APPENDIX E

Noise Modelling Study

Joyce Lake Direct Shipping Iron Ore Project

Noise Modeling Study

121-18002-01

February 2015

WSP

JOYCE LAKE DIRECT SHIPPING IRON ORE PROJECT

NOISE MEDELING STUDY

Labec Century Iron Ore Inc.

Final Version

Project No.: 121-18002-01
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Reference to be cited:

WSP. 2015. *Joyce Lake Direct Shipping Iron Ore Project. Noise Modeling Study.* Report prepared for Labec Century Iron Ore Inc. 19 p. + appendices.

GLOSSARY AND ABBREVIATIONS

Terminology used in this document is defined where it is first mentioned. The following list will assist readers who may choose to review only portions of the document.

%HA	Percent Highly Annoyed
Ambient noise	The all-encompassing noise associated within a given environment. It is the composite of sounds from many sources, both near and far.
Background noise	The underlying level of noise present in the ambient noise, excluding the noise source under investigation.
Decibel (dB)	The unit used to describe sound levels and noise exposure. It is equivalent to 10 times the logarithm (to base 10) of the ratio of a given sound pressure to a reference pressure.
dB(A)	Environmental noise levels such as noise generated by industry, construction and road traffic are commonly expressed in dB(A). The A-weighting scale follows the average human hearing response and enables comparison of the intensity of noise with different frequency characteristics. The A-weighted level is an adjustment made to the dB sound level to approximate the response of the human ear.
L_d	Daytime (07:00 to 22:00) equivalent sound level
L_{dn}	Day-night equivalent sound level with a 10 dB penalty for the nighttime period.
L_{eq} / L_{Aeq}	This level represents the equivalent, or average noise energy, during a measurement period. For instance, the Leq, 15min noise descriptor simply refers to the Leq noise level calculated over a 15-minute period.
L_n	Nighttime (22:00 to 07:00) equivalent sound level.
Project, the	The Joyce Lake Direct Shipping Iron Ore Project
Sound Power Level (L_w)	This is a measure of the total power radiated by a source. The Sound Power of a source is a fundamental property of the source and is independent of the surrounding environment.

EXECUTIVE SUMMARY

Labec Century Iron Ore Inc. (Labec Century; the Proponent) is proposing to develop an iron mine in western Labrador, approximately 20 kilometres northeast of the Town of Schefferville, Québec. The Joyce Lake Direct Shipping Iron Ore Project (the Project) lies on a peninsula of land in Attikamagen Lake and all physical elements of the Project, except the access road which will be upgraded, lie within Labrador. The mine will produce up to two million and half tonnes (Mt) of product per year. The product will be transported to the existing rail line owned by Tshiuetin Rail Transportation Inc. for transportation to Sept-Îles, where they will be stockpiled on IOC land prior to shipping to market.

The Project will require approval from the Government of Newfoundland and Labrador and is subject to environmental assessment (EA) under the Newfoundland and Labrador *Environmental Protection Act* (NL EPA) and associated Environmental Assessment Regulations. Under the *Canadian Environmental Assessment Act, 2012* (CEAA 2012) the Project is a Designated Project pursuant to Section 15(a) Regulations Designating Physical Activities and will require federal EA.

Sound measurements of the background noise (the underlying noise without the mine activities) were made over a continuous period from September 26 to September 30, 2012 around the future mining site and rail yard. These measurements were made while there was no mining activity to evaluate the daytime (L_d) and nighttime (L_n) ambient noises at five receptor points. These measurements established the baseline conditions required to be compared with the Project's future operations on a "worst case" scenarios basis.

In Canada, railway operations are mainly managed by federal government legislation. The sound assessment criteria employed in this study are based on Health Canada's guidelines concerning noise as it relates to annoyance. The guidelines state that the day-night sound level (L_{dn}) should not exceed 75 dBA and the resulting change in percentage of highly annoyed receptors (%HA) should be less than 6.5%.

Noise simulations were performed to evaluate the sound emitted by the Project activities. Once the sound power levels of the equipment were defined, the sound pressure level (L_{eq}) from the activities of the equipment was calculated at receptor points located around the site using the sound propagation software SoundPLAN v7.3 (www.soundplan.com). The sound pressure levels were calculated by taking into account the topography of the studied area. The activities for the Project production year 1 were simulated. This year represents the worst case scenario as mine tonnage is at its maximum and the mine pit is at its highest level and does not procure a significant screening effect. The results of noise do not exceed any day-night level greater than 75 dBA or any change in %HA greater than 6.5% at the seasonal dwellings in the study area. The Project operations, as simulated, will be conforming to the federal regulation.

TABLE OF CONTENTS

TABLES

FIGURES

APPENDICES

1 INTRODUCTION

Labec Century Iron Ore Inc. (Labec Century; the Proponent) is proposing to develop an iron mine in western Labrador, approximately 20 kilometres (km) northeast of the Town of Schefferville, Québec. The Joyce Lake Direct Shipping Iron Ore (DSO) Project (the Project) lies on a peninsula of land in Attikamagen Lake and all physical elements of the Project lie within Labrador (Figure 1).

The mine will produce up to two million and half tonnes (Mt) of ore per year. The ore will be transported to the existing rail owned by Tshiuetin Rail Transportation Inc., and further onto the Québec North Shore and Labrador Railway (QNS&L) for transportation to Sept-Îles where they will be stockpiled on IOC land prior to shipping to market.

The Project will require approval from the Government of Newfoundland and Labrador and is subject to environmental assessment (EA) under the Newfoundland and Labrador *Environmental Protection Act* (NL EPA) and associated Environmental Assessment Regulations. Under the *Canadian Environmental Assessment Act, 2012* (CEAA 2012) the Project is a Designated Project pursuant to Section 15(a) Regulations Designating Physical Activities and will require federal EA.

1.1 PROJECT OVERVIEW

The Joyce Lake mining prospect lies in an undeveloped area adjacent to the small Joyce Lake waterbody on a peninsula within Attikamagen Lake, in an area with a number of interconnecting large lakes. The prospect can be reached from the mainland by crossing a relatively narrow stretch of water, called Iron Arm. Currently, the prospect is accessed from Schefferville either directly by helicopter or by ground via an existing gravel road to Iron Arm and then by helicopter to the Joyce Lake prospect.

The Project consists of mining a high grade direct shipping iron ore deposit in western Labrador, approximately 20 km northeast of Schefferville, as shown in Figure 1. The physical works for the proposed Joyce Lake Project, except an upgrade to the existing access road, are subject to assessment, and is located wholly in Labrador. The mine area lies within two map-staked licences (309 claims) covering 12,665 hectares (ha).

The physical elements of the Project include the Joyce Lake mining area, a beneficiation plant, a rock causeway across Iron Arm, a new haul road to connect to a new rail loop by Astray Lake, and an accommodation camp. Power for the Project will be provided by a power plant of a capacity up to 3.0 MW using fuel stored mainly at the beneficiation plant, with smaller tanks at other locations where small generators may be required. Other physical elements of the Project include stockpiles for overburden, waste rock, low grade and high grade ore (pre- and post-processing), water supply systems, settling ponds, domestic waste water treatment, drainage ditches, explosives storage, a hazardous materials storage and management area, and ancillary buildings (e.g., offices, workshops, warehouse/storage areas, worker facilities, mobile equipment storage). All structures and equipment will be constructed so that they can be moved from the site and re-used elsewhere when no longer required for this Project.

The Project's estimated annual production of iron ore product is provided in Table 1, and is based on preliminary open pit designs from November 2014. The current estimated target production is 2.5 Mt/yr of product. The first seven years of operation would focus on production of DSO with a high iron content (~62% iron at cut-off grade 55%), with two stockpiles of low grade material (~50-52% and ~52-55% iron). The actual tonnage mined for both are 3.64 Mt and 63.75 Mt respectively for the life of mine (LOM). The bigger one Fe 52-55% will be 100% put through the plant and processed as final product and the lower grade one will possibly be processed but only in favorable market conditions.

Table 1. Estimated Annual Production of Iron Ore in Phase I for the Joyce Lake Project

PRODUCT	UNIT	ESTIMATED PIT RELEASE BY YEAR						
		Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7
Phase I Ore (DSO; 62% Fe)	tonne	2,500,000	2,500,000	2,500,000	2,500,000	2,500,000	2,500,000	2,000,000
Waste Rock	tonne	10,800,000	9,700,000	9,500,000	3,600,000	7,000,000	7,000,000	
Overburden	tonne	500,000	1,000,000	1,000,000	1,000,000	1,000,000		

Construction would begin upon release from EA and with receipt of the relevant permits. Mining activities will occur through the year. The mining activities will include moving the stockpiled ore by truck from the mine site to the crushing and screening plant using mine roadways. After crushing and screening, the products will be hauled by truck over the new road to the new rail yard. At the present time, it is anticipated that the Project will include seven years of production (2015 to 2021). The total life-of-mine is anticipated to be up to seven years, but this timeframe may be adjusted as exploration proceeds.

Extraction of the resource will be by open pit and construction of this pit will require dewatering of Joyce Lake. The mining operation will consist of removing ore from the single open pit using drilling and blasting, hydraulic excavators and haul trucks. The pre-stripping of overburden at the open pit will likely start during the summer, with waste rock and low grade ore being stockpiled outside the pit limits.

Beneficiation will consist of a dry circuit with two crushing and two screening steps necessitating no water addition, except as may be necessary for dust suppression. The beneficiation plant will be operated 240 days per year (during the warmer months). Ore will be processed generating two different products: lump and sinter feed. The plant will not produce any tailings as only dry circuit will be used and conversion of ore to products will be at 100% recovery.

