CHALEUR VENTUS WIND ENERGY PROJECT

APPENDIX C - NOISE IMPACT ASSESSMENT

CHALEUR VENTUS LIMITED PARTNERSHIP

November 2019

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WSP PROJECT NO.: 181-07802
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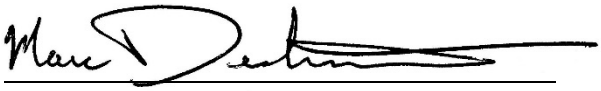

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1 INTRODUCTION

This report provides a summary of the Noise Impact Assessment completed in support of the Chaleur Ventus Wind Energy Project (Project) Registration Document that was submitted to the Sustainable Development, Planning and Impact Evaluation Branch, Department of Environment and Local Government in September of 2019.

The purpose of this report is to determine the potential noise impact resulting from the Project's operation and the Project's compliance with the Department of Environment and Local Government Additional Information Requirements for Wind Turbines document.

1.1 PROJECT OVERVIEW

Chaleur Ventus Limited Partnership (CVLP) is proposing the development of the Project. The Project is located on privately owned land south of route 303 in Gloucester County, New Brunswick, and will have an aggregate electrical capacity of 20 megawatts (MW). The Project will consist of five wind energy converters (WECs), access roads, collection system, substation, and associated temporary laydown areas required for construction. An approximate 9 kilometre (km) transmission line is proposed that runs south and southwest from the Project area to a proposed substation that will be located on Crown land approximately 2.8 km southeast of Saint-Leolin.

The Project is expected to consist of Enercon E-126 WECs with a nominal power of 4 MW. Each assembly will consist of the tower, hub, nacelle, rotor blades, and controller, with a total height of 179.5 to 194.5 metres (m) and is dependent on WEC availability from Enercon. The total WEC rotor diameter will be 127 m. It is anticipated that each WEC will be erected on a concrete foundation. The dimensions, depth, and type of foundation will depend on an evaluation of the local soil, surficial geology characteristics, wind forces at the location, and site-specific details of each location.

2 EXISTING ACOUSTIC ENVIRONMENT

The existing acoustic environment surrounding the Project site was determined by way of an ambient sound measuring campaign.

