ug/g)	100	MOE 3013, APHA 4110 C
Conductivity	(uS/cm)	5	MOE 3137
Nitrate as N	(ug/g)	50	MOE 3013, APHA 4110 C
Nitrite as N	(ug/g)	15	MOE 3013, APHA 4110 C
pH	-	-	MOE 9045
Sulphate	(ug/g)	100	MOE 3013, APHA 4110 C

Cynthia Ridge, C. Chem.
Q.A./Q.C. Officer

Suman Punani, C. Chem.
Laboratory Manager

CHARTERED
Suman Punani
CHEMIST

/bpj

~ GENERAL COMMENTS ~

MDL	Method Detection Limit
RDL	Reporting Detection Limit
ANR	Analysis not required
NA	Analysis not applicable
NP	Not Provided
NR	No Lab Replicate

Result in (brackets) represents Lab Replicate.

Results relate only to the items tested.

Client:	AMEC Earth and Environmental, A Division of AMEC Americas Limited 133 Crosbie Road, Suite 202, P.O. Box 13216 St. John's, Newfoundland A1B 4A5	Report Date: Received Date: Page:	October 06, 2008 September 18, 2008 1 of 5
Project Name:	DSOP West Labrador / East Quebec	Sample Type:	Sediment
Project Number:	TF 8165902	Lab Ref.:	F2008-1849
Contact:	Eugene Lee		Final

CERTIFICATE OF ANALYSIS

ICP Metals + Hydrides

Lab Number			S2008-13081	S2008-13082	S2008-13083	S2008-13084	S2008-13085
Sample ID			DS03-14	Star 1	DS02-03	Timmins 1	DS03-05
Date Collected			10-Sep-08	11-Sep-08	11-Sep-08	12-Sep-08	13-Sep-08
Parameters	**Unit**	**MDL**					
Aluminum	(µg/g)	5	7290	3150	4420	1510	7430
Antimony	(µg/g)	0.5	0.7	0.6	1.4	1.3	1.7
Arsenic	(µg/g)	0.5	5.3	4.4	10.2	3.0	9.2
Barium	(µg/g)	0.5	24.8	6.2	24.2	70.4	14.6
Beryllium	(µg/g)	0.2	0.2	0.3	0.4	0.3	0.3
Bismuth	(µg/g)	0.2	<0.2	<0.2	0.7	0.7	1.0
Boron	(µg/g)	1	13	8	37	42	33
Cadmium	(µg/g)	0.5	<0.5	<0.5	0.9	0.8	0.8
Calcium	(µg/g)	25	291	1750	2680	119	116
Chromium	(µg/g)	1	11	9	12	4	17
Cobalt	(µg/g)	1	1	2	7	19	5
Copper	(µg/g)	1	9	4	5	12	11
Iron	(µg/g)	5	16600	7620	40600	45000	38400
Lead	(µg/g)	5	9	<5	12	13	13
Magnesium	(µg/g)	10	1100	1030	2250	486	2030
Manganese	(µg/g)	1	71	70	1420	2800	228
Mercury	(µg/g)	0.01	0.10	0.04	0.03	0.16	0.06
Molybdenum	(µg/g)	2	<2	<2	<2	<2	<2
Nickel	(µg/g)	5	6	<5	9	5	10
Phosphorous	(µg/g)	5	739	781	565	116	310
Potassium	(µg/g)	10	860	562	457	173	380
Rubidium	(µg/g)	2	9	6	6	3	6
Selenium	(µg/g)	0.1	0.3	0.8	0.3	<0.1	0.1
Silicon	(µg/g)	5	7	8	19	26	11
Silver	(µg/g)	0.25	0.36	<0.25	<0.25	<0.25	<0.25
Sodium	(µg/g)	25	168	131	141	104	139
Strontium	(µg/g)	2	2	<2	3	<2	<2
Sulphur	(µg/g)	5	1690	4690	458	23	114
Tellerium	(µg/g)	2	<2	<2	5	5	5
Thallium	(µg/g)	0.5	<0.5	<0.5	<0.5	2.3	<0.5
Tin	(µg/g)	2	<2	<2	<2	<2	<2
Titanium	(µg/g)	2	97	37	91	68	59
Uranium	(µg/g)	0.5	22.7	10.4	55.1	65.3	59.5
Vanadium	(µg/g)	5	16	<5	11	<5	13
Zinc	(µg/g)	2	23	36	45	17	29

Client:	AMEC Earth and Environmental, A Division of AMEC Americas Limited 133 Crosbie Road, Suite 202, P.O. Box 13216 St. John's, Newfoundland A1B 4A5	Report Date: Received Date: Page:	October 06, 2008 September 18, 2008 2 of 5
Project Name:	DSOP West Labrador / East Quebec	Sample Type:	Sediment
Project Number:	TF 8165902	Lab Ref.:	F2008-1849
Contact:	Eugene Lee		Final

CERTIFICATE OF ANALYSIS

ICP Metals + Hydrides

Lab Number **Sample ID** **Date Collected**			**S2008-13086** **DS03-07** **13-Sep-08**	**S2008-13086** **DS03-07** **13-Sep-08**	**S2008-13087** **DS03-03** **13-Sep-08**
Parameters	**Unit**	**MDL**		**(Replicate)**	
Aluminum	(µg/g)	5	6110	5950	6230
Antimony	(µg/g)	0.5	1.2	1.0	0.5
Arsenic	(µg/g)	0.5	2.9	3.3	3.9
Barium	(µg/g)	0.5	13.9	12.9	10.6
Beryllium	(µg/g)	0.2	0.4	0.4	0.3
Bismuth	(µg/g)	0.2	<0.2	<0.2	<0.2
Boron	(µg/g)	1	19	15	38
Cadmium	(µg/g)	0.5	0.5	0.5	0.7
Calcium	(µg/g)	25	266	250	174
Chromium	(µg/g)	1	13	12	9
Cobalt	(µg/g)	1	5	5	1
Copper	(µg/g)	1	10	10	10
Iron	(µg/g)	5	23000	22300	16400
Lead	(µg/g)	5	12	11	6
Magnesium	(µg/g)	10	2550	2430	1150
Manganese	(µg/g)	1	136	129	36
Mercury	(µg/g)	0.01	0.04	0.04	0.05
Molybdenum	(µg/g)	2	<2	<2	<2
Nickel	(µg/g)	5	14	13	6
Phosphorous	(µg/g)	5	427	417	397
Potassium	(µg/g)	10	436	409	390
Rubidium	(µg/g)	2	5	5	6
Selenium	(µg/g)	0.1	<0.1	<0.1	0.1
Silicon	(µg/g)	5	55	49	8
Silver	(µg/g)	0.25	<0.25	<0.25	<0.25
Sodium	(µg/g)	25	131	118	107
Strontium	(µg/g)	2	<2	<2	<2
Sulphur	(µg/g)	5	292	283	1370
Tellerium	(µg/g)	2	3	2	3
Thallium	(µg/g)	0.5	<0.5	<0.5	<0.5
Tin	(µg/g)	2	<2	<2	<2
Titanium	(µg/g)	2	54	51	36
Uranium	(µg/g)	0.5	34.5	33.0	24.2
Vanadium	(µg/g)	5	10	10	8
Zinc	(µg/g)	2	48	47	17

Client:	AMEC Earth and Environmental, A Division of AMEC Americas Limited 133 Crosbie Road, Suite 202, P.O. Box 13216 St. John's, Newfoundland A1B 4A5	Report Date: Received Date: Page:	October 06, 2008 September 18, 2008 3 of 5
Project Name:	DSOP West Labrador / East Quebec	Sample Type:	Sediment
Project Number:	TF 8165902	Lab Ref.:	F2008-1849
Contact:	Eugene Lee		Final

CERTIFICATE OF ANALYSIS

ICP Metals + Hydrides

			Lab Blank (µg/g)	Q.C. Standards Actual (mg/L)	Q.C. Standards Expected (mg/L)	Date of Analysis
Parameters	**Unit**	**MDL**				
Aluminum	(µg/g)	5	<5	1.04	1.00	29-Sep-08
Antimony	(µg/g)	0.5	<0.5	1.04	1.00	29-Sep-08
Arsenic	(µg/g)	0.5	<0.5	0.89	1.00	29-Sep-08
Barium	(µg/g)	0.5	<0.5	0.45	0.50	29-Sep-08
Beryllium	(µg/g)	0.2	<0.2	0.49	0.50	29-Sep-08
Bismuth	(µg/g)	0.2	<0.2	0.96	1.00	29-Sep-08
Boron	(µg/g)	1	<1	0.99	1.00	29-Sep-08
Cadmium	(µg/g)	0.5	<0.5	0.49	0.50	29-Sep-08
Calcium	(µg/g)	25	<25	9.50	10.0	29-Sep-08
Chromium	(µg/g)	1	<1	0.48	0.50	29-Sep-08
Cobalt	(µg/g)	1	<1	0.48	0.50	29-Sep-08
Copper	(µg/g)	1	<1	0.99	1.00	29-Sep-08
Iron	(µg/g)	5	<5	0.97	1.00	29-Sep-08
Lead	(µg/g)	5	<5	0.95	1.00	29-Sep-08
Magnesium	(µg/g)	10	<10	3.75	4.00	29-Sep-08
Manganese	(µg/g)	1	<1	0.48	0.50	29-Sep-08
Mercury	(µg/g)	0.01	<0.01	0.002	0.002	24-Sep-08
Molybdenum	(µg/g)	2	<2	0.95	1.00	29-Sep-08
Nickel	(µg/g)	5	<5	0.97	1.00	29-Sep-08
Phosphorous	(µg/g)	5	<5	2.00	2.00	29-Sep-08
Potassium	(µg/g)	10	<10	18.0	20.0	29-Sep-08
Rubidium	(µg/g)	2	<2	0.11	0.10	29-Sep-08
Selenium	(µg/g)	0.1	<0.1	0.003	0.003	24-Sep-08
Silicon	(µg/g)	5	<5	0.91	1.00	29-Sep-08
Silver	(µg/g)	0.25	<0.25	0.93	1.00	29-Sep-08
Sodium	(µg/g)	25	<25	21.0	20.0	29-Sep-08
Strontium	(µg/g)	2	<2	0.92	1.00	29-Sep-08
Sulphur	(µg/g)	5	<5	2.01	2.00	29-Sep-08
Tellerium	(µg/g)	2	<2	0.08	0.10	29-Sep-08
Thallium	(µg/g)	0.5	<0.5	0.99	1.00	29-Sep-08
Tin	(µg/g)	2	<2	0.99	1.00	29-Sep-08
Titanium	(µg/g)	2	<2	0.94	1.00	29-Sep-08
Uranium	(µg/g)	0.5	<0.5	0.09	0.10	29-Sep-08
Vanadium	(µg/g)	5	<5	0.48	0.50	29-Sep-08
Zinc	(µg/g)	2	<2	0.49	0.50	29-Sep-08

amec

Client: AMEC Earth and Environmental,
A Division of AMEC Americas Limited
133 Crosbie Road, Suite 202, P.O. Box 13216
St. John's, Newfoundland A1B 4A5

Report Date: October 06, 2008
Received Date: September 18, 2008

Page: 4 of 5

Project Name: DSOP West Labrador / East Quebec

Sample Type: Sediment

Project Number: TF 8165902

Lab Ref.: F2008-1849

Contact: Eugene Lee

Final

CERTIFICATE OF ANALYSIS

ICP Metals + Hydrides

			Method References
Parameters	**Unit**	**MDL**	
Aluminum	(µg/g)	5	SW 846, 3050, 6010 C
Antimony	(µg/g)	0.5	SW 846, 3050, 6010 C
Arsenic	(µg/g)	0.5	SW 846, 3050, 6010 C
Barium	(µg/g)	0.5	SW 846, 3050, 6010 C
Beryllium	(µg/g)	0.2	SW 846, 3050, 6010 C
Bismuth	(µg/g)	0.2	SW 846, 3050, 6010 C
Boron	(µg/g)	1	SW 846, 3050, 6010 C
Cadmium	(µg/g)	0.5	SW 846, 3050, 6010 C
Calcium	(µg/g)	25	SW 846, 3050, 6010 C
Chromium	(µg/g)	1	SW 846, 3050, 6010 C
Cobalt	(µg/g)	1	SW 846, 3050, 6010 C
Copper	(µg/g)	1	SW 846, 3050, 6010 C
Iron	(µg/g)	5	SW 846, 3050, 6010 C
Lead	(µg/g)	5	SW 846, 3050, 6010 C
Magnesium	(µg/g)	10	SW 846, 3050, 6010 C
Manganese	(µg/g)	1	SW 846, 3050, 6010 C
Mercury	(µg/g)	0.01	SW 846, 7741, 1994
Molybdenum	(µg/g)	2	SW 846, 3050, 6010 C
Nickel	(µg/g)	5	SW 846, 3050, 6010 C
Phosphorous	(µg/g)	5	SW 846, 3050, 6010 C
Potassium	(µg/g)	10	SW 846, 3050, 6010 C
Rubidium	(µg/g)	2	SW 846, 3050, 6010 C
Selenium	(µg/g)	0.1	SW 846, 3050, 7061
Silicon	(µg/g)	5	SW 846, 3050, 6010 C
Silver	(µg/g)	0.25	SW 846, 3050, 6010 C
Sodium	(µg/g)	25	SW 846, 3050, 6010 C
Strontium	(µg/g)	2	SW 846, 3050, 6010 C
Sulphur	(µg/g)	5	SW 846, 3050, 6010 C
Tellerium	(µg/g)	2	SW 846, 3050, 6010 C
Thallium	(µg/g)	0.5	SW 846, 3050, 6010 C
Tin	(µg/g)	2	SW 846, 3050, 6010 C
Titanium	(µg/g)	2	SW 846, 3050, 6010 C
Uranium	(µg/g)	0.5	SW 846, 3050, 6010 C
Vanadium	(µg/g)	5	SW 846, 3050, 6010 C
Zinc	(µg/g)	2	SW 846, 3050, 6010 C

ASSOCIATION OF THE CHEMICAL PROFESSION OF ONTARIO
CHARTERED
Suman Punani
CHEMIST

Cynthia Ridge, C. Chem.
Q.A./Q.C. Officer

Suman Punani, C. Chem.
Laboratory Manager

/bpj

~ GENERAL COMMENTS ~

MDL	Method Detection Limit
RDL	Reporting Detection Limit
ANR	Analysis not required
NA	Analysis not applicable
NP	Not Provided
NR	No Lab Replicate
	Result in (brackets) represents Lab Replicate.
	Results relate only to the items tested.

Request for Analysis

AMEC EARTH AND ENVIRONMENTAL
a Division of AMEC Americas Ltd.
160 Traders Boulevard, Unit 4, Mississauga, Ont L4Z 3K7
Tel. (905) 890-0785 Fax: (905) 890-1141

The Work specified herein shall be performed in accordance with the terms and conditions on the reverse of this document; or, as may be applicable, in accordance with the terms and conditions of the Blanket Purchase Order Number________

LQ#________ AUTHORIZED SIGNATURE:________ DATE:________ TIME:________

DATE REQUIRED:________ RECEIVED AT LAB BY:________ DATE:________ TIME:________

LOGGED AT LAB BY: JS DATE: Sept 18 TIME: 2:45

FILE #: 1849 BOX #: 67

(A) ARE THESE WATER SAMPLES FROM SOURCES IN ONTARIO - YES / [✓ NO]
(B) ARE THESE SAMPLES POTABLE or FOR HUMAN CONSUMPTION - YES / [✓ NO]
IF YES TO (A) and (B). CONTACT THE LAB BEFORE SHIPPING.

PROJECT # / P.O #: TF8165902
CONTACT: Eugene Lee
PROJECT NAME: DSOP West Labrador / East Quebec
COMPANY NAME: AMEC E&E
MAILING ADDRESS: 133 Crosbie Rd. St John's, NL A1B 4A5
TELEPHONE NUMBER: 709-722-7023
FAX NUMBER: 709-722-7353

TURNAROUND BUSINESS DAY
☐ NORMAL (5-7) ☐ RUSH (3) ☐ SUPER (24Hrs)

Regulatory Requirements:
☐ Brownfields 153/04
☐ Table ___
☐ PWQO
☑ CCME
☐ ODWS
☐ TCLP
☐ Other
☐ uncertainty reported on C of A

separate request for Analysis Form required for Ontario Drinking water samples

note: unless stated otherwise, all water samples will be treated as non-potable and will not be subject to ODWS regulation requirements

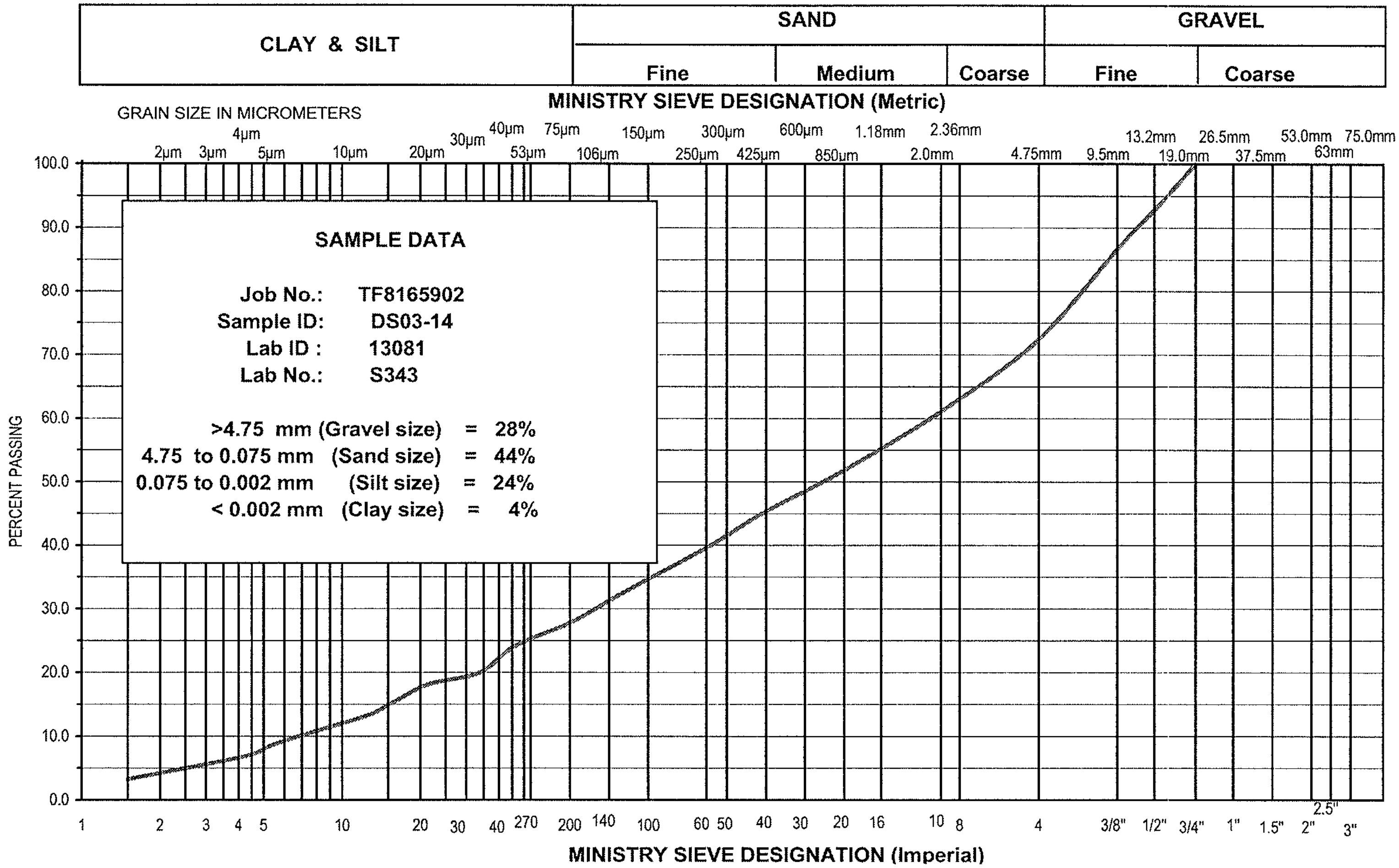
Temperature 18.8/19.7 Sample Condition

							ANALYSIS REQUESTED								
LAB USE ONLY	SAMPLE ID	DATE	TYPE	AMOUNT COLLECTED	PRESERVATIVES	LAB FILTRATION REQUIRED	Gen Chem	Metals	TOC	Grain Size					LEVEL OF CONTAMINATION (H, L, U)
S2008-13081	DS03-14	10 Sept08	Sediment	3-250mL 1-60mL			✓	✓	✓	✓					
S2008-13082	DS02-02 [illegible]	11 Sept08	↓	3-250mL 1-60mL			✓	✓	✓	✓					
S2008-13083	DS02-03	11 Sept08		2-250mL 1-60mL			✓	✓	✓	✓*					
S2008-13084	Timmins 1	12Sept08		3-250mL 1-60mL			✓	✓	✓	✓					
S2008-13085	DS03-05	13Sept08		3-250mL 1-60mL			✓	✓	✓	✓					
S2008-13086	DS03-07	↓	↓	3-250mL			✓	✓	✓*	✓					
S2008-13087	DS03-03	13 Sept08	Sediment	3-250mL 1-60mL			✓	✓	✓	✓					
~~**S2008-13088**~~	Star 1	~~11 Sept08~~					~~✓~~	~~✓~~	~~✓~~	~~✓~~					
S2008-13089	Lab Blank No Sample.														

COMMENTS: Please try to analyse Grain Size in DS02-03 & TOC in DS03-07 using sample from other jars if possible. Sampled & sent by Maureen Cameron-MacMillan, 15 Sept 2008 at 12:00pm

Revision 2006 -2

UNIFIED SOIL CLASSIFICATION SYSTEM



SAMPLE DATA

Job No.: TF8165902
Sample ID: DS03-14
Lab ID : 13081
Lab No.: S343

>4.75 mm	(Gravel size)	=	28%
4.75 to 0.075 mm	(Sand size)	=	44%
0.075 to 0.002 mm	(Silt size)	=	24%
< 0.002 mm	(Clay size)	=	4%

AMEC Earth & Environmental,
A division of AMEC Americas Limited
104 Crockford Blvd., Scarborough, Ontario
Canada, M1R 3C3
Tel +1 (416) 751 6565, Fax +1 (416) 751 7592
www.amec.com

GRAIN SIZE DISTRIBUTION

SILTY GRAVELLY SAND with organics trace clay

Client :- Hemispheres le Groupe
Project:- DSOP-Field Program-New Millenium
Location:- Newfoundland
Lab No. :- S343
Date :- 01 Oct 2008

Grain Size Analysis

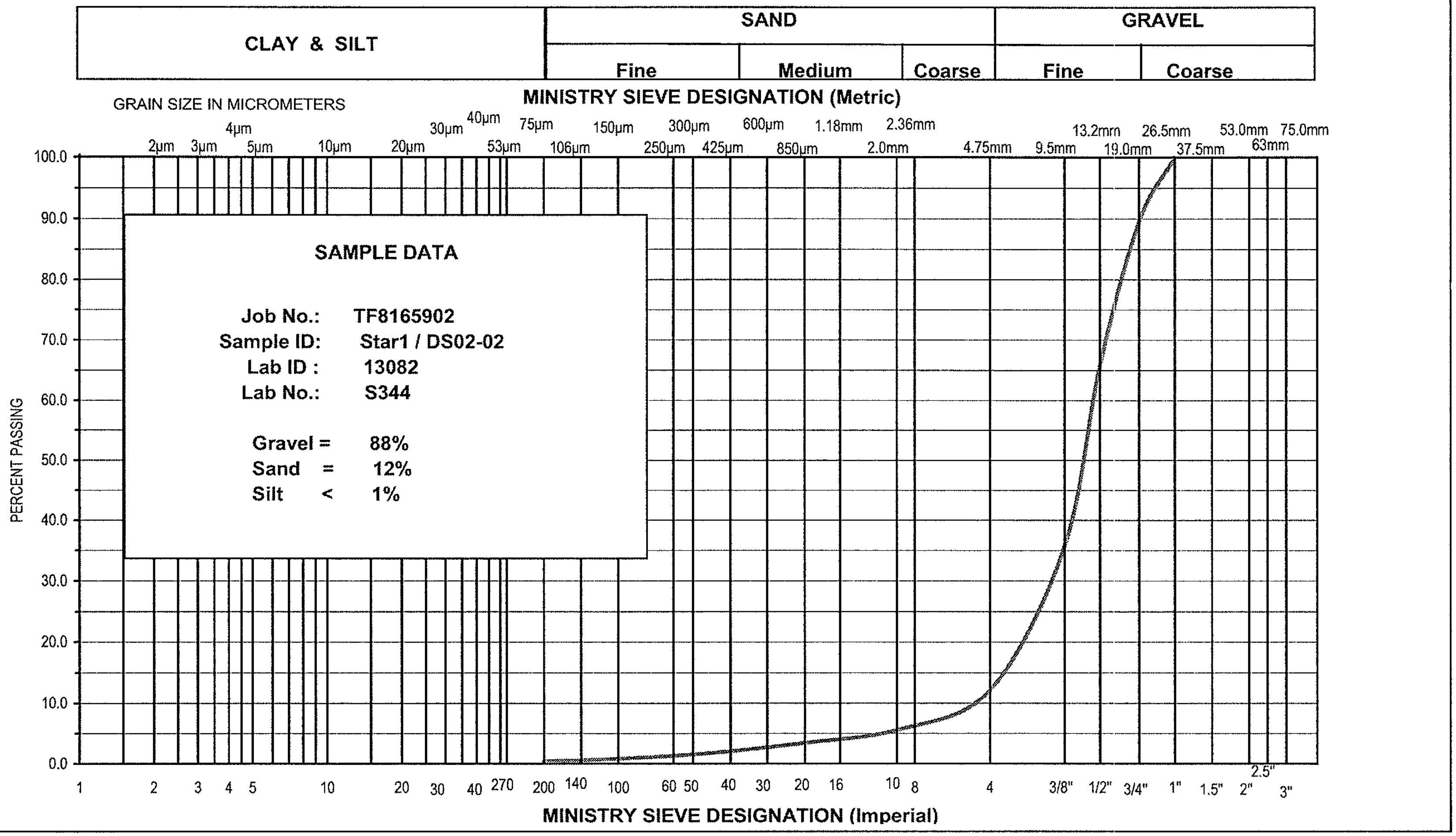
Project:-	DSOP-Field Program-New Millenium	**Location:-**	Newfoundland
Client :-	Hemispheres le Groupe	**Date :-**	1-Oct-08
Job# :-	TF8165902	**Tested By :-**	TQ/WA
Sample ID :-	DS03-14	**Lab ID # :-**	13081
Lab No. :-	S343	**Checked By :-**	SB

Sieve size (mm)	Cumm. Wt. Retained (g)	%passing
19.00	0.00	100.0
13.20	11.80	92.8
9.50	21.87	86.7
4.75	45.20	72.4
2.00	63.81	61.1
0.85		51.8
0.425		45.3
0.250		39.6
0.150		34.6
0.106		31.3
0.075		27.8
0.0463		24.1
0.0335		19.9
0.0214		18.1
0.0154		15.1
0.0127		13.3
0.0090		11.5
0.0064		9.7
0.0053		8.5
0.0046		7.2
0.0034		6.0
0.0015		3.3

Total Wt (g)	164.98

Wt used for Hydrometer (g)		
50.54		
Pass 2mm Retained 0.075mm		
0.850	7.65	0.849
0.425	13.02	0.742
0.250	17.79	0.648
0.150	21.87	0.567
0.106	24.66	0.512
0.075	27.57	0.454
Pan	28.30	

UNIFIED SOIL CLASSIFICATION SYSTEM



SAMPLE DATA

Job No.: TF8165902
Sample ID: Star1 / DS02-02
Lab ID : 13082
Lab No.: S344

Gravel = 88%
Sand = 12%
Silt < 1%

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GRAIN SIZE DISTRIBUTION

GRAVEL

some sand, trace silt and organics

Client :- Hemispheres le Groupe
Project:- DSOP-Field Program-New Millenium
Location:- Newfoundland
Lab No. :- S344
Date :- 01 Oct 2008

Grain Size Analysis

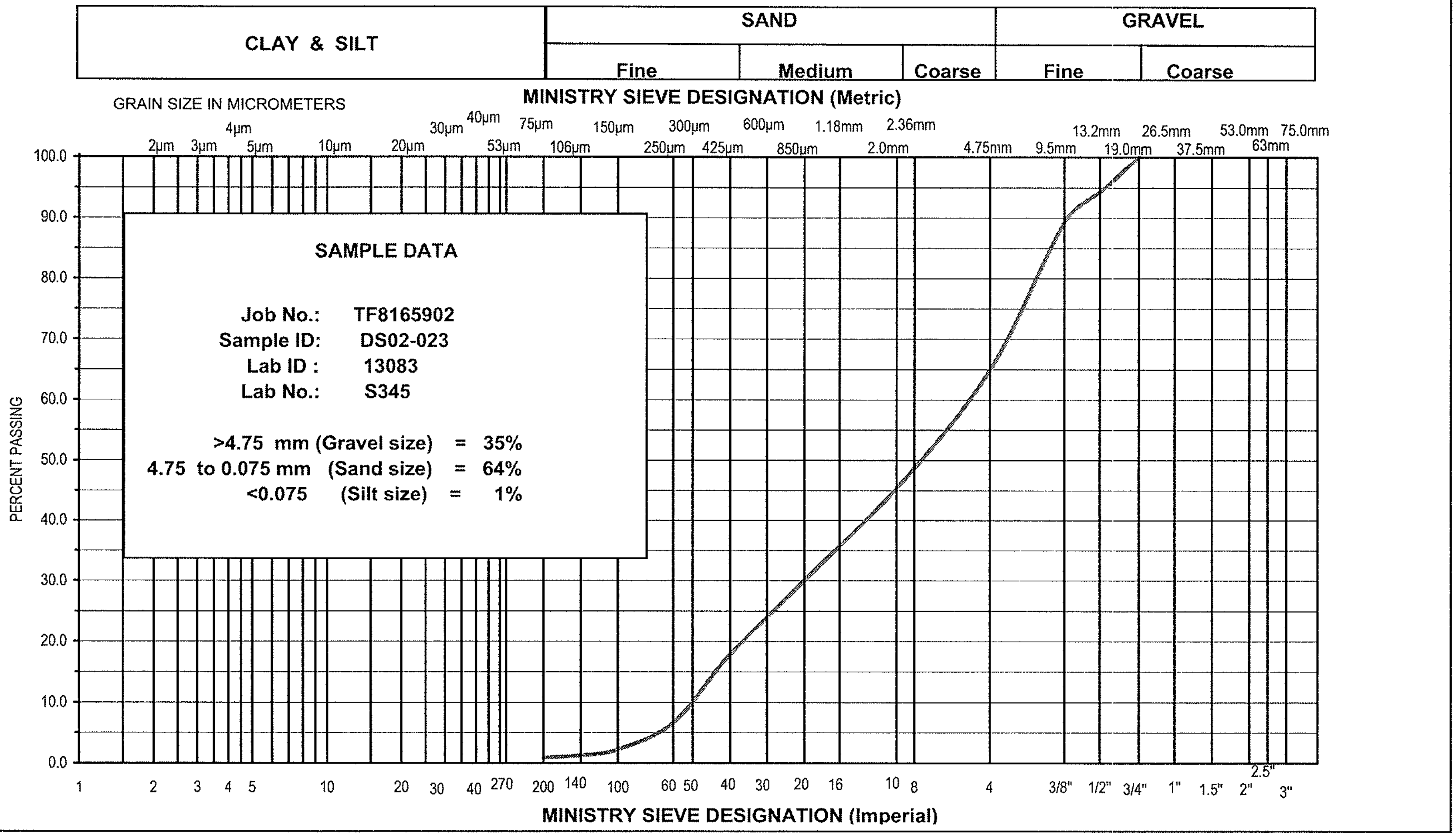
Project:- DSOP-Field Program-New Millenium
Client :- Hemispheres le Groupe
Job# :- TF8165902
Sample ID # :- Star1/DS02-02
Lab No. :- S344