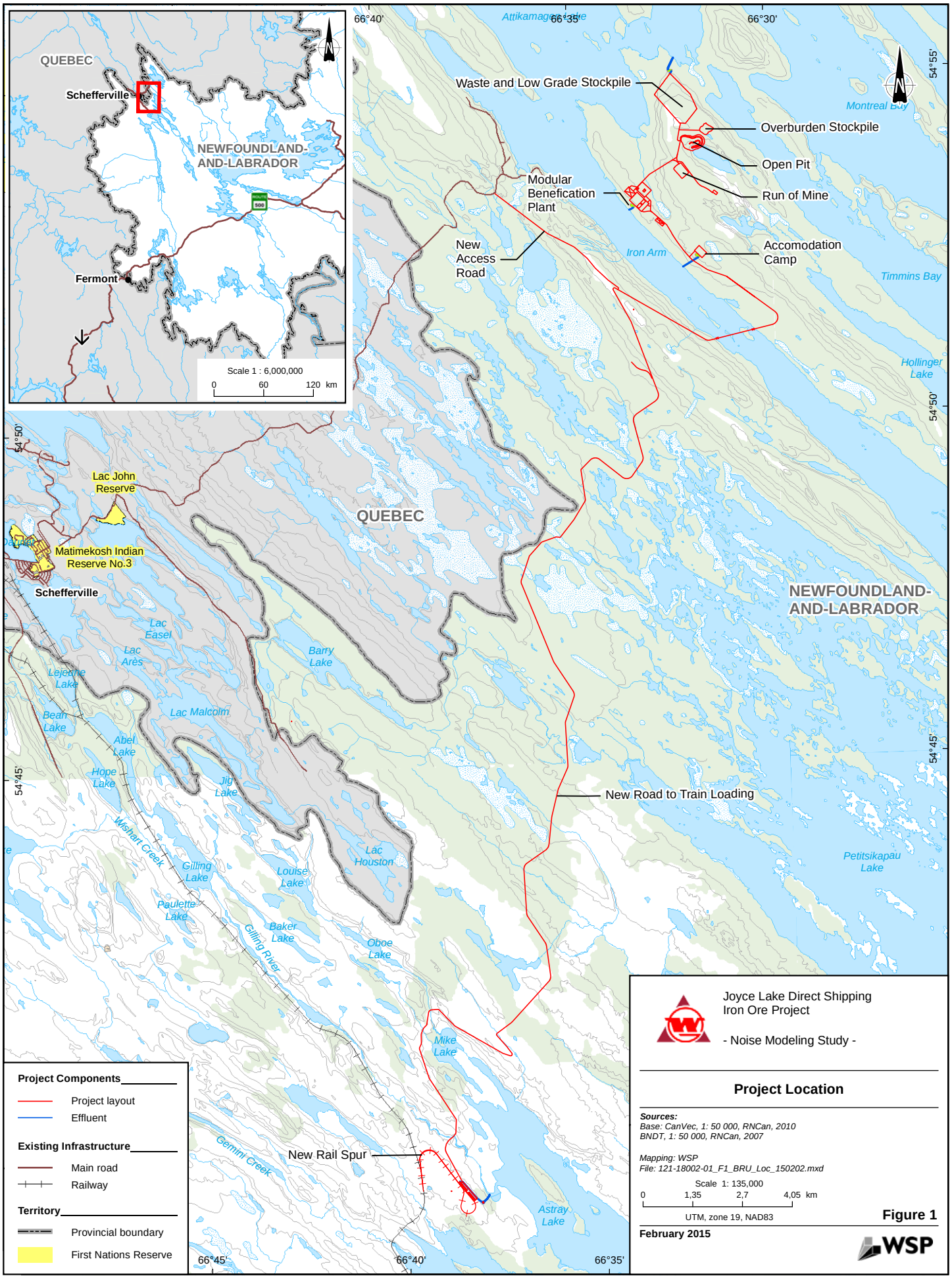
The final products will be hauled by truck from the beneficiation plant to the rail yard, a distance of approximately 40 km along a new haul road. At the rail yard, the product will be loaded onto rail cars on a new ~6 km rail loop that will connect to the existing Tshiuetin Rail. The products will be railed south to Sept-Îles, Québec, where they will be stockpiled on IOC land prior to shipping to market.

1.2 ORGANIZATION OF THIS BASELINE STUDY

The remainder of this Noise Modeling Study outlines the scope, methodology, results of the baseline program and is presented in six sections, as follows:

- Section 1: Introduction¸
- Section 2: Objectives and Rationale
- Section 3: Methodology
- Section 4: Results
- Section 5: Summary and Closure
- Section 6: References

Additional supporting information and documentation is presented in the appendices.


QUEBEC
Schefferville
NEWFOUNDLAND-
AND-LABRADOR
Fermont
Scale 1 : 6,000,000
0 60 120 km
66°40'
66°35'
66°30'
54°55'
54°50'
54°45'
Waste and Low Grade Stockpile
Overburden Stockpile
Open Pit
Run of Mine
Modular
Benefication
Plant
New
Access
Road
Accomodation
Camp
Iron Arm
Timmins Bay
Hollinger
Lake
Montreal Bay
Lac John
Reserve
Matimekosh Indian
Reserve No.3
Lac
Easel
Lac
Arès
Barry
Lake
Lejeune
Lake
Bean
Lake
Lac Malcolm
Abel
Lake
Hope
Lake
Jill
Lake
Mishart Creek
Gilling
Lake
Louise
Lake
Lac
Houston
Paulette
Lake
Baker
Lake
Gilling River
Oboe
Lake
Mike
Lake
Gemini Creek
New Rail Spur
Astray
Lake
New Road to Train Loading
Petitsikapau
Lake
Project Components
Project layout
Effluent
Existing Infrastructure
Main road
Railway
Territory
Provincial boundary
First Nations Reserve
Joyce Lake Direct Shipping
Iron Ore Project
- Noise Modeling Study -
Project Location
Sources:
Base: CanVec, 1: 50 000, RNCan, 2010
BNDT, 1: 50 000, RNCan, 2007
Mapping: WSP
File: 121-18002-01_F1_BRU_Loc_150202.mxd
Scale 1: 135,000
0 1,35 2,7 4,05 km
UTM, zone 19, NAD83
Figure 1
February 2015
WSP

2 OBJECTIVES AND RATIONALE

Labec Century Iron Ore Inc has mandated WSP to conduct a sound study for the sensitive zones around the projected mine infrastructure.

The open pit mine will produce 2.5 million tonnes of iron DSO products per year. During production, the mine will be working on both day and night shifts.

The specific objectives of this study were:

- to characterise the existing noise environment in the periphery of the mine infrastructure;
- to evaluate the noise from the future activities of the mine;
- to evaluate the acoustical conformity of the project with respect to the applying regulation;
- to identify acoustical mitigation, if needed.

3 METHODOLOGY

3.1 DESCRIPTION OF THE STUDY AREA

Project Development Area

The Project Development Area (PDA) is the most basic and immediate area of the Project. The PDA is limited to the anticipated area of physical disturbance associated with the construction or operation of the Project. For this Project, the mine area lies within two map-staked licences (309 claims) covering 12,665 ha. The PDA includes the mining area, Iron Arm crossing, a beneficiation plant, a new haul road, site roads and an existing access road, an accommodation camp, and a rail loop near the existing railroad (Figure 1).

Study Area

The Study Area is the maximum area within which Project-related environmental effects can be predicted or measured with a reasonable degree of accuracy and confidence. The Study Area includes the PDA and any adjacent areas where Project-related environmental effects may reasonably be expected to occur. The Noise Modeling Study Area is shown on Figure 2. The seasonal dwellings around the site are of the single family type. The majority of them are located along Iron Arm. Some houses are located in the area of Astray Lake near the rail loop and road access to train loading.

3.2 LEGISLATION AND REGULATION

The following section presents the noise criteria that were used to evaluate the sound emitted from the mine projected activities.

Health Canada produced a draft report on February 4, 2010 entitled "*Health Canada Noise Impact Assessment Guidance for Environmental Assessments*". The purpose of this document is to guide stakeholders in their evaluation of the effects on human health as related to noise in an environmental assessment and to facilitate understanding of comments made by Health Canada in the environmental assessment process.

Annoyance, more specifically the change in percentage of highly annoyed (% HA) as a consequence of changing noise levels, is a criteria that isn't directly measured but self-reported in surveys. Although individual reaction varies greatly, the reported change in % HA among an average community in reaction to certain sound levels has been shown to be uniform (Michaud *et al.* 2008). The calculated % HA provides information on how an average community responds to a noise level. Health Canada considers the change in % HA as an appropriate indicator of noise-induced human health effects for project operational noise and for long-term construction noise (more than one year) exposure. Health Canada advises that noise mitigation measures need to be considered when a change in the calculated % HA at any given receptor exceeds 6.5%.

As indicated in the report published by the Ministry of Health in 2010 entitled "*Useful Information for Environmental Assessments*" section 6:

"…*For construction noise at receptors with durations of more than one year (i.e. long-term), for operational noise, and where noise levels are in the range of 45-75 dB, Health Canada advises that health impact endpoints be evaluated on the change in the percentage of the population (at a specific receptor location) who become highly annoyed (% HA). Health Canada suggests that mitigation be proposed if the predicted*

change in % HA at a specific receptor is greater than 6.5% between project and baseline noise environments, or when the project-related noise is in excess of 75 dB…".

The criteria for this project are no exceedance of the 6.5% change (% HA) and a maximum 75 dBA (L_{dn}) project-related noise.

3.3 DATA COLLECTION

Sound measurements of the background noise (without mining activity) over a continuous period were made from September 26 to September 30, 2012 around the future mining site and rail yard. These measurements where made while there were no mining activity.

To evaluate the background noise, sound measurements were made at five receptor points around the future mine. The periods of measurement and the coordinates for each receptor point are as follow:

- P1 September 26 to 27, 2012 54o54'29.82'' N – 66o36'55.98'' W
- P2 September 29 to 30, 2012 54o53'20.40'' N – 66o35'15.72'' W
- P3 September 28 to 29,2012 54o40'17.70'' N – 66o37'26.40'' W
- P4 September 28 to 29, 2012 54o38'18.06'' N – 66o38'51.30'' W
- P5 September 29 to 30, 2012 54°54'42.54'' N – 66°35'48.84'' W

Figure 2 shows the receptor points locations. The receptor points were located near seasonal dwellings located in the vicinity of the Project infrastructure.

The measurement stations were made up of one sound level meter, with a wind screen on the microphone, installed on a tripod and equipped with a voice digital recorder. The following instruments were used:

- 4 Larson Davis sound level meters, model LXT, type 1; NS: 0002646, 0002784, 0002789, 0003027;
- 4 voice digital recorders;
- Larson Davis Calibrator CAL 200;
- wind screen at all times.