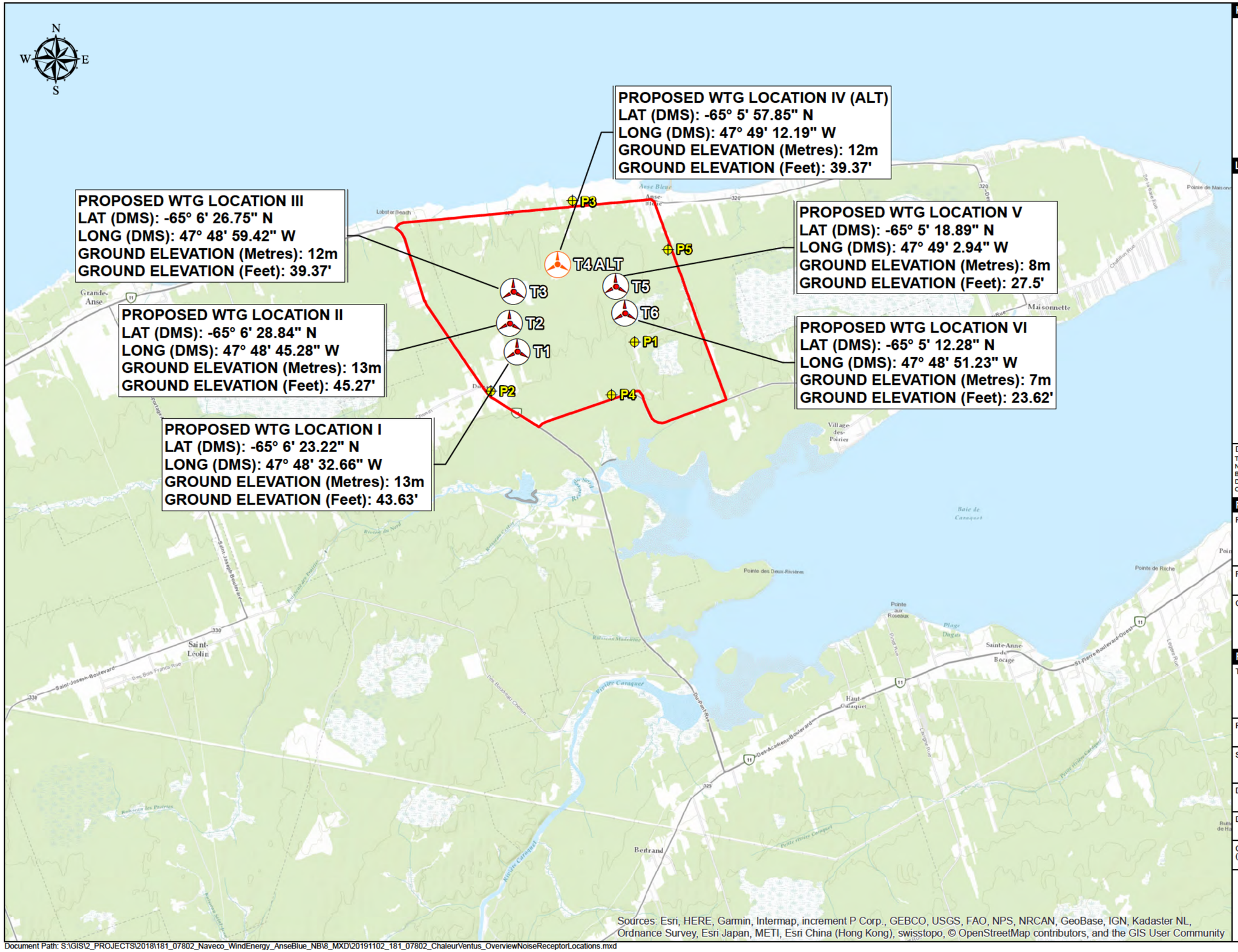
2.1 DATA COLLECTION

Ambient sound levels were measured at five receptor locations (P1 to P5) over a 24-hour period and used for the Wind Turbine Noise Impact Assessment (Section 4). Ambient sound level data was collected from October 22 to October 23, 2018 (P2 to P4) and November 5 to November 6, 2018 (P1 and P5).

The receptor points are located at the following locations:

- Receptor P1: abandoned farm at 47°48'38.13"N | 65° 5'5.44"W
- Receptor P2: residence [redacted]
- Receptor P3: residence [redacted]
- Receptor P4: residence [redacted]
- Receptor P5: residence [redacted]

See Figure 1 for the Project footprint and Receptor Locations.



KEY MAP:

LEGEND:

- TURBINE LAYOUT
- ALTERNATE TURBINE LAYOUT
- NOISE RECEPTOR LOCATIONS
- WEC SITE STUDY AREA

PROJECT:

PROJECT:
CHALEUR VENTUS
WIND ENERGY PROJECT

PROJECT NO.:
181-07802

CLIENT:
CHALEUR VENTUS
LIMITED PARTNERSHIP

FIGURE:

TITLE:
CHALEUR VENTUS
WIND ENERGY PROJECT AND
RECEPTOR LOCATIONS

FIGURE NO.:	REVISION NO.:
1	0

SCALE:
0 500 1,000 2,000 3,000
Metres

DATUM:	PROJECTION:
NAD 83 CSRS	NB Stereographic
DRAWN BY:	CHECKED BY:
T. MOREHOUSE	T. MacAULAY
CREATED DATE: (YYYY-MM-DD) 2019-11-02	REVISION DATE: (YYYY-MM-DD) 2019-11-03

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Document Path: S:\GIS\2_PROJECTS\2018\181_07802_Naveco_WindEnergy_AnseBlue_NB\8_MXD\20191102_181_07802_ChaleurVentus_OverviewNoiseReceptorLocations.mxd

The microphones were located away from any large reflecting surfaces and approximately 1.5 m above ground. Sound measurements were performed using the following sound level meters and an acoustic calibrator:

- Larson Davis sound level meters, models LXT, SN: 3302, 4823, and 4826
- Larson Davis precision acoustic calibrator, model CAL200

The sound level meters meet the IEC 61672 Class I specifications. All instruments had a valid calibration certificate issued by an independent laboratory.

Site calibration was also performed at the beginning and end of the monitoring period. The differential calibration did not exceed 0.5 dBA.

In general, meteorological conditions were acceptable for environmental noise measurements:

- No precipitation;
- Winds < 20 km/h;
- Temperature > 10°C;
- Relative humidity < 90%.

Environment Canada's meteorological conditions reports are presented in Appendix A.

2.2 ANALYSIS AND RESULTS

Sound measurements were analyzed and extraordinary events, such as people speaking and animal noises close to the microphone or helicopters flying overhead, were excluded from the analysis.