Location:- Newfoundland
Date :- 1-Oct-08
Tested By :- TQ
Lab ID:- 13082
Checked By :- SB

Sieve size (mm)	Cumm. Wt. Retained (g)	%passing
26.50	0.00	100.0
19.00	23.43	89.6
13.20	76.49	65.9
9.50	144.04	35.8
4.75	197.11	12.1
2.00	211.79	5.6
0.85		3.5
0.425		2.1
0.250		1.3
0.150		0.8
0.106		0.6
0.075		0.4

Total Wt (g)	224.35	
Sieve size		
	12.36	g
	wt. retained	%passing
0.85	4.7	61.7
0.425	7.8	37.1
0.250	9.5	23.4
0.150	10.5	14.8
0.106	11.1	10.0
0.075	11.5	6.9
Pan	11.6	6.1

UNIFIED SOIL CLASSIFICATION SYSTEM



SAMPLE DATA

Job No.: TF8165902
Sample ID: DS02-023
Lab ID : 13083
Lab No.: S345

>4.75 mm (Gravel size) = 35%
4.75 to 0.075 mm (Sand size) = 64%
<0.075 (Silt size) = 1%

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GRAIN SIZE DISTRIBUTION

GRAVELLY SAND with organics
trace silt

Client :- Hemispheres le Groupe
Project:- DSOP-Field Program-New Millenium
Location:- Newfoundland
Lab No. :- S345
Date :- 01 Oct 2008

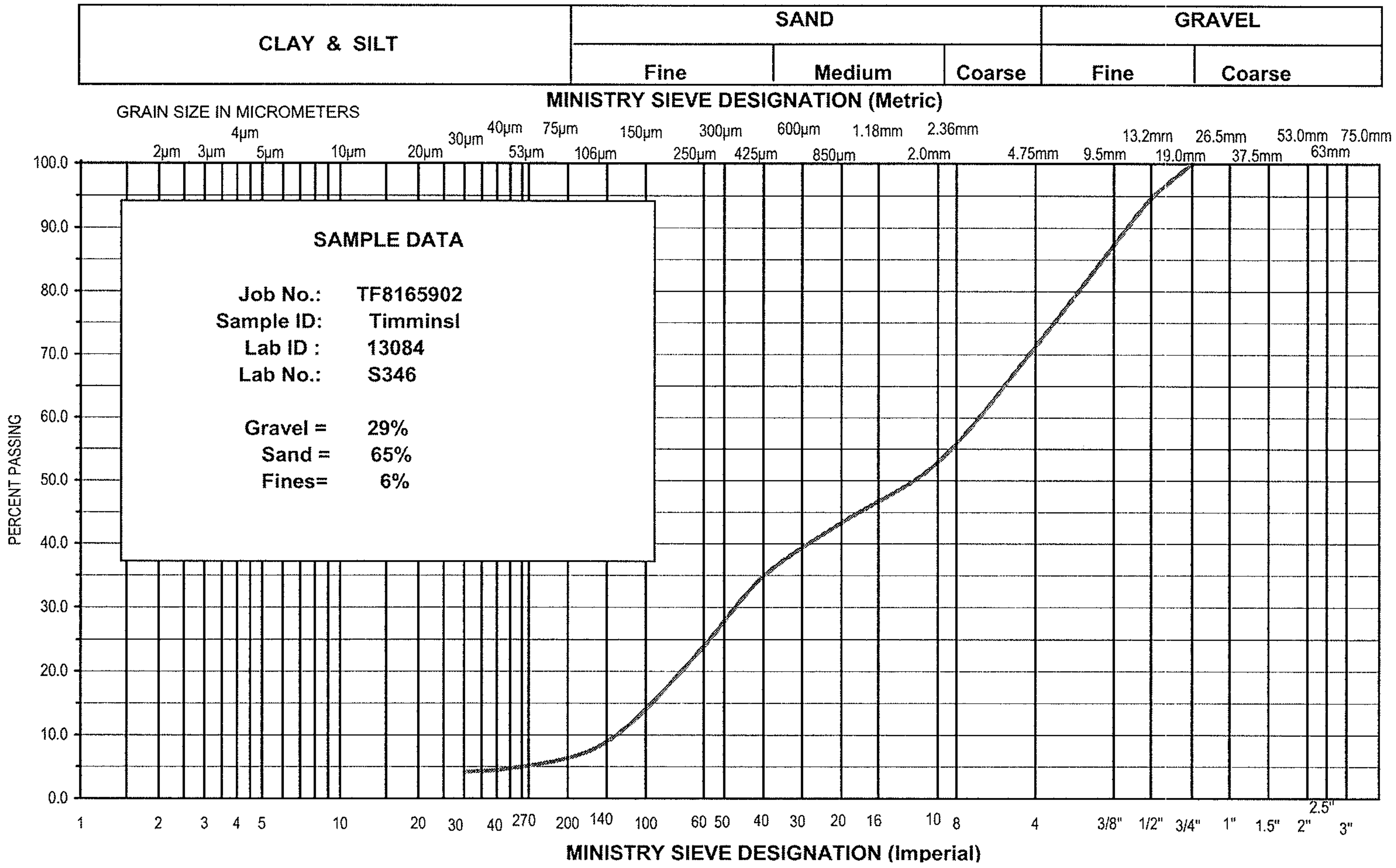
Grain Size Analysis

Project:-	DSOP-Field Program-New Millenium	**Location:-**	Newfoundland
Client :-	Hemispheres le Groupe	**Date :-**	1-Oct-08
Job# :-	TF8165902	**Tested By :-**	TQ
Sample ID # :-	DS02-03	**Lab ID:-**	13083
Lab No. :-	S345	**Checked By :-**	SB

Sieve size (mm)	Cumm. Wt. Retained (g)	%passing
19	0.00	100.0
13.2	18.37	94.2
9.5	34.02	89.3
4.75	111.58	64.9
2.00	173.72	45.4
0.85		30.1
0.425		17.9
0.250		6.6
0.150		2.2
0.106		1.3
0.075		0.9

Total Wt (g)		317.94
Sieve size (mm)	**62.93**	g
	wt. retained	%passing
0.85	21.2	66.3
0.425	38.2	39.4
0.250	53.8	14.6
0.150	59.8	4.9
0.106	61.2	2.8
0.075	61.7	2.0
Pan	61.8	

UNIFIED SOIL CLASSIFICATION SYSTEM



SAMPLE DATA

Job No.: TF8165902
Sample ID: Timminsl
Lab ID : 13084
Lab No.: S346

Gravel = 29%
Sand = 65%
Fines= 6%

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www.amec.com

GRAIN SIZE DISTRIBUTION

GRAVELLY SAND

trace clay and silt

Client :- Hemispheres le Groupe
Project:- DSOP-Field Program-New Millenium
Location:- Newfoundland
Lab No. :- S346
Date :- 01 Oct 2008

Grain Size Analysis

Project:- DSOP-Field Program-New Millenium
Client :- Hemispheres le Groupe
Job# :- TF8165902
Sample ID :- Timminsl
Lab No. :- S346

Location:- Newfoundland
Date :- 1-Oct-08
Tested By :- TQ/WA
Lab ID # :- 13084
Checked By :- SB

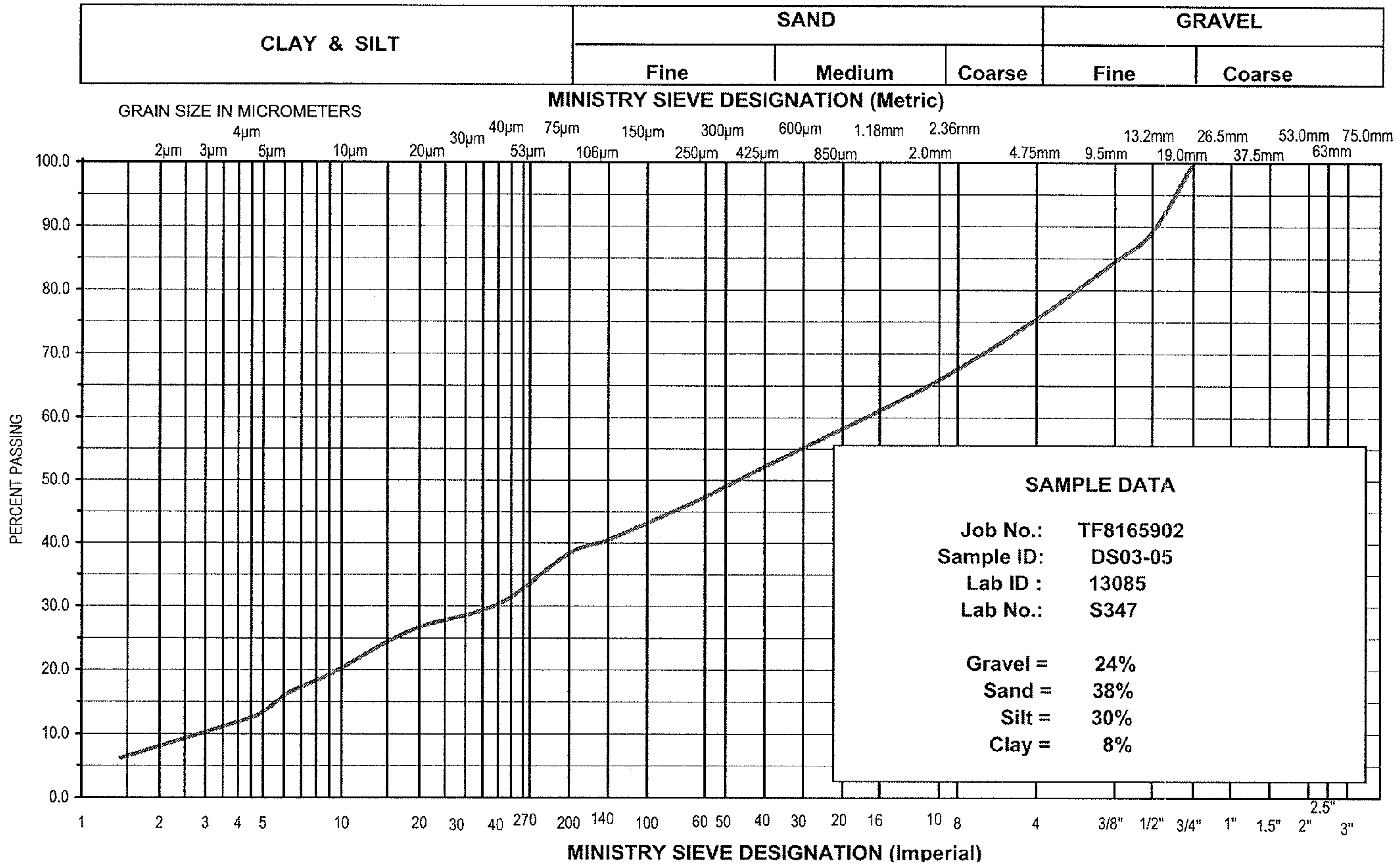
Sieve size (mm)	Cumm. Wt. Retained (g)	%passing
19.00	0.00	100.0
13.20	25.16	94.6
9.50	58.69	87.3
4.75	133.15	71.3
2.00	218.19	52.9
0.85		43.4
0.425		34.9
0.250		23.9
0.150		14.1
0.106		8.9
0.075		6.3
0.0431		4.6
0.0306		4.2

Total Wt (g)	464.29

Wt used for Hydrometer (g)	
50.57	

Pass 2mm Retained 0.075mm		
0.850	9.15	0.819
0.425	17.25	0.659
0.250	27.74	0.451
0.150	37.13	0.266
0.106	42.03	0.169
0.075	44.52	0.120

UNIFIED SOIL CLASSIFICATION SYSTEM



SAMPLE DATA

Job No.:	TF8165902
Sample ID:	DS03-05
Lab ID :	13085
Lab No.:	S347
Gravel =	24%
Sand =	38%
Silt =	30%
Clay =	8%

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GRAIN SIZE DISTRIBUTION

GRAVELLY SILTY SAND

trace clay

Client :- Hemispheres le Groupe

Project:- DSOP-Field Program-New Millenium

Location:- Newfoundland

Lab No. :- S347

Date :- 01 Oct 2008

Grain Size Analysis

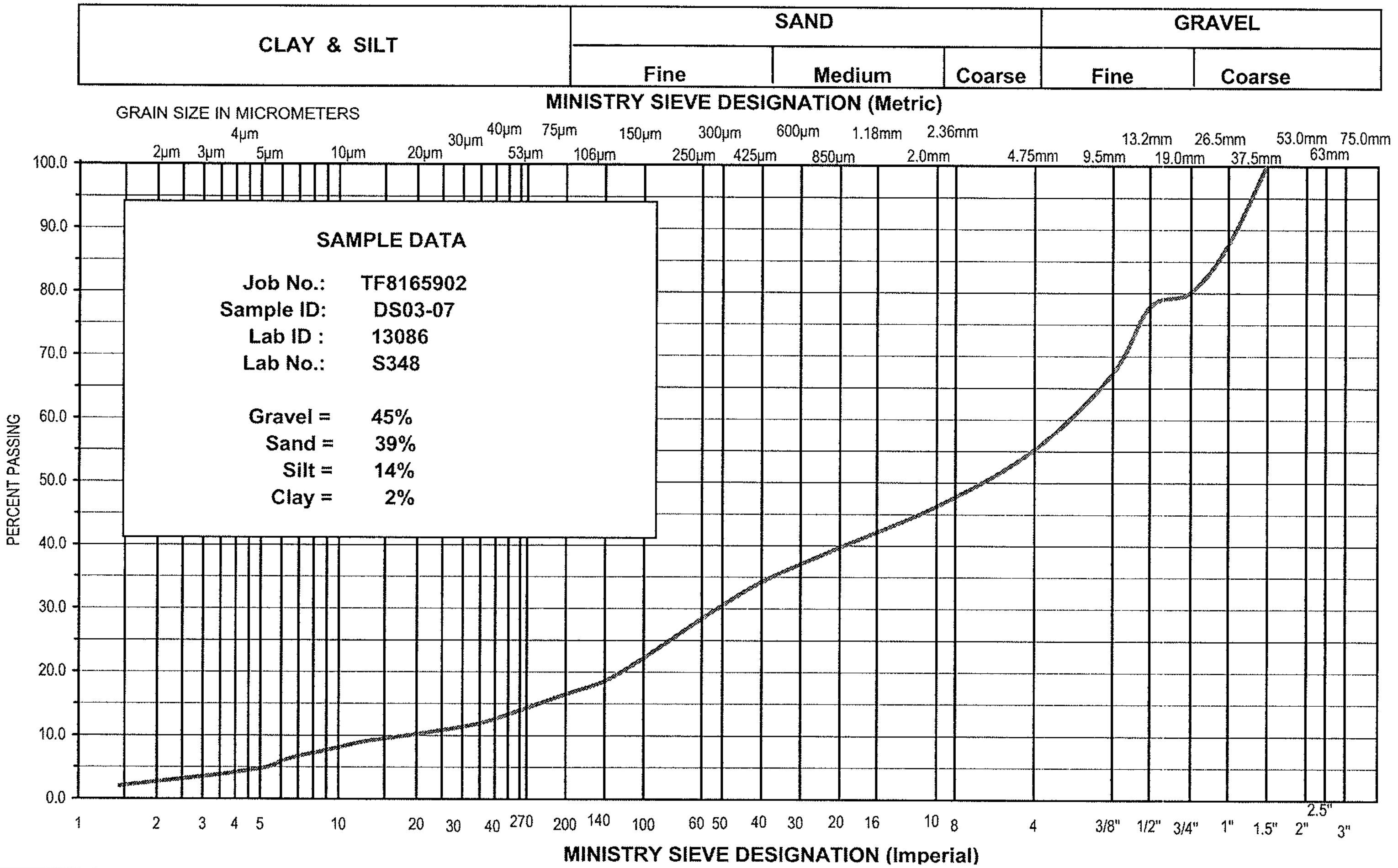
Project:- DSOP-Field Program-New Millenium
Client :- Hemispheres le Groupe
Job# :- TF8165902
Sample ID :- DS03-05
Lab No. :- S347

Location:- Newfoundland
Date :- 1-Oct-08
Tested By :- TQ/WA
Lab ID # :- 13085
Checked By :- SB

Sieve size (mm)	Cumm. Wt. Retained (g)	%passing
19.00	0.00	100.0
13.20	40.21	89.2
9.50	57.66	84.5
4.75	91.25	75.5
2.00	126.82	65.9
0.85		58.2
0.425		52.2
0.250		47.3
0.150		43.2
0.106		40.5
0.075		38.3
0.0452		31.5
0.0324		28.9
0.0207		26.9
0.0148		24.3
0.0122		22.3
0.0088		19.0
0.0063		16.4
0.0052		13.8
0.0045		12.5
0.0031		10.5
0.0014		6.2

Total Wt (g)	374.15	
Wt used for Hydrometer (g)		
50.04		
Pass 2mm Retained 0.075mm		
0.850	5.85	0.883
0.425	10.44	0.791
0.250	14.11	0.718
0.150	17.28	0.655
0.106	19.32	0.614
0.075	20.95	0.581

UNIFIED SOIL CLASSIFICATION SYSTEM



SAMPLE DATA

Job No.:	TF8165902
Sample ID:	DS03-07
Lab ID :	13086
Lab No.:	S348
Gravel =	45%
Sand =	39%
Silt =	14%
Clay =	2%

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GRAIN SIZE DISTRIBUTION

GRAVEL AND SAND

some silt, trace clay

Client :- Hemispheres le Groupe
Project:- DSOP-Field Program-New Millenium
Location:- Newfoundland
Lab No. :- S347
Date :- 01 Oct 2008

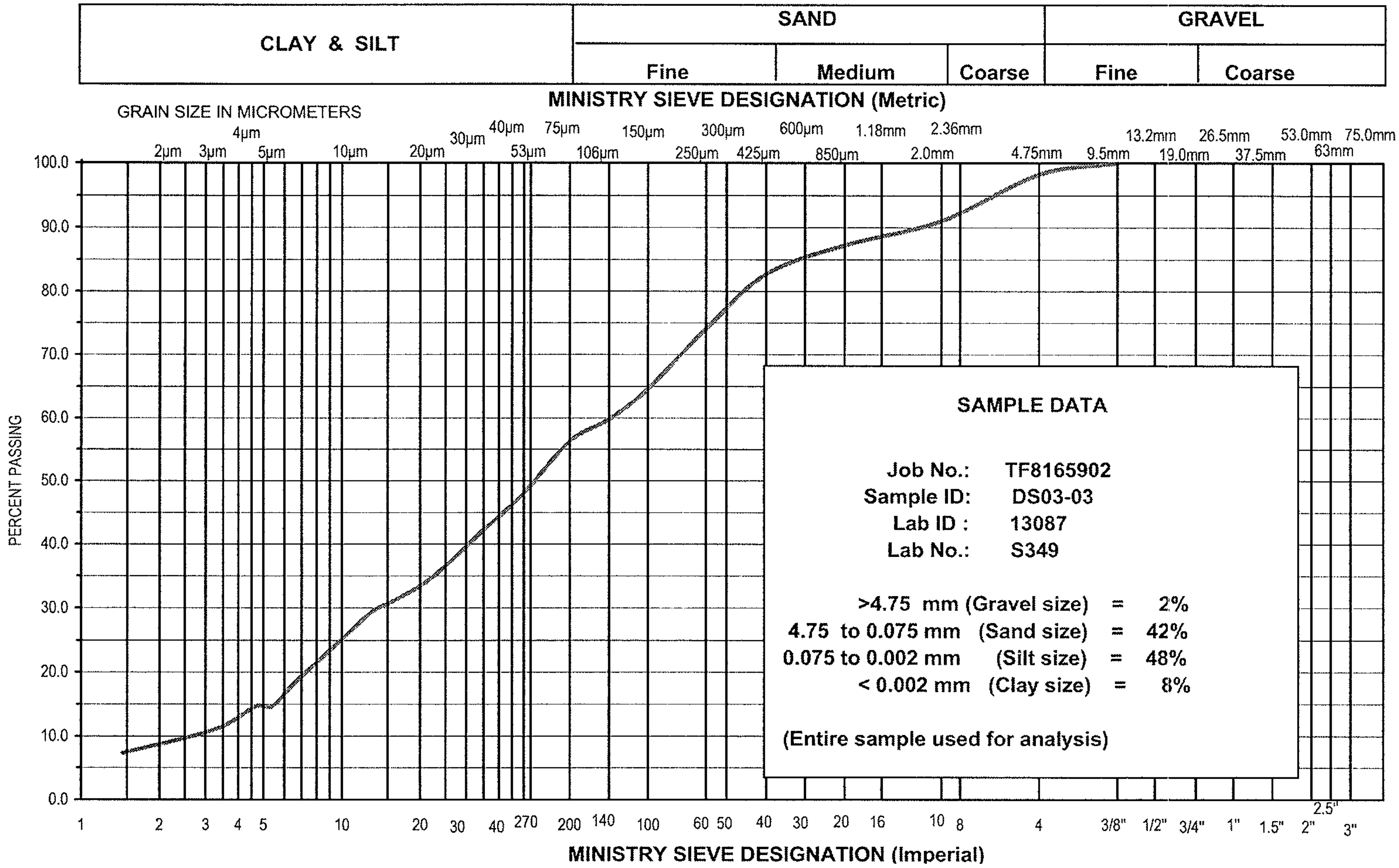
Grain Size Analysis

Project:-	DSOP-Field Program-New Millenium	**Location:-**	Newfoundland
Client :-	Hemispheres le Groupe	**Date :-**	1-Oct-08
Job# :-	TF8165902	**Tested By :-**	TQ/WA
Sample ID :-	DS03-07	**Lab ID # :-**	13086
Lab No. :-	S347	**Checked By :-**	SB

Sieve size (mm)	Cumm. Wt. Retained (g)	%passing
37.00	0.00	100.0
26.50	50.94	87.7
19.00	82.58	80.1
13.20	92.05	77.8
9.50	135.56	67.3
4.75	185.83	55.2
2.00	223.07	46.3
0.85		39.8
0.425		34.2
0.250		28.4
0.150		22.2
0.106		18.6
0.075		16.5
0.0480		13.7
0.0344		11.8
0.0219		10.5
0.0156		9.6
0.0128		9.1
0.0091		7.7
0.0065		6.4
0.0054		5.0
0.0046		4.6
0.0032		3.6
0.0014		2.0

Total Wt (g)	416.64	
Wt used for Hydrometer (g)		
50.62		
Pass 2mm Retained 0.075mm		
0.850	7.11	0.860
0.425	13.17	0.740
0.250	19.52	0.614
0.150	26.33	0.480
0.106	30.28	0.402
0.075	32.57	0.357

UNIFIED SOIL CLASSIFICATION SYSTEM



SAMPLE DATA

Job No.: TF8165902
Sample ID: DS03-03
Lab ID : 13087
Lab No.: S349

>4.75 mm (Gravel size) = 2%
4.75 to 0.075 mm (Sand size) = 42%
0.075 to 0.002 mm (Silt size) = 48%
< 0.002 mm (Clay size) = 8%

(Entire sample used for analysis)

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GRAIN SIZE DISTRIBUTION

SILT AND SAND with organics
trace clay and gravel

Client :- Hemispheres le Groupe
Project:- DSOP-Field Program-New Millenium
Location:- Newfoundland
Lab No. :- S349
Date :- 01 Oct 2008

Grain Size Analysis

Project:- DSOP-Field Program-New Millenium
Client :- Hemispheres le Groupe
Job# :- TF8165902
Sample ID :- DS03-03
Lab No. :- S349

Location:- Newfoundland
Date :- 1-Oct-08
Tested By :- TQ/WA
Lab ID # :- 13087
Checked By :- SB

Sieve size (mm)	Cumm. Wt. Retained (g)	%passing
9.50	0.00	100.0
4.75	0.73	98.2
2.00	3.70	91.0
0.85		87.2
0.425		82.7
0.250		74.1
0.150		64.6
0.106		59.8
0.075		56.3
0.0486		47.6
0.0347		42.1
0.0222		34.7
0.0158		31.1
0.0129		29.3
0.0092		23.8
0.0066		18.3
0.0054		14.6
0.0047		14.6
0.0032		11.0
0.0014		7.3

Total Wt (g)	42.70	
Wt used for Hydrometer (g)		
25.59		
Pass 2mm Retained 0.075mm		
0.850	1.06	0.959
0.425	2.33	0.909
0.250	4.77	0.814
0.150	7.43	0.710
0.106	8.79	0.657
0.075	9.77	0.618

Your C.O.C. #: 00557581

Attention: Suman Punani
AMEC Earth & Environmental Ltd
160 Traders Blvd E
Suite 110
Mississauga, ON
L4Z 3K7

Report Date: 2008/10/21

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: A8C0878
Received: 2008/10/16, 11:31

Sample Matrix: Soil
Samples Received: 12

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Method Reference
Total Organic Carbon in Soil	12	N/A	2008/10/21	CAM SOP-00468	LECO Combustion

* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.

EMA GITEJ,
Email: ema.gitej@maxxamanalytics.com
Phone# (905) 817-5700

==
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

RESULTS OF ANALYSES OF SOIL

Maxxam ID		AU2860		AU2861		AU2862		
Sampling Date		2008/09/09		2008/09/11		2008/09/11		
COC Number		00557581		00557581		00557581		
	Units	**13081 DS03-14**	**QC Batch**	**13082 STAR1/DS02-02**	**QC Batch**	**13083 DS02-03**	**RDL**	**QC Batch**
Inorganics								
Total Organic Carbon	mg/kg	180000	1647355	11000	1647691	40000	500	1647355

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

Maxxam ID		AU2863	AU2864	AU2865	AU2866		
Sampling Date		2008/09/12	2008/09/13	2008/09/13	2008/09/13		
COC Number		00557581	00557581	00557581	00557581		
	Units	**13084 TIMMINS 1**	**13085 DS03-05**	**13086 DS03-07**	**13087 DS03-03**	**RDL**	**QC Batch**
Inorganics							
Total Organic Carbon	mg/kg	710	12000	19000	97000	500	1647355

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

Maxxam ID		AU2867	AU2868	AU2869	AU2870	AU2871		
Sampling Date		2008/10/01	2008/10/02	2008/10/02	2008/10/03	2008/09/29		
COC Number		00557581	00557581	00557581	00557581	00557581		
	Units	**14647 BH36 SS2**	**14648 BH25 SS3**	**14649 DUP3**	**14650 BH32 SS3**	**14651 BH13 SS2**	**RDL**	**QC Batch**
Inorganics								
Total Organic Carbon	mg/kg	9200	5700	12000	1700	9200	500	1647691

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

Package 1	7.0°C

Each temperature is the average of up to three cooler temperatures taken at receipt

GENERAL COMMENTS

Results relate only to the items tested.

AMEC Earth & Environmental Ltd
Attention: Suman Punani
Client Project #:
P.O. #:
Project name:

Quality Assurance Report

Maxxam Job Number: MA8C0878

QA/QC Batch Num	Init	QC Type	Parameter	Date Analyzed yyyy/mm/dd	Value	Recovery	Units	QC Limits
1647355	OK	QC STANDARD	Total Organic Carbon	2008/10/21		94	%	80 - 120
		Method Blank	Total Organic Carbon	2008/10/21	ND, RDL=0.05		mg/kg	
		RPD	Total Organic Carbon	2008/10/21	11.2		%	50
1647691	OK	QC STANDARD	Total Organic Carbon	2008/10/21		91	%	N/A
		Method Blank	Total Organic Carbon	2008/10/21	ND, RDL=0.05		mg/kg	
		RPD	Total Organic Carbon	2008/10/21	10.3		%	50

ND = Not detected
N/A = Not Applicable
RPD = Relative Percent Difference
QC Standard = Quality Control Standard

Validation Signature Page

Maxxam Job #: A8C0878

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

BRAD NEWMAN, Scientific Specialist

==

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SPRING SURVEY OF CARIBOU IN THE VICINITY OF SCHEFFERVILLE
MAY 2009

Prepared for:

NEW MILLENNIUM CAPITAL CORP. AND LABRADOR IRON MINES LIMITED

FINAL REPORT – WITHOUT PREJUDICE

***Natalie D'Astous*, Groupe Hémisphères**
***Perry Trimper*, Jacques Whitford Stantec Limited**

November 2009

EXECUTIVE SUMMARY

During May 2009, Labrador Iron Mines Limited and New Millennium Capital Corp. partnered to complete an aerial survey for caribou in consultation with the Newfoundland and Labrador Wildlife Division. Both companies are undergoing environmental reviews for mining projects located in the vicinity of Schefferville, Quebec. Working under the regulatory direction of the Provincial Wildlife Division in Newfoundland and Labrador and the ministère des Ressources naturelles et de la Faune du Quebec, consultants for these proponents (i.e., Jacques Whitford Stantec Limited (JWSL) and Groupe Hémisphères (GH), respectively) worked together to assess the presence/absence of sedentary caribou in the area surrounding these proposed iron ore developments. The survey was a requirement of the Newfoundland and Labrador environmental assessment process.

Prior to field investigations, a literature search was conducted to identify a Study Area of 50 km in radius centred on each proposed development. Letters explaining the objectives and other aspects of the survey were sent to the leaders of the local First Nations concerned, namely the Innu Nation, Innu Takuaikan Uashat mak Mani-Utenam, the Naskapi Nation of Kawawachikamach and the Nation Innu Matimekush-Lac John. Given the presence of staging waterfowl, a portion of Attikamagen and Petitsikapau Lakes was avoided to reduce potential effects on the goose hunting activities being conducted at the time, at the request of these leaders. The necessary provincial approvals, scientific permits and a federal Animal Care Certificate were obtained before the start of the survey.

The survey was completed between May 4-8, 2009 using an Astar 350BA helicopter at an altitude of approximately 100 m (AGL) and average speed between 160 and 200 km/hr. Flight lines were 4 km apart, with transects oriented in a NW/SE direction consistent with the orientation of topographic features. Three observers (two staff from the Newfoundland and Labrador Wildlife Division and a senior biologist with JWSL) plus the pilot (also a senior biologist with GH) searched an area of approximately 250 m either side of the aircraft. When fresh tracks were encountered, the helicopter would veer off transect to locate any caribou. All observations of caribou, tracks, land use and other relevant information, such as weather and start and end times of each transect, were recorded by the navigator. In addition, sightings or sign of wildlife were also noted. A total of 31.1 hrs was flown, including ferry time from Wabush, Labrador.

Three confirmed sightings of caribou, totalling 7 individuals, were observed. All of these sightings were at least 24 km from the ore bodies associated with either project. One sighting was of a dead female that appeared to have recently been killed by a lone wolf. A second group comprised four individuals (including one adult female accompanied by a calf, another female and a yearling male). The Study Team captured the lone female with a net gun and applied an Argos GPS collar and numbered ear tag on the animal. The remaining caribou observed were two males (a yearling and a two-year-old) that were not pursued for capture. Morphological measurements were recorded from the collared female and from the remains of the dead female. A sample of ear dermis from both of these animals was also taken with a punch and frozen for genetic analysis and comparison to genetic reference samples by Dr. Steeve Côté at the Université Laval in Quebec City.