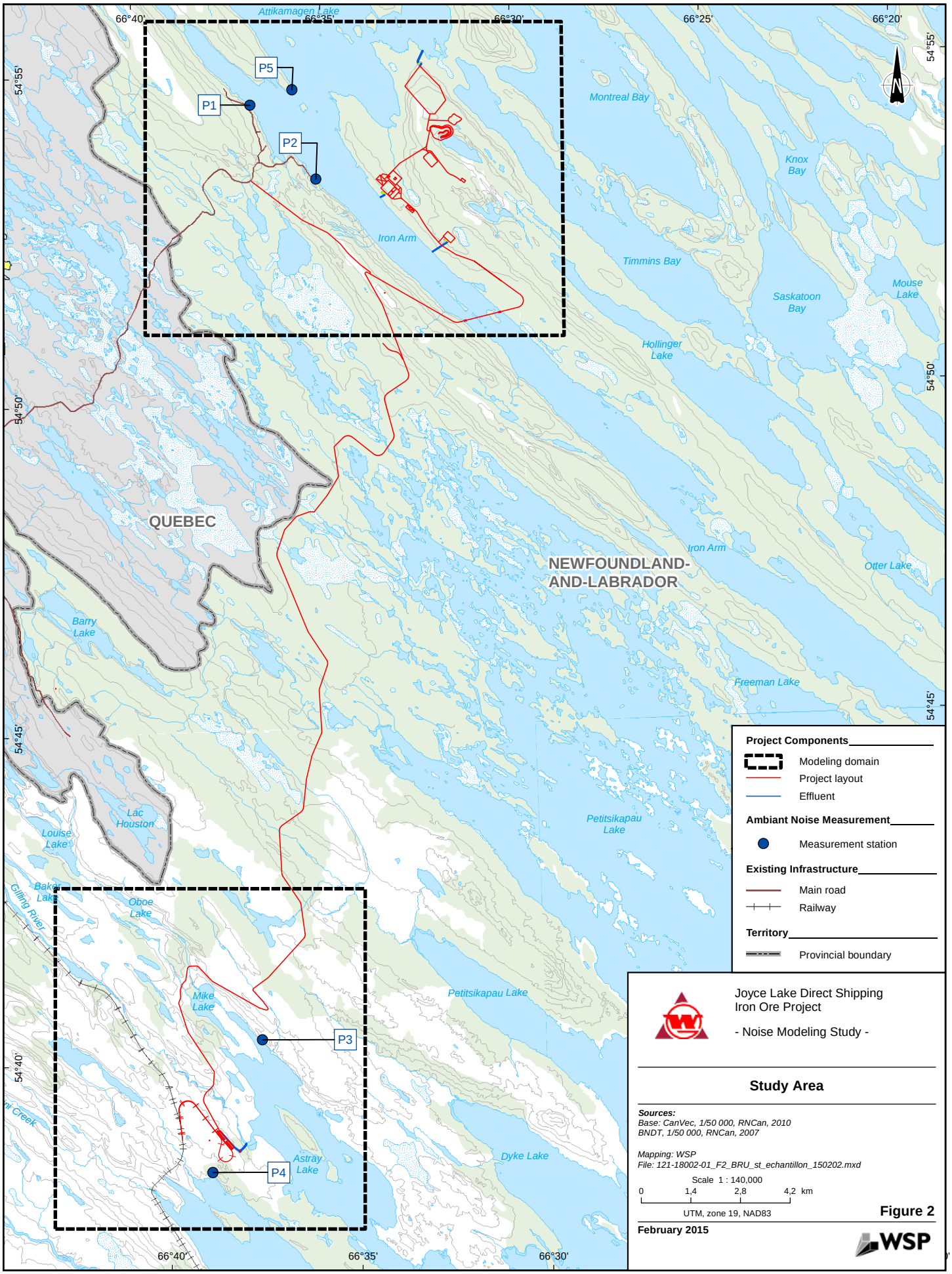
Photos of the installations at each station are presented in Appendix A.

Each apparatus was calibrated on-site before and after each measurement and no deviation above 0.5 dBA was observed during the calibration process. Furthermore, every apparatus goes under verification by an independent certified laboratory on an annual basis.

The appropriate weather conditions for environmental noise measurements are:

- wind speed below 14 km/hr;
- no precipitation.

The details of the weather conditions during the measurement period were collected from the Schefferville station and are presented in Appendix B.


Attikamagen Lake
66°40'
66°35'
66°30'
66°25'
66°20'
54°55'
54°50'
54°45'
54°40'
P1
P2
P3
P4
P5
Montreal Bay
Knox Bay
Iron Arm
Timmins Bay
Saskatoon Bay
Mouse Lake
Hollinger Lake
QUEBEC
NEWFOUNDLAND-AND-LABRADOR
Iron Arm
Otter Lake
Barry Lake
Freeman Lake
Lac Houston
Louise Lake
Petitsikapau Lake
Baker Lake
Oboe Lake
Gilling River
Mike Lake
Petitsikapau Lake
Astray Lake
Dyke Lake
N
Project Components
Modeling domain
Project layout
Effluent
Ambiant Noise Measurement
Measurement station
Existing Infrastructure
Main road
Railway
Territory
Provincial boundary
Joyce Lake Direct Shipping
Iron Ore Project
- Noise Modeling Study -
Study Area
Sources:
Base: CanVec, 1/50 000, RNCan, 2010
BNDT, 1/50 000, RNCan, 2007
Mapping: WSP
File: 121-18002-01_F2_BRU_st_echantillon_150202.mxd
Scale 1 : 140,000
0 1,4 2,8 4,2 km
UTM, zone 19, NAD83
Figure 2
February 2015
WSP

3.4 MODELING STUDY

A production schedule (mine plan) was developed for the Joyce Lake DSO Project, which produces 2.5 Mt/year of DSO products. The project operations include mining, year round as well as beneficiation and hauling to the rail yard which takes place from April to November/December (warmest days for about 240 days) and observe a pause for the winter season.

It is estimated that the Project operational workforce will include 145 employees during the peak production period. This workforce is composed of 17 employees that will work on day shift only and 128 employees that will work both day and night shifts.

The activity simulated and the results presented are for the year 1 project operations. This year is simulated because it represents the worst case scenario as the mined tonnage is at its maximum and the mine pit is at its highest level and does not procure a significant screening effect.

The final products will be hauled by truck from the beneficiation plant to the rail yard, a distance of approximately 40 km along a new haul road. At the rail yard, the products will be loaded onto rail cars on a new ~6 km rail loop that will connect to the existing Tshiuetin Rail. The product will be railed south to Sept-Îles, Québec, where it will be stockpiled on IOC land prior to shipping to market.

3.4.1 SIMULATED SCENARIO FOR YEAR 1

A working time of 100% has been conservatively considered for the equipment. The simulated distribution of the equipment for the year 1 is as follow:

For the mine and beneficiation plant section

- 15 150t CAT 785D haulage trucks:
  - 3 trucks will go from the mine to the ROM (back and forth);
  - 11 trucks will go from the mine to waste pile (back and forth);
  - 1 truck will go from the mine to the overburden pile (back and forth);
  - 1 truck will go from the mine to low grade pile (back and forth);
- 4 Komatsu PC-1250 excavators located in the pit;
- 3 production drills with a working time in the pit;
- 2 CAT D8T track dozers, one on the waste pile and one on the overburden pile;
- 1 CAT 14M motor grader on the mine roadways;
- 1 water/sand truck on the mine roadways;
- 1 CAT 345 excavator, as support on the mine roadways;
- 1 jaw crusher and 1 cone crusher located on the plant;
- 5 CAT 988H and 2 CAT 980H located on the plant area;
- 1 CAT 14M motor grader as support on the access and causeway roads;
- 1 power plant of 3 MW capacity located near the beneficiation plant;

For the Rail yard section

- 1 train with 240 rail cars and 3 locomotives for 18 hours loading time over a 24-h period;
- 4 CAT 988 wheel loaders;
- 8 Smithco side dump trailers, 6 travelling continually back and forth from the Project site to the rail yard.

3.4.2 NOISE EMISSION

Sound power characterizes the sound emission intensity of a noise source or the energy radiated by the noise source in all directions. In contrast, the level of noise measured by a sound level meter is the energy perceived in a specific place. The level of noise is affected by the distance of the noise source, obstacles (reflections and diffractions), atmospheric absorption, etc.

Sound power level (L_w) is independent of the environment and is used to calculate the level of sound pressure (L_p - sometimes called noise level) in a given environment. By making an analogy with light, sound power corresponds to the power of a light bulb (40 watts, 60 watts, etc.), while the luminosity - measured in Lux - corresponds to the level of sound pressure, which depends on the environment. For example, for a light bulb of a given power, luminosity will be different if the walls of a room have a light color compared to another of dark color, or if an obstacle is present between the point of measurement and the light bulb.

The numerical values of sound power are normally much higher than the numerical values of a sound level. For example, for a noise source and a receiver close to a reflective ground, in a free field (e.g.: outside), the sound pressure (noise level) measured by a sound level meter at a distance of 15 m from the noise source will be 32 dB lower than the sound power.

In summary, sound power characterizes the source of noise, while sound pressure characterizes the perception of noise at a given place.

Table 2 shows the sound power level of the equipment fleet used in the simulation. The sound power values by octave band are presented in Appendix C. The sound power level was evaluated from the manufacturing specification and our database from acoustic surveys conducted on similar equipment in previous projects.

The equipment for the dewatering of Joyce Lake is not included in the simulations. The pump(s) are negligible compared to the other equipment like the mining trucks. Also, the distance between Joyce Lake and the receptor points is quite large and a part of the noise emitted by the pump(s) will be attenuated by the atmosphere. For these reasons, the sound contribution of the pump(s) at the receptor points is therefore minimal.

Once the sound power level of the equipment's were defined, as given in Table 2, the sound pressure level from the activities of the equipment was calculated at receptor points around the site using the sound propagation software SoundPLAN v7.3 (www.soundplan.com). The sound pressure levels were calculated by taking into account the topography of the studied area.

This software traces a sound rays between the noise sources and the receivers. It then calculates the attenuation caused by distance and air absorption. It also takes into account the ground effects and the effects of noise abatement of finite length, as in barriers, buildings, screens and topography. These calculations are performed according to the ISO standard 9613 Parts 1 and 2 entitled "*Attenuation of sound during propagation outdoors.*" This standard calculates the level of noise under downwind (5 m/s) conditions to each receptor.

Table 2. Sound Power Level of Equipment Fleet Used in the Simulation

EQUIPMENT	SOUND POWER LEVEL (DBA)[A]
Haul Truck – Cat 785D	121
Excavator – PC 1250	109
Production drill – Cat MD5125	125
Track Dozer – Cat D8T	121
Road Grader – Cat 14M	110
Water truck	118
Utility Excavator - Cat 345	107
Wheel Loader – Cat 980	113
Wheel Loader CAT 988H	114
Smithco side dump trailer	112
Power plant (3 MW)	126
Train in straight line	100 dBA/m
Train in curve	111 dBA/m

Note: [a] Sound power level rounded at 1 dBA, ref: $1x10^{-12}$ W.

4 RESULTS

4.1 ENVIRONMENTAL NOISE MEASUREMENT

Table 3 presents the daytime sound level (L_d), the night time sound level (L_n) and the day-night sound level (L_{dn}) of the ambient noise measured at the five receptors points. The daytime period is from 7 am to 10 pm and the night-time period is from 10 pm to 7 am.

Table 3. Ambient Noise Level

RECEPTOR POINT	MEASURED SOUND LEVEL (DBA)[A]		
	Daytime Sound Level (L_d - 7 am to 10 pm)	Night-Time Sound Level (L_n - 10 pm to 7 am)	Day-Night Sound Level (L_{dn})
P1	29	27	34
P2	32	28	35
P3	30	30	36
P4	32	24	33
P5	34	33	40

Note : [a] Noise level rounded to 1 dBA, ref: $2x10^{-5}$ Pa.

The measurements were taken in an isolated area of the northern Labrador wilderness. Besides the human activities of the prospect group on the site (which were excluded from the measurements), there was no activity. The ambient noise at the five receptors points was very calm and at times, and it was possible to hear the sound of the waves as the wind carried them to the shore.

The results in graphical form of each receptor point are presented in Appendix D. It is possible to see on the graphs that for certain receptor points the floor level of the instrument was reach as the noise level in the area was very low. The floor level of the instrument is cause by the noise of the electronics of the sound level meter and does not affect the acquisition of data.

4.2 PROJECTED NOISE

Table 4 presents the results (L_d, L_n et L_{dn}) and Table 5 presents the % HA for the year 1 simulation.

Table 4. Noise Level (Ld, Ln and Ldn) at the Receptors Points for the Year 1

RECEPTOR POINT	PREDICTED SOUND LEVEL (DBA)[A]		
	Daytime Sound Level (L_d - 7 am to 10 pm)	Night-Time Sound Level (L_n - 10 pm to 7 am)	Day-Night Sound Level (L_{dn})
P1	38	38	44
P2	43	43	50
P3	34	35	41
P4	43	45	51
P5	44	44	50

Note : [a] Noise level rounded to 1 dBA, ref: $2x10^{-5}$ Pa.

Table 5. Noise Level and % HA at the Receptors Points for the Year 1

RECEPTOR POINT	BASELINE L_{DN} (DBA)[A]	BASELINE % HA	BASELINE + OPERATIONS L_{DN} (DBA)[A]	BASELINE + OPERATIONS % HA	% HA INCREASE	EXCEEDS 6.5% % HA INCREASE
P1	33.8	0.3	44	1.1	0.8	No
P2	35.3	0.3	50	2.1	1.8	No
P3	36.4	0.4	41	0.8	0.4	No
P4	32.9	0.2	51	2.4	2.2	No
P5	39.6	0.6	50	2.3	1.7	No

Note : [a] Ref: $2x10^{-5}$ Pa.

The results of the simulations show that the Project activities will not exceed the 6.5% (% HA) criteria at any receptor point.

All noise levels are less than the residential criterion of 75 dBA (L_{dn}). The graphical results of the simulations with isophonic curves are presented in Appendix E.

5 SUMMARY AND CLOSURE

Five sound measurements were made around the projected mine infrastructure to evaluate the background noise (without mining activities). These measurements established the baseline conditions required to be compared with the Project's future operations on "worst case" scenario basis.

The sound assessment criteria employed in this study are based on Health Canada's guidelines concerning noise as it relates to annoyance. The guidelines state that the day-night sound level (L_{dn}) should not exceed 75 dBA and the resulting change in percentage of highly annoyed receptors (%HA) should be less than 6.5%.

To evaluate the maximum sound emitted by the Project activities, the year 1 has been simulated. This year has been simulated because it represents the worst case scenario as the mine tonnage is at its maximum and the mine pit is at its highest level and does not procure a significant screening effect.

The results show that there is no day-night level superior to 75 dBA or any change in %HA superior to 6.5% measured at the seasonal dwellings located in the study area. The Project operations, as simulated, will then be conforming to the federal regulation.

REFERENCES

- HEALTH CANADA. 2010. *Health Canada Noise Impact Assessment Guidance for Environmental Assessments,* Draft document, Environmental Assessment Division, Ottawa, Ontario, 61 p.
- HEALTH CANADA. 2010. *Useful Information for Environmental Assessments.* Ottawa, Ontario, 15 p.
- MICHAUD, D.S., BLY, S.H.P. AND S.E. KEITH. 2008. "*Using a change in percentage highly annoyed with noise as a potential health effect measure for projects under the Canadian Environmental Assessment Act*." Canadian Acoustics. Vol. 36: 13-30.

Appendix A

MEASUREMENT STATION PHOTOGRAPHS

Photo 1: **Measurement Station at P1**

Photo 2: **Measurement Station at P1**

Photo 3: **Measurement Station at P2**

Photo 4: **Measurement Station at P2**

Photo 5: **Sound Level Meter at P3**

Photo 6: **Measurement Station at P3**

Photo 7: **Measurement Station at P4**

Photo 8: **Measurement Station at P4**

Photo 9: **Measurement Station at P5**

Photo 10: **Measurement Station at P5**

Appendix B

WEATHER CONDITIONS

Hourly Data Report for September 26, 2012

All times are specified in Local Standard Time (LST). Add 1 hour to adjust for Daylight Saving Time where and when it is observed.

SCHEFFERVILLE
QUEBEC

Latitude: 54°48'19.000" N **Longitude**: 66°48'19.000" W **Elevation**: 520.90 m

Climate ID: 7117823 **WMO ID**: 71921 **TC ID**: YKL

Hourly Data Report for September 26, 2012

Time	Temp °C	Dew Point Temp °C	Rel Hum %	Wind Dir 10s deg	Wind Spd km/h	Visibility km	Stn Press kPa	Hmdx	Wind Chill	Weather
00:00‡	3.2	1.3	87	23	18	16.1	94.44			NA
01:00‡	3.6	1.2	84	24	21	16.1	94.44			NA
02:00‡	3.4	1.1	85	22	11	16.1	94.47			NA
03:00‡	3.4	1.3	86	20	9	16.1	94.49			NA
04:00‡	3.1	1.4	89	22	13	16.1	94.50			NA
05:00‡	3.1	1.2	87	21	17	16.1	94.53			NA
06:00‡	2.7	1.0	89	22	22	16.1	94.56			NA
07:00‡	3.2	0.9	85	21	18	16.1	94.59			NA
08:00‡	4.0	0.8	79	22	18	16.1	94.63			NA
09:00‡	4.3	1.0	79	20	21	16.1	94.65			NA
10:00‡	5.0	0.8	74	21	21	16.1	94.60			NA
11:00‡	5.6	1.4	74	23	17	16.1	94.60			NA
12:00‡	6.1	0.6	68	22	21	16.1	94.58			NA
13:00‡	6.3	-0.3	63	23	26	16.1	94.57			NA
14:00‡	6.1	0.9	69	23	15	16.1	94.57			NA
15:00‡	6.2	0.6	68	24	11	16.1	94.55			NA
16:00‡	6.2	0.5	67	22	13	16.1	94.57			NA
17:00‡	5.6	0.1	68	23	9	16.1	94.57			NA
18:00‡	4.6	1.0	77	20	4	16.1	94.60			NA
19:00‡	3.7	1.4	85	M	4	16.1	94.61			NA
20:00‡	3.4	1.9	90	30	4	16.1	94.60			NA
21:00‡	3.4	2.7	95	9	4	16.1	94.59			NA
22:00‡	3.3	2.7	96	29	4	16.1	94.57			NA
23:00‡	2.9	2.3	96	31	4	16.1	94.58			NA

Legend
M = Missing
E = Estimated
NA = Not Available
‡ = Partner data that is not subject to review by the National Climate Archives

Hourly Data Report for September 27, 2012

All times are specified in Local Standard Time (LST). Add 1 hour to adjust for Daylight Saving Time where and when it is observed.

SCHEFFERVILLE
QUEBEC

Latitude: 54°48'19.000" N **Longitude**: 66°48'19.000" W **Elevation**: 520.90 m

Climate ID: 7117823 **WMO ID**: 71921 **TC ID**: YKL

Hourly Data Report for September 27, 2012

Time	Temp °C	Dew Point Temp °C	Rel Hum %	Wind Dir 10s deg	Wind Spd km/h	Visibility km	Stn Press kPa	Hmdx	Wind Chill	Weather
00:00‡	2.4	1.8	96	31	5	16.1	94.59			NA
01:00‡	2.4	2.0	97	32	9	14.5	94.59			NA
02:00‡	2.5	2.1	97	32	8	16.1	94.58			NA
03:00‡	2.4	2.0	97	32	8	16.1	94.59			NA
04:00‡	2.5	2.2	98	32	11	16.1	94.63			NA
05:00‡	2.3	2.0	98	33	11	16.1	94.67			NA
06:00‡	2.2	1.9	98	32	11	16.1	94.71			NA
07:00‡	1.8	1.4	97	32	18	12.9	94.76			NA
08:00‡	1.9	1.6	98	32	13	8.1	94.81			NA
09:00‡	3.8	3.1	95	31	18	16.1	94.82			NA
10:00‡	4.5	3.0	90	32	21	16.1	94.86			NA
11:00‡	3.5	2.3	92	33	18	12.9	94.89			NA
12:00‡	5.8	2.5	79	35	22	16.1	94.88			NA
13:00‡	6.7	2.6	75	33	21	16.1	94.91			NA
14:00‡	4.5	2.5	87	34	21	16.1	94.95			NA
15:00‡	5.2	2.4	82	33	17	16.1	94.98			NA
16:00‡	4.5	3.0	90	33	13	16.1	95.04			NA
17:00‡	3.6	2.8	94	31	13	9.7	95.10			NA
18:00‡	3.1	2.5	96	32	11	11.3	95.14			NA
19:00‡	3.1	2.4	95	33	15	11.3	95.18			NA
20:00‡	3.4	2.8	96	32	18	16.1	95.22			NA
21:00‡	2.9	2.2	95	32	15	16.1	95.25			NA
22:00‡	2.4	1.7	95	31	17	16.1	95.24			NA
23:00‡	2.2	1.5	95	33	15	16.1	95.31			NA

Legend
M = Missing
E = Estimated
NA = Not Available
‡ = Partner data that is not subject to review by the National Climate Archives

Hourly Data Report for September 28, 2012

All times are specified in Local Standard Time (LST). Add 1 hour to adjust for Daylight Saving Time where and when it is observed.