Based on currently available data, the ecotype affiliation of the six live (and one dead) caribou observed is inconclusive. Although the migratory George River caribou herd was not recorded as migrating through this area during the winter of 2008-2009, the physical measurements of the animals handled suggest they were of the migratory ecotype. Additional data was anticipated to result from the deployment of satellite collars on captured caribou, but, despite being tested by the Wildlife Division before the survey, the satellite system of the deployed collar has not yet emitted a signal, and it appears that this unit has malfunctioned. At the time of writing, additional information/insight is anticipated from the genetic analyses (scheduled for early 2010) and improved reporting functioning of the telemetered female that might provide additional insight as to the ecotype of these caribou. Despite the outstanding questions, current information (i.e., this survey and informant interviews) has confirmed that the density of caribou in the vicinity of the proposed developments is usually low in late winter/early spring, as demonstrated by the results of the intensive nature of the survey, the large area covered, and the excellent tracking conditions during this effort.

Note that copies of this executive summary will be provided to First Nations in the region.

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STUDY TEAM

Project Manager

Linda Wrong	Labrador Iron Mines Limited
Paul F. Wilkinson	New Millennium Capital Corp.

Research, Writing and Analysis

Perry Trimper	Jacques Whitford Stantec Limited
Natalie D’Astous	Consulting Biologist, Groupe Hémisphères

Survey Team

Perry Trimper - navigator and observer
John Neville[1] - observer and net-gunner
Kirsten Miller[2] - observer
Natalie D’Astous - helicopter pilot (Canadian Helicopters Limited)

Figures and Maps

Carolyn Pelley	Jacques Whitford Stantec Limited

Text Reviewers

John Neville	[1]Wildlife Biologist, Government of Newfoundland and Labrador
Kirsten Miller	[2]Ecosytem Management Ecologist, Government of Newfoundland and Labrador

1.0 CONTEXT

New Millennium Capital Corp. (NML) and Labrador Iron Mines Limited (LIM) are engaged in separate environmental assessment processes of proposed iron ore mines in western Labrador, in the case of LIM, and in western Labrador and Québec, in the case of NML, near Schefferville, Québec. This area of the Ungava Peninsula includes a part of the range of the large George River Caribou Herd (GRCH), a migratory ecotype, that was estimated at approximately 296,000 individuals (post-calving estimate) (Couturier et al. 2004). When this herd migrates through the Schefferville area, hunting provides important quantities of country food for local residents and contributes to employment in outfitting camps. However, satellite telemetry (MRNF 2009) and observations from local residents (R. McKenzie, pers. comm.) confirmed the GRCH did not migrate near this area during the fall and winter of 2008-2009.

The other form of caribou that was historically known to occur in this region is the forest-ecotype or sedentary caribou. These animals were referred to as the McPhadyen Caribou Herd (Bergerud et al. 2008, St-Martin 1987, Phillips 1982). Sedentary caribou are classified as an endangered species in Canada and in Labrador (COSEWIC 2001, Newfoundland and Labrador Endangered Species Act). The Government of Newfoundland and Labrador (GNL) is concerned that forest-ecotype (sedentary) caribou may exist in the vicinity of both of these projects and has requested this issue be included as part of the environmental assessment.

A study of the McPhadyen Herd and another sedentary herd located to the south, the Lac Joseph Herd, was conducted between May, 1984, and October, 1986 (Saint-Martin 1987). Seven female caribou from the McPhadyen Herd were radio-collared by the Newfoundland and Labrador Wildlife Division in April, 1984. The approximate range of the McPhadyen Herd (as defined by a polygon surrounding the outermost locations of seven radio-collared caribou) suggested that the range extended north of Schefferville. However, the small sample size of collared caribou did not permit an adequate description of population dynamics (Saint-Martin 1987). The researchers noted the following at the time regarding the McPhadyen Herd: the animals were present at low density; some animals travelled towards the area north of the McPhadyen River in winter, followed by a return movement in late winter and spring; travel rates increased as fall and spring approached; groups of up to 33 and 46 animals were observed in fall and late winter respectively; groups of up to four animals were widely dispersed during the calving period; and individual females did not show marked fidelity toward specific calving grounds.

To complete the requirements of the Newfoundland and Labrador environmental assessment process, both NML and LIM were requested to perform a spring survey of their respective properties to assess the presence/absence of sedentary caribou. If such animals were located, satellite telemetry collars were to be attached to adult female caribou, and certain body measurements were to be taken. In addition, the consulting team received an offer from Université Laval to carry out genetic testing on any caribou accessed during the survey. This offer was accepted by the GNL Wildlife Division as a supplemental and voluntary component of the program. It was anticipated that some combination of the foregoing would permit a determination whether the animals in question belonged to the migratory or the sedentary ecotype. This affiliation identification would then be used for the selection, design and implementation of appropriate mitigation and monitoring strategies.

Both proponents have a common interest in documenting whether sedentary caribou are present in the vicinity of their proposed iron ore developments. The survey areas accepted by the GNL Wildlife Division were found to overlap. NML and LIM therefore agreed to collaborate and to share the resources and expenses required to carry out the program in collaboration with the Wildlife Division of Newfoundland and Labrador and with the approval of Québec's ministère des Ressources naturelles et de la Faune.

1.1 Objectives

The main objective of the study was to determine if sedentary caribou are present within an area surrounding the iron ore mining project sites of LIM and NML immediately prior to the calving season. If caribou were observed, adult females would be captured and equipped with satellite telemetry collars provided and tested by the GNL Wildlife Division. Other information is important to identify the ecotype: location of calving ground; habitat use; and site fidelity. Such information can be acquired only if females are collared. Satellite telemetry has been demonstrated to provide an effective indication of caribou movements and distribution for monitoring purposes and implementation of improved mitigation measures (Trimper and Chubbs 2003).

2.0 METHODOLOGY

2.1 Field Preparation

To define the size of the Study Area the Study Team considered the size of the seasonal ranges of sedentary caribou reported in the literature. The distance covered by sedentary caribou between summer and winter ranges can attain 80 km, but it is more often reported as between 10 and 40 km (Edwards and Ritcey 1959, Fuller and Keith 1981, Paré and Huot 1985, Cummings and Beange 1987, Edmonds 1988, Seip 1992, Cichowski 1993, Paré and Brassard 1994). Therefore, a conservative radius of 50 km centred on each proposed development was approved by GNL Wildlife to represent the Study Area.

Given the overlap of the range of the GRCH with the Study Area and the difficulty of distinguishing this ecotype from the sedentary ecotype, should they be present, during the survey, the Study Team contacted the responsible provincial departments in Labrador and Québec to determine the location of the migratory ecotype immediately prior to the start of the survey. Based on the display of satellite collars from the GRCH on the MRNF and the GNL websites, and through communications with the nearby Naskapi and Innu communities, the information indicated that most of the GRCH did not pass through the Study Area during the winter of 2008-2009. Note that no telemetry collars are known to be currently attached to sedentary caribou, if present, in this area.

Before the start of the survey, letters prepared by NML and LIM explaining its objectives were sent to the leaders of the First Nations concerned, namely the Innu Nation, Innu Takuaikan Uashat mak Mani-Utenam (ITUM), the Naskapi Nation of Kawawachikamach (NNK) and the Nation Innu Matimekush-Lac John (NIMLJ). Moreover, members of the Study Team met with representatives of the local band councils (i.e., Sylvain Vollant (NIMLJ), Jimmy James Einish (NNK)) to further explain the objectives and to identify whether the planned survey lines would pass near goose-hunting areas. At the request of these leaders a portion of Attikamagen and Petitsikapau Lakes was avoided to reduce potential effects on goose-hunting activities. The

Study Team indicated that a report summarizing the results of the survey would be provided (in English and French) to the ITUM, the NNK, the NIMLJ and the Innu Nation, but the exact location of caribou observations within the survey area would be kept confidential.

The necessary provincial approvals, scientific permits and a federal Animal Care Certificate were obtained before the start of the survey.

2.2 Field Techniques

At the beginning of the survey, a health and safety checklist of all hazards and actions for their management was completed and discussed amongst all participants on the Study Team. Issues related to safety were also reviewed and discussed each morning using a 'last minute risk assessment'. Various scenarios related to capture techniques were rehearsed in advance and in the field prior to application.

The survey was completed during 4-8 May 2009, in an Astar 350BA helicopter at an altitude of approximately 100 m (AGL) and average speed of 160 to 200 km/hr depending on conditions and habitats. Flight lines were spaced every 4 km with transects oriented in a NW/SE direction consistent with the landscape topography. Flights ceased if there was precipitation or other factors (e.g., extensive shadows) that reduced visibility. Portions (in total 1,234 km^2 or <10 percent of the 12,900 km^2) of the Study Area were not surveyed due to poor weather conditions at the time and to avoid areas of intensive goose hunting. Where fresh tracks were encountered, the helicopter would veer off transect to locate any caribou. All observations of caribou, tracks, land use and other relevant information, such as weather and start and end times of each transect, were recorded by the navigator. A total of 31.1 hrs was flown, including ferry from Wabush, Labrador.

The relatively late arrival of spring conditions made it possible to take advantage of persistent snow cover and ice conditions for tracking (Appendix A, Photo 1). Locations where tracks had been observed or suspected previously were further investigated during the final day of the survey. Particular attention was placed on areas of higher elevation, where the depth of snow was less and conditions were more suitable for caribou.

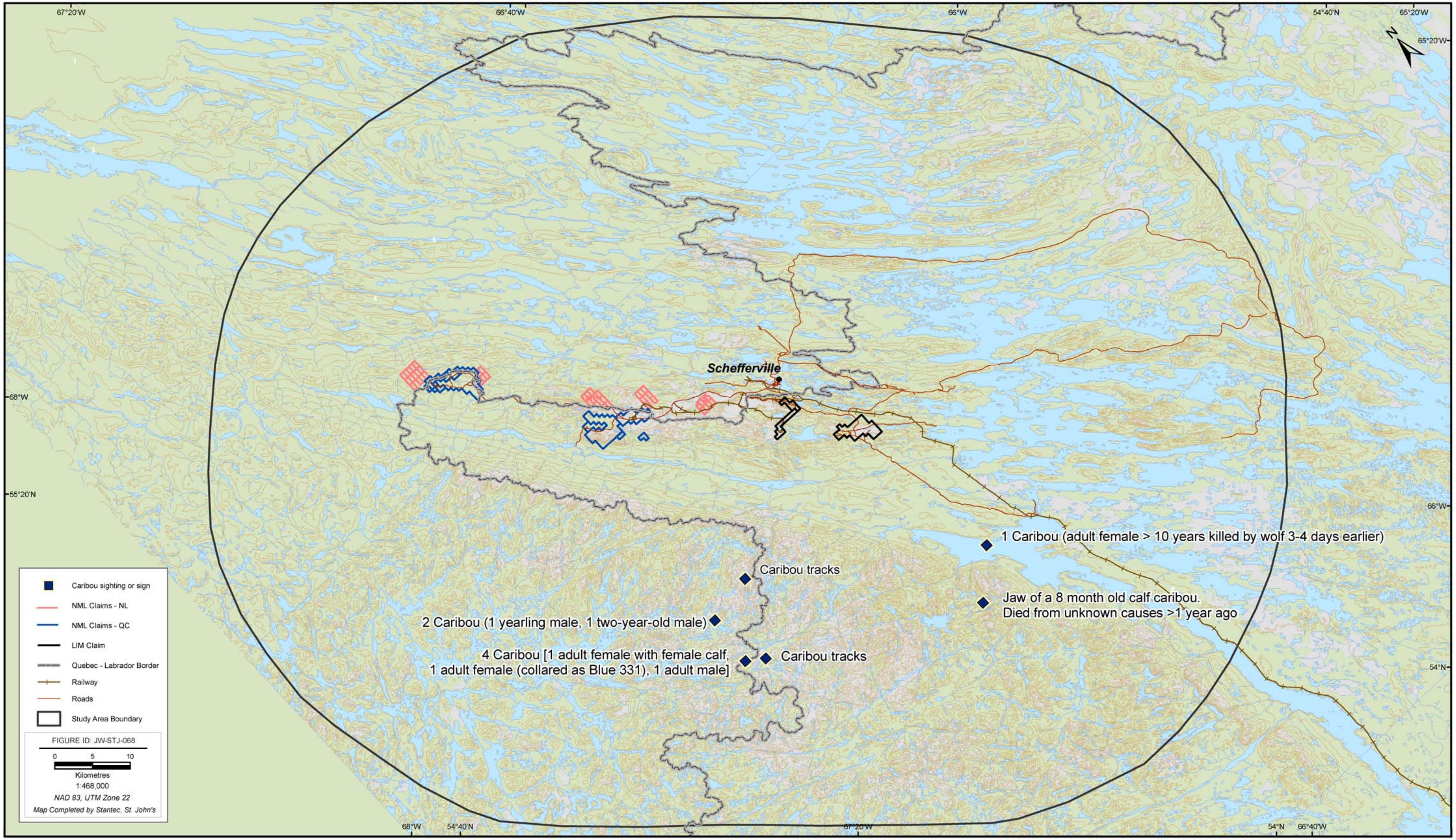
If caribou were encountered, the helicopter flew low to estimate the age and confirm the sex of each animal. When an adult female caribou was observed, the Study Team attempted to capture it with a net gun (Coda 308 with a 17' net). An Argos GPS collar and numbered ear tag were placed on the animal, with the following morphological measurements recorded: body length, heart girth and hind foot length. The animal's age was estimated on the basis of tooth wear. Moreover, a sample of ear dermis was taken with a punch and frozen for genetic analysis and comparison to on file genetic reference samples (to be completed by Dr. Steeve Côté, Université Laval, Québec).

3.0 RESULTS

3.1 Observations of Caribou

Complete snow cover provided excellent tracking conditions during the five-day aerial survey (Appendix A, Photo 1). Approximately 29 hrs of helicopter effort searched an estimated area of 11,670 km^2 and confirmed three sightings of caribou totalling 7 individuals. One other location of confirmed caribou tracks that could be conclusively separated from these sightings was identified (Figure 3.1).

Figure 3.1 Observations of Caribou and Sign during May 2009 Survey



The first sighting was of a female caribou that had recently been killed by a lone wolf (*Canis lupus*) (based on tracks) at Menihek Lake on 5 May (Appendix A - Photo 2, Figure 3.1). This location is approximately 28 km south of Schefferville [24 km from the nearest ore body of LIM (Redmond) and 48 km from the nearest ore body of NML (Timmins 3N)]. Tracks indicated the lone caribou had been pursued (in a southerly direction) by the wolf from a black spruce (*Picea mariana)* stand approximately 2 km to the north on to the ice. Various signs indicated the death of the estimated 10+ year old female caribou had occurred recently (less than 2 or 3 days). Examination of marrow in the femur indicated that the animal had been in good physical condition. A skin sample was retained for genetic analysis. An adult Bald Eagle (*Haliaeetus leucocephalus*) was feeding on the carcass when encountered by the Study Team. This location was revisited and searched further on 8 May. No other sign of caribou or wolf were noted in this area.

On 6 May, tracks were encountered approximately 35 km southwest of Schefferville [approximately 32 km from the nearest LIM property (Redmond) and 32 km from the nearest property of NML (Redmond 5)]. The Study Team followed these tracks over higher elevation for approximately 2 km before encountering a group of four caribou (i.e., one adult female accompanied by a calf, another female and a yearling male) (Appendix A, Photo 3, Figure 3.1). These animals appeared to have been moving in a northwesterly direction and were following the higher terrain features, apparently to take advantage of better snow conditions for travel. After returning to Schefferville for fuel and to prepare equipment, the Study Team later captured the lone adult female identified as Blue 331 (Appendix A, Photo 4). Upon release of this animal, an attempt was made to capture the second female, but the group was cohesive and it was difficult to separate the other individuals from Blue 331, so the effort was aborted. This location was revisited on 8 May, at which time the Study Team relocated tracks moving in a northwest direction, but was unable to relocate the animals.

On 8 May, the final group of caribou encountered consisted of two males (a yearling and a two-year-old) that were located on hills approximately 25 km west of Schefferville [29 km from the nearest ore body on the LIM property (Redmond) and 29 km from the nearest property of NML (Timmins 3N)]. There was no obvious pattern to their movement.

Note that during a rest break on 6 May, the Study Team found a jaw from a calf caribou aged at eight months (Appendix B), but the sample was too old for genetic analysis (J. Taillon, pers. comm.). This location was on the top of a prominent hill, west of Menihek Lake and 30 km south of Schefferville.

3.2 Caribou Measurements

There were two opportunities to collect morphological data on caribou. Standard measurements (Couturier et al., Submitted) were recorded for the captured female (Blue 331) west of Schefferville and the dead female (partial measurements only due to the condition of the carcass) encountered on Menihek Lake (Table 3.1).

Table 3.1 Morphological measurements of two adult female caribou near Schefferville, May 2009

	Estimated age	Hind foot length	Heart girth	Body length
Dead female	≥10 years	56.5 cm	-	-
Blue 331	3 -4 years	56.0 cm	118.0 cm	192.0 cm

3.3 Movement of Telemetered Caribou

As of the time of writing, a signal has not been received from the Argos satellite collar. Conversations between the GNL and the supplier of the collar (i.e., Telonics) suggest the inability to transmit may be caused by a process called passivation, where a stored collar develops a corrosion layer that may block signal transmission. It is hoped that the corrosion may wear to the point that transmission will occur normally. The VHF beacon was tested and confirmed by the GNL (who provided the collar) to be functioning normally prior to deployment (J. Neville, pers. comm.).

3.4 Observations of Other Wildlife

Moose (*Alces alces*) and sign were concentrated in the southeast portion of the Study Area, where one adult male and four other separate locations of tracks were observed (Figures 3.2 and 3.3). Black bear (*Ursus americanus)* and tracks were common, with four sightings of live animals and at least ten sightings of tracks throughout the Study Area. Wolf tracks were observed only twice [in association with the recently killed caribou located at Menihek Lake (Section 3.1)] and in the southeastern portion of the Study Area (Figure 3.2). Canada Goose (*Branta canadensis*) were migrating through the area in large numbers. Flocks of 10-100 were often observed flying north or loafing on ice or *ashkui* (an Innu term that refers to areas of permanent or temporary open water during winter). Over the course of the survey, other migratory avifauna [e.g., American Robin (*Turdus migratorius),* Common Snipe (*Capella gallinago*)] began to appear in Schefferville and increased in abundance in the subsequent days.

Figure 3.2 Observations of Other Wildlife and Sign during May 2009 Survey – Southeast Section

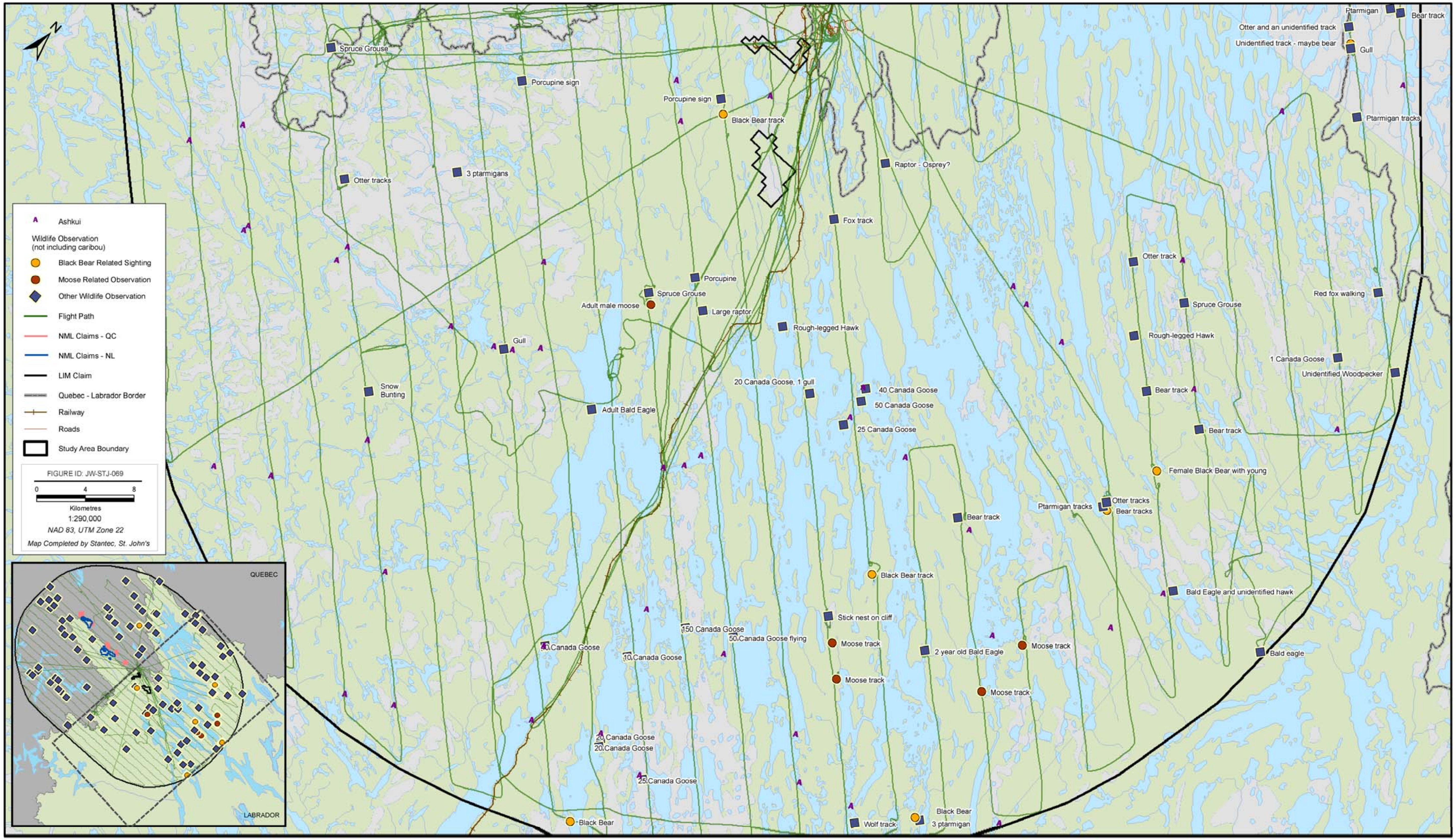


Figure 3.3 Observations of Other Wildlife and Sign during May 2009 Survey – Northwest Section

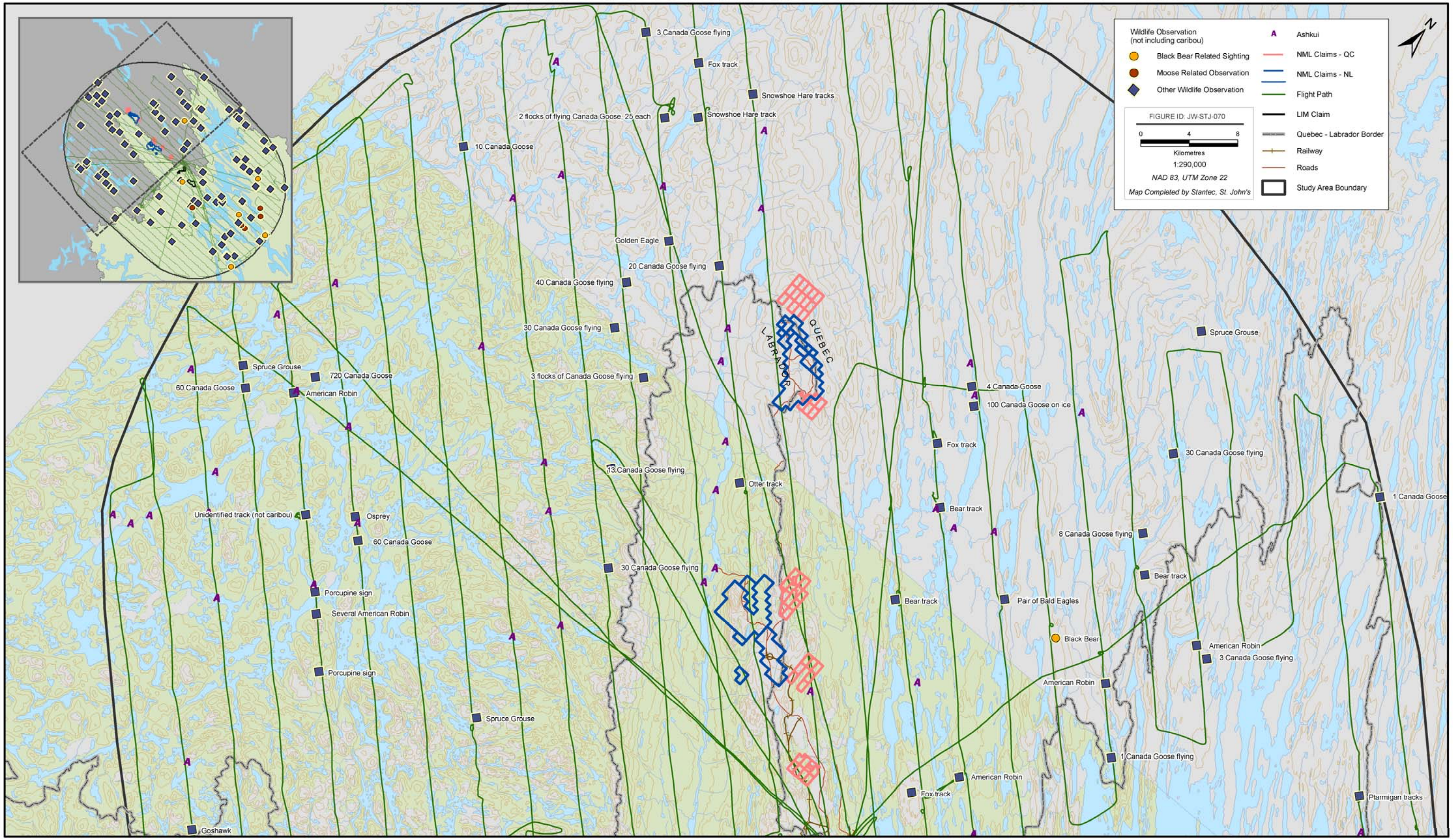


Figure 3.4 Observations of Land Use Activity during May 2009 Survey – Southeast Section

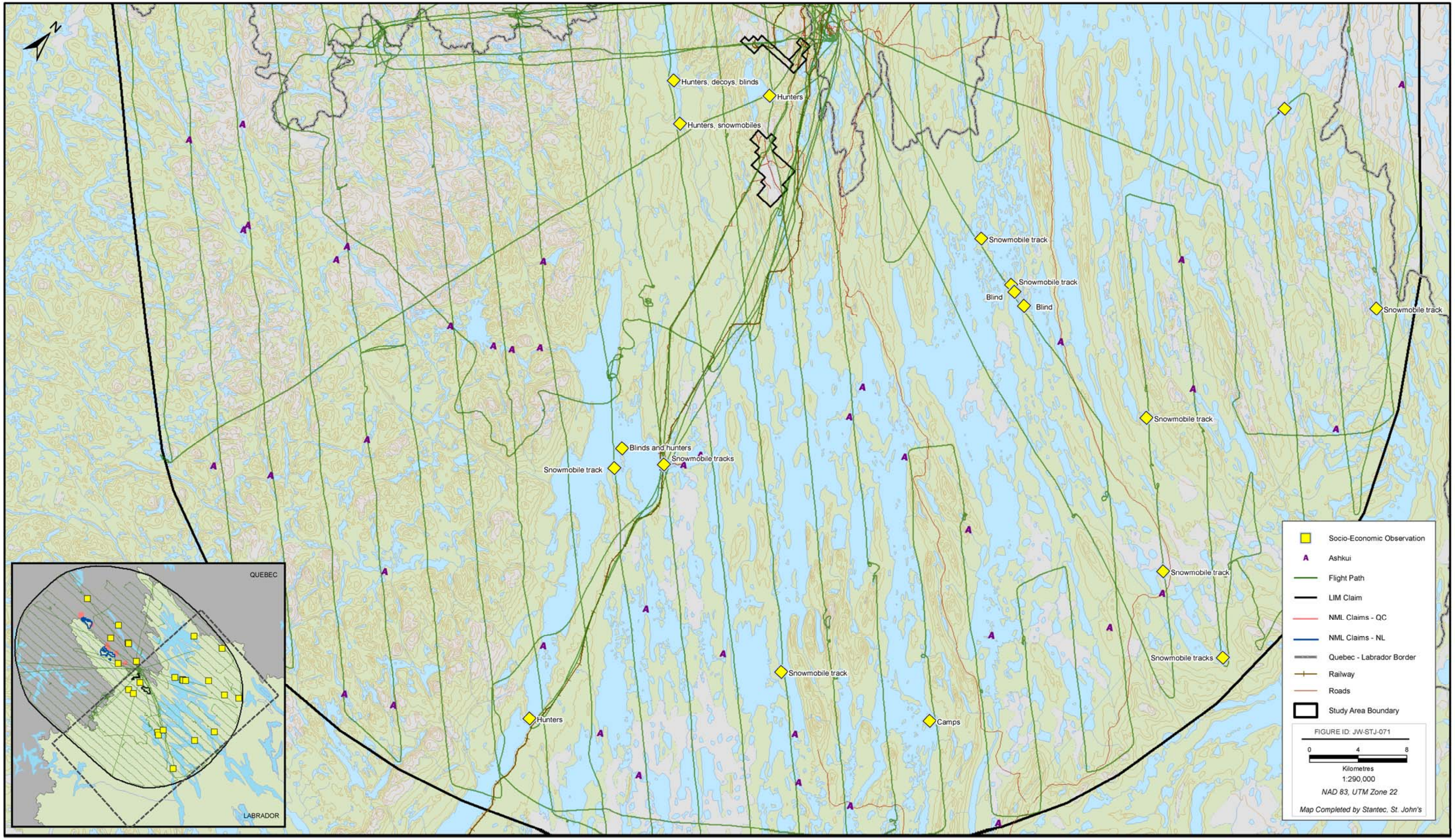


Figure 3.5 Observations of Land Use Activity during May 2009 Survey – Northwest Section

Land use activity was extensive throughout the eastern and southern portions of the Study Area. There was a particular concentration of activity in the vicinity of Attikamagen and Petitsikapau lakes, where evidence of hunting for geese (e.g., decoys, blinds, snowmobiles) was noted in association with *ashkui* (Figures 3.4 and 3.5).

4.0 DISCUSSION

The caribou of the Ungava region are classified as woodland caribou Rangifer tarandus caribou (Bergerud et al. 2008). There are three ecotypes in this region: the migratory (represented by the George River or Leaf River Herds for example), the mountain (represented by the Torngat Mountains Herd) and sedentary caribou (e.g., Lac Joseph or Red Wine Herds). The sedentary ecotype of interest for this study is in difficulty in most parts of North America. Predation, hunting and habitat modifications have frequently been suggested as the main causes to explain the decline of sedentary caribou (Schaefer et al. 2001, Sorenson et al. 2008). Situations where caribou become concentrated in residual habitat patches favour the establishment of alternative prey such as moose, which results in increased predators and/or extends their seasonal presence in an area. Increased access to areas used by caribou often results in increased poaching. Finally, habitat fragmentation by human activities, particularly forest cutting, concentrates caribou and increases their vulnerability to hunting and predation (Courtois 2003, Chubbs and Schaefer 1997, Schaefer et al. 2001, Bergerud et al. 2008). While the survey confirmed that the number and density of caribou in the Study Area at this time of year are low, the challenge is to determine the ecotype affiliation of the few caribou observed during May 2009.