SCHEFFERVILLE
QUEBEC

Latitude: 54°48'19.000" N **Longitude**: 66°48'19.000" W **Elevation**: 520.90 m

Climate ID: 7117823 **WMO ID**: 71921 **TC ID**: YKL

Hourly Data Report for September 28, 2012

Time	Temp °C	Dew Point Temp °C	Rel Hum %	Wind Dir 10s deg	Wind Spd km/h	Visibility km	Stn Press kPa	Hmdx	Wind Chill	Weather
00:00‡	1.9	1.0	94	32	17	16.1	95.34			NA
01:00‡	2.0	0.4	89	33	21	16.1	95.37			NA
02:00‡	1.5	0.9	96	33	15	6.4	95.43			NA
03:00‡	1.4	1.1	98	32	18	6.4	95.47			NA
04:00‡	1.2	0.8	97	34	9	16.1	95.52			NA
05:00‡	1.3	0.9	97	31	9	16.1	95.56			NA
06:00‡	1.7	1.0	95	33	13	16.1	95.60			NA
07:00‡	2.3	1.3	93	33	15	16.1	95.65			NA
08:00‡	3.0	1.8	92	30	9	16.1	95.70			NA
09:00‡	4.1	1.5	83	30	9	16.1	95.71			NA
10:00‡	4.9	0.4	73	30	9	16.1	95.72			NA
11:00‡	5.7	0.6	70	32	13	16.1	95.69			NA
12:00‡	6.0	0.9	70	27	11	16.1	95.66			NA
13:00‡	7.1	1.8	69	6	9	16.1	95.65			NA
14:00‡	7.8	1.6	65	30	9	16.1	95.67			NA
15:00‡	7.5	2.3	69	28	11	16.1	95.68			NA
16:00‡	6.6	1.9	72	29	5	16.1	95.71			NA
17:00‡	6.0	1.6	73	29	9	16.1	95.74			NA
18:00‡	3.6	1.6	86	26	9	16.1	95.77			NA
19:00‡	4.9	1.5	79	26	9	16.1	95.81			NA
20:00‡	3.5	0.7	82	26	8	16.1	95.83			NA
21:00‡	2.2	0.4	88	19	9	16.1	95.86			NA
22:00‡	2.1	0.5	89	17	5	16.1	95.89			NA
23:00‡	1.3	0.3	93		0	16.1	95.92			NA

Legend
M = Missing
E = Estimated
NA = Not Available
‡ = Partner data that is not subject to review by the National Climate Archives

Hourly Data Report for September 29, 2012

All times are specified in Local Standard Time (LST). Add 1 hour to adjust for Daylight Saving Time where and when it is observed.

SCHEFFERVILLE
QUEBEC

Latitude: 54°48'19.000" N **Longitude**: 66°48'19.000" W **Elevation**: 520.90 m

Climate ID: 7117823 **WMO ID**: 71921 **TC ID**: YKL

Hourly Data Report for September 29, 2012

Time	Temp °C	Dew Point Temp °C	Rel Hum %	Wind Dir 10s deg	Wind Spd km/h	Visibility km	Stn Press kPa	Hmdx	Wind Chill	Weather
00:00‡	2.7	0.3	84	16	5	16.1	95.94			NA
01:00‡	2.8	0.4	84	15	8	16.1	95.92			NA
02:00‡	2.4	0.1	85	14	8	16.1	95.93			NA
03:00‡	3.8	0.6	79	M	5	16.1	95.96			NA
04:00‡	4.1	1.4	82	12	8	16.1	95.97			NA
05:00‡	4.6	1.6	81	16	9	16.1	96.01			NA
06:00‡	4.8	1.5	79	14	9	16.1	96.05			NA
07:00‡	5.1	1.9	80	17	8	16.1	96.09			NA
08:00‡	6.2	2.6	77	M	4	16.1	96.14			NA
09:00‡	8.8	2.4	64	21	13	16.1	96.14			NA
10:00‡	9.4	1.6	58	21	18	16.1	96.14			NA
11:00‡	9.4	1.5	58	22	13	16.1	96.10			NA
12:00‡	9.7	1.5	57	25	15	16.1	96.07			NA
13:00‡	11.0	1.3	51	24	15	16.1	96.03			NA
14:00‡	11.3	1.1	49	22	22	16.1	96.00			NA
15:00‡	11.2	1.8	52	25	18	16.1	95.99			NA
16:00‡	10.6	1.5	53	24	18	16.1	96.00			NA
17:00‡	8.1	1.9	65	27	8	16.1	96.06			NA
18:00‡	6.3	1.6	72	26	8	16.1	96.07			NA
19:00‡	5.5	1.1	73	27	5	16.1	96.10			NA
20:00‡	5.1	1.0	75	18	8	16.1	96.06			NA
21:00‡	4.4	1.1	79	19	5	16.1	96.06			NA
22:00‡	3.0	0.7	85		0	16.1	96.09			NA
23:00‡	3.4	1.5	88	11	4	16.1	96.08			NA

Legend
M = Missing
E = Estimated
NA = Not Available
‡ = Partner data that is not subject to review by the National Climate Archives

Hourly Data Report for September 30, 2012

All times are specified in Local Standard Time (LST). Add 1 hour to adjust for Daylight Saving Time where and when it is observed.

SCHEFFERVILLE
QUEBEC

Latitude: 54°48'19.000" N **Longitude**: 66°48'19.000" W **Elevation**: 520.90 m

Climate ID: 7117823 **WMO ID**: 71921 **TC ID**: YKL

Hourly Data Report for September 30, 2012

Time	Temp °C	Dew Point Temp °C	Rel Hum %	Wind Dir 10s deg	Wind Spd km/h	Visibility km	Stn Press kPa	Hmdx	Wind Chill	Weather
00:00‡	3.0	0.7	85		0	16.1	96.08			NA
01:00‡	4.3	1.0	79	26	13	16.1	96.05			NA
02:00‡	5.3	0.9	73	26	18	16.1	96.04			NA
03:00‡	5.3	0.6	72	27	17	16.1	96.04			NA
04:00‡	5.6	0.5	70	26	17	16.1	96.04			NA
05:00‡	5.0	0.4	72	27	15	16.1	96.03			NA
06:00‡	4.8	0.4	73	25	5	16.1	96.04			NA
07:00‡	6.0	0.8	69	31	5	16.1	96.05			NA
08:00‡	7.6	1.3	64	26	22	16.1	96.03			NA
09:00‡	9.7	2.0	59	24	15	16.1	96.02			NA
10:00‡	11.4	2.5	54	26	22	16.1	95.99			NA
11:00‡	12.1	2.1	50	24	22	16.1	95.95			NA
12:00‡	13.2	2.0	46	26	17	16.1	95.86			NA
13:00‡	13.4	1.7	45	25	21	16.1	95.81			NA
14:00‡	14.0	2.0	44	25	21	16.1	95.78			NA
15:00‡	13.8	2.2	45	25	21	16.1	95.71			NA
16:00‡	13.3	2.0	46	25	13	16.1	95.66			NA
17:00‡	11.0	2.7	56	24	8	16.1	95.64			NA
18:00‡	7.9	2.6	69	27	4	16.1	95.64			NA
19:00‡	4.4	2.6	88	20	8	16.1	95.65			NA
20:00‡	3.8	2.0	88	M	4	16.1	95.66			NA
21:00‡	2.6	1.9	95	13	8	16.1	95.62			NA
22:00‡	3.1	2.2	94		0	16.1	95.56			NA
23:00‡	1.7	1.4	98	12	5	16.1	95.49			NA

Legend
M = Missing
E = Estimated
NA = Not Available
‡ = Partner data that is not subject to review by the National Climate Archives