Distribution and Movement

Female caribou have two distinct distribution patterns for reducing predation risk. In the first, the cows can be widely dispersed in the spring (space-out), thereby increasing the search effort for wolves and bears during this sensitive period. In the second pattern, the cows can move away from the distribution of predators (space-away) (Bergerud et al. 2008). Space-out behaviour is typical of the sedentary ecotype; Space-away behaviour, including migration to calving grounds on the tundra, is typical of the migratory ecotype (Schaefer et al. 2000, Bergman et al. 2000, Adams et al. 1995 a, b, Bergerud and Page 1987).

The caribou observed during the survey were using the hills to the west and southwest of Schefferville. Based on their tracks, the group of four caribou was moving in a northwesterly direction, while the two male caribou had been occupying a relatively small area for at least several days. If the female caribou were affiliated with the GRCH, they should have been much further north at the calving grounds, although not all females arrive at the calving grounds before dropping their calves. Males of the migratory ecotype do not follow females to the calving grounds.

Physical Measurements

According to Couturier et al. (Submitted) the morphological measurements indicate that the two caribou measured (Table 3.1) belong to the migratory ecotype (Table 4.1). The variable that presents the most differentiation between ecotypes is hind foot length. The two samples collected, 56.0 and 56.5 cm, are closer to the recorded values for migratory caribou than to those of sedentary caribou. The morphology of the caribou associated with the various herds appears to be changing, however, according to demographics and habitat quality (Dr. Steeve Côté, pers. comm., May 15, 2009).

Table 4.1 **Morphological measurements of adult female caribou from seven herds and three ecotypes from the Québec-Labrador Peninsula (from Couturier et al. Submitted)**

Ecotype	Herd	Study period	Hind foot length[a]	Heart girth[a]	Body length[a]
Migratory	George (*n* = 344)	1983-2002	55.6 ± 0.1[a]	114.0 ± 0.4[a]	186.6 ± 0.5[a]
	Feuilles (*n* = 104)	2002-2002	55.6 ± 0.2[a]	108.6 ± 0.6[b]	184.2 ± 0.9[a]
Mountain	Torngat (*n* = 14)	2001	53.6 ± 0.2[b]	122.4 ± 0.6[c]	200.3 ± 2.1[b]
Sedentary	Red Wine (*n* = 42)	1993-2002	60.6 ± 0.4[cd]	124.2 ± 1.2[c]	209.2 ± 1.8[c]
	Lac Jos (*n* = 38)	1998-2002	61.6 ± 0.3[c]	117.3 ± 0.9[ac]	205.6 ± 1.1[bc]
	Jamésie (n = 24)	2003-2004	61.5 ± 0.3[c]	119.9 ± 1.5[c]	200.9 ± 2.3[b]
	Mealy (*n* = 27)	2002-2005	59.6 ± 0.6[d]	123.5 ± 0.9[c]	208.1 ± 1.2[bc]

[a] Indicates values with the same letter did not differ significantly (Tukey post-hoc comparisons)

A review of more recent data on the hind foot length of migratory caribou (Table 4.2) suggests that it cannot be used to discriminate between ecotypes with certainty. It appears that the hind foot length of caribou from the GRCH is below the values obtained subsequently. Still, from an examination of the minimum and maximum values (Table 4.2), which are not available for Table 4.1, the variability between individuals seems considerable. More recent data (2007-2009) for Jamésie caribou (sedentary ecotype) show values that range from 58.5 cm to 66.0 cm for 11 adult females (more than three years old) and are greater than those measured in this survey (MRNF unpublished, Chibougamau). The female caribou (Blue 331) captured on 6 May 2009 and the female found dead on 4 May 2009 appear to have morphology consistent with the migratory ecotype such as the GRCH.

Table 4.2 **Recent hind foot length (cm, mean ± SE) of adult female George River Herd caribou (source: Caribou Ungava Project, Université Laval, Joëlle Taillon)**

Study period	Hind foot length	N	Min/max
2007	54.8 ± 0.4	38	52 cm/58 cm
2008	55.0 ± 0.5	30	51 cm/61 cm

Traditional Environmental Knowledge

The Naskapi and the Innu in the region have always depended on caribou economically and culturally, as well as from philosophical and religious standpoints (Clément Mai 2009; Weiler 2006). The migratory ecotype of caribou is the main source of this dependence. There are two annual migrations and routes recognized by the Innu (Clément Mai 2009):

"The first main route is as follows. The caribou arrive from the George River and pass through the region from east to west (actually from the north-east to the south-west). In the past, that movement could begin as early as August 15, but it is usually observed in the fall, from September to November depending on the year. Caribou are present for about three to four weeks. Some of the caribou coming from the George River branch off into the sector and move further south towards the Smallwood Reservoir. Others overwinter in the region of Fermont, returning to cross the Study Area in April-May. Another Innu speaks of two waves in the fall from George River: the first wave occurs in September, and these caribou stay for three weeks about 30 miles north of the area; the second wave follows in November, lasting for about one week, and they move on to Schefferville. They stay within a group, when passing through.

The second main migration route follows the opposite direction. Caribou come from Caniapiscau at the same time, from August 15 until November, depending on the year and the experience of each informant. These caribou migrate from west to east (in fact from the south-west to the north-east). They cross the Howells River in the Study Area over a period of one month. Some of them branch off, returning north by La Militière Lake.

There are other variations, such as migrating from the north (via Greenbush) in the fall. Yet another informant indicated the following migration corridor: from the George River at Kuujjuaq to Caniapiscau and returning towards the George River.

Lastly, a spring migration is also indicated above. It usually occurs in April-May. According to some, the caribou can come from the south (Fermont, Esker). According to others, they came from the George River. In the former case, it is said that the caribou pass through only for one week, heading towards Champdoré Lake. In the latter case, the caribou follow a chain of hills, returning northward by lakes Ishkueu-shakaikan (Squaw Lake) and Pishishueu-shakaikan (Vacher Lake)".

According to Clément (Mai 2009), some of the Matimekush-Lac John Innu do not know the sedentary caribou. Others, however, recognize the existence of two caribou ecotypes. Some Innu see no morphological differences between the two ecotypes, except for the different habitats that they use. Others make a distinction based on morphological features, attributing to the sedentary caribou a stouter body and smaller antlers, as compared to the migratory caribou (Clément Mai 2009). The flesh of the sedentary caribou is said to taste better than that of the migratory caribou, because the former ecotype is more sedentary and is suggested to have a higher fat content. Those Innu who recognize the existence of the sedentary caribou (*minashkuat-atik* in Innu aimun) say that it is extremely rare in, if not totally absent from, the region (Clément Mai 2009). Most observations of sedentary caribou have been made outside the Schefferville area, south of Wabush or in the Cabana Lake area (70 miles south of Matimekush). One Elder interviewed by Clément (Mai 2009) asserted, however, that females of the sedentary caribou ecotype sometimes calve in the vicinity of lac Annabel (approximately 15 km north of NML's project).

According to Weiler (2006), several, mostly older, hunters harvest caribou also on the plateau west of the Howells Valley throughout the winter. This region is reported to be a wintering area for smaller groups of caribou, and an important hunting area when caribou are scarce elsewhere (Clément Mai 2009). Informants identified that caribou from the Caniapiscau, Opiscoteo and McPhadyen Herds generally remained within 100 km around Caniapiscau and Delorme lakes when they were observed. Calving areas for these caribou would be south and southwest of Caniapisacau/Delorme lakes and north and northeast of Lake Clairambault (Weiler 2006).

Summary

Given their behaviour at the time of capture (small groups) and their location, for they were present in the wintering area identified by Naskapi informants, it is uncertain as to the ecotype affiliation of the caribou observed. The morphological (i.e., hind foot) measurements indicate that the two caribou measured have dimensions similar to those of migratory caribou including the recent measurements presented in Table 4.2.

The scientific community classifies sedentary caribou in different herds. However, dispersion of animals from these herds makes it difficult to differentiate between herds. The genetic analyses should assist in determining whether the caribou observed are sedentary or migratory. However, at the time of writing, the genetic analysis will not be available until next year and it is also not known if a reference sample for the type of caribou sampled is on file. Outstanding information not available for this report will be issued under separate cover upon receipt.

According to acquired Native knowledge (Weiler 2006) and information from Saint-Martin (1987) and Bergerud et al. (2008), the increasing presence of moose in the southern portion of the Study Area (Clément Mai 2009) and the many observations of bear in the eastern portion, the area that presents the best potential for caribou occupying the area (seasonally or permanently) is the western portion of the Study Area. Caribou will spatially segregate themselves from predators and alternate prey such as moose (Stuart-Smith et al. 1997, McCutchen 2007). Only approximately one third of the Study Area offers an area of potentially lower density of predators and moose. This area, situated in the west and northwest portion of the Study Area, offers relatively better potential for winter habitat for caribou with mountains with less snow and more available food. Portions of the Study Area with numerous lakes and bogs would present a good potential for calving grounds but the increased density of moose and predators seriously threatens the survival of females and calves.

5.0 CONCLUSIONS

The ecotype affiliation of the six live (and one dead) caribou observed during the May 2009 survey in the vicinity of Schefferville is currently uncertain. While the GRCH was not recorded to migrate through this area during the winter of 2008-2009 and was reported to be concentrated to the north during this survey (as evidenced by the regular reporting of satellite collared caribou), it is possible the observed animals are affiliated with the migratory ecotype based on physical measurements and interviews with local Innu, who doubt whether sedentary caribou remain.

If the caribou observed during this survey are sedentary caribou, they will continue to be subjected to limiting adverse factors such as the presence of moose in the southern portion (which encourages the presence of wolves) and black bear in more than half of the Study Area; and accessibility to hunting from local communities. Comments by local Innu indicate that sedentary caribou were present formerly.

Genetic analyses and hopefully the improved reporting functioning of the single female that was captured and collared in May will provided additional insight. Regardless, the density of caribou is low, as demonstrated by the results of the intensive nature of the survey, the large area covered and the excellent tracking conditions.

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Dr. Steeve Côté	Université Laval, QC
J. Taillon	Doctoral Candidate, Université Laval, PQ

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APPENDIX A

Photographs From May 2009 Survey

Photo 1 Snow and ice conditions in the vicinity of Schefferville, 5 May 2009

Photo 2 **Female caribou estimated at 10+ years, killed recently by single wolf at Menihek Lake, 28 km south of Schefferville, 5 May 2009**

Photo 3 Four caribou [one adult female accompanied by a calf, another adult female (later captured as Blue #331) and a yearling male], 35 km southwest of Schefferville, 6 May 2009

Photo 4 J. Neville and P. Trimper attach ARGOS collar to adult female caribou (Blue #331), 35 km southwest of Schefferville, 6 May 2009

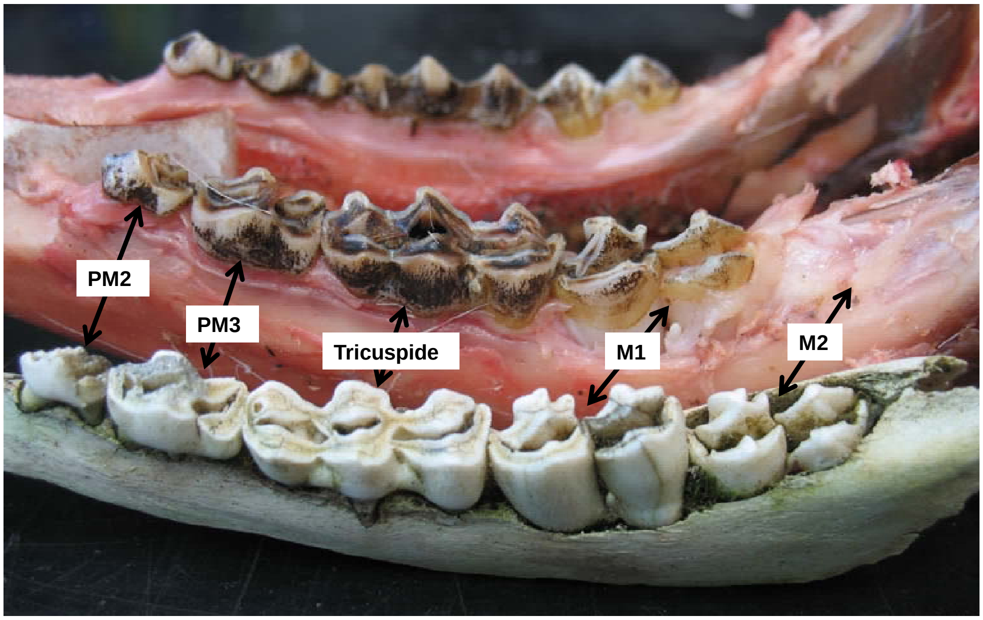
APPENDIX B

Age Determination of Caribou Jaw collected near Schefferville,
May 2009

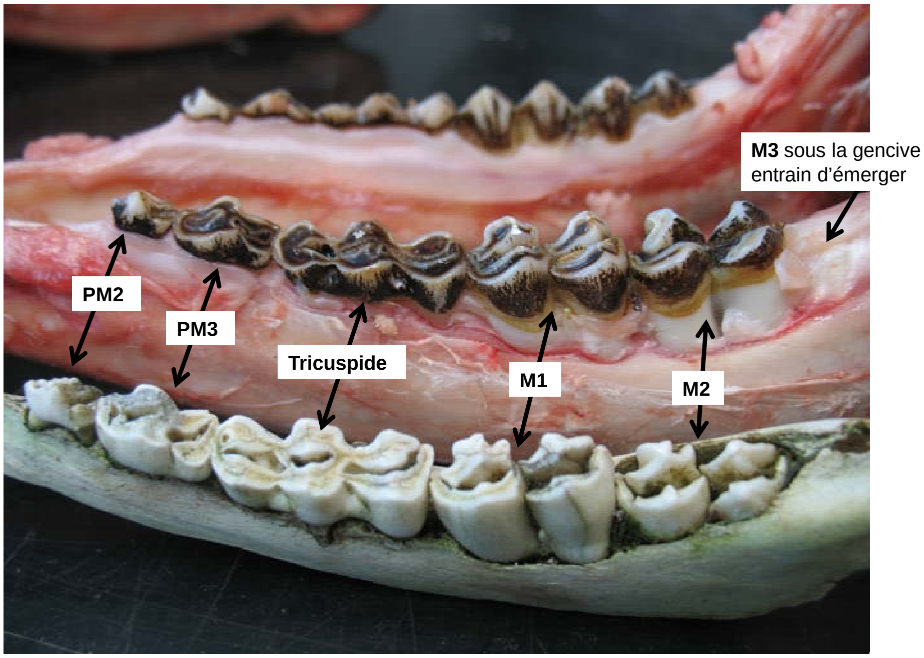
Source: Joëlle Taillon D. candidate at Université Laval

Comparaison avec mâchoire de faon femelle récoltée le 12-02-2009 (faon abattu lors de la chasse d'hiver 2008-2009). Ce faon provenait du troupeau de la Rivière aux Feuilles. En 2008, la date moyenne de mise base pour le Feuilles est estimée autour du 10 juin. Donc, ce faon avait autour de 8 mois d'âge lorsqu'il a été abattu et il était sur l'aire d'hivernage de la Rivière aux Feuilles

PM=Pré-molaire et **M**=Molaire. Comme nous en avions discuté, l'individu dont vous avez trouvé la mâchoire est jeune puisque la tricuspide est encore présente (sera remplacée par PM4 à l'âge adulte). La M1 vient d'émerger et la M2 est entrain d'émerger. Elle est encore dans l'os et entourée de gencive pour le faon femelle d'âge connu. La M3 n'a pas encore émergée. Ainsi, l'individu que vous avez trouvé avait un peu plus de 8 mois d'âge.



Comparaison avec mâchoire de faon que vous avez trouvé avec la mâchoire d'un yearling (1.5an). On remarque que la M2 est totalement émergée et que la M3 est sous la gencive mais commence à paraître. Les dents sont aussi plus usées chez le yearling.



New Millennium Capital Corp.

Inventaire 2008 et 2009 des oiseaux nicheurs du futur site DSO

Rapport technique

Décembre 2009

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Numéro	**Date**	**Modification ou détail de publication**
00	29-10-2009	Rapport technique préliminaire
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Illustrations de la couverture :
Avant-plan : Point d'inventaire dans la toundra
Arrière-plan : Petit lac avec tourbière

♻ Recyclable et fait de papier recyclé à 55%

On peut citer le présent rapport de la façon suivante :

Groupe Hémisphères (2009) *Inventaire 2008 et 2009 des oiseaux nicheurs du futur site DSO.* Rapport technique réalisé pour New Millennium Capital Corp., 22 p. et 4 annexes

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COSEPAC	Comité sur la situation des espèces en péril au Canada
km	Kilomètre
km^2	Kilomètre carré
km/h	Kilomètre par heure
IOC	Iron Ore Company of Canada
m	Mètre
NML	New Millennium Capital Corp.

1 INTRODUCTION

1.1 Contexte de l'étude

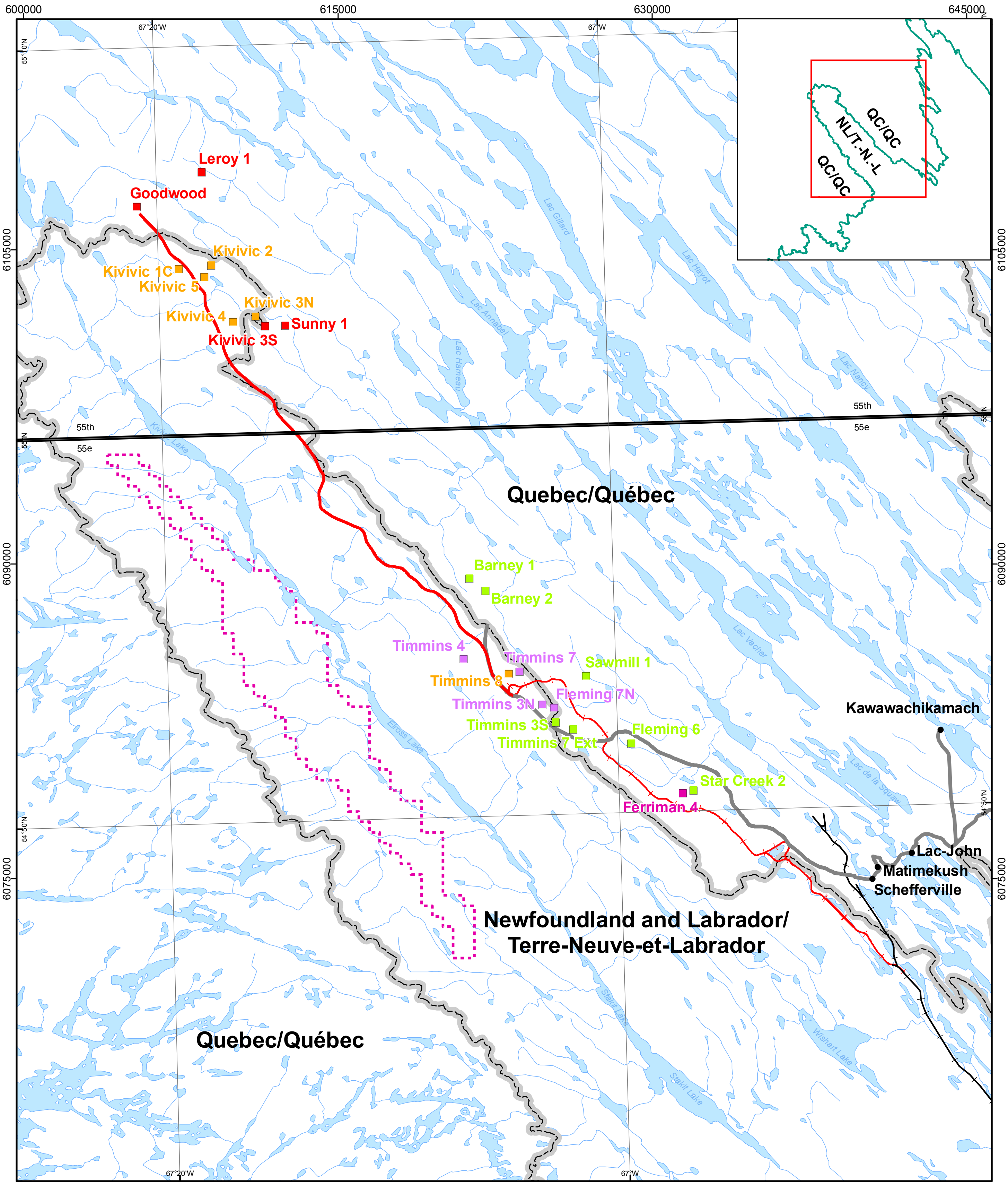
Le prix du minerai de fer a augmenté considérablement depuis 2002, rendant profitable l'exploitation de la chaîne ferrière Millennium, localisée dans la région de Schefferville. Le projet Direct Shipping Ore, ou DSO, est l'un des trois projets de la compagnie New Millennium Capital Corp. (NML). Il s'agit d'un projet d'exploitation de minerai de fer à enfournement direct. La phase 1 du projet DSO, ci-après nommé le « projet », prévoit l'exploitation de cinq gisements, au sud du 55^e^ parallèle, constituant les unités d'évaluation 1a et 1b, au Labrador et au Québec respectivement. La phase 2 concerne 14 autres gisements de part et d'autre de la frontière Québec/Labrador (unités d'évaluation 2a, 2b et 2c). La majorité des gisements de la phase 2 sont situés au nord du 55^e^ parallèle. Les sites de la phase 1 ont déjà été partiellement exploités par Iron Ore Company of Canada (IOC), leur environnement biophysique étant ainsi passablement perturbé. Les autres sites sont pour leur part plus intègres et naturels. La figure 1 montre l'emplacement des gisements et des unités d'évaluation dans l'aire d'étude relativement à la frontière Québec/Labrador et au 55^e^ parallèle.

1.2 Mandat et objectifs

Groupe Hémisphères a été mandaté par NML pour effectuer, entre autres, les inventaires biologiques sur le site du projet, dont l'inventaire des oiseaux nicheurs. Les objectifs de cette étude sont :

- Effectuer un inventaire quantitatif des oiseaux terrestres nicheurs;
- Effectuer un inventaire qualitatif des oiseaux présents en période de nidification;
- Effectuer un inventaire des oiseaux à statut précaire;
- Effectuer une évaluation du potentiel de présence des oiseaux à statut précaire;
- Couvrir le secteur des phases 1 et 2.

Ce rapport est une mise à jour du rapport *Inventaire des oiseaux nicheurs du futur site DSO* (Groupe Hémisphères, octobre 2008) et inclut les données des campagnes de terrain 2008 et 2009.



LEGEND/LÉGENDE

Assessment groups/ unités d'évaluation

🟪	1a
🟪	1b
🟥	2a
🟧	2b
🟩	2c

● City/ ville

Main access road/ route d'accès principale

Proposed haul road/ voie de halage proposée

Existing railway/ voie ferrée existante

Proposed railway/ voie ferrée proposée

Border/ frontière

Watercourse/ cours d'eau

Waterbody/ étendue d'eau

LabMag project/ projet LabMag

55th parallel/ 55ème parallèle

*Hydronyms are oriented along the direction of water flow
*Les hydronymes sont orientés selon le sens d'écoulement de l'eau

Assessment groups location

Localisation unités d'évaluation

0 2 4 6 8
Kilometers/kilomètres

SCALE/ÉCHELLE:
1:250 000

UTM 19N Nad 83

FILE, VERSION, DATE, AUTHOR/
FICHIER, VERSION, DATE, AUTEUR:
GH-0124-00, 2009-12-21 , A.A.

HEMISPHERES
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Figure 1

2 *BIOLOGIE DES ESPÈCES AVIAIRES À STATUT PRÉCAIRE*

Le nombre d'espèces à statut précaire susceptibles de fréquenter l'aire d'étude (définie à la section 4.1) s'élève à six (tableau 1). Cela inclut celles qui pourraient théoriquement s'y reproduire d'après leur aire de nidification et l'existence d'habitats potentiels (MRNF, 2009; Environment and Conservation, 2009; COSEPAC, 2009).

Tableau 1. Espèces à statut précaire potentiellement présentes dans la zone d'étude

Nom français	**Nom latin**	***Statut***		
		Québec	**Terre-Neuve/ Labrador**	**Canada**
Aigle royal	*Aquila chrysaetos*	Vulnérable	—	Non en péril
Arlequin plongeur	*Histrionicus histrionicus*	Vulnérable	Vulnérable	Préoccupante
Faucon pèlerin ssp. *anatum*	*Falco peregrinus anatum*	Vulnérable	Menacée	Préoccupante
Hibou des marais	*Asio flammeus*	ESDMV	Vulnérable	Préoccupante
Pygargue à tête blanche	*Haliaeetus leucocephalus*	Vulnérable	—	Non en péril
Quiscale rouilleux	*Euphagus carolinus*	—	—	Préoccupante

2.1.1 Aigle royal

L'espèce habite généralement les secteurs montagneux ou montueux, mais parfois peu vallonnés (Brodeur et Morneau, 1999). L'aigle royal chasse essentiellement dans les habitats ouverts, notamment les sommets dénudés, les brûlis, les tourbières, les marais et même dans des coupes à blanc (Tjernberg, 1983 ; Brodeur et Morneau, 1999 ; McGrady et coll., 2004). La superficie de milieux ouverts s'avère cruciale pour l'occupation d'un territoire de nidification (Morneau 2003 ; McGrady et coll., 2004). Dans la forêt boréale, les connaissances actuelles indiquent que l'occupation d'un territoire de nidification par l'aigle royal est souvent temporaire; la succession végétale finissant tôt ou tard par faire disparaître les brûlis et les espaces dénudés jusqu'à la prochaine perturbation majeure (Whitfield et coll. 1969 ; Morneau, 2003). Les couples habitent un domaine vital qui varie généralement entre 25 et 100 km^2 (McGrady et coll., 2004). Les falaises constituent le principal support des nids au Québec (Morneau et coll., 1994 ; SOS-POP, 2008).

2.1.2 Arlequin plongeur

L'arlequin plongeur niche le long des cours d'eau pourvus de rapides. Il habite généralement les cours d'eau d'ordre ≥ 4 (Morneau et coll, 2008; Robert, 1995). Un cours d'eau d'ordre 1 n'a pas de tributaire, mais se déverse dans un cours d'eau d'ordre 2, ainsi de suite. L'arlequin plongeur, aussi appelé le canard arlequin, s'alimentent principalement de larves d'insectes tapissant le fond rocheux des rapides. Sa répartition est mal connue dans le nord-est du Québec.

2.1.3 Faucon pèlerin de la sous-espèce anatum

Le faucon pèlerin niche essentiellement sur des falaises ou des structures d'origine anthropique, tels des ponts, des édifices en hauteur et des carrières (Bird, 1997). Deux sous-espèces habitent le Québec : *tundrius* et *anatum* ; la première vit, en été, dans la partie la plus septentrionale du Québec, mais la limite sud de son aire de reproduction est mal connue. À l'inverse, la sous-espèce anatum, dont les effectifs sont en augmentation, habite le sud de la province, au moins jusqu'à la rivière Saguenay, mais la limite nord de son aire de reproduction n'est pas connue.

2.1.4 Pygargue à tête blanche

Le pygargue à tête blanche habite les rives des grands lacs, des rivières et de la mer (Lessard, 1996 ; Fradette, 1998). Étant principalement piscivore, son nid se situe généralement à moins de 200 m d'une eau riche en poisson et libre de glace tôt dans l'année (Gerrard & Bertolotti, 1988). Des preuves de nidification du pygargue ont été trouvées dans toutes les régions du Québec, bien que la densité soit plus grande dans le sud de la province (Gauthier & Aubry, 1995).

2.1.5 Hibou des marais

En période de nidification, le hibou des marais fréquente une variété de milieux ouverts étendus, comme des milieux dunaires, des tourbières, des marais, des prairies humides, des pâturages ou la toundra arctique (Holt et Leasure, 1993). L'abondance de l'espèce est tributaire de celle des campagnols, qui fluctue grandement. Le hibou des marais peut même être absent certaines années, si ces derniers subissent une baisse démographique. L'espèce se trouve probablement dans toutes les régions du Québec en période de nidification (Todd, 1963).

2.1.6 Quiscale rouilleux

En période de reproduction, le quiscale rouilleux habite près de l'eau; il fréquente les tourbières, les marécages, les marais en bordure des forêts, les bois humides et les fourrés de grands buissons où persistent des mares d'eau. Il se retrouve aussi aux abords partiellement inondés des lacs et des étangs de castors (Godfrey, 1986, Nadeau, 1995). Contrairement aux autres quiscales, il niche généralement loin des régions habitées. Le quiscale rouilleux est commun partout au sud de la limite des arbres au Québec (Gauthier & Aubry, 1995).

3 MÉTHODOLOGIE

3.1 Préparation aux travaux de terrain

Une analyse des cartes disponibles a permis de localiser les biotopes[1] à inventorier. Les points d'écoute ont été espacés de plus de 250 m et localisés à plus de 125 m de tout écotone. Une rencontre préalable a été effectuée avec les ornithologues dans le but d'uniformiser les méthodes. L'objectif étant d'inventorier les espèces présentes dans l'écosystème et d'évaluer la densité en couples nicheurs, les points d'écoute ont été sélectionnés en fonction des biotopes présents et de l'accessibilité plutôt qu'en fonction de l'emplacement des futures infrastructures. Effectivement, les oiseaux sont rarement confinés à un site précis, mais utilisent plutôt un ou plusieurs types de biotopes répartis dans une région.

3.2 Techniques d'inventaire

3.2.1 Points d'écoute

Les inventaires des oiseaux nicheurs visent principalement les passereaux et les pics et sont effectués par points d'écoute. La technique est issue d'une combinaison de celle du dénombrement à rayon limité (DRL ; Bibby et coll. 1992) et de la technique des indices ponctuels d'abondance (IPA ; Blondel et coll. 1981). La dernière technique dicte de noter tous les oiseaux détectés pour une période de vingt minutes, indépendamment de la distance à laquelle ils se trouvent. Cette technique a l'avantage de couvrir une plus grande superficie et ainsi d'améliorer les chances de détection des espèces rares. Suite à une période d'accalmie d'environ cinq minutes, permettant aux oiseaux de se remettre du dérangement occasionné par le déplacement des observateurs, le recensement par dénombrement limité débute. Chaque point d'écoute dure 10 minutes, divisé en deux périodes de cinq minutes. Le choix d'effectuer des points d'écoute d'une durée de 10 minutes se justifie par le fait que la distance entre les points d'écoute équivalait à plus de 15 minutes de marche (Ralph et coll., 1995). Les oiseaux à l'intérieur d'un rayon de 50 m étaient distingués de ceux situés à une distance supérieure. Bien que les inventaires par points d'écoute visent essentiellement les passereaux et les pics, les observations des autres espèces d'oiseaux ont aussi été notées. La période de dénombrement des oiseaux nicheurs par points d'écoute débutait dès le lever du soleil jusqu'à environ quatre heures plus tard. Un seul observateur a effectué tous les points d'écoute en 2009, tandis que deux observateurs se sont séparés la tâche en 2008. Dans tous les cas, les observateurs travaillaient toujours seuls au moment de l'écoute. Tous les points d'écoute ont été approchés en camion, pour être ensuite atteints à pied, vu leur positionnement à l'écart de la route. En général, les conditions météorologiques ne représentaient pas une contrainte pour l'écoute à l'intérieur du rayon de 50 m. Par contre, le vent ou la pluie peuvent avoir eu une influence sur le nombre d'observations faites à l'extérieur du rayon de 50 m.