Appendix C

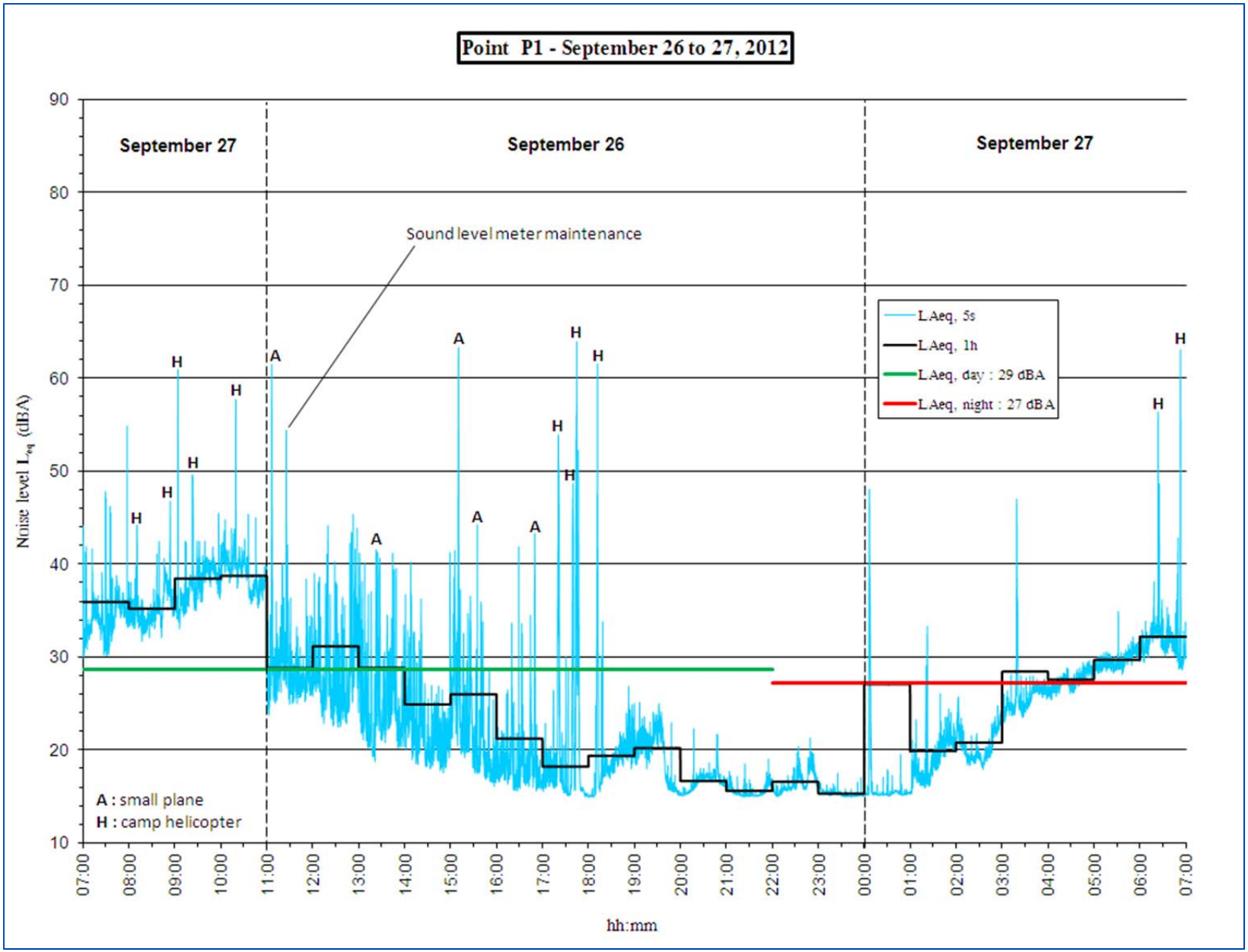
OCTAVE BAND SOUND POWER LEVELS

Equipment	Lw dB(A)[a]	Sound Power (dB[a]) per Octave Band (Hz)							
		63	125	250	500	1000	2000	4000	8000
Haul Truck – Cat 785D	121	112	118	104	103	103	100	93	87
Excavator – PC 1250	109	114	108	104	105	105	102	97	88
Production drill – Cat MD5125	125	111	117	117	118	117	120	118	114
Track Dozer – Cat D8T	121	124	121	111	116	114	114	113	108
Road Grader – Cat 14M	110	101	107	108	106	102	98	94	87
Water truck	118	111	111	106	105	105	103	96	91
Utility Excavator - Cat 345	107	106	100	94	94	92	94	87	78
Wheel Loader – Cat 988	114	102	112	108	111	111	105	97	91
Loader Cat 980	113	123	118	111	110	109	104	97	91
Smithco side dump trailer	112	111	111	104	107	110	103	97	87
Power plant	126	120	132	124	123	121	118	111	105
	Lw dB(A)[a]/m	**Sound Power (dB[a]/m) per Octave Band (Hz)**							
Train locomotive (Straight line)	100	114	99	97	94	94	95	87	83
Train (curve)	111	96	95	98	98	92	106	103	105

Note: [a] Sound power level rounded at 1 dB(A), ref: 1x10-12 W.

Appendix D

RESULTS IN GRAPHICAL FORM


Point P1 - September 26 to 27, 2012
September 27
September 26
September 27
Sound level meter maintenance
LAeq, 5s
LAeq, 1h
LAeq, day : 29 dBA
LAeq, night : 27 dBA
A : small plane
H : camp helicopter
Noise level L_{eq} (dBA)
hh:mm
90
80
70
60
50
40
30
20
10
07:00
08:00
09:00
10:00
11:00
12:00
13:00
14:00
15:00
16:00
17:00
18:00
19:00
20:00
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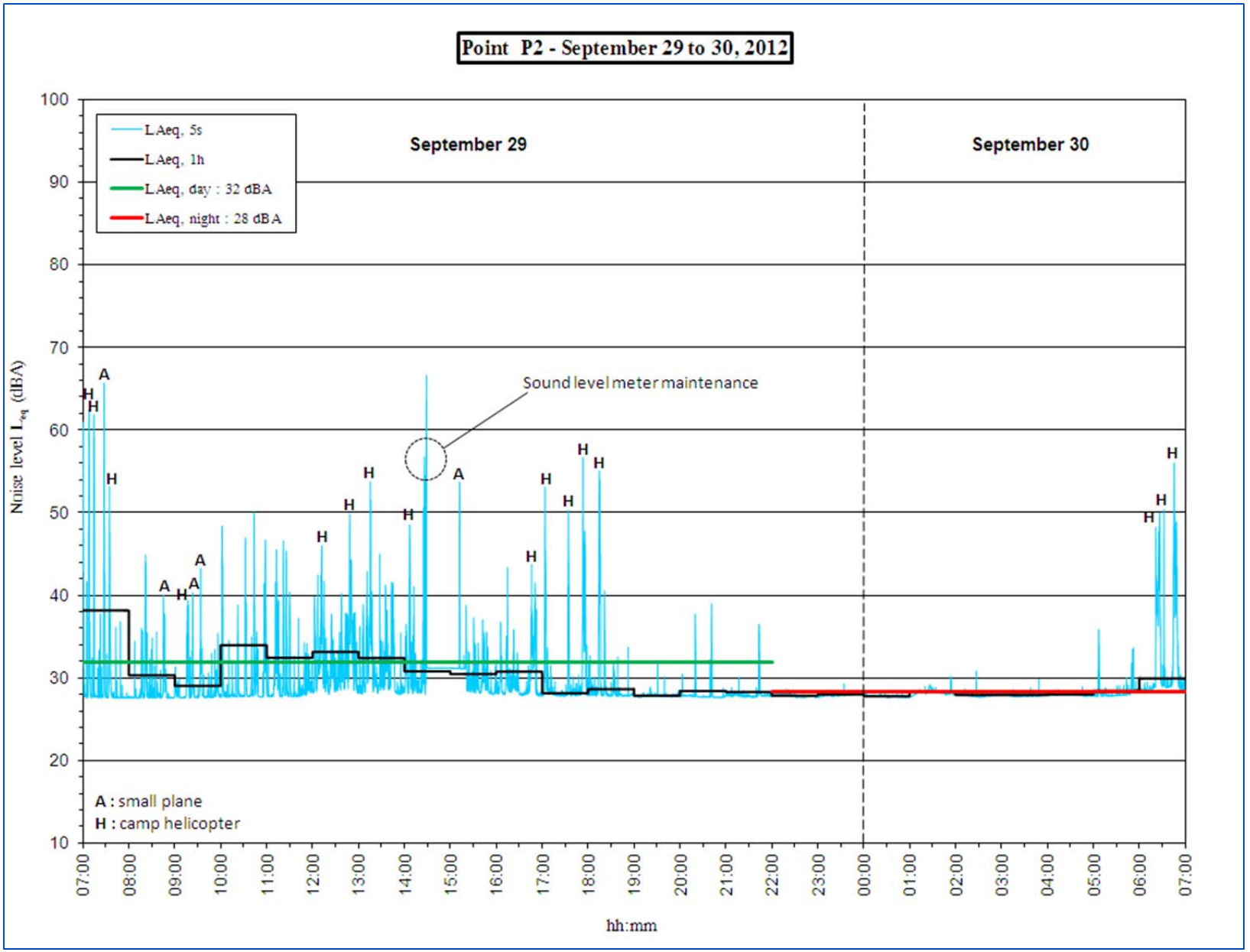
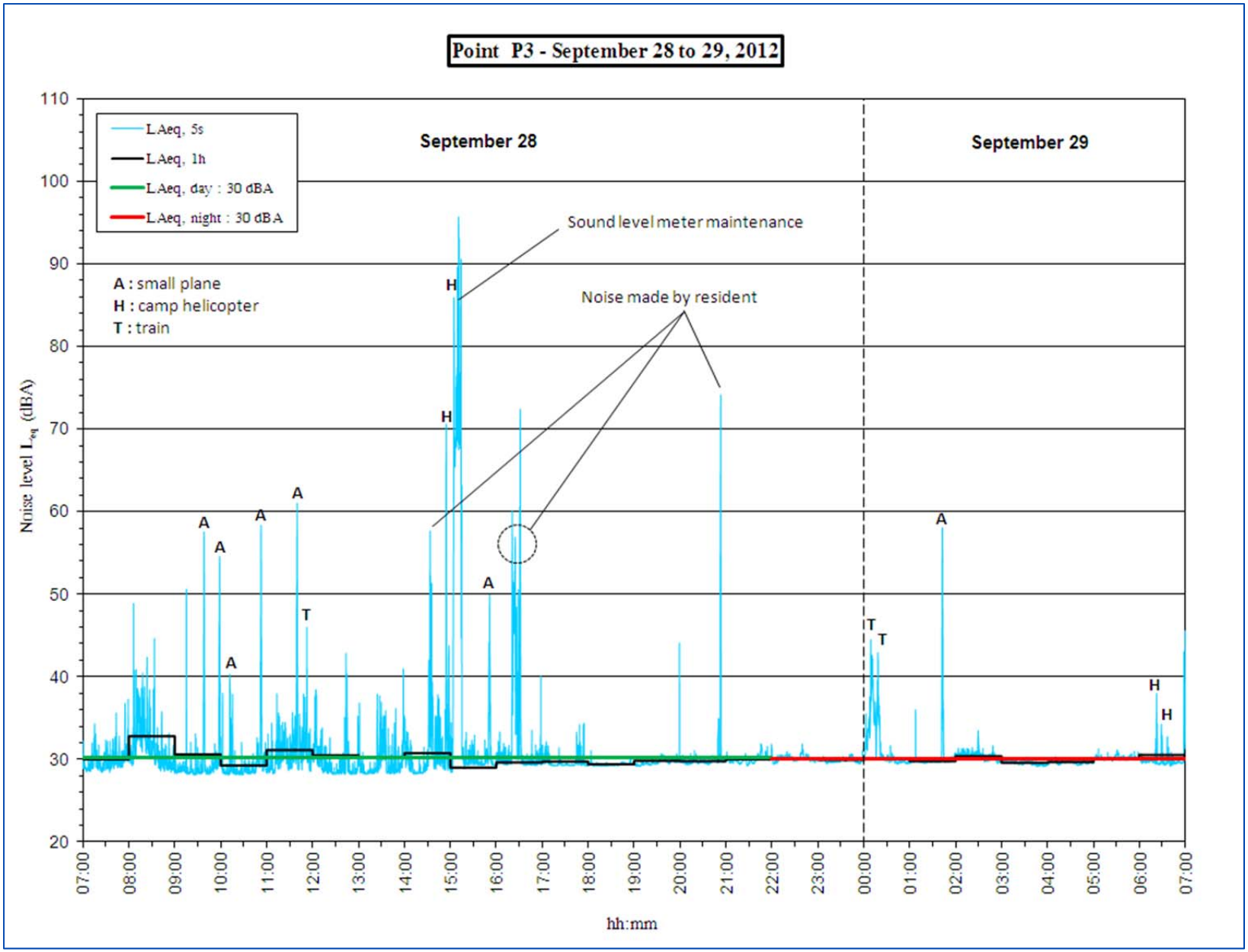
02:00
03:00
04:00
05:00
06:00
07:00