3.2.2 Visites adaptées

Visites des milieux humides

Plusieurs lacs, étangs et milieux humides sont présents dans la zone d'étude. Ces milieux ont été examinés en 2008 afin d'identifier les espèces pouvant y nicher. Au total, 35 milieux humides ont été examinés. Cette activité s'est déroulée à la suite de l'inventaire des passereaux nicheurs, soit après neuf heures. Chaque visite durait entre 5 et 10 minutes et toutes les espèces observées étaient notées. Aucune visite des milieux humides n'a eu lieu en 2009.

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[1] Un biotope correspond à un milieu physique relativement bien délimité dans l'espace et de composition végétale strictement définie. Il regroupe divers habitats spécifiques.

Examen des falaises

Des falaises ont été examinées en 2008 dans le but de vérifier la présence d'oiseaux de proie nicheurs. Elles ont été scrutées afin d'y trouver la présence de nid occupé ou non. Aucun examen des falaises n'a eu lieu en 2009.

3.3 Traitement des données

3.3.1 Points d'écoute

Le nombre de couples nicheurs a été compilé et les espèces observées sont présentées en fonction du biotope où elles ont été observées. Les couples nicheurs détectés à l'intérieur du rayon de 50 m sont ceux comptabilisés pour le calcul des oiseaux nicheurs.

3.3.2 Oiseaux détectés à l'extérieur de l'inventaire des nicheurs

Tous les oiseaux observés à l'extérieur du rayon de 50 m lors des points d'écoute des oiseaux nicheurs ont également été comptabilisés. Ces données sont incluses dans le calcul de la richesse en espèces, mais sont traitées séparément pour le reste des analyses.

3.3.3 Oiseaux observés en déplacement

Les oiseaux observés lors des déplacements entre les points d'écoute et par les biologistes des autres équipes de terrain ont également été comptabilisés et utilisées pour le calcul de la richesse en espèces.

3.3.4 Visites des milieux humides

Tous les oiseaux détectés dans les milieux humides visités ont été consignés et classés par groupe d'espèces, c'est-à-dire les oiseaux de proie, les oiseaux aquatiques et les oiseaux terrestres.

3.3.5 Richesse totale de la zone d'étude

La richesse (nombre d'espèces d'oiseaux) de la zone d'étude a été calculée à l'aide de toutes les données disponibles, incluant les données prises pendant les déplacements.

3.3.6 Statut de nicheur

La liste commentée des oiseaux du Québec de Normand David (1996) présente le statut de nicheur des espèces d'oiseaux dans les différentes zones du Québec. La zone Nord-du-Québec, incluant le site du projet DSO, fut utilisée pour vérifier le statut officiel des espèces observées lors de cet inventaire. Cette zone peut être visualisée à la figure 2.

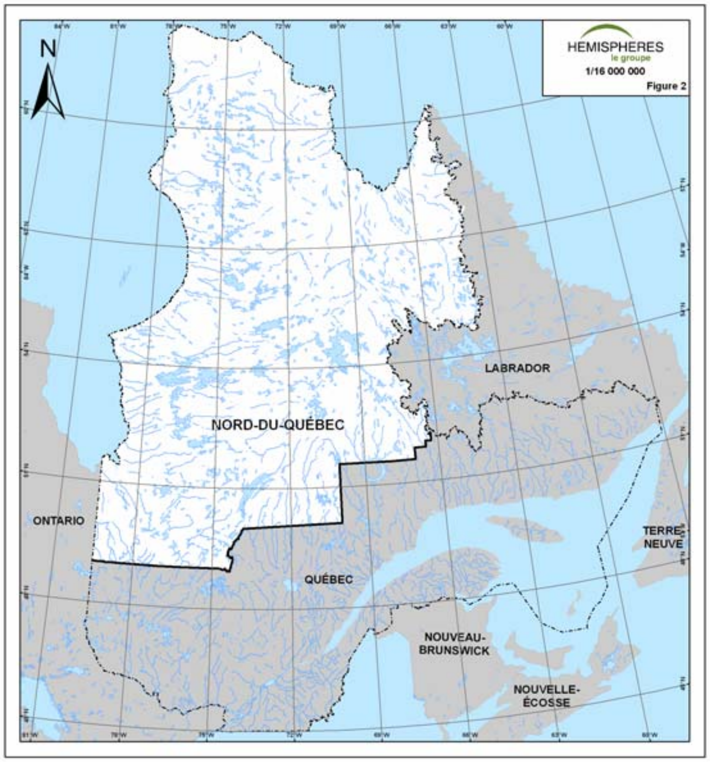

Figure 2. Délimitation de la zone Nord-du-Québec

4 RÉSULTATS ET DISCUSSION

4.1 Description générale de l'aire d'étude

L'aire d'étude est localisée au nord de la municipalité de Schefferville. Elle s'étend sur environ 40 km sur un axe nord-ouest/sud-est et elle couvre une aire de part et d'autre de la frontière Québec/Labrador et du 55^{e} parallèle englobant les unités d'évaluation 1a, 1b, 2a, 2b et 2c (figure 1). L'aire d'étude est située entre la vallée de la rivière Howells et une zone lacustre plus à l'est. L'altitude varie de 500 à 790 m, la partie nord de l'aire d'étude étant généralement plus élevée.

Dans la partie au sud du 55^{e} parallèle, la zone à l'étude est caractérisée principalement par une végétation forestière ouverte, soit la pessière à mousse ou à lichen. La plupart des sommets sont caractérisés par une végétation alpine (toundra). Quelques lacs de petite taille et des milieux humides, nommément des étangs et des fens, sont présents dans cette partie. C'est aussi dans cette partie que l'on retrouve les anciennes exploitations minières (unités d'évaluation 1a et 1b) qui comprennent de larges fosses profondes et escarpées, des haldes de stériles, des zones décapées et de nombreux chemins qui seront identifiés comme des aires dénudées plus loin dans le rapport.

La partie au nord du 55^{e} parallèle est principalement caractérisée par une végétation alpine (toundra). Les fonds de vallée sont caractérisés par la pessière à mousse ou à lichen. Le principal type de plan d'eau dans ce secteur est la mare. Elle se distingue par une faible superficie et une faible profondeur, ce qui explique que ce type de plan d'eau puisse parfois s'assécher. Cette partie englobe les unités d'évaluations 2a et 2b.

Un reportage photographique montrant les différents biotopes présents peut être consulté à l'annexe I.

4.2 Revue de la littérature

Diverses études sur les populations d'oiseaux nicheurs ont été effectuées en 2005 dans le cadre du projet minier LabMag. Ce dernier est localisé le long du bassin de la rivière Howells, située à moins de cinq kilomètres du projet DSO (figure 1).

Un inventaire des oiseaux nicheurs par points d'écoute a été réalisé par Golder Associates (2005). Cet inventaire a été réalisé dans deux biotopes, soit la taïga forestière et les milieux humides. Au total, 95 points d'inventaire de cinq minutes ont été effectués, soit 53 dans la taïga forestière et 42 dans les milieux humides. Il est à noter que la taïga forestière correspond au même habitat que la forêt de conifère mentionné dans le présent rapport. De plus, des points d'écoute ont été effectués dans des sites témoins. Certains des points témoins ont été faits autour des lacs Kivivic, qui se trouvent à l'intérieur de la zone à l'étude du projet DSO.

Un inventaire des anatidés et des oiseaux aquatiques nicheurs a aussi été réalisé dans le cadre du projet LabMag (Minaskuat Limited Partnership, 2008). L'inventaire a été effectué à la mi-mai à partir d'un hélicoptère. Cette étude a démontré que les espèces d'anatidés nichant hâtivement utilisent principalement les mares, celles-ci étant libres de glace plus rapidement que les grandes étendues d'eau. Les auteurs mentionnent d'ailleurs que l'implantation d'infrastructures à proximité des lacs serait moins nocive pour les populations d'anatidés, car les lacs ne sont que des habitats temporaires, tandis que les mares et les milieux humides servent au moment de la reproduction.

4.3 Conditions et effort d'inventaire

L'inventaire des oiseaux nicheurs a été effectué dans plusieurs biotopes, soit la toundra, la forêt de conifères et le dénudé. Les efforts ont été plus importants dans la toundra (tableau 2), puisque c'est l'habitat le plus fréquent. Effectivement plus de 50 % du territoire de l'aire à l'étude est constitué du biotope de type toundra, tandis qu'environ 40 % et 10 % sont respectivement constitués des biotopes de type forêt de conifères et dénudé. Tout de même, une emphase proportionnellement plus grande a été mise sur le biotope de type toundra, car l'inventaire de Golder Associates (2005) comprend déjà 53 points d'écoute dans le biotope de type forêt de conifères (taïga forestière) et plusieurs de ces stations sont limitrophes, voire superposées avec l'aire de la présente étude.

4.3.1 Effort d'inventaire en 2008

Cinquante (50) stations d'écoute ont été visitées entre le 11 et le 16 juillet 2008 (stations 01 à 46), pour un effort total de 500 minutes. L'emplacement des stations peut être visualisé sur les figures 2 et 3. Sur ces figures, les numéros de station précédés d'un «M» montrent l'emplacement des milieux humides visités, ceux précédés d'un «F» montre l'emplacement des falaises scrutées et ceux suivis d'un «A» sont des stations qui ont été déplacées sur le terrain pour mieux représenter le biotope à l'étude.

Les conditions d'inventaire ont été qualifiées de moyennes à excellentes. Le vent étant le facteur ayant le plus d'influence sur l'écoute. Il était habituellement continu, mais certaines journées ont été caractérisées par des rafales de 4 ou 5 sur l'échelle de Beaufort (20 à 38 km/h). Toutefois, le vent n'était jamais assez fort pour compromettre l'inventaire à l'intérieur du rayon de 50 m. Aucune précipitation n'a été enregistrée durant l'inventaire. Des températures de 8 à 16°C ont été consignées durant les points d'écoute.

4.3.2 Effort d'inventaire en 2009

Trente-trois (33) stations d'écoute ont été visitées entre le 10 et le 15 juillet 2009 (stations 50 à 86), pour un effort total de 330 minutes. L'emplacement des stations peut être visualisé sur les figures 2 et 3.

Les conditions d'inventaire ont été qualifiées de mauvaises à excellentes, mais dans la majorité des cas les conditions étaient de moyennes à bonnes pendant l'écoute. Le ciel était généralement couvert et plusieurs stations ont fait l'objet d'un dénombrement des oiseaux dans le brouillard. Cependant, l'échantillonnage étant basé sur le chant des oiseaux, cela n'a pas eu d'influence sur les données recueillies. Aucune précipitation n'a été enregistrée durant les points d'écoute. Le vent se classait généralement de force 3 ou 4 sur l'échelle de Beaufort et ne présentait pas un problème pour l'écoute. Enfin, la température, pendant les dénombrements, a varié de 6,7 à 18,0°C, mais était généralement de 11 à 14°C

Tableau 2. Effort d'échantillonnage des oiseaux nicheurs par biotopes en 2008 et 2009

Habitat	Dénudé (2008)	Toundra		Forêt		Total
		2008	2009	2008	2009	
Nombre de points d'écoute	13	32	25	5	8	**83**
Temps d'écoute (minutes)	130	320	250	50	80	**830**
Nom des stations	01; 02; 05; 06B; 07; 08; 09; 10; 11; 12; 13; 14; 15	06; 16; 17; 18; 19; 20; 21; 22; 23; 24; 25; 26; 27; 28; 29; 30 ; 31; 32; 33; 34; 35; 36; 37; 38; 39; 40; 41; 42; 43; 44; 45; 46	63; 52; 53; 54; 55; 56; 57; 60; 61; 62; 64; 65; 66; 67; 68; 69; 70; 71; 72A; 73A; 74A; 77; 78; 84; 83; 80	03; 04; 16; 26; 27	50; 51; 75; 76; 79; 85; 86	

4.4 Généralités sur l'avifaune

La richesse totale de l'aire d'étude est de 52 espèces d'oiseaux (annexe II). Quatre espèces d'oiseaux de proie, 13 espèces d'oiseaux aquatiques et 35 espèces d'oiseaux terrestres ont été détectées. Il est à noter que les identifications faites seulement au genre ne sont pas comptabilisées dans le nombre d'espèces. Toutes les espèces d'oiseaux identifiées ont un statut de nicheur confirmé, probable ou possible[2] dans le Nord-du-Québec hormis le pluvier argenté qui est un migrateur de passage selon David (1996).

4.5 Indices de présence des espèces aviaires à statut précaire

Une espèce à statut précaire, soit un quiscale rouilleux, a été observée à l'extérieur du rayon de 50 m lors de l'inventaire des oiseaux nicheurs. D'autres quiscales rouilleux et un aigle royal ont également été formellement identifiés lors d'autres inventaires de terrain ou lors du déplacement des ornithologues (voir section 4.5.1 et 4.5.6). Ces observations sont présentées aux figures 2 et 3. Aucune autre espèce aviaire à statut précaire n'a été observée, mais le potentiel de l'habitat de celle-ci est tout de même analysé dans cette section.

4.5.1 Aigle royal

L'aigle royal ne semble pas nicher dans la zone d'étude. Les falaises étudiées en 2008 ne supportaient aucun nid. Un individu a été observé à deux reprises dans les environs du camp Goodwood (Québec, nord du 55^{e} parallèle) le 3 septembre 2009 par l'équipe de compensation de l'habitat du poisson. Cet oiseau de proie tend habituellement à éviter les secteurs où il y a des activités humaines, ce qui est le cas d'une partie de la zone d'étude, soit dans les zones qui ont connu l'exploitation minière, car les chemins connaissent un certain va-et-vient aujourd'hui. Toutefois, l'espèce niche dans la région, soit à moins de 100 km (SOS-POP, 2008) de la zone d'étude et il est probable qu'un ou des individus viennent à l'occasion y chasser, notamment dans le secteur nord, en raison de la superficie importante en biotopes ouverts. C'est probablement le cas de l'individu observé dans la zone à l'étude.

4.5.2 Arlequin plongeur

Aucun arlequin plongeur n'a été observé dans l'aire à l'étude. D'ailleurs, il n'y a aucun cours d'eau d'ordre ≥ 4 avec rapides dans la zone à l'étude. Il est donc peu probable que l'arlequin plongeur s'y reproduise. Toutefois, il est possible qu'à l'occasion des individus de cette espèce fassent une halte migratoire sur des plans d'eau de la zone à l'étude lors de leur périple entre leur lieu de reproduction et leur aire de mue ou d'hivernage, car la zone à l'étude est située entre ceux-ci (Morneau et coll., 2008; Robert, 1995)).

4.5.3 Faucon pèlerin de la sous-espèce anatum

Aucun faucon pèlerin n'a été repéré dans l'aire à l'étude. Il ne niche probablement pas dans la zone à l'étude pour les mêmes raisons que l'aigle royal. De plus, aucun nid de cette espèce n'a encore été découvert entre le Saguenay et le secteur de la baie d'Ungava, hormis les côtes de la baie d'Hudson (SOS-POP, 2008). Il faut aussi mentionner que l'espèce habite généralement dans le Nord, les vallées des grandes rivières ou la côte et non les crêtes qui caractérisent la zone à l'étude (Bird, 1997). Mentionnons également que les falaises correspondent davantage à des escarpements, car elles n'offrent pas de parois verticales avec surplomb, la roche en place étant trop friable. Pour ces raisons, ces falaises situées autour des grandes fosses minières ou en milieu naturel ne pourraient pas satisfaire cette espèce.

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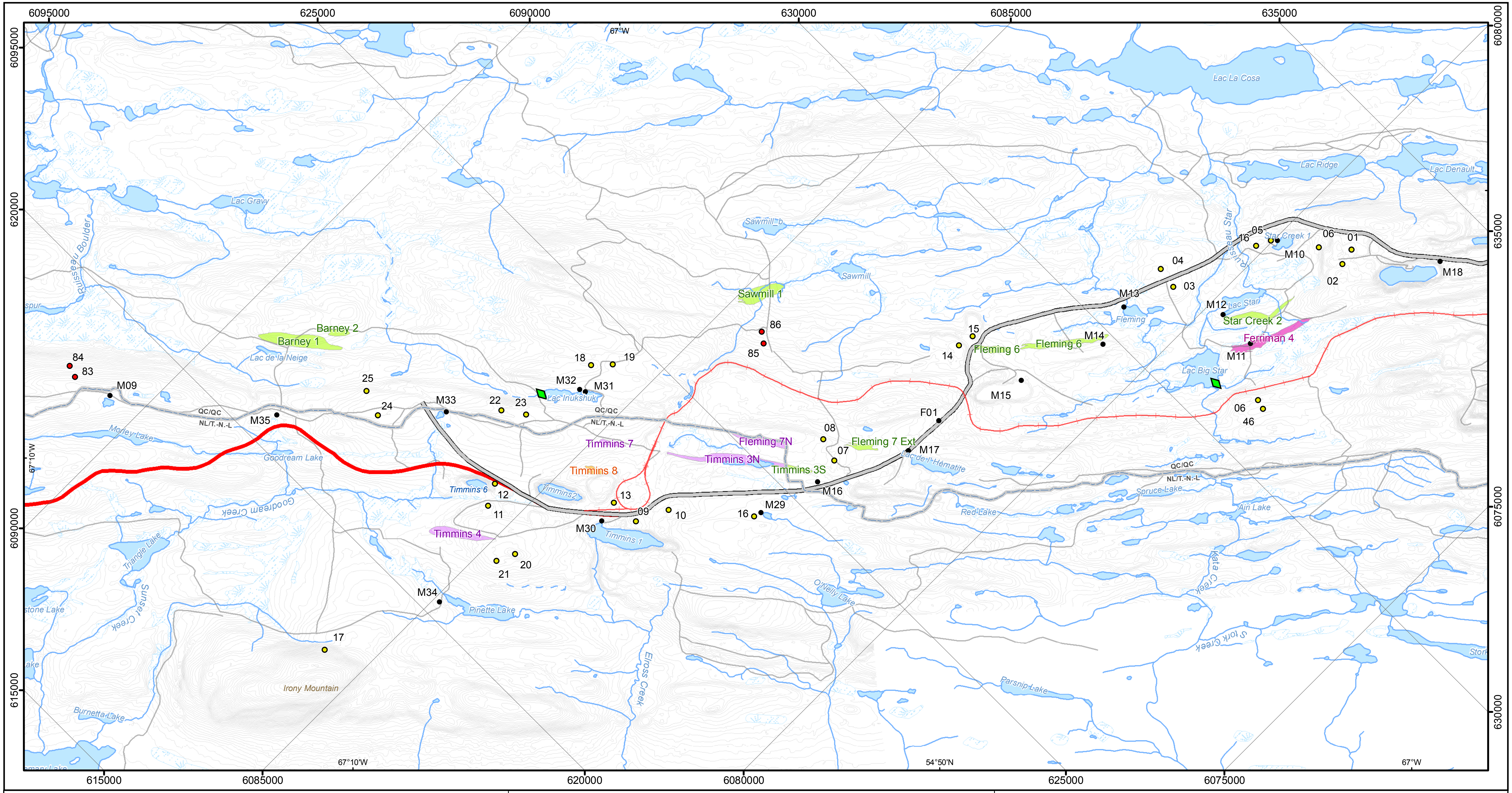
[2] Cette terminologie est celle utilisée par l'Atlas des oiseaux nicheurs du Québec (Gauthier et Aubry, 1995).



LEGEND/LÉGENDE

- ● Listening points - 2008/ points d'écoute - 2008
- ● Listening points - 2009/ points d'écoute - 2009
- ● Adapted visit/ visite adaptée

Species with status/espèces à statut

- ◆ Rusty blackbird/ quiscale rouilleux
- ◆ Golden eagle/ aigle royal

- Border/frontière
- Projected railway/ voie ferrée projetée
- Main Access Road/ route d'accès principale
- Road to be constructed (NL)/ route à contruire (T.-N.-L.)
- Road/route
- Contour Interval/courbe de niveau

- Watercourse/cours d'eau
- Intermittent watercourse/ cours d'eau intermittent
- Torrential channel/ chenal torrentiel
- Disappearing watercourse/ cours d'eau disparaissant
- Artesian spring/ source jaillissante
- Waterbody/ plan d'eau
- Disappearing pond/ étang disparaissant
- Wetland/ millieu humide

Assessment groups/ unités d'évaluation

- 🟪 1a
- 🟪 1b
- 🟧 2b
- 🟩 2c

*Hydronyms are oriented along the direction of water flow
*Les hydronymes sont orientés selon le sens d'écoulement de l'eau

Location of survey points - 2008 and 2009

Localisation des points d'inventaire - 2008 et 2009

0 1 2 3 4
Kilometers/Kilomètres

SCALE/ÉCHELLE:
1:55 000

UTM 19N NAD 83

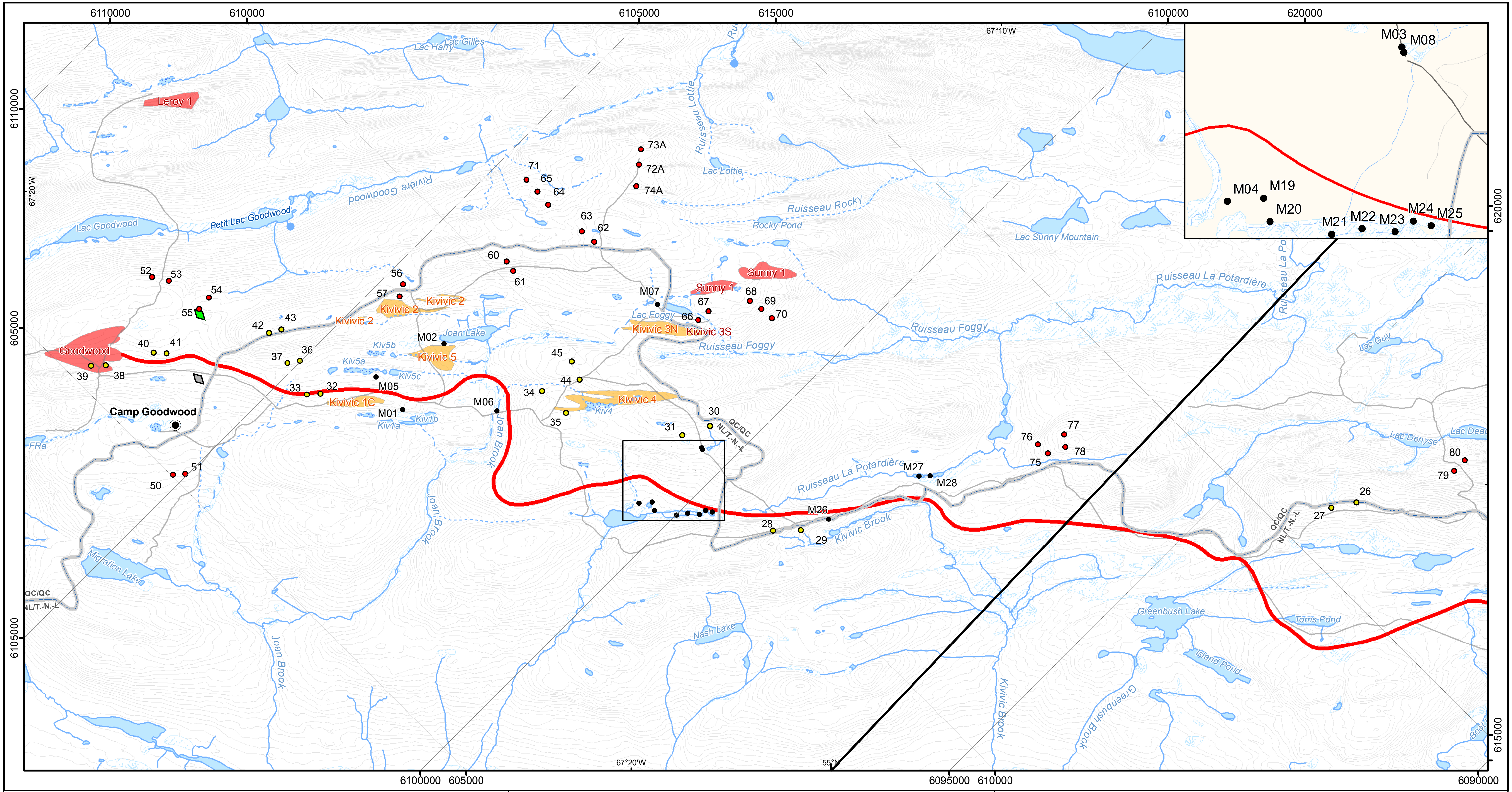
FILE, VERSION, DATE, AUTHOR/FICHIER, VERSION, DATE, AUTEUR:
GH-0088-00, 2009-12-21, A.A.

Sources:
Gov. of Canada, NTDB, 1:50,000, 1979
Gov. of NL and gov. of QC, Boundary used for claims
New Millennium Capital Corp., Mining sites and roads
Groupe Hémisphères, Hydrology update, 2009

Gouv. du Canada, BNDT, 1/50 000, 1979
Gouv. de T-N-L et gouv. du QC, frontière utilisée pour les titres miniers
New Millennium Capital Corp., gisements et routes
Groupe Hémisphères, mise à jour de l'hydrologie, 2009

HEMISPHERES
le groupe

Figure 3



LEGEND/LÉGENDE

🟡 Listening points - 2008/ points d'écoute - 2008
🔴 Listening points - 2009/ points d'écoute - 2009
● Adapted visit/ visite adaptée

Species with status/espèces à statut

◆ Rusty blackbird/ quiscale rouilleux
◆ Golden eagle/ aigle royal

Border/frontière
Main Access Road/ route d'accès principale
Road to be constructed (NL)/ route à contruire (T.-N.-L.)
Road/route
Contour Interval/courbe de niveau
55th parallel/ 55e parallèle
◉ **Camp Goodwood**

Watercourse/cours d'eau
Intermittent watercourse/ cours d'eau intermittent
Torrential channel/ chenal torrentiel
Disappearing watercourse/ cours d'eau disparaissant
Artesian spring/ source jaillissante
Waterbody/ plan d'eau
Disappearing pond/ étang disparaissant
Wetland/ millieu humide

Assessment groups/ unités d'évaluation

🟥 2a
🟧 2b

***Hydronyms are oriented along the direction of water flow**
***Les hydronymes sont orientés selon le sens d'écoulement de l'eau**

Location of survey points - 2008 and 2009

Localisation des points d'inventaire - 2008 et 2009

0 1 2 3 4
Kilometers/Kilomètres

SCALE/ÉCHELLE:
1:50 000

UTM 19N NAD 83

FILE, VERSION, DATE, AUTHOR/FICHIER, VERSION, DATE, AUTEUR:
GH-0088-00, 2009-12-21, A.A.

Sources:
Gov. of Canada, NTDB, 1:50,000, 1979
Gov. of NL and gov. of QC, Boundary used for claims
New Millennium Capital Corp., Mining sites and roads
Groupe Hémisphères, Hydrology update, 2009

Gouv. du Canada, BNDT, 1/50 000, 1979
Gouv. de T-N-L et gouv. du QC, frontière utilisée pour les titres miniers
New Millennium Capital Corp., gisements et routes
Groupe Hémisphères, mise à jour de l'hydrologie, 2009

HEMISPHERES
le groupe

Figure 4

4.5.4 Pygargue à tête blanche

Aucun pygargue à tête blanche n'a été repéré dans l'aire à l'étude. D'ailleurs, il ne niche certainement pas dans la zone à l'étude, car il n'y a aucun grand plan d'eau, aucune rivière et les arbres propices à sa nidification sont rares.

4.5.5 Hibou des marais

Aucun hibou des marais n'a été observé dans la zone à l'étude. Les recherches ont eu lieu le jour alors que l'espèce est crépusculaire et pas toujours facile à repérer. De plus, elle n'est présente que lors des années où l'abondance des campagnols est moyenne ou élevée. Enfin, notons la présence de grandes superficies de biotopes propices, en l'occurrence la toundra du secteur nord. Il n'est donc pas impossible que le hibou des marais se reproduise dans la zone à l'étude, du moins certaines années.

4.5.6 Quiscale rouilleux

Comme mentionné précédemment, un quiscale rouilleux a été observé le 18 juillet 2008 à proximité de la station M31, dénommée lac Inukshuk par l'équipe du milieu aquatique (Québec, sud du 55^{e} parallèle). Ce secteur est localisé à l'extérieur de la zone des travaux du projet DSO et servira de témoin à l'étude d'impact. Un mâle, une femelle et un individu juvénile ont également été observés à proximité du lac Big Star (Québec, sud du 55^{e} parallèle) par l'équipe de caractérisation des cours d'eau en 2009, confirmant la présence de couples nicheurs à l'intérieur de l'aire à l'étude. Un individu a aussi été détecté dans le secteur de Goodwood près du point d'écoute 55 (Québec, nord du 55^{e} parallèle) lors de l'inventaire des oiseaux nicheurs en 2009, mais il n'a pas été possible de confirmer s'il s'agissait d'un individu nicheur. Un autre individu avait également été observé en 2005 lors des inventaires dans le bassin de la rivière Howell (Golder Associates, 2005).

4.6 Espèces d'intérêt

Sept espèces d'intérêt, peu communes ou rares selon la liste de David (1996), ont été vues dans la zone d'étude (tableau 3). Il est cependant à noter que cette liste date de plus de 10 ans et que les aires de répartition des oiseaux sont sujettes à de rapides changements. Malheureusement, aucune liste plus récente n'est disponible à ce jour. L'appellation «peu commun» indique seulement que ces oiseaux ne présentent généralement pas une grande densité, mais la plupart ont une distribution assez générale, ce qui n'est pas le cas de la macreuse brune.

Tableau 3. Espèces d'intérêt observées dans la zone d'étude selon les statuts retrouvés dans David (1996)

Nom français	Nom latin	Statut au Québec
Bec-croisé bifascié	*Loxia leucoptera*	Nicheur résident peu commun
Bruant fauve	*Passerella iliaca*	Nicheur migrateur peu commun, hivernant inusité
Durbec des sapins	*Pinicola enucleator*	Nicheur résident peu commun
Grive à joues grises	*Catharus minimus*	Nicheur migrateur peu commun
Macreuse brune	*Melanitta fusca*	Nicheur migrateur peu commun
Mésangeai du Canada	*Perisoreus canadensis*	Nicheur résident peu commun
Pipit d'Amérique	*Anthus rubescens*	Nicheur migrateur peu commun

C’est pourquoi l’observation de plusieurs macreuses brunes soit seules soit en petits groupes allant jusqu’à dix individus dans l’aire à l’étude est particulièrement intéressante. Elles ont essentiellement été observées sur des petits plans d’eau peu profonds à proximité de Schefferville. Bien que ces plans d’eau soient propices à la reproduction de l’espèce (Benoit *et al.* 1993b), le statut de nicheur ne peut être confirmé pour l’aire d’étude. De plus, les dates d’inventaires (11 au 16 juillet) n’étaient probablement pas appropriées à l’observation de la reproduction à cette latitude. Tout de même, une couvée a été observée près de la rivière Caniapiscau (GREBE, 1992) à environ 100 km à l’ouest de l’aire d’étude. Ceci suggère que la nidification de l’espèce n’y est pas impossible, bien qu’elle n’ait jamais été répertoriée à ce jour. Effectivement, il est plutôt rare d’en observer autant aussi loin de l’aire de concentration, localisée sur la côte nord de la Baie James (Gauthier & Aubry, 1995). C’est pourquoi ces observations sont d’un intérêt particulier.

4.7 Oiseaux aquatiques

Un total de 13 espèces d’oiseaux aquatiques ont été observées sur l’aire à l’étude, incluant toutes les méthodes d’observations. Onze de ces espèces fréquentaient les milieux humides de l’aire d’étude en 2008. Deux nouvelles espèces d’oiseau aquatique ont été observées en 2009, soit le pluvier argenté et le bécasseau minuscule. Le tableau 4 présente les espèces les plus fréquemment observées. Dans le cas du fuligule sp. (petit ou milouinan), il n’est pas possible d’identifier l’espèce, car les différences morphologiques sont trop difficiles à distinguer. La liste complète des oiseaux aquatiques détectés dans les milieux humides est présentée à l’annexe III.

Tableau 4. Principales espèces d’anatidés et autres oiseaux aquatiques repérés

Espèce	Nombre d’oiseaux identifiés
Bernache du Canada	**20**
Macreuse brune	**17**
Garrot à œil d’or	**11**
Fuligule sp. (petit ou milouinan)	**10**
Pluvier argenté	**8**
Sarcelle d’hiver	**7**

4.8 Oiseaux de proie

Quatre espèces d’oiseaux de proie ont été observées, soit le balbuzard pêcheur, la buse pattue, l’aigle royal et le faucon émerillon. Le balbuzard a été observé à plusieurs endroits dans l’aire d’étude. Une buse pattue a également été repérée en vol au-dessus d’une fosse minière dans la région de Schefferville en 2008. De plus, un aigle royal et un faucon émerillon ont été observés à deux reprises dans les environs du camp Goodwood en 2009. L’examen des falaises fait en 2008 n’a pas permis de localiser de nids ou d’individus dans ces habitats.

4.9 Passereaux et autres oiseaux terrestres

Au total, 35 espèces de passereaux et autres oiseaux terrestres ont été observées. L'inventaire par points d'écoute a permis de valider des couples nicheurs appartenant à 16 espèces d'oiseaux terrestres (intérieur du rayon d'écoute de 50 m) (tableau 5). Le nombre et le nombre moyen de couples nicheurs pour chaque espèce d'oiseau terrestre y est présenté par point d'écoute dans les différents biotopes étudiés (annexe IV).

Le bruant à couronne blanche est la seule espèce nicheuse terrestre ayant été détectée dans le milieu dénudé à l'intérieur du rayon d'écoute de 50 m. C'est aussi l'espèce qui a été le plus souvent observée dans tous les biotopes, faisant d'elle une espèce manifestement dominante dans la région du point de vue de la densité de population. D'autre part, la richesse (nombre d'espèces) du biotope forêt de conifères est de loin supérieure à la richesse du biotope toundra, malgré un nombre de points d'écoute bien inférieur. Par contre, un nombre moyen semblable de couples nicheurs par point d'écoute (2,8 couples nicheurs par point d'écoute) indique une densité semblable dans la toundra et la forêt comparativement à une moyenne d'un couple nicheur par point d'écoute dans le biotope dénudé.

Tableau 5. Nombre total et nombre moyen de couples nicheurs d'oiseaux terrestres par point d'écoute observé à l'intérieur du rayon de 50 m dans les différents biotopes à l'étude en 2008 et 2009 et statut de nicheur selon David (1996)

Espèce	Statut nicheur	Dénudé (13)		Toundra (57)		Forêt de conifères (13)	
		nb.	nb. moy / pt. d'écoute	nb.	nb. moy / pt. d'écoute	nb.	nb. moy / pt. d'écoute
Alouette hausse-col	NM			18	0,11		
Bruant à couronne blanche	**NM**	**13**	**0,93**	**86**	**0,53**	**6**	**0,17**
Bruant hudsonien	NM			28	0,17	1	0,03
Bruant familier	NM					1	0,03
Bruant fauve	NM					4	0,11
Durbec des sapins	NR					1	0,03
Grive à joues grises	NM			1	0,01	3	0,08
Junco ardoisé	NM					4	0,11
Merle d'Amérique	NM			5	0,03	3	0,08
Moucherolle à ventre jaune	NM					2	0,06
Paruline à calotte noire	NM					1	0,03
Paruline à croupion jaune	NM					2	0,06
Paruline rayée	NM					3	0,08
Pipit d'Amérique	NM			16	0,10		
Roitelet à couronne rubis	NM					1	0,03
Sizerin flammé	NR			8	0,05	4	0,11

NM : nicheur migrateur dans le Nord-du-Québec
NR : nicheur résident dans le Nord-du-Québec

Les 19 autres espèces d'oiseau terrestre répertoriées comprennent les espèces qui ont été détectées par point d'écoute, mais à l'extérieur du rayon de 50 m. Deux hirondelles bicolores et une paruline jaune ont également été détectées lors des visites adaptées.

Le tableau 6 présente les oiseaux terrestres qui ont été observés par d'autres méthodes que les points d'écoute, ou à l'extérieur du rayon de 50 m lors des points d'écoute. Ces espèces sont donc présentes dans l'aire à l'étude et contribuent à la richesse en oiseaux, mais le statut de nicheur des individus ne peut être confirmé par nos observations. Par contre, ce sont toutes des espèces nicheuses confirmées, probables ou possibles dans le Nord-du-Québec selon David (1996).

Tableau 6. Nombre d'oiseaux terrestres observés à l'extérieur du rayon de 50 m durant les points d'écoute, lors de l'inventaire des milieux humides et pendant les déplacements en 2008 et 2009

Espèces	Point d'écoute (>50 m)	Milieux humides	Déplacement
Lagopède des saules	1	2	4
Pic chevelu	1		
Moucherolle à ventre jaune	3		1
Alouette hausse-col	22	6	7
Mésangeai du Canada	4	1	2
Corneille d'Amérique	3		
Mésange à tête brune	1		4
Roitelet à couronne dorée	2		
Roitelet à couronne rubis	8	2	1
Grive à joues grises	8		2
Grive solitaire	4		
Merle d'Amérique	31	1	4
Pipit d'Amérique	11	1	4
Paruline à croupion jaune	1	4	6
Paruline rayée	3		3
Paruline des ruisseaux	2	4	
Paruline à calotte noire	6		
Bruant hudsonien	24	5	5
Bruant familier	5		
Bruant des prés	3	2	1
Bruant fauve	26	1	
Bruant à gorge blanche	7		2
Bruant à couronne blanche	81	25	29
Junco ardoisé	9	3	8
Quiscale rouilleux *	**1**	**1**	**3**
Durbec des sapins	2		
Bec-croisé bifascié	21		10
Sizerin flammé	28		5
Hirondelle bicolore		2	
Paruline jaune		1	
Tétras du Canada			1
Grand corbeau			7
Pie-grièche grise			2
Paruline verdâtre			1
Bruant chanteur			1

* Espèce à statut précaire

5 CONCLUSION

La richesse totale du site est de 52 espèces d'oiseaux ayant toutes un statut de nicheuse confirmée probable ou possible dans le Nord-du-Québec selon David (1996). Quatre espèces d'oiseaux de proie, 13 espèces d'oiseaux aquatiques et 35 espèces d'oiseaux terrestres ont été détectées. L'inventaire par points d'écoute a permis de détecter des couples nicheurs appartenant à 16 espèces d'oiseaux terrestres.

Aucune espèce à statut précaire n'a été détectée à l'intérieur des points d'écoute lors de cet inventaire, mais quelques quiscales rouilleux (espèce désignée préoccupante par le COSEPAC) ont été observés lors d'autres types d'inventaires ou à l'extérieur du rayon de 50 m des points d'écoute. Une famille a d'ailleurs été observée dans les environs du lac Big Star en juillet 2009, confirmant la présence de couples nicheurs. Les données existantes démontrent effectivement que son habitat de reproduction (tourbières, marécages et marais en bordure des forêts, ainsi que les boisés humides et les fourrés de grands buissons où persistent des mares d'eau (Nadeau, 1995)) est présent dans l'aire d'étude. La seule autre espèce à statut précaire observée fut l'aigle royal (espèce désignée vulnérable par le MRNF) dans la région du camp Goodwood en septembre 2009, mais celui-ci était probablement dans le secteur pour chasser et les falaises environnantes ne semblent pas propices à la nidification de l'espèce. Toutefois, l'espèce est connue pour nicher à proximité, soit à moins de 100 km (SOS-POP, 2008).

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ANNEXES

ANNEXE I

REPORTAGE PHOTOGRAPHIQUE

Biotope de type toundra, où les points d’écoute ont été réalisés

Biotope de type dénudé, où les points d’écoute ont été réalisés

Mare d’eau dans la toundra

Petit lac où une visite a été réalisée

ANNEXE II

LISTE COMPLÈTE DES ESPÈCES OBSERVÉES EN 2008 ET 2009

Liste de toutes les espèces observées - 2008 et 2009

Code de l'espèce	Nicheur (n)	Nom français	Nom anglais	Nom latin
SPAN		Anatidés sp. (canard ou oie)	Anatid (Duck or Swan)	-
BECA	n	Bernache du Canada	Canada Goose	*Branta canadensis*
SAHI	n	Sarcelle d'hiver	Green-winged Teal	*Anas crecca*
SPFU		Fuligule sp.	*Aythya sp.*	*Aythya sp.*
FUCO	n	Fuligule à collier	Ring-necked Duck	*Aythya collaris*
PEFU	n	Petit fuligule	Lesser Scaup	*Aythya affinis*
MABR	n	Macreuse brune	White-winged Scoter	*Melanitta fusca*
SPGA		Garrot sp.	Bucephala sp.	*Bucephala sp.*
GAOO	n	Garrot à œil d'or	Common Goldeneye	*Bucephala clangula*
BAPE	n	Balbuzard pêcheur	Osprey	*Pandion haliaetus*
BUPA	n	Buse pattue	Rough-legged Hawk	*Buteo lagopus*
AIRO	n ***	Aigle royal	Golden Eagle	*Aquila chrysaetos*
FAEM	n	Faucon émerillon	Merlin	*Falco columbarius*
TECA	n	Tétras du Canada	Spruce Grouse	*Falcipennis canadensis*
LASA	n	Lagopède des saules	Ruffed Grouse	*Lagopus lagopus*
PLAR		Pluvier argenté	Black-bellied Plover	*Pluvialis squatarola*
PLSE	n	Pluvier semipalmé	Semipalmated Plover	*Charadrius semipalmatus*
SPCH		Chevalier sp.	Plover	-
CHGR	n	Chevalier grivelé	Spotted Sandpiper	*Actitis macularius*
CHSO	n	Chevalier solitaire	Solitary Sandpiper	*Tringa solitaria*
BEMI	n	Bécasseau minuscule	Least Sandpiper	*Calidris minutilla*
SPGO		Goéland sp.	Gull	-
GOAR	n	Goéland argenté	Herring Gull	*Larus argentatus*
STAR	n	Sterne arctique	Arctic Tern	*Sterna paradisaea*
SPPI		Picidé sp.	Woodpecker	-
PICH	n	Pic chevelu	Hairy Woodpecker	*Picoides villosus*
SPMO		Moucherolle sp.	Flycatcher	-
MOVJ	n	Moucherolle à ventre jaune	Yellow-bellied Flycatcher	*Empidonax flaviventris*
ALHC	n	Alouette hausse-col	Horned Lark	*Eremophila alpestris*
HIBI	n	Hirondelle bicolore	Tree Swallow	*Tachycineta bicolor*
MECA	n	Mésangeai du Canada	Gray Jay	*Perisoreus canadensis*
COAM	n	Corneille d'Amérique	American Crow	*Corvus brachyrhynchos*
GRCO	n	Grand corbeau	Common Raven	*Corvus corax*
METB	n	Mésange à tête brune	Boreal Chickadee	*Poecile hudsonica*
ROCD	n	Roitelet à couronne dorée	Golden-crowned Kinglet	*Regulus satrapa*
ROCR	n	Roitelet à couronne rubis	Ruby-crowned Kinglet	*Regulus calendula*
GRJG	n	Grive à joues grises	Gray-cheeked Thrush	*Catharus minimus*
GRSO	n	Grive solitaire	Hermit Thrush	*Catharus guttatus*
MEAM	n	Merle d'Amérique	American Robin	*Turdus migratorius*
PIAM	n	Pipit d'Amérique	American Pipit	*Anthus rubescens*
PGGR	n	Pie-grièche grise	Northern Shrike	*Lanius excubitor*
PAVE	n	Paruline verdâtre	Orange-crowned Warbler	*Vermivora celata*
PAJA	n	Paruline jaune	Yellow Warbler	*Dendroica petechia*
PACJ	n	Paruline à croupion jaune	Yellow-rumped Warbler	*Dendroica coronata*
PARA	n	Paruline rayée	Blackpoll Warbler	*Dendroica striata*

Liste de toutes les espèces observées - 2008 et 2009

Code de l'espèce	Nicheur (n)	Nom français	Nom anglais	Nom latin
PARU	n	Paruline des ruisseaux	Northern Waterthrush	*Seiurus noveboracensis*
PACN	n	Paruline à calotte noire	Wilson's Warbler	*Wilsonia pusilla*
BRHU	n	Bruant hudsonien	American Tree Sparrow	*Spizella arborea*
BRFA	n	Bruant familier	Chipping Sparrow	*Spizella passerina*
BRPR	n	Bruant des prés	Savannah Sparrow	*Passerculus sandwichensis*
BRFV	n	Bruant fauve	Fox Sparrow	*Passerella iliaca*
BRCH	n	Bruant chanteur	Song Sparrow	*Melospiza melodia*
BRGB	n	Bruant à gorge blanche	White-throated Sparrow	*Zonotrichia albicollis*
BRCB	n	Bruant à couronne blanche	White-crowned Sparrow	*Zonotrichia leucophrys*
JUAR	n	Junco ardoisé	Dark-eyed Junco	*Junco hyemalis*
QURO	n ***	Quiscale rouilleux	Rusty Blackbird	*Euphagus carolinus*
DUSA	n	Durbec des sapins	Pine Grosbeak	*Pinicola enucleator*
BCBI	n	Bec-croisé bifascié	White-winged Crossbill	*Loxia leucoptera*
SIFL	n	Sizerin flammé	Common Redpoll	*Carduelis flammea*

*** : indique une espèce en péril au sens de la législation canadienne ou québécoise

n : indique une espèce nicheuse dans le Nord-du-Québec selon la liste de David (1996)

ANNEXE III

ESPÈCES OBSERVÉES DANS LES MILIEUX HUMIDES ET LORS DES DÉPLACEMENTS EN 2008 ET 2009

Espèces observées en période de nidification en 2008 et 2009

*** indique une espèce en péril au sens de la législation canadienne ou québécoise

Nombre d'oiseaux observés

Site / Inventaire	Groupe	Code et nom de l'espèce	belvédère	virée courte	virée longue	autres méthodes	total
DSO						**347**	**347**
MILIEU HUMIDE						**196**	**196**
	OISEAUX DE PROIE					**1**	**1**
		BAPE Balbuzard pêcheur				1	1
	OISEAUX AQUATIQUES					**134**	**134**
		SPAN Anatidés sp. (canard ou oie)				12	12
		BECA Bernache du Canada				20	20
		SAHI Sarcelle d'hiver				7	7
		SPFU Fuligule sp.				46	46
		FUCO Fuligule à collier				1	1
		PEFU Petit fuligule				1	1
		MABR Macreuse brune				17	17
		SPGA Garrot sp.				2	2
		GAOO Garrot à œil d'or				13	13
		SPCH Chevalier sp.				2	2
		CHGR Chevalier grivelé				4	4
		CHSO Chevalier solitaire				2	2
		SPGO Goéland sp.				1	1
		GOAR Goéland argenté				5	5
		STAR Sterne arctique				1	1
	OISEAUX TERRESTRES					**61**	**61**
		LASA Lagopède des saules				2	2
		ALHC Alouette hausse-col				6	6
		HIBI Hirondelle bicolore				2	2
		MECA Mésangeai du Canada				1	1
		ROCR Roitelet à couronne rubis				2	2
		MEAM Merle d'Amérique				1	1
		PIAM Pipit d'Amérique				1	1
		PAJA Paruline jaune				1	1
		PACJ Paruline à croupion jaune				4	4
		PARU Paruline des ruisseaux				4	4
		BRHU Bruant hudsonien				5	5
		BRPR Bruant des prés				2	2
		BRFV Bruant fauve				1	1
		BRCB Bruant à couronne blanche				25	25
		JUAR Junco ardoisé				3	3
		*** QURO Quiscale rouilleux				1	1
DÉPLACEMENT						**151**	**151**
	OISEAUX DE PROIE					**4**	**4**
		BUPA Buse pattue				1	1
		*** AIRO Aigle royal				1	1
		FAEM Faucon émerillon				2	2

Espèces observées en période de nidification en 2008 et 2009

*** indique une espèce en péril au sens de la législation canadienne ou québécoise

Site / Inventaire	Groupe	Code et nom de l'espèce		Nombre d'oiseaux observés				
				belvédère	**virée courte**	**virée longue**	**autres méthodes**	**total**
	OISEAUX AQUATIQUES						**26**	**26**
		SAHI	Sarcelle d’hiver				1	1
		MABR	Macreuse brune				11	11
		PLAR	Pluvier argenté				8	8
		PLSE	Pluvier semipalmé				3	3
		BEMI	Bécasseau minuscule				1	1
		GOAR	Goéland argenté				2	2
	OISEAUX TERRESTRES						**121**	**121**
		TECA	Tétras du Canada				1	1
		LASA	Lagopède des saules				4	4
		SPPI	Picidé sp.				3	3
		SPMO	Moucherolle sp.				5	5
		MOVJ	Moucherolle à ventre jaune				1	1
		ALHC	Alouette hausse-col				7	7
		MECA	Mésangeai du Canada				2	2
		GRCO	Grand corbeau				7	7
		METB	Mésange à tête brune				4	4
		ROCR	Roitelet à couronne rubis				1	1
		GRJG	Grive à joues grises				2	2
		MEAM	Merle d’Amérique				4	4
		PIAM	Pipit d’Amérique				4	4
		PGGR	Pie-grièche grise				2	2
		PAVE	Paruline verdâtre				1	1
		PACJ	Paruline à croupion jaune				6	6
		PARA	Paruline rayée				3	3
		BRHU	Bruant hudsonien				5	5
		BRPR	Bruant des prés				1	1
		BRCH	Bruant chanteur				1	1
		BRGB	Bruant à gorge blanche				2	2
		BRCB	Bruant à couronne blanche				29	29
		JUAR	Junco ardoisé				8	8
		*** QURO	Quiscale rouilleux				3	3
		BCBI	Bec-croisé bifascié				10	10
		SIFL	Sizerin flammé				5	5

ANNEXE IV

ESPÈCES OBSERVÉES À L'INTÉRIEUR DU RAYON DE 50 M PENDANT LES POINTS D'ÉCOUTE SELON LE BIOTOPE EN 2008 ET 2009

Espèces observées pendant les points d'écoute selon le biotope en 2008 et 2009

*** indique une espèce en péril au sens de la Loi canadienne ou québécoise

Site	Habitat	Code et nom de l'espèce		Nb. de couples nicheurs à l'intérieur du rayon de 50 m	
DSO					**212**
	DÉNUDÉ				14
		PLSE	Pluvier semipalmé	1	
		BRCB	Bruant à couronne blanche	13	
	FORÊT CONIFÈRE				36
		MOVJ	Moucherolle à ventre jaune	2	
		ROCR	Roitelet à couronne rubis	1	
		GRJG	Grive à joues grises	3	
		MEAM	Merle d'Amérique	3	
		PACJ	Paruline à croupion jaune	2	
		PARA	Paruline rayée	3	
		PACN	Paruline à calotte noire	1	
		BRHU	Bruant hudsonien	1	
		BRFA	Bruant familier	1	
		BRFV	Bruant fauve	4	
		BRCB	Bruant à couronne blanche	6	
		JUAR	Junco ardoisé	4	
		DUSA	Durbec des sapins	1	
		SIFL	Sizerin flammé	4	
	TOUNDRA				162
		ALHC	Alouette hausse-col	18	
		GRJG	Grive à joues grises	1	
		MEAM	Merle d'Amérique	5	
		PIAM	Pipit d'Amérique	16	
		BRHU	Bruant hudsonien	28	
		BRCB	Bruant à couronne blanche	86	
		SIFL	Sizerin flammé	8	

New Millennium Capital Corporation

Reconnaissance de l'habitat du poisson le long de deux tracés hypothétiques de la route principale d'accès entre les secteurs DSO3 et DSO4, projet DSO

Rapport technique final

Décembre 2009

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Illustrations de la couverture :

Avant-plan, vue aval de la station AR-G03-2

Arrière-plan, vue aval de la station AR-JO2

Recyclable et fait de papier recyclé à 55 %

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^{0}C	Celsius
µg/L	Microgramme par litre
µmhos/cm	Micromhos par centimètre
cm	Centimètre
cm/s	Centimètre par seconde
DDPH	Concerne la « destruction, la détérioration et la perturbation des habitats » du poisson
GHI	Groupe Hémisphères Inc.
IOC	Iron Ore Company of Canada
km	Kilomètre
m	Mètre
m/s	Mètre par seconde

MPO	Pêches et Océans Canada
NML	New Millennium Capital Corp.
NTU	Unité standard de mesure de la turbidité
pH	Potentiel hydrogène

GLOSSAIRE

Chenal Torrentiel :	Partie d'un torrent à pente forte et à écoulement sporadique (Brochu et Michel, 1994) généralement associé à la fonte des neiges dans le Grand Nord.
Cours d'eau intermittent :	Cours d'eau à écoulement des eaux linéairement intermittentes, parfois en partie souterrain, permettant l'écoulement de l'eau en milieu terrestre (RNC, 2009).
Cours d'eau permanent :	Cours d'eau à écoulement pérenne (RNC, 2009)

1 INTRODUCTION

1.1 Mise en contexte

Le prix du minerai de fer a augmenté considérablement depuis 2002, rendant profitable l'exploitation de la chaîne ferrifère Millennium, localisée dans la région de Schefferville. Le projet Direct Shipping Ore, ou DSO, est l'un des trois projets de la compagnie New Millennium Capital Corp. (NML). Il s'agit d'un projet d'exploitation de minerai de fer à enfournement direct. La phase 1 du projet DSO, ci-après nommé le « projet », prévoit l'exploitation de quelques gisements situés au sud du 55^{ième} parallèle, au Québec et au Labrador respectivement (unités d'évaluation 1b et 1a). La phase 2 concerne d'autres gisements au nord du 55^{ième} parallèle, de part et d'autre de la frontière Québec/Labrador (unités d'évaluation 2a et 2b), ainsi qu'au sud du 55^{ième} parallèle, côté Québec (unité d'évaluation 2c). Les gisements de la phase 1 ont déjà été partiellement exploités par Iron Ore Company of Canada (IOC), leur environnement biophysique étant ainsi passablement perturbé. Les autres sites sont pour leur part plus intègres et naturels, des chemins de terre offrent actuellement un accès à des véhicules tout-terrain. La phase 2 du projet requiert l'utilisation de machineries lourdes, nécessitant la construction d'une nouvelle route d'accès entre les secteurs DSO3 et DSO4 plus large et à dénivelé minimum.

1.2 Mandat et objectifs

Les modifications physiques du milieu riverain représentent une source de pression contribuant à la dégradation de l'habitat des communautés de poisson (Smokorowski et Pratt, 2007). Smokorowski et Pratt (2007) proposent un lien direct entre l'habitat et l'abondance ou la biomasse des poissons. Selon le MPO (2008a), il est important de protéger l'habitat qui offre aux poissons une eau saine, un lieu de fraie et d'alevinage, un approvisionnement adéquat en nourriture et des voies de migration dégagées. Selon le MPO (2008b) l'omble de fontaine (*Salvelinus fontinalis*) est très répandu au Labrador, rendant ainsi essentiel la caractérisation de son habitat. Selon MPO Canada (2008a), l'habitat du poisson est identifié comme étant les endroits qui répondent aux besoins de l'espèce en matière de nourriture, d'abri, de reproduction et de mouvement. C'est dans ce contexte qu'a été réalisée une étude de caractérisation de l'habitat du poisson des cours d'eau qui seront potentiellement traversés par la future route.

La reconnaissance de l'habitat du poisson a été effectuée par le Groupe Hémisphères (GHI) le long de deux tracés potentiels, l'un majoritairement localisé au Québec et l'autre majoritairement au Labrador. La future route d'accès doit relier le complexe de traitement du minerai localisé dans la phase 1 (secteur DSO3) aux gisements de la phase 2 (secteur DSO4). Les deux tracés sont de longueur similaire, soit d'environ 35 km chacun.

2 MÉTHODOLOGIE

2.1 Échantillonnage des cours d'eau

Les cartes fédérales à l'échelle 1/50 000 indiquent 28 traverses possibles de cours d'eau le long du tracé de la route localisée majoritairement au Québec, et 19 le long du tracé du Labrador. L'objectif premier de cette étude était de valider la présence des cours d'eau qui pourraient potentiellement être traversés par la future route. Dans l'affirmative, une description visant à déterminer la qualité de l'habitat du poisson a été effectuée 30 m en aval et en amont de chaque point de traverse, le tout formant une station d'échantillonnage. Ces stations sont présentées aux figures 1 et 2.

Les cours d'eau ont été échantillonnés de la manière suivante : un appareil de positionnement GPS à 12 canaux, avec fonction WAAS activée, a servi à localiser la station et les points d'échantillonnage. La nature du substrat et les conditions hydrologiques ont été notées lors de la reconnaissance de l'habitat du poisson (voir la feuille de terrain, annexe I). Une observation visuelle de la présence de poisson a également été réalisée.

2.2 Calendrier des travaux de reconnaissance

La photo-interprétation des cartes de la région a permis d'identifier les emplacements de cours d'eau potentiels qui pourraient être traversés par les futures routes d'accès. Cette étape, prise en charge par Julie Tremblay, a eu lieu au printemps 2009.

En deuxième lieu, Marie-Ève Dion, Dan Hilaire Ambroise et Simon Barrette ont réalisé la reconnaissance de l'habitat du poisson sur le terrain pour le tracé du Québec entre le 27 juillet et le 4 août 2009. La reconnaissance pour le tracé du Labrador s'est poursuivie du 2 au 7 septembre 2009 par Simon Barrette, Peter-Paul Mameanskum et Dan Hilaire Ambroise.

2.3 Reconnaissance de l'habitat du poisson et des usages

La méthodologie est similaire à celle utilisée par GHI en 2008 lors de la reconnaissance de l'habitat du poisson le long du tracé de la voie ferrée à reconstruire et du chemin d'accès existant entre Schefferville et le secteur DSO3 (Groupe Hémisphères, 2008), ainsi que de l'inventaire des traversées de cours d'eau pour le projet LabMag en 2005 (AMEC Earth & Environmental, December 2005). Cette méthodologie est basée sur le *Standard Methods Guide for Freshwater Fish and Fish Habitat Survey in Newfoundland and Labrador: Rivers and Streams* (Sooley *et al*., 1998). Ce guide a été produit par des biologistes de Pêches et Océans Canada (MPO) afin de permettre une classification des habitats aquatiques dans l'optique d'évaluer la destruction, la détérioration et la perturbation des habitats (DDPH) pouvant être engendrées par des projets de développement.

Il est important de mentionner que toute discussion concernant le poisson dans ce rapport concerne principalement l'habitat de l'omble de fontaine parce que *a priori*, cette espèce est la plus abondante de la région, notamment dans les cours d'eau en plus haute altitude. De plus, c'est une espèce qui possède une valeur économique importante. La section 3 présente une fiche descriptive de l'omble de fontaine et de son habitat.

La reconnaissance de l'habitat du poisson consiste à évaluer le rayon hydraulique du cours d'eau par la mesure de sa largeur et de la profondeur moyenne, la composition et la qualité du substrat, la végétation du littoral et des rives (type et recouvrement), de même que son intégrité. Les distances ont été mesurées à l'aide d'un ruban de 30 m, alors qu'un clinomètre Suunto a permis d'évaluer les pentes de tronçons.

L'annexe II décrit les faciès d'écoulement utilisés pour cette étude, faciès en grande partie conforme à Malavoi (1989). En résumé, les cours d'eau se divisent en sept faciès d'écoulement : bassin, glisse, fosse/radiers, radier, rapide, cascade et chute.

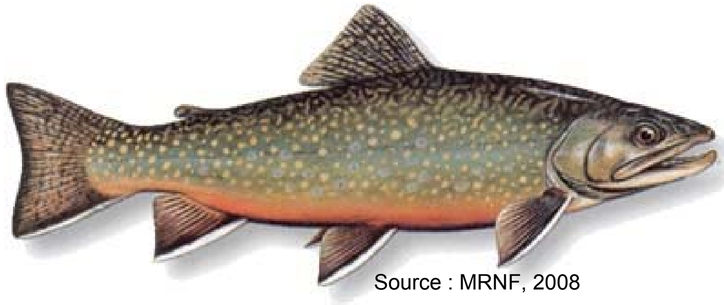
Finalement, des données physico-chimiques de base ont été prises durant ce relevé, soit la température de l'eau (°C), la conductivité (µS/cm) et le pH (unité) à l'aide de sondes Hanna. De l'eau était également prélevée afin de mesurer dans les 24 heures la turbidité (NTU) à l'aide d'un turbidimètre (Marque *LaMotte*, modèle 2020e).

3 BIOLOGIE DE L'OMBLE DE FONTAINE

OMBLE DE FONTAINE / BROOK TROUT

Salvelinus fontinalis

DESCRIPTION DE L'ESPÈCE



Source : MRNF, 2008

Morphologie : Corps allongé et fusiforme, légèrement comprimé latéralement; longueur de 20 à 30 cm (Scott and Crossman 1974; marbrures sur le dos et les nageoires dorsales et caudales; taches rouges bordées d'un halo bleu; nageoires pectorales et pelviennes bordées d'une bande blanche suivie d'une bande noire; nageoire caudale carrée ou très légèrement fourchue (MRNF, 2008)
Distribution : L'omble de fontaine est une espèce indigène de l'Amérique du Nord appartenant à la famille des salmonidés et retrouvée entre Terre-Neuve et le nord-est du Manitoba (Scott et Crossman, 1974).
Commentaires : L'omble de fontaine est un des poissons sportifs les plus populaires de l'est du Canada. Sa popularité à titre de poisson sportif a valu à l'omble de fontaine d'être introduit dans un grand nombre de régions partout dans le monde.

DESCRIPTION DE L'HABITAT DE L'ESPÈCE

L'omble de fontaine se retrouve dans les lacs et cours d'eau frais (T°≤ 20 °C). Juin et juillet sont les mois de migration précédant la fraie (fin août à décembre) (Scott et Crossman, 1974).
Reproduction : Le frai nécessite une remontée du cours d'eau afin de trouver un habitat constitué d'une eau continue, claire, fraîche et bien oxygénée (radier/glisse), aux températures froides (5 à 10 °C), au fond graveleux exempt de silt et possédant un bon couvert végétal (Grant&Lee, 2004; Raleigh 1982). Une grosseur de substrat de 3 à 8 cm de diamètre avec moins de 5 % de substrat fin est donc primordiale afin d'assurer une bonne oxygénation des interstices où sont les œufs (Therrien et Lachance, 1997).Ces caractéristiques sont généralement retrouvées dans les têtes de cours d'eau, mais se trouvent parfois à l'embouchure des lacs.
Alevinage et croissance : Les alevins se dispersent le long des rives de rivières, des bassins, ou même au milieu des cours d'eau à faible débit. Certains alevins se retrouveront dans les lacs à des profondeurs de moins de deux mètres. En général, les juvéniles demeurent dans un courant de l'ordre de 0,01 à 0,5 m/s et même parfois plus (Grant & Lee, 2004), mais à l'âge de 1-3 ans, ces derniers se déplacent généralement vers les lacs (Bradbury *et al*, 1999). Cependant, dans la partie nord de son aire de répartition, l'omble de fontaine peut passer l'été en rivière (Scott et Crossman, 1974). Une alternance de zones courantes et de zones calmes est alors importante afin de fournir des zones de repos entre les épisodes d'alimentation dans les zones à substrat et à courant moyen plus riches en proies (Therrien et Lachance, 1997).
Régime : Carnivore avec une diète très variée se composant de vers, de sangsues, d'insectes aquatiques et terrestres, d'araignées, de mollusques, de crustacés, de salamandres, de grenouilles, de petits rongeurs et de poissons (Nature Québec, 1998).