Point P2 - September 29 to 30, 2012
LAeq, 5s
LAeq, 1h
LAeq, day : 32 dBA
LAeq, night : 28 dBA
September 29
September 30
Sound level meter maintenance
Noise level L_{eq} (dBA)
100
90
80
70
60
50
40
30
20
10
A : small plane
H : camp helicopter
07:00
08:00
09:00
10:00
11:00
12:00
13:00
14:00
15:00
16:00
17:00
18:00
19:00
20:00
21:00
22:00
23:00
00:00
01:00
02:00
03:00
04:00
05:00
06:00
07:00
hh:mm


Point P3 - September 28 to 29, 2012
LAeq, 5s
LAeq, 1h
LAeq, day : 30 dBA
LAeq, night : 30 dBA
September 28
September 29
Sound level meter maintenance
Noise made by resident
A : small plane
H : camp helicopter
T : train
Noise level Leq (dBA)
hh:mm
110
100
90
80
70
60
50
40
30
20
07:00
08:00
09:00
10:00
11:00
12:00
13:00
14:00
15:00
16:00
17:00
18:00
19:00
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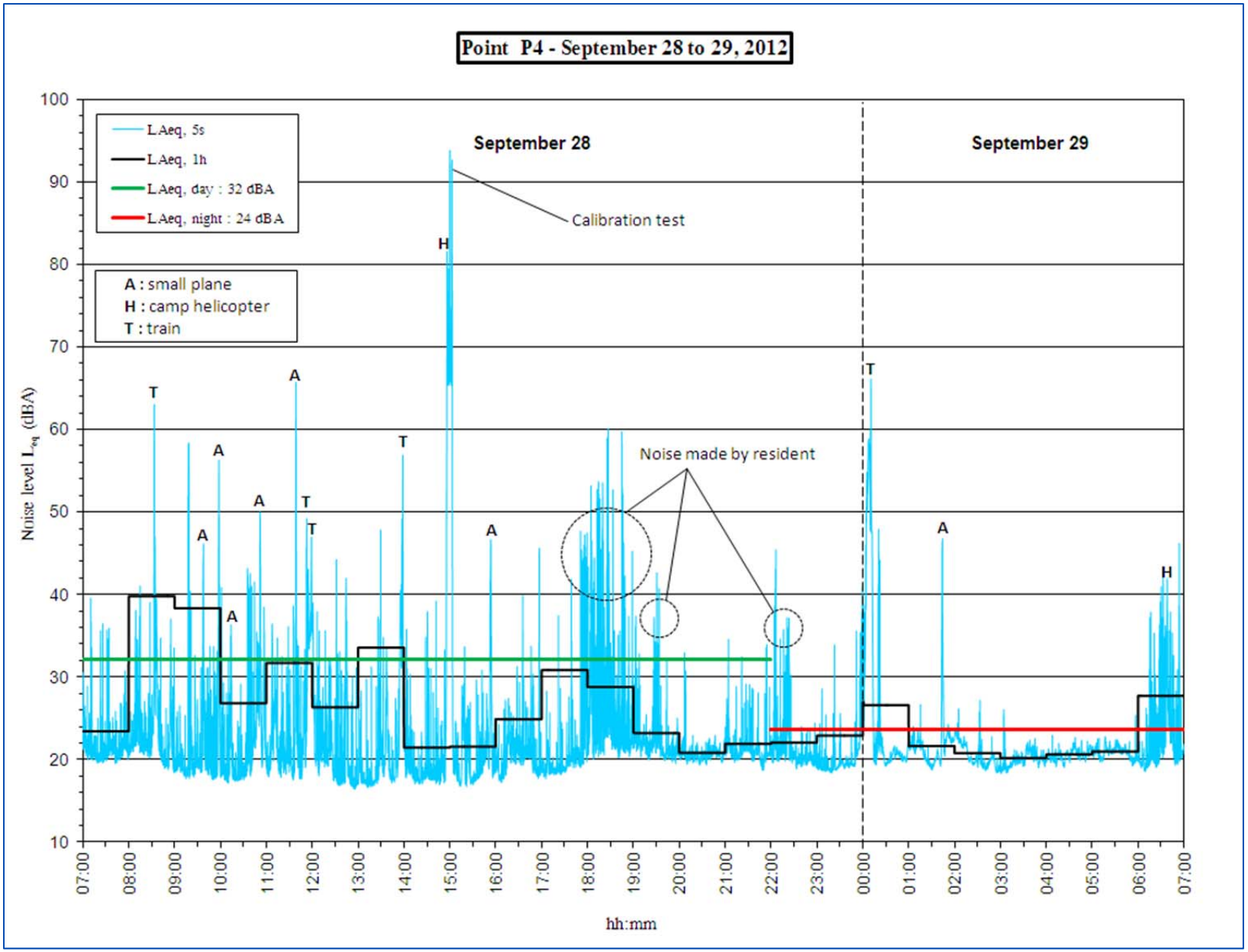
02:00
03:00
04:00
05:00
06:00
07:00


Point P4 - September 28 to 29, 2012
LAeq, 5s
LAeq, 1h
LAeq, day : 32 dBA
LAeq, night : 24 dBA
A : small plane
H : camp helicopter
T : train
September 28
September 29
Calibration test
Noise made by resident
Noise level Leq (dBA)
hh:mm
100
90
80
70
60
50
40
30
20
10
07:00
08:00
09:00
10:00
11:00
12:00
13:00
14:00
15:00
16:00
17:00
18:00
19:00
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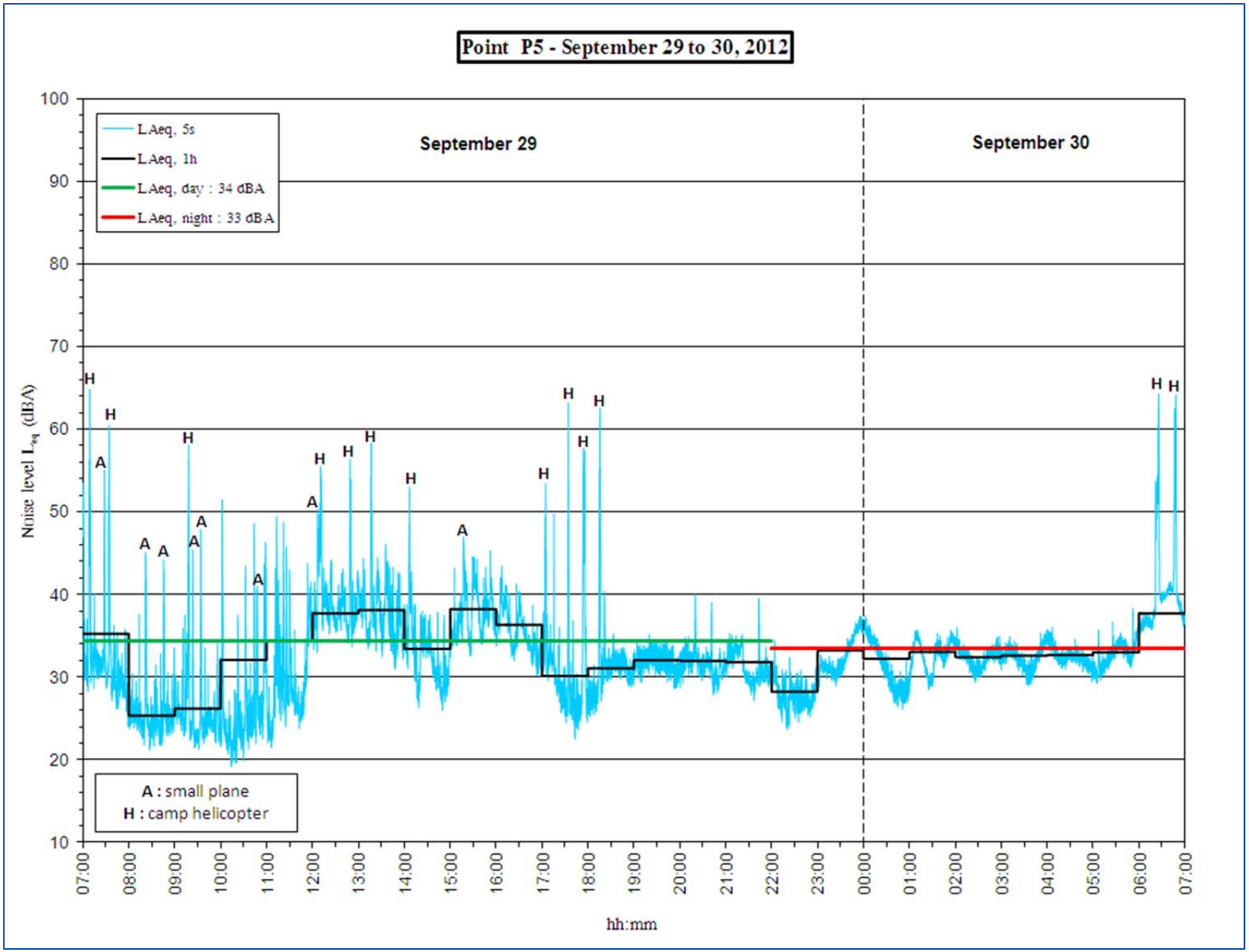
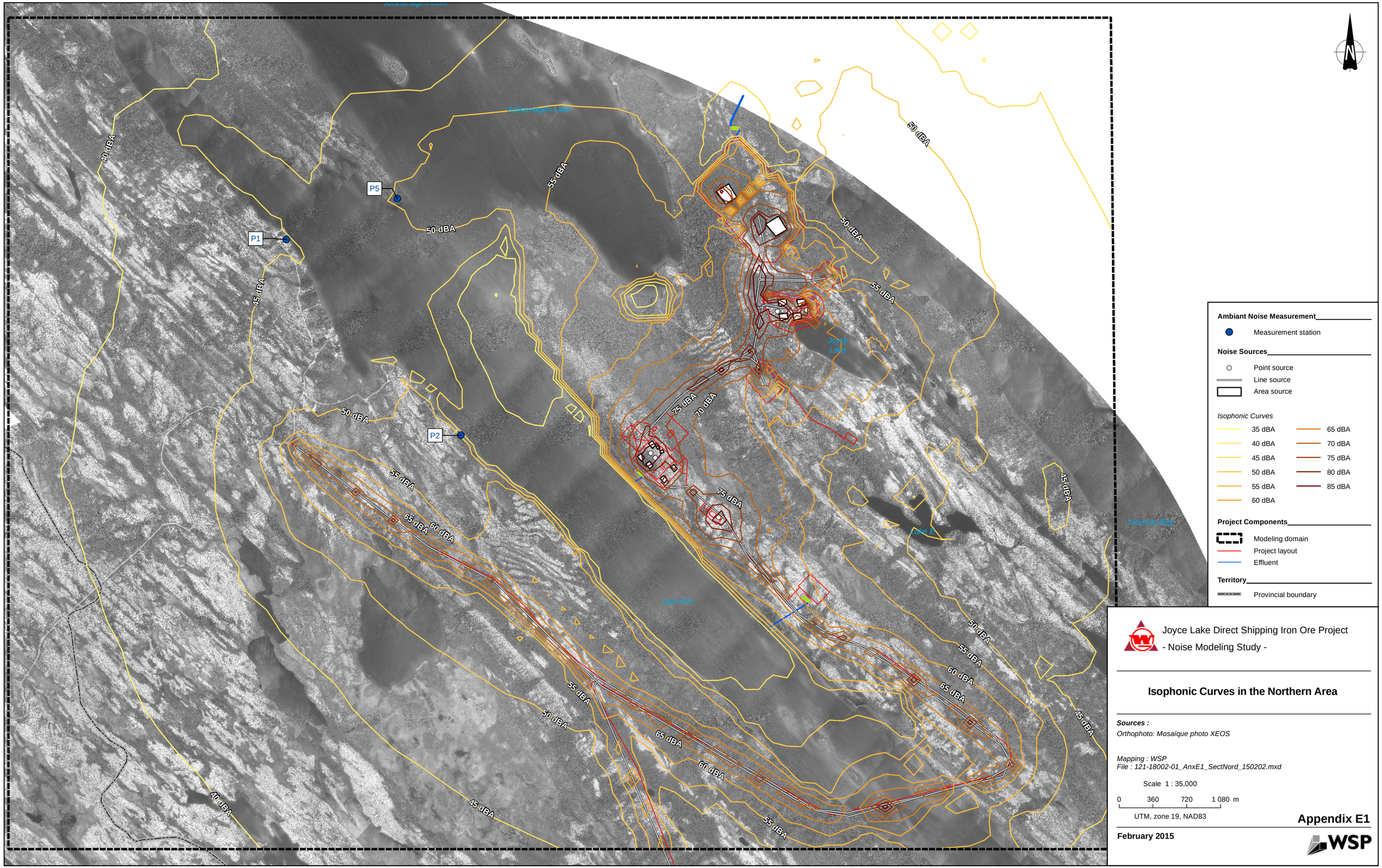
02:00
03:00
04:00
05:00
06:00
07:00


Point P5 - September 29 to 30, 2012
LAeq, 5s
LAeq, 1h
LAeq, day : 34 dBA
LAeq, night : 33 dBA
September 29
September 30
Noise level L_{eq} (dBA)
100
90
80
70
60
50
40
30
20
10
A : small plane
H : camp helicopter
07:00
08:00
09:00
10:00
11:00
12:00
13:00
14:00
15:00
16:00
17:00
18:00
19:00
20:00
21:00
22:00
23:00
00:00
01:00
02:00
03:00
04:00
05:00
06:00
07:00
hh:mm

Appendix E

ISOPHONIC CURVES OF DAY-NIGHT NOISE LEVEL



Ambiant Noise Measurement

Measurement station

Noise Sources

Point source
Line source
Area source

Isophonic Curves

35 dBA
40 dBA
45 dBA
50 dBA
55 dBA
60 dBA
65 dBA
70 dBA
75 dBA
80 dBA
85 dBA

Project Components

Modeling domain
Project layout
Effluent

Territory

Provincial boundary

Joyce Lake Direct Shipping Iron Ore Project
- Noise Modeling Study -

Isophonic Curves in the Northern Area

Sources :
Orthophoto: Mosaïque photo XEOS

Mapping : WSP
File : 121-18002-01_AnxE1_SectNord_150202.mxd

Scale 1 : 35,000

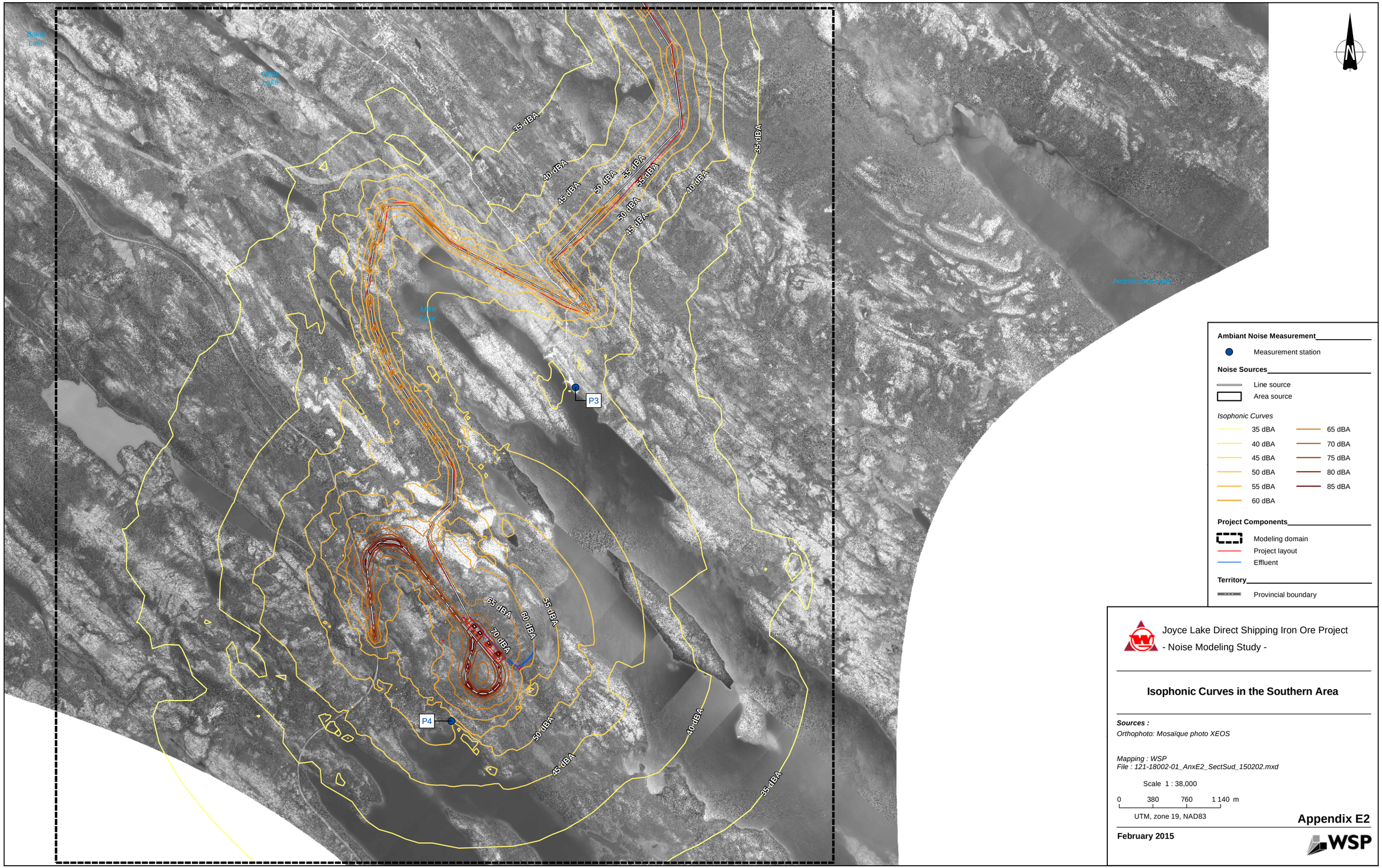
0 360 720 1 080 m

UTM, zone 19, NAD83

Appendix E1

February 2015

WSP



Ambiant Noise Measurement

Measurement station

Noise Sources

Line source

Area source

Isophonic Curves

35 dBA	65 dBA
40 dBA	70 dBA
45 dBA	75 dBA
50 dBA	80 dBA
55 dBA	85 dBA
60 dBA	

Project Components

Modeling domain

Project layout

Effluent

Territory

Provincial boundary

Joyce Lake Direct Shipping Iron Ore Project

- Noise Modeling Study -

Isophonic Curves in the Southern Area

Sources :

Orthophoto: Mosaïque photo XEOS

Mapping : WSP

File : 121-18002-01_AnxE2_SectSud_150202.mxd

Scale 1 : 38,000

0 380 760 1 140 m

UTM, zone 19, NAD83

Appendix E2

February 2015

WSP

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