SAVOIR TRADITIONNEL AUTOCHTONE

Traduction innue de l'omble fontaine : Matamek
Les Innus reconnaissent plusieurs formes de *Matamek* ou d'omble fontaine. Elle se retrouve en abondance dans la région, plus particulièrement au lac John, à la rivière Howells, au lac Elross, à Island Pond, au lac Boot et au lac Squaw. Selon certains Innus, la population d'omble fontaine serait en augmentation. Le réchauffement planétaire qui réduit la période de gel, pourrait expliquer en partie cette hausse (Clément, 2009).

4 RÉSULTATS

4.1 Description générale du site

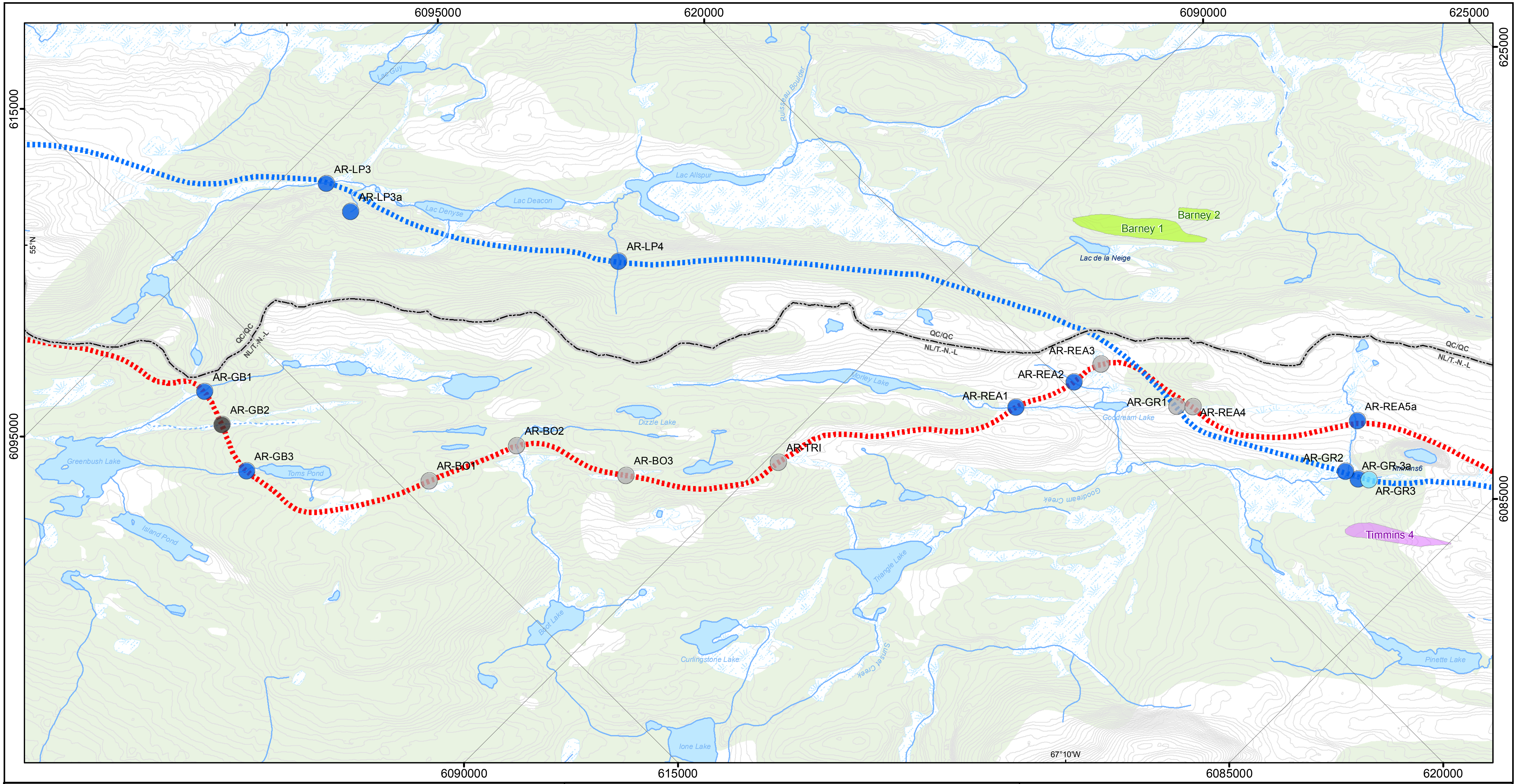
La zone d'étude est localisée au nord de la municipalité de Schefferville (figures 1 et 2). Elle s'étend sur environ 35 km sur un axe nord-ouest/sud-est. Les tracés des routes potentielles commencent aux environs de Timmins 4 et suivent la frontière Québec/Labrador jusqu'au gisement Goodwood. Le premier tracé reste du côté Labrador jusqu'aux environs du lac Goodream (ce qui représente 17% du tronçon) pour par la suite traverser la frontière et rester du côté du Québec jusqu'au gisement Goodwood (tracé du Québec). Le deuxième tracé est majoritairement localisé au Labrador (tracé du Labrador) et contient deux sections, pour un total de 11% du tronçon, situées au Québec. Pour les deux tracés, l'altitude varie de 500 à 790 m, la partie nord de la zone d'étude étant généralement plus élevée.

La majorité des traverses potentielles se trouve dans la portion nord des deux tracés et correspond en grande partie au territoire entourant les dépôts miniers de la phase 2 du projet. Cette zone est principalement caractérisée par une végétation de toundra alpine avec certaines zones plus riches dans les dépressions. Plusieurs cours d'eau intermittents sont présents et étaient déjà asséchés à la fin du mois de juillet, alors que la fonte des neiges se poursuit jusqu'à la fin de juin. Quelques lacs de petite taille et des milieux humides, dont des étangs disparaissant et des fens, sont présents dans les vallées et les dépressions. Les traverses potentielles se trouvant à mi-parcours (consulter les figures 1 et 2) sont dans une zone moins élevée et davantage forestière, mais dont le haut des crêtes est tout de même dominé par une végétation de toundra. Au sud, près du complexe de transformation du minerai, on retrouve d'anciennes exploitations minières, comprenant de larges fosses profondes et escarpées, des haldes de stériles, des zones décapées et de nombreux chemins secondaires.

4.2 Description des stations d'échantillonnage

Cette section présente les résultats ainsi que l'interprétation des données obtenues pour chaque station d'échantillonnage. Les figures 1 et 2 présentent des cartes localisant toutes les stations.

L'annexe III présente les photos de chacun des sites dans un ordre géographique, en débutant du complexe de transformation du minerai au sud et se terminant au dépôt Goodwood au nord. L'annexe IV présente le type d'écoulement et les paramètres physico-chimiques des cours d'eau. L'annexe V présente l'hydrologie des cours d'eau. L'annexe VI présente la composition du substrat à chaque station. L'annexe VII présente pour sa part la composition du couvert végétal. Finalement, les tableaux 1 et 2 présentent l'ensemble des stations d'échantillonnage et leurs coordonnées géographiques, tandis que le tableau 3 présente les habitats potentiels pour le poisson et les types d'obstacles rencontrés.



LEGEND/LÉGENDE

Fish habitat survey/
reconnaissance de l'habitat du poisson

- ● No flow /aucun écoulement
- ● Torrential flow/ écoulement torrentiel
- ● Intermittent flow/ écoulement intermittent
- ● Permanent flow/ écoulement permanent

Assessment groups/unités d'évaluation

- 🟪 1a
- 🟩 2c

- Watercourse/cours d'eau
- Intermittent watercourse/ cours d'eau intermittent
- Torrential channel/ chenal torrentiel
- Disappearing watercourse/ cours d'eau disparaissant
- Artesian spring/ source jaillissante
- Waterbody/ plan d'eau
- Disappearing pond/ étang disparaissant
- Wetland/milieu humide

- Border/frontière
- Contour interval/ courbe de niveau
- 🟩 Wooded area/ aire boisée

Proposed road/route proposée

- Quebec route/ tracé du Quebec
- Newfoundland and Labrador route/ tracé du Terre-Neuve-et-Labrador

Sampling sites for the fish habitat survey – South

Stations d'échantillonnage de la reconnaissance de l'habitat du poisson – Sud

0 0,5 1 1,5 2 2,5

Kilometers/kilomètres

SCALE/ÉCHELLE:
1:35 000

UTM 19N NAD 83

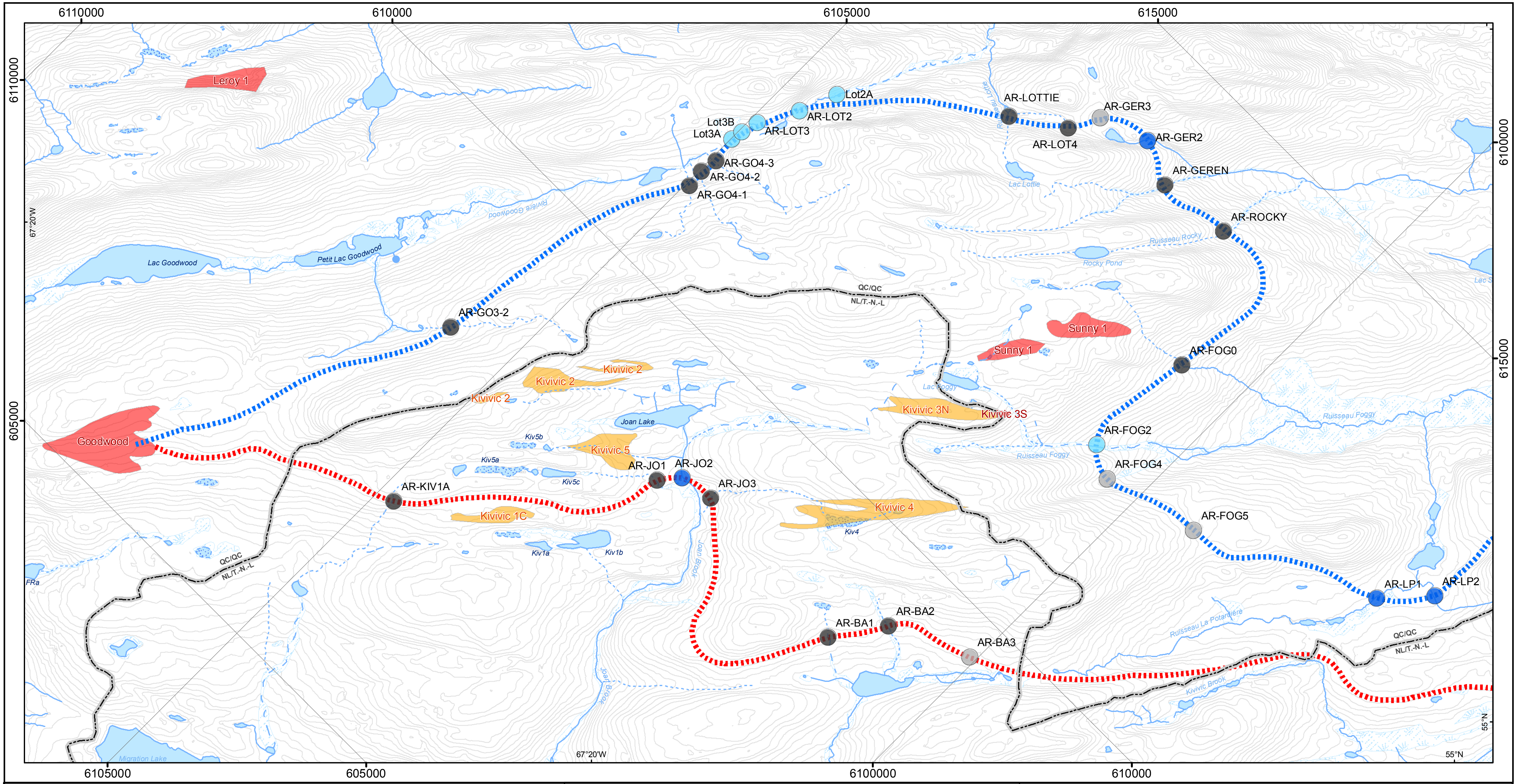
FILE, VERSION, DATE, AUTHOR/
FICHIER, VERSION, DATE, AUTEUR:
GH-0095-01, 2009-12-03, A.A.

HEMISPHERES
le groupe

SOURCES:
Government of Canada, NTDB, 1:50,000, 1979
Government of NL and government of Quebec, Boundary used for mining claims
New Millennium Capital Corp., Mining sites and roads
Groupe Hémisphères, Hydrology update, 2009

Gouvernement du Canada, BNDT, 1/50 000, 1979
Gouvernement de T-N-L et gouvernement du Québec, frontière utilisée pour les titres miniers
New Millennium Capital Corp., gisements et routes
Groupe Hémisphères, mise à jour de l'hydrologie, 2009

Figure 1



LEGEND/LÉGENDE

Fish habitat survey/ reconnaissance de l'habitat du poisson

- ● No flow /aucun écoulement
- ● Torrential flow/ écoulement torrentiel
- ● Intermittent flow/ écoulement intermittent
- ● Permanent flow/ écoulement permanent

Assessment groups/unités d'évaluation

- 🟥 2a
- 🟧 2b

- Watercourse/cours d'eau
- Intermittent watercourse/ cours d'eau intermittent
- Torrential channel/ chenal torrentiel
- Disappearing watercourse/ cours d'eau disparaissant
- Artesian spring/ source jaillissante
- Waterbody/ plan d'eau
- Disappearing pond/ étang disparaissant
- Wetland/milieu humide

- Border/frontière
- Contour interval/ courbe de niveau
- 🟩 Wooded area/ aire boisée

Proposed road/route proposée

- Quebec route/ tracé du Quebec
- Newfoundland and Labrador route/ tracé du Terre-Neuve-et-Labrador

Sampling sites for the fish habitat survey – North

Stations d'échantillonnage de la reconnaissance de l'habitat du poisson – Nord

0 0,5 1 1,5 2 2,5

Kilometers/kilomètres

SCALE/ÉCHELLE:
1:35 000

UTM 19N NAD 83

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Groupe Hémisphères, Hydrology update, 2009

Gouvernement du Canada, BNDT, 1/50 000, 1979
Gouvernement de T-N-L et gouvernement du Québec, frontière utilisée pour les titres miniers
New Millennium Capital Corp., gisements et routes
Groupe Hémisphères, mise à jour de l'hydrologie, 2009

Figure 2

4.2.1 Traverses potentielles du tracé du Québec

Le tableau 1 présente les localisations des stations d'échantillonnage pour le tracé localisé majoritairement au Québec. Une description détaillée de ces stations est présentée dans les paragraphes suivants.

Tableau 1. Coordonnées des stations d'échantillonnage pour le tracé du Québec

Station	Coordonnées (Nad 83)		Province
	Lat. (Nord)	Long. (Ouest)	
AR-GR3	54,90572	67,10716	NL
AR-GR3a	54,90643	67,10813	NL
AR-GR2	54,90762	67,10858	NL
AR-GR1	54,92149	67,11854	NL
AR-LP4	54,96338	67,15872	QC
AR-LP3	54,98542	67,17964	QC
AR-LP3a	55,00945	67,18782	QC
AR-LP2	55,01081	67,23193	QC
AR-LP1	55,01416	67,23794	QC
AR-FOG5	55,02907	67,24908	QC
AR-FOG4	55,03720	67,25226	QC
AR-FOG2	55,03979	67,24975	QC
AR-FOG0	55,03922	67,23291	QC
AR-ROCKY	55,04436	67,21480	QC
AR-GER-EN	55,05055	67,21576	QC
AR-GER2	55,05409	67,21287	QC
AR-GER3	55,05827	67,21515	QC
AR-LOT4	55,05960	67,21943	QC
AR-LOTTIE	55,06387	67,22407	QC
AR-LOT2	55,07675	67,24438	QC
AR-LOT2a	55,07542	67,23894	QC
AR-LOT3	55,07860	67,24986	QC
AR-LOT3a	55,07919	67,25412	QC
AR-LOT3b	55,07903	67,25236	QC
AR-G04-3	55,07892	67,25795	QC
AR-G04-2	55,07921	67,26049	QC
AR-G04-1	55,07909	67,26323	QC
AR-G03-2	55,08535	67,30184	QC

Aucun lit d'écoulement

Aucun lit d'écoulement n'a été repéré aux emplacements des stations AR-GR1, AR-FOG5, AR-FOG4 et AR-GER3. Aucune caractérisation n'a donc été réalisée et le potentiel en habitat pour le poisson est nul. La station AR-GER3 est localisée dans un fen herbacé et il y a résurgence d'eau à certains endroits mais aucun lit d'écoulement défini.

Chenaux torrentiels

Les stations AR-FOG0, AR-ROCKY, AR-GER-EN, AR-LOT4, AR-LOTTIE, AR-GO4-3, AR-GO4-2, AR-GO4-1 et AR-GO3-2 coïncident avec des chenaux torrentiels. Dans la zone d'étude, les chenaux torrentiels présentent un substrat généralement très grossier (voir photos, annexe III) et selon toute vraisemblance l'écoulement est associé à la fonte des neiges dans ce milieu nordique et quasi alpin. La caractérisation du substrat et de la végétation riveraine a été effectuée, mais les mesures d'hydrologie et de qualité de l'eau n'ont pu être collectées du fait de l'absence d'eau. Ces sites ne constituent donc pas des habitats pour le poisson. Toutefois, les chenaux torrentiels permettent probablement une certaine connectivité si un habitat (plan d'eau) est présent en amont, ce qui est le cas des stations AR-FOG0, AR-ROCKY et AR-LOTTIE (figure 2). En contrepartie, l'écoulement printanier engendre probablement un courant à très forte vélocité, empêchant la migration de poissons vers l'amont

Cours d'eau intermittents

Les stations AR-GR3, AR-FOG2, AR-LOT2, AR-LOT2a, AR-LOT3, AR-LOT3a et AR-LOT3b concordent avec des cours d'eau intermittents. On les reconnaît habituellement par la présence d'un lit d'écoulement dans lequel il y a quelques marres apparemment isolées qui sont vraisemblablement connectées à la suite de fortes précipitations (voir photo, annexe III). Une caractérisation complète a donc été faite lorsque le niveau d'eau le permettait, c'est-à-dire à la station AR-FOG2. Seule la caractérisation du substrat et de la végétation riveraine a été réalisée aux autres stations.

Toutes les stations observées dans les cours d'eau intermittents présentent des habitats potentiels peu probables pour le poisson, c'est-à-dire qu'elles présentent peu d'indices de présence de poissons ou que leur caractérisation ne montre pas un fort potentiel. Effectivement, le seul fait que le cours d'eau s'assèche partiellement (fluctuation du niveau d'eau supérieure à 50 % du niveau maximal) réduit considérablement la qualité de l'habitat (Therrien et Lachance, 1997; voir section 3). Cependant, la présence d'un lit d'écoulement avec de l'eau à certains endroits indique qu'il n'est pas impossible que certains poissons y vivent. Il faut mentionner que des pêches électriques ont eu lieu à environ 500 m en aval de la station AR-FOG2 au moment de la caractérisation des cours d'eau du volet milieux aquatiques en 2009 et qu'aucun poisson n'a été capturé, suggérant l'absence de poisson dans cet habitat. Par contre, du mené de lac fut observé dans le lac Foggy à environ 1 km en amont. Il n'est donc pas impossible que des menés soient emportés jusqu'au site lors de la fonte des neiges, mais leur survie reste peu probable.

Cours d'eau permanents

Des cours d'eau permanents ont été caractérisés aux stations AR-GR3a, AR-GR2, AR-LP4, AR-LP3, AR-LP3a, AR-LP2, AR-LP1 et AR-GER2. La permanence de l'écoulement assure une meilleure qualité d'habitat en fournissant un niveau d'eau minimum et une oxygénation continue tout au long de l'année.

AR-LP3 est la seule station du tracé du Québec où la présence de poissons a pu être confirmée par observation de prédation d'insectes à la surface de l'eau. Cependant, le substrat composé de particules fines à 75 % indique que l'habitat n'est pas adéquat pour la fraie, car les particules fines empêchent la circulation de l'oxygène essentielle au développement des embryons (Grant et Lee, 2004).

Comme le cours d'eau de la station AR-LP3a se déverse dans celui de la station AR-LP3, les chances que le poisson l'utilise sont bonnes (habitat potentiel probable). Cependant, le substrat étant composé à 75 % de débris organiques, la reproduction ne peut y avoir lieu. Des habitats potentiels probables ont également été observés aux stations AR-GR3a, AR-GR2 et AR-LP1. Pour ce qui est des deux premières, la qualité et le niveau de l'eau, ainsi que la végétation des rives sont les éléments qui font en sorte qu'il pourrait s'agir d'un habitat potentiel. Néanmoins, le substrat principalement organique et le faible courant en réduisent l'utilisation à l'alimentation et au repos (Therrien et Lachance, 1997). La station AR-LP1 présente un substrat variant de moyen à grossier souvent retrouvé dans les zones d'alevinage. Toutefois, une proportion de substrat fin trop élevée limite son utilisation pour la fraie.

Les stations AR-LP4, AR-LP2 et AR-GER2 présentent un habitat potentiel peu probable. Les caractéristiques de la station AR-LP4 semblent idéales, soit un faible courant sur un faciès de type radier à substrat principalement moyen et avec un recouvrement arbustif important. Une pente d'environ 30 % à 80 m en aval de la station empêche toutefois la remontée du poisson vers les lacs plus en amont et il ne semble pas y avoir d'autres plans d'eau en aval. Vu la petite taille du cours d'eau, les plans d'eau deviennent essentiels à la survie de l'espèce durant l'hiver (Scott et Crossman, 1974). Ainsi, le potentiel que ce cours d'eau soit un habitat du poisson est faible. L'eau à la station AR-LP2 est stagnante et un substrat totalement organique a été observé. L'omble de fontaine pourrait s'y reposer, mais le milieu ne répond pas aux besoins vitaux de l'espèce (Beak, 1980). De plus, le cours d'eau semble disparaître dans un fen en aval. À l'inverse, AR-GER2 présente un substrat intéressant, mais la très faible hauteur du niveau de l'eau (5 cm) s'avère très limitant (Therrien et Lachance, 1997).

4.2.2 Traverses potentielles du tracé du Labrador

Le tableau 2 présente les localisations des stations d'échantillonnage pour le tracé du Labrador. Une description détaillée de ces stations est présentée dans les paragraphes suivants.

Tableau 2. Coordonnées des stations d'échantillonnage pour le tracé du Labrador

Station	Coordonnées (Nad 83)		Province
	Lat. (Nord)	Long. (Ouest)	
AR-REA5a	54,90978	67,10217	NL
AR-REA4	54,92049	67,11698	NL
AR-REA3	54,92846	67,12160	NL
AR-REA2	54,92907	67,12612	NL
AR-REA1	54,93112	67,13460	NL
AR-TRI	54,94227	67,16390	NL
AR-BO3	54,95071	67,18038	NL
AR-BO2	54,95899	67,18815	NL
AR-BO1	54,96225	67,20051	NL
AR-GB3	54,97379	67,21761	NL
AR-GB2	54,97791	67,21518	NL
AR-GB1	54,98084	67,21347	NL
AR-BA3	55,03528	67,28465	NL
AR-BA2	55,04194	67,28947	NL
AR-BA1	55,04491	67,29667	NL
AR-JO3	55,05995	67,29380	NL
AR-JO2	55,06282	67,29455	NL
AR-JO1	55,06418	67,29727	NL
AR-Kiv1a	55,07881	67,32575	NL

Aucun lit d'écoulement

Aucun lit d'écoulement n'a été repéré aux emplacements des stations AR-REA4, AR-REA3, AR-TRI, AR-BO3, AR-BO2, AR-BO1 et AR-BA3. Aucune caractérisation n'a donc été faite et le potentiel en habitat pour le poisson est nul. Les stations AR-REA4 et AR-REA3 sont situées dans des milieux humides. Dans le premier cas, il s'agit d'un fen herbacé longitudinal formé dans une dépression naturelle du terrain. Dans le deuxième cas, il s'agit d'un fen herbacée avec présence d'eau au centre. L'eau d'un étang en amont coule dans un marécage arbustif, traverse la tourbière puis continue dans un autre marécage arbustif jusqu'au lac Goodream en aval.

Chenaux torrentiels

Les stations AR-GB2, AR-BA2, AR-BA1, AR-JO3, AR-JO1 et AR-KIV1a étaient localisées sur des chenaux torrentiels. Ces sites ne représentent pas des habitats pour le poisson, mais les chenaux torrentiels permettent probablement une certaine connectivité si un habitat intéressant (e.g. un plan d'eau) est présent en amont, ce qui est le cas des stations AR-BA1, AR-JO3 et AR-JO1 (figure 2). Cependant, l'écoulement printanier fortement turbulent et à vitesse élevée empêchera la migration des poissons vers l'amont.

Cours d'eau intermittents

Aucun cours d'eau intermittent n'a été caractérisé le long de ce tracé.

Cours d'eau permanents

Des cours d'eau permanents ont été caractérisés aux stations AR-REA5a, AR-REA2, AR-REA1, AR-GB3, AR-GB1 et AR-JO2.

AR-GB1 et AR-JO2 sont les seules stations du tracé côté Labrador où la présence de poissons a pu être confirmée. D'abord, un omble de fontaine de 25 cm a été aperçu dans le cours d'eau de la station AR-GB1. Effectivement, le substrat moyen à grossier, la profondeur (14 cm) et la vitesse du courant (0,45 m/s) en font un habitat parfait pour les adultes et probable pour la fraie. Quelques juvéniles bons nageurs pourraient également utiliser cet habitat, mais le courant est définitivement trop fort pour les alevins (Therrien et Lachance, 1997). En ce qui à trait à AR-JO2, des pêches électriques, faites par l'équipe de caractérisation des cours d'eau du volet milieux aquatiques en 2009, ont confirmé la présence de poissons dans ce cours d'eau. Ce site présente un habitat intéressant pour l'omble de fontaine avec un substrat moyen exempt de particule fine, une pente douce et une eau claire. Le courant est par contre un peu fort pour les juvéniles et les alevins (0,67 m/s), mais la présence régulière d'obstacles composés de blocs crée probablement des micro-habitats propices à la fraie, en plus de fournir des aires de repos pour les poissons en quête alimentaire (Grant et Lee 2004).

Des habitats potentiels probables ont été observés aux stations AR-REA5a et AR-REA1. À la station AR-REA5a, le substrat un peu grossier et le recouvrement de végétaux important jumelé à une eau claire occasionne un habitat d'alevinage et de croissance intéressant. Le très faible débit d'eau et la faible proportion de substrat moyen (gravier) en limite toutefois l'utilité pour la fraie (Raleigh, 1982; Scott et Crossman, 1974). Quoique colmaté, donc inadéquat pour la fraie, le lit du cours d'eau de la station AR-REA1 est exempt de végétation immergée. Jumelé à un faible courant et à un recouvrement végétal presque complet, le site devient intéressant en tant qu'abri et site d'alimentation. Malheureusement, le niveau d'eau un peu bas, dû à la séparation du lit en plusieurs bras au travers d'un marécage arbustif, en réduit l'usage pour les plus gros poissons (Therrien et Lachance, 1997).

Les deux autres stations, soit AR-REA2 et AR-GB3, présentent un habitat potentiel peu probable. Les caractéristiques de la station AR-REA2 sont plutôt mauvaises, avec 90 % de recouvrement du substrat par de la mousse et un courant nul. De plus, le cours d'eau provient d'un fen arbustif en amont. Néanmoins, la qualité de l'eau et la connectivité avec deux plans d'eau (lac Goodream en aval et lac Morley en amont) indique qu'il n'est pas impossible que certains poissons y transitent. En ce qui concerne la station AR-GB3, la qualité de l'habitat est faible malgré le bon recouvrement végétal. Effectivement, le substrat est composé à 100 % de particule fine et il y a présence d'un obstacle temporaire en amont, soit une zone marécageuse. Par contre, la présence d'un plan d'eau (Tom's Pond) à quelques centaines de mètres en amont permet possiblement le passage du poisson au-delà de l'obstacle lorsque le niveau de l'eau est plus élevé.

4.2.3 Traverses avec un potentiel d'habitat

Le tableau 3 présente les traverses avec un potentiel d'habitat pour le poisson, le degré de probabilité et les obstacles à proximité, si observés. Trois habitats confirmés ont été notés, car des individus ont été observés parcourant le cours d'eau. L'analyse des caractéristiques biophysiques indique également la présence de plusieurs habitats potentiels peu probables, c'est-à-dire d'habitats présentant peu ou pas de caractéristiques favorables à la présence de poissons. Quelques habitats potentiels probables sont aussi présents, ces habitats sont ceux présentant plusieurs caractéristiques favorables à la présence de poissons. La présence d'un site propice à la fraie à une traverse donnée en fait automatiquement un habitat potentiel probable.

Tableau 3. Traverses avec un potentiel d'habitat pour le poisson et type d'obstacle

Station	Présence de poisson	Commentaires sur l'habitat du poisson	Type d'obstacle	Description de l'obstacle
Tracé du Québec				
AR-GR3	inconnu	habitat potentiel peu probable	-	-
AR-GR3a	inconnu	habitat potentiel probable	-	-
AR-GR2	inconnu	habitat potentiel probable	-	-
AR-LP4	inconnu	habitat potentiel peu probable	permanent	pente de 30% environ 80 m en aval
AR-LP3	oui	habitat confirmé	-	-
AR-LP3a	inconnu	habitat potentiel probable	-	-
AR-LP2	inconnu	habitat potentiel peu probable	-	-
AR-LP1	inconnu	habitat potentiel peu probable	-	-
AR-FOG2	inconnu	habitat potentiel peu probable	-	-
AR-GER2	inconnu	habitat potentiel probable	-	-
AR-LOT2	inconnu	habitat potentiel peu probable	-	-
AR-LOT2a	inconnu	habitat potentiel peu probable	-	-
AR-LOT3	inconnu	habitat potentiel peu probable	-	-
AR-LOT3a	inconnu	habitat potentiel peu probable	-	-
AR-LOT3b	inconnu	habitat potentiel peu probable	-	-
Tracé du Labrador				
AR-REA5a	inconnu	habitat potentiel probable	-	-
AR-REA2	inconnu	habitat potentiel peu probable	-	-
AR-REA1	inconnu	habitat potentiel probable	-	-
AR-GB3	inconnu	habitat potentiel peu probable	temporaire	traverse une zone marécageuse sans lit d'écoulement
AR-GB1	oui	habitat confirmé	-	-
AR-JO2	oui	habitat confirmé	-	-

Habitat potentiel peu probable = peu d'indices de présence
Habitat potentiel probable = beaucoup d'indices de présence
Habitat confirmé = poissons observés ou pêchés

5 CONCLUSION

La firme New Millennium Capital Corporation a retenu les services professionnels de Groupe Hémisphères afin d'approfondir les connaissances sur l'habitat du poisson le long de deux tracés hypothétiques, soit un au Québec et un au Labrador, pour la construction de la future route d'accès reliant le complexe de transformation du minerai dans le secteur DSO3 au gisement Goodwood dans le secteur DSO4. Le but premier était de caractériser l'habitat du poisson dans les cours d'eau potentiellement traversés par la route d'accès, avec une emphase sur l'étude de l'habitat de l'omble de fontaine. La caractérisation a été effectuée sur une longueur de 60 m, soit 30 m en amont et 30 m en aval de part et d'autre du point de traverse.

Sur les 28 traverses potentielles identifiées par photo-interprétation le long du tracé du Québec, 8 étaient des cours d'eau permanents, 7 étaient des cours d'eau intermittents tandis que les autres stations ne coïncident pas avec des lits d'écoulement proprement dits. L'habitat a pu être confirmé pour une de ces stations, tandis que les autres présentaient un potentiel d'habitat peu probable ou probable. Des milieux humides ont été observés à la station AR-GER3 et près de la station AR-LP2.

Pour ce qui est du tracé du Labrador, 19 traverses potentielles ont été visitées, mais seulement 6 d'entre elles présentaient un écoulement permanent, aucune ne présentait d'écoulement intermittent tandis que les autres stations ne coïncident pas avec des lits d'écoulement proprement dits. Cependant, sur les 6 cours d'eau, 2 sont des habitats confirmés, tandis que les autres présentaient un potentiel d'habitat peu probable ou probable. Des milieux humides ont été observés aux stations AR-REA4 et AR-REA3.

Ces informations permettent de constater que le tracé du Québec a un plus grand potentiel de perturbation de l'habitat du poisson avec 15 habitats confirmés, probables ou peu probables, alors que le tracé du Labrador n'en a que 6. La présence de deux milieux humides le long des deux tracés nous amène à suggérer un réaménagement du tracé pour éviter ces milieux sensibles et pour faciliter l'implantation d'une telle infrastructure.

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ANNEXES

ANNEXE I

FEUILLE DE TERRAIN UTILISÉE POUR CARACTÉRISER L’HABITAT DU POISSON

HEMISPHERES
le groupe

HABITAT DU POISSON

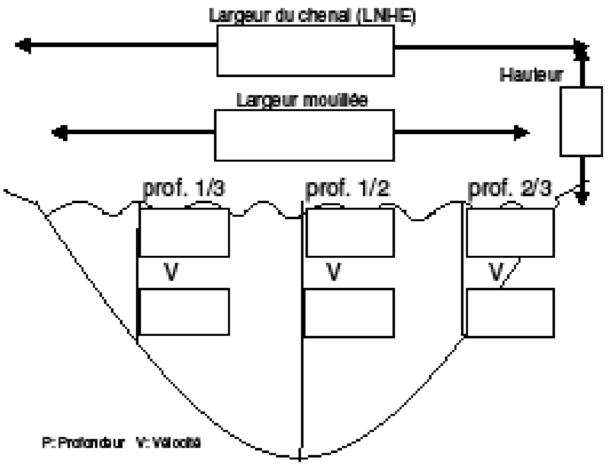
Projet ____________ Date ____________
Équipe ____________ No. ____________

CARACTÉRISATION DU TRONÇON

\# tronçon ________ Localisation ____________________
GPS ________ Photo ____________________

Fossé ○
Cours d'eau ○ **permanent** ○
intermittent ○

DESCRIPTION DES COMPOSANTES PHYSIQUES



Profondeur moyenne du cours d'eau ____________ m
Vitesse moyenne du courant ____________ m/s
Débit ____________ m³/s
Pente vers l'amont: ____________ %

CROQUIS

Substrat du lit

Texture	%
Roc	
Bloc	
Galet	
Gravier	
Sable grossier	
Sable fin	
Silt	
Argile	
Matière organique	

Pierrosité

gravier	2-20mm
galet	2-20cm
bloc	>20cm

Qualité de l'eau

Température :			
pH :			
conductivité :			
turbidité :			
couleur :			

Infrant à proximité:

Usage:

Commentaires:

Présence de poisson:

DESCRIPTION DU COUVERT VÉGÉTAL

Physionomie

Forêt fermée ○
Forêt ouverte ○
Friche arborescente ○
Friche arbustive ○
Friche herbacée ○

Milieu humide riverain

Marais ○
Marécage ○
Prairie humide ○
Tourbière ○

Recouvrement par strate

% recouv. / Strate	Riveraine G	Riveraine D	Surplombante G	Surplombante D	Aquatique
A1 (25m+)					Émergée:
A2 (15-25m)					
A3 (10-15m)					
B1 (1-10m)					Flottante :
B2 (-1m)					
C1 (+1m)					Submergée :
C2 (-1m)					
D					

Strate: A: Arborescente ; B: Arbustive ; C: herbacée ; D: muscinale

Perturbation?

Intensité / Type	F	M	F	TF
Entretient routier				
Coupe forestière				
Ornementation				
Éclaircissement				
Aménagement urbain				

v. 2006-09-10

ANNEXE II

DESCRIPTION DES FACIÈS D’ÉCOULEMENT UTILISÉS POUR CARACTÉRISER LES COURS D’EAU

Description des faciès d’écoulement utilisés pour caractériser les cours d’eau

Faciès d'écoulement	Vitesse d’écoulement	Description
Bassin (flat ou steady)	Lent	Zone à l’amont de certaines obstructions (pont, resserrement…), pente assez faible et courant lent. Granulométrie fine.
Glisse (glide)	Lent	Zone large et peu profonde à écoulement calme et dont la surface est sans turbulence. Granulométrie moyenne (graviers, galets).
Fosses/Radiers	Moyen	Zone caractérisée par des bassins (zone profonde à faible écoulement) séparés par des radiers (voir plus bas). Écoulement déterminé par les gros éléments de rugosité. Pente et vitesse du courant variables.
Radier (run)	Rapide	Zone peu profonde, à écoulement vif et turbulent, mais sans obstruction majeure du cours. Granulométrie de moyenne à grossière.
Rapide	Rapide	Zone de pente de > 4%, vitesse du courant et turbulence très fortes. Granulométrie grossière et niveau d'eau faible.
Cascade	Rapide	Zone à pente forte et irrégulière avec granulométrie grossière provoquant des zones de forte turbulence. Ce type d'obstacle est habituellement franchissable par le poisson.
Chute	Rapide	Zone où se présente une dénivellation brusque généralement causée par de gros blocs, des arbres ou la forme du roc. Ce type de segment est souvent infranchissable par le poisson.

Source : Adapté Montgomery et Buffington (1997) et Malavoi (1989)

ANNEXE III

REPORTAGE PHOTOGRAPHIQUE

Catalogue de photographies des traverses

Côté: Québec

Traverses: AR-GR3

Aval

2009-08-04 12:11:44

Substrat

2009-08-04 12:11:22

Catalogue de photographies des traverses

Côté: Québec

Traverses: AR-GR3a

Aval

2009-08-04 12:27:58

Catalogue de photographies des traverses

Côté: Québec

Traverses: AR-GR2

Amont

2009-08-04 12:21:02

Côté: Québec

Traverses: AR-GR1

Amont

2009-07-28 10:10:36

Substrat

2009-07-28 10:10:46

Catalogue de photographies des traverses

Côté: Québec

Traverses: AR-LP4

Amont

2009-08-02 10:35:10

Substrat

2009-08-02 10:35:04

Catalogue de photographies des traverses

Côté: Québec

Traverses: AR-LP3

Aval

2009-08-02 14:36:30

Substrat

2009-08-02 14:36:42

Catalogue de photographies des traverses

Côté: Québec

Traverses: AR-LP3a

Aval

2009-08-02 13:59:52

Catalogue de photographies des traverses

Côté: Québec

Traverses: AR-LP2

Chenal lentique dans un fen

Amont

2009-07-29 09:28:46

Se perd dans le fen

Aval

2009-07-29 09:28:58

Catalogue de photographies des traverses

Côté: Québec

Traverses: AR-LP1

Amont

2009-07-29 10:26:08

Aval

2009-07-29 10:26:14

Côté: Québec

Traverses: AR-FOG5

Amont

2009-07-29 11:45:00

Aval

2009-07-29 11:45:14

Catalogue de photographies des traverses

Côté: Québec

Traverses: AR-FOG2

Amont

2009-07-28 14:12:04

Aval

2009-07-28 14:11:54

Catalogue de photographies des traverses

Côté: Québec

Traverses: AR-FOG0

Amont

2009-07-28 13:40:58

Aval

2009-07-28 13:40:50

Catalogue de photographies des traverses

Côté: Québec

Traverses: AR-ROCKY

Amont

2009-07-28 12:52:08

Amont

2009-07-28 12:55:54

Aval

2009-07-28 12:55:48

Catalogue de photographies des traverses

Côté: Québec

Traverses: AR-GER-EN

Amont

2009-07-28 12:31:20

Aval

2009-07-28 12:31:14

Catalogue de photographies des traverses

Côté: Québec

Traverses: AR-GER2

Amont

2009-07-28 11:50:28

Aval

2009-07-28 11:49:34

Substrat

2009-07-28 11:50:54

Côté: Québec

Traverses: AR-GER3

Amont

2009-07-28 11:32:46

Aval

2009-07-28 11:32:56

Aval

2009-07-28 11:33:50

Catalogue de photographies des traverses

Côté: Québec

Traverses: AR-LOT4

Amont

2009-07-28 11:23:50

Aval

2009-07-28 11:24:04

Amont

2009-07-28 11:06:40

Aval

2009-07-28 11:07:06

Aval

2009-07-28 11:07:16

Catalogue de photographies des traverses

Côté: Québec

Traverses: AR-LOT2

Amont

2009-07-28 10:05:34

Aval

2009-07-28 09:59:26

Aval

2009-07-28 10:00:04

Catalogue de photographies des traverses

Côté: Québec

Traverses: AR-LOT2a

Amont

2009-07-28 10:33:12

Aval

2009-07-28 10:32:56

Substrat

2009-07-28 10:32:48

Catalogue de photographies des traverses

Côté: Québec

Traverses: AR-LOT3

Amont

2009-07-28 09:46:16

Aval

2009-07-28 09:46:24

Catalogue de photographies des traverses

Côté: Québec

Traverses: AR-LOT3a

Amont

2009-07-28 09:27:06

Aval

2009-07-28 09:26:50

Aval

2009-07-28 09:27:00

Amont

2009-07-28 09:33:08

Aval

2009-07-28 09:33:38

Aval

2009-07-28 09:33:54

Amont

2009-07-28 09:10:22

Amont

2009-07-28 09:11:06

Aval

2009-07-28 09:10:28

Catalogue de photographies des traverses

Côté: Québec

Traverses: AR-GO4-2

Amont

2009-07-28 09:01:46

Aval

2009-07-28 09:01:58

Aval

2009-07-28 09:02:06

Catalogue de photographies des traverses

Côté: Québec

Traverses: AR-GO4-1

Amont

2009-07-28 08:19:30

Aval

2009-07-28 08:19:56

Aval

2009-07-28 08:20:08

Catalogue de photographies des traverses

Côté: Québec

Traverses: AR-GO3-2

Amont

2009-07-30 07:54:02

Aval

2009-07-30 07:54:14

Catalogue de photographies des traverses

Côté: Terre-Neuve-et-Labrador

Traverses: AR-REA5a

Amont

2009-09-05 11:03:18

Aval

2009-09-05 11:03:02

Substrat

2009-09-05 11:03:36

Catalogue de photographies des traverses

Côté: Terre-Neuve-et-Labrador

Traverses: AR-REA4

Amont

2009-09-05 09:52:06

Aval

2009-09-05 09:51:58

Catalogue de photographies des traverses

Côté: Terre-Neuve-et-Labrador

Traverses: AR-REA3

Amont

2009-09-06 09:38:12

Aval

2009-09-06 09:38:06

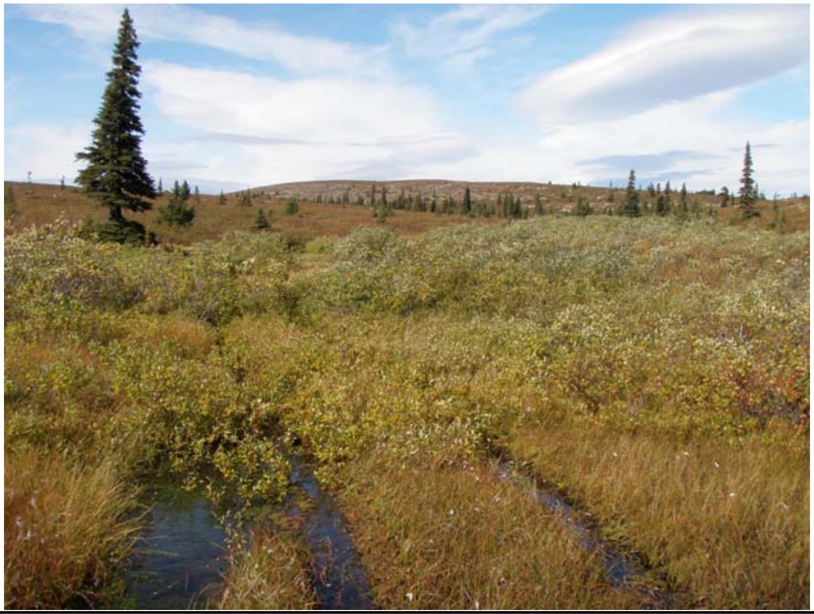
Catalogue de photographies des traverses

Côté: Terre-Neuve-et-Labrador

Traverses: AR-REA2

Amont

2009-09-06 08:50:30



Aval

2009-09-06 08:50:36

Substrat

2009-09-06 08:50:44

Catalogue de photographies des traverses

Côté: Terre-Neuve-et-Labrador

Traverses: AR-REA1

Amont

2009-09-06 07:46:58

Aval

2009-09-06 07:47:14

Substrat

2009-09-06 07:47:28

Catalogue de photographies des traverses

Côté: Terre-Neuve-et-Labrador

Traverses: AR-TRI

Amont

2009-09-06 06:11:44

Aval

2009-09-06 06:11:52

Substrat

2009-09-06 06:12:12

Catalogue de photographies des traverses

Côté: Terre-Neuve-et-Labrador

Traverses: AR-BO3

Amont

2009-09-06 05:11:16

Aval

2009-09-06 05:11:08

Substrat

2009-09-06 05:11:26

Catalogue de photographies des traverses

Côté: Terre-Neuve-et-Labrador

Traverses: AR-BO2

Amont

2009-09-06 04:06:50

Aval

2009-09-06 04:06:42

Catalogue de photographies des traverses

Côté: Terre-Neuve-et-Labrador

Traverses: AR-BO1

Amont

2009-09-05 08:13:14

Aval

2009-09-05 08:13:22

Substrat

2009-09-05 08:13:44

Catalogue de photographies des traverses

Côté: Terre-Neuve-et-Labrador

Traverses: AR-GB3

Amont

2009-09-05 06:37:52

Aval

2009-09-05 06:37:38

Substrat

2009-09-05 06:38:26

Catalogue de photographies des traverses

Côté: Terre-Neuve-et-Labrador

Traverses: AR-GB2

Amont

2009-09-02 11:19:00

Rétention d'eau par la route

Aval

2009-09-02 11:18:42

Substrat

2009-09-02 11:18:54

Catalogue de photographies des traverses

Côté: Terre-Neuve-et-Labrador

Traverses: AR-GB1

Amont

2009-09-02 10:35:44

Aval

2009-09-02 10:39:56

Substrat

2009-09-02 10:39:50

Catalogue de photographies des traverses

Côté: Terre-Neuve-et-Labrador

Traverses: AR-BA3

Amont

2009-09-04 04:44:24

Substrat

2009-09-03 11:40:00

Catalogue de photographies des traverses

Côté: Terre-Neuve-et-Labrador

Traverses: AR-BA2

Amont

2009-09-03 10:38:24

Aval

2009-09-03 10:38:18

Substrat

2009-09-03 10:39:44

Catalogue de photographies des traverses

Côté: Terre-Neuve-et-Labrador

Traverses: AR-BA1

Amont

2009-09-03 09:29:54

Aval

2009-09-03 09:29:44

Substrat

2009-09-03 09:30:40

Catalogue de photographies des traverses

Côté: Terre-Neuve-et-Labrador

Traverses: AR-JO3

Amont

2009-09-03 03:56:04

Aval

2009-09-03 03:55:58

Substrat

2009-09-03 03:56:16

Catalogue de photographies des traverses

Côté: Terre-Neuve-et-Labrador

Traverses: AR-JO2

Amont

2009-09-03 05:05:26

Aval

2009-09-03 05:05:20

Substrat

2009-09-03 05:06:04

Catalogue de photographies des traverses

Côté: Terre-Neuve-et-Labrador

Traverses: AR-JO1

Amont

2009-09-03 06:02:44

Aval

2009-09-03 06:02:36

Substrat

2009-09-03 06:03:02

Catalogue de photographies des traverses

Côté: Terre-Neuve-et-Labrador

Traverses: AR-KIV1a

Amont

2009-09-03 02:48:52

Aval

2009-09-03 02:48:36

Substrat

2009-09-03 02:49:10

ANNEXE IV

TYPE D’ÉCOULEMENT ET QUALITÉ DE L’EAU

Type d’écoulement et qualité de l’eau

Station	Type d'écoulement	Type de faciès	Température (ºC)	pH	Conductivité (µmhos/cm)	Turbidité (NTU)
Tracé du Québec						
AR-GR3	cours d’eau intermittent	bassin	-	-	-	-
AR-GR3a	cours d’eau permanent	bassin	16,5	7,8	13	9,37
AR-GR2	cours d’eau permanent	bassin	16,5	8,0	0	0,91
AR-GR1	aucun	-	-	-	-	-
AR-LP4	cours d’eau permanent	radier	7,3	9,0	7	1,24
AR-LP3	cours d’eau permanent	bassin	15,0	8,5	70	0,61
AR-LP3a	cours d’eau permanent	glisse	7,1	8,8	48	2,40
AR-LP2	cours d’eau permanent	bassin	17,6	8,5	95	1,81
AR-LP1	cours d’eau permanent	glisse	15,4	8,5	14	0,89
AR-FOG5	aucun	-	-	-	-	-
AR-FOG4	aucun	-	-	-	-	-
AR-FOG2	cours d’eau intermittent	rapide	17,0	7,9	3	0,81
AR-FOG0	chenal torrentiel	*radier/rapide*	-	-	-	-
AR-ROCKY	chenal torrentiel	*rapide/cascade*	-	-	-	-
AR-GER-EN	chenal torrentiel	*rapide*	-	-	-	-
AR-GER2	cours d’eau permanent	radier	15,3	8,0	3	2,05
AR-GER3	aucun	milieu humide	-	-	-	-
AR-LOT4	chenal torrentiel	*radier*	-	-	-	-
AR-LOTTIE	chenal torrentiel	*radier/rapide*	-	-	-	-
AR-LOT2	cours d’eau intermittent	*radier*	-	-	-	-
AR-LOT2a	cours d’eau intermittent	*fosses/radiers*	-	-	-	-
AR-LOT3	cours d’eau intermittent	*fosses/radiers*	-	-	-	-
AR-LOT3a	cours d’eau intermittent	*fosses/radiers*	-	-	-	-
AR-LOT3b	cours d’eau intermittent	*fosses/radiers*	-	-	-	-
AR-G04-3	chenal torrentiel	*radier*	-	-	-	-
AR-G04-2	chenal torrentiel	*radier/cascade*	-	-	-	-
AR-G04-1	chenal torrentiel	*radier/cascade*	-	-	-	-
AR-G03-2	chenal torrentiel	*rapide*	-	-	-	-
Tracé du Labrador						
AR-REA5a	cours d’eau permanent	radier	9,7	5,4	0	0,19
AR-REA4	aucun	milieu humide	-	-	-	-
AR-REA3	aucun	milieu humide/marécage	-	-	-	-
AR-REA2	cours d’eau permanent	bassin	12,7	6,4	5	1,74
AR-REA1	cours d’eau permanent	glisse	10,7	7,2	15	0,65
AR-TRI	aucun	-	-	-	-	-
AR-BO3	aucun	-	-	-	-	-
AR-BO2	aucun	-	-	-	-	-
AR-BO1	aucun	-	-	-	-	-
AR-GB3	cours d’eau permanent	glisse	9,0	5,5	0	0,50
AR-GB2	chenal torrentiel	*rapide*	-	-	-	-
AR-GB1	cours d’eau permanent	radier/rapide	12,5		34	0,43
AR-BA3	aucun	-	-	-	-	-
AR-BA2	chenal torrentiel	*rapide*	-	-	-	-
AR-BA1	chenal torrentiel	*radier*	-	-	-	-
AR-JO3	chenal torrentiel	*rapide*	-	-	-	-
AR-JO2	cours d’eau permanent	radier	6,4		0	0,37
AR-JO1	chenal torrentiel	*rapide*	-	-	-	-
AR-KIV1a	chenal torrentiel	*cascade*	-	-	-	-

Les stations sans valeurs de qualité de l’eau ne présentaient aucun écoulement lors de l’échantillonnage. Les types de faciès d’écoulement associés à ces cours (en *italique*) sont déduits de la morphologie du lit et sont donc théorique

ANNEXE V

HYDROLOGIE DES COURS D'EAU

Hydrologie des cours d’eau

Station	Largeur à la LNHE* (m)	Largeur mouillée (m)	Profondeur (m)			Vitesse (m/s)		
			1/4	1/2	3/4	1/4	1/2	3/4
Tracé du Québec								
AR-GR3	19	0,40	-	-	-	-	-	-
AR-GR3a	89	2,10	-	0,40	-	-	-	-
AR-GR2	95	1,20	-	0,35	-	-	0,00	-
AR-LP4	50	0,30	-	0,15	-	-	0,10	-
AR-LP3	39	25,0	-	0,20	-	-	0,00	-
AR-LP3a	60	0,90	-	0,15	-	-	0,07	-
AR-LP2	28	4,70	-	0,30	-	-	0,00	-
AR-LP1	3,9	1,45	-	0,40	-	-	0,00	-
AR-FOG2	3,9	3,90	-	0,10	-	-	0,00	-
AR-FOG0	0,7	-	-	-	-	-	-	-
AR-ROCKY	4,0	-	-	-	-	-	-	-
AR-GER-EN	11	-	-	-	-	-	-	-
AR-GER2	0,8	0,80	-	0,05	-	-	0,00	-
AR-LOT4	5,0	-	-	-	-	-	-	-
AR-LOTTIE	4,3	-	-	-	-	-	-	-
AR-LOT2	1,4		-	-	-	-	-	-
AR-LOT2a	5	1,30	-	0,10	-	-	-	-
AR-LOT3	30	-	-	0,10	-	-	-	-
AR-LOT3a		-	-	-	-	-	-	-
AR-LOT3b		-	-	-	-	-	-	-
AR-G04-3	9,2	-	-	-	-	-	-	-
AR-G04-2	2 à 0,5	-	-	-	-	-	-	-
AR-G04-1	1,2 à 0,5	-	-	-	-	-	-	-
AR-G03-2	0,8 à 3,4	-	-	-	-	-	-	-
Tracé du Labrador								
AR-REA5a	0,9	0,80	0,17	0,24	0,26	0,00	0,00	0,00
AR-REA2	20	0,95	0,27	0,27	0,24	0,00	0,00	0,00
AR-REA1	32	0,86	0,11	0,13	0,04	0,20	0,24	0,15
AR-GB3	0,9	0,90	0,19	0,22	0,21	0,00	0,00	0,00
AR-GB2	0,8	-	-	-	-	-	-	-
AR-GB1	2,8	0,62	0,09	0,10	0,23	0,48	0,64	0,22
AR-BA2	20	-	-	-	-	-	-	-
AR-BA1	1,3	-	-	-	-	-	-	-
AR-JO3	2,2	-	-	-	-	-	-	-
AR-JO2	8,3	5,30	0,19	0,16	0,12	0,65	0,78	0,56
AR-JO1	3,0	-	-	-	-	-	-	-
AR-KIV1a	5,9	-	-	-	-	-	-	-

LNHE = Ligne naturelle des hautes eaux
Les stations ne présentant pas de lit d’écoulement ne sont pas présentées dans ce tableau.
Les mesures d’hydrologie n’ont pas été prises dans certains cours d’eau intermittents due à l’absence d’eau

ANNEXE VI

COMPOSITION DU SUBSTRAT

Composition du substrat

Station	Composition du substrat (%)						
	Organique	Fin		Moyen		Grossier	
	débris	fin	sable	gravier	galet	bloc	roc
Tracé du Québec							
AR-GR3	100	-	-	-	-	-	-
AR-GR3a	100	-	-	-	-	-	-
AR-GR2	90	-	-	2	5	3	-
AR-LP4	-	-	45	35	20	-	-
AR-LP3	75	-	-	-	15	10	-
AR-LP3a	85	-	-	-	15	-	-
AR-LP2	100	-	-	-	-	-	-
AR-LP1	5	5	10	25	35	20	-
AR-FOG2	-	-	-	20	60	20	-
AR-FOG0	-	-	-	20	30	50	-
AR-ROCKY	-	-	-	10	80	10	-
AR-GER-EN	-	-	10	25	50	15	-
AR-GER2	-	5	10	65	20	-	-
AR-LOT4	-	5	5	10	30	60	-
AR-LOTTIE	-	-	-	30	55	15	-
AR-LOT2	-	-	-	35	55	10	-
AR-LOT2a	5	5	-	40	40	5	5
AR-LOT3	90	-	-	-	10	-	-
AR-LOT3a	90	-	-	-	10	-	-
AR-LOT3b	90	-	-	-	10	-	-
AR-G04-3	-	-	-	45	50	5	-
AR-G04-2	-	-	-	50	50	-	-
AR-G04-1	-	-	-	50	50	-	-
AR-G03-2	-	-	-	20	70	10	-
Tracé du Labrador							
AR-REA5a	-	-	10	10	10	70	-
AR-REA2	100	-	-	-	-	-	-
AR-REA1	80	-	-	-	20	-	-
AR-GB3	100	-	-	-	-	-	-
AR-GB2	-	-	-	-	20	80	-
AR-GB1	-	-	-	5	15	80	-
AR-BA2	-	-	-	20	40	40	-
AR-BA1	-	-	-	40	40	20	-
AR-JO3	-	-	-	15	65	20	-
AR-JO2	-	-	-	30	40	30	-
AR-JO1	-	-	-	30	30	40	-
AR-KIV1a	-	-	-	5	35	60	-

Les stations ne présentant pas de lit d’écoulement ne sont pas présentées dans ce tableau.

ANNEXE VII

COMPOSITION DU COUVERT VÉGÉTAL

Composition du couvert végétal pour le tracé du Québec

Station	Couverture végétale (%)																		
	Arborescente				Arbustive				Herbacée				Muscinale				Végétation aquatique		
	Rive		Surplomb		Rive		Surplomb		Rive		Surplomb		Rive		Surplomb		Immergée	Flottante	Submergée
	G	D	G	D	G	D	G	D	G	D	G	D	G	D	G	D			
AR-GR3	-	-	-	-	40	60	-	-	-	-	-	-	-	-	-	-	-	-	-
AR-GR3a	-	-	-	-	15	25	-	-	80	90	-	-	100	100	-	-	-	-	-
AR-GR2	-	-	-	-	5	5	-	-	95	95	-	-	100	100	-	-	-	-	-
AR-LP4	-	-	5	2	90	80	80	70	5	10	-	-	90	80	-	-	-	-	-
AR-LP3	5	5	-	-	5	5	-	-	90	90	-	-	-	-	-	-	30	-	-
AR-LP3a	5	10	-	-	25	20	-	-	45	30	-	-	-	-	-	-	-	-	-
AR-LP2	-	-	-	-	-	-	-	-	70	100	-	-	-	-	-	-	-	-	-
AR-LP1	-	-	-	-	25	60	-	-	80	70	-	-	50	50	-	-	-	-	-
AR-FOG2	-	-	-	-	80	70	-	-	20	15	-	-	-	-	-	-	-	-	-
AR-FOG0	-	-	-	-	80	70	-	-	25	30	-	-	-	-	-	-	-	-	-
AR-ROCKY	-	-	-	-	95	80	-	-	-	-	-	-	-	-	-	-	-	-	-
AR-GER-EN	-	-	-	-	5	20	-	-	10	10	-	-	-	-	-	-	-	-	-
AR-GER2	-	-	-	-	80	15	-	-	15	15	-	-	-	-	-	-	-	-	-
AR-LOT4	-	-	-	-	50	45	-	-	25	35	-	-	-	-	-	-	-	-	-
AR-LOTTIE	-	-	-	-	15	5	-	-	25	10	-	-	-	-	-	-	-	-	-
AR-LOT2	-	-	-	-	70	50	-	-	50	50	-	-	25	25	-	-	-	-	-
AR-LOT2a	-	-	-	-	25	35	-	-	50	50	-	-	20	40	-	-	-	-	-
AR-LOT3	-	-	-	-	25	40	-	-	50	50	-	-	-	-	-	-	-	-	-
AR-LOT3a	-	-	-	-	25	40	-	-	50	50	-	-	-	-	-	-	-	-	-
AR-LOT3b	-	-	-	-	25	40	-	-	50	50	-	-	-	-	-	-	-	-	-
AR-G04-3	-	-	-	-	20	25	-	-	25	35	-	-	-	-	-	-	-	-	-
AR-G04-2	-	-	-	-	-	-	-	-	20	30	-	-	30	40	-	-	-	-	-
AR-G04-1	-	-	-	-	-	-	-	-	20	30	-	-	30	40	-	-	-	-	-
AR-G03-2	-	-	-	-	20	15	-	-	30	25	-	-	80	90	-	-	-	-	-

Les stations ne présentant pas de lit d’écoulement ne sont pas présentées dans ce tableau.
G = rive gauche
D = rive droite

Composition du couvert végétale pour le tracé du Labrador

Station	**Couverture végétale (%)**																		
	Arborescente				**Arbustive**				**Herbacée**				**Muscinale**				**Végétation aquatique**		
	Rive		surplomb		Rive		surplomb		Rive		surplomb		Rive		surplomb		Immergée	Flottante	Submergée
	G	**D**	**G**	**D**	**G**	**D**	**G**	**D**	**G**	**D**	**G**	**D**	**G**	**D**	**G**	**D**			
AR-REA5a	-	-	-	-	60	40	20	20	30	40	10	10	60	80	-	-	-	-	-
AR-REA2	-	-	-	-	50	70	-	-	70	50			50	50	-	-	-	-	90
AR-REA1	-	-	-	-	70	80	50	60	40	20	15	10	50	60	-	-	-	-	-
AR-GB3	-	-	-	-	60	90	40	40	50	30	10	10	80	90	-	-	-	-	-
AR-GB2	5	-	-	-	80	95	-	-	70	70	-	-	30	-	-	-	-	-	-
AR-GB1	-	-	-	-	100	95	-	-	70	70	-	-	60	60	-	-	-	-	10
AR-BA2	-	-	-	-	15	20	-	-	20	20	-	-	60	60	-	-	-	-	-
AR-BA1	-	-	-	-	50	90	40	80	40	30	10	20	80	90	-	-	-	-	-
AR-JO3	-	-	-	-	60	90	-	-	15	10	-	-	60	90	-	-	-	-	-
AR-JO2	-	-	-	-	40	4	5	-	10	5	-	-	40	-	-	-	-	-	-
AR-JO1	-	-	-	-	10	90	-	-	10	30	-	-	0	20	-	-	-	-	-
AR-KIV1a	-	-	-	-	3	12	-	-	1	4	-	-	3	12	-	-	-	-	-

Les stations ne présentant pas de lit d'écoulement ne sont pas présentées dans ce tableau.
G = rive gauche
D = rive droite