Table 1 presents a summary of the ambient sound measurement results. Results in graphical form are presented in Appendix B.

Table 1 Summary of Ambient Sound Levels

RECEPTOR	$L_{Aeq,\ 24h}$ (dBA)[1]	$L_{Aeq,\ 1\ h\ min}$ (dBA)[2]	$L_{Aeq,\ 1h\ max}$ (dBA)[3]
P1	N/A	22	34
P2	50	42	54
P3	48	43	51
P4	47	38	51
P5	42	19	51

1 $L_{Aeq,\ 24h}$: equivalent continuous sound level over the 24 hour period, in dBA
2 $L_{Aeq,\ 1h\ min}$: minimum 1 hour equivalent continuous sound level, in dBA
3 $L_{Aeq,\ 1h\ max}$: maximum 1 hour equivalent continuous sound level, in dBA

For receptor points P2 to P4, the dominant ambient noise source was road traffic from the adjacent highways #11, #320 and #303, respectively. Receptor P5 was in proximity to a local road with less traffic, hence the very low minimum 5 second and 1 hour equivalent continuous sound levels recorded (i.e., no traffic at night). The existing acoustic environment at receptor P1 is very quiet, with the dominant sound from natural sources (i.e., sounds of nature), because it is located far from main road arteries.

3 SOUND LEVEL CRITERIA

Department of Environment and Local Government recommends sound criteria for wind turbines in the Additional Information Requirements for Wind Turbines document. These guidelines suggest that the noise assessment should be performed for all sensitive receptors within 1 km of the nearest WEC to show compliance with the criteria presented in Table 2.

Table 2 Recommended Sound Criteria for Wind Turbines

Wind Speed (m/s)	4	5	6	7	8	9	10	11
Wind Turbine Noise Criteria (dBA)	40	40	40	43	45	49	51	53

4 WIND TURBINE NOISE IMPACT ASSESSMENT

4.1 METHODS

The dispersion and attenuation of sound in the atmosphere is modelled using algorithms based on the conversion of energy and the absorption of the expanding sound waves by the atmosphere and barriers in the path. The SoundPLAN® version 7.4 software was used to conduct the Project's sound modelling.

The Project's sound contribution at each sensitive receptor was calculated based on the ISO 9613-2 model. This noise propagation model is widely accepted as an appropriate model for the assessment of wind farms when appropriate inputs are used. The ISO 9613-2 model has the ability to take into account the distance between the source and receptor, topography, hardness of the ground and atmospheric absorption at different frequencies.

The ISO 9613-2 model is based on meteorological conditions favourable to sound propagation. According to the standard these conditions are for downwind propagation, or, equivalently, propagation under a well-developed moderate ground-based temperature inversion.

The assessment has been based on the inputs described in the following subsections.

4.1.1 *METEOROLOGICAL FACTORS*

The following meteorological conditions were considered for the noise assessment:

- Ambient air temperature: 10°C;
- Ambient barometric pressure: 101.32 kPa;
- Relative humidity: 70%.

These are the standard values recommended as per ISO 9613-2 as they maximize sound transmission.

4.1.2 *TERRAIN AND VEGETATION*

The following inputs were considered:

- Local topography;
- Global ground absorption factor: 0.7.

The ground absorption factor is a decimal value varying from 0 to 1.0.

4.1.3 *WIND TURBINE SOUND LEVEL*

Enercon E-126 EP3 – 4.0 MW WECs with a 116 m or 135 m hub height will be used for the Project. Blades will have serrated trailing edges. The WEC's broadband and third-octave band sound power levels were provided by Enercon, the turbine manufacturer. The acoustic emission levels used in this assessment are shown in Table 3.

Table 3 Enercon E-126 EP3 – Sound Power Levels – Operating Mode 3500 kW s (Blades with Serrated Trailing Edge) – Wind Speed v_H at Hub Height: 11 m/s (Loudest Condition)

Octave Band Center Frequency (Hz)	31.5	63	125	250	500	1000	2000	4000	8000
Sound Power Level (dBA)	77.4	89.1	94.9	97.9	100.1	99.9	97.3	88.5	67.8

4.1.4 *RECEPTORS*

The noise sensitive receptors are located closest to or within 1 km of the nearest WEC. There are four noise sensitive receptors corresponding to the four measuring locations P2 to P5 used for collecting the ambient sound level data (Section 2). P1 is an abandoned farm and was measured for indicative purposes only. The WEC and receptor locations are presented on Figure 1.

4.2 RESULTS

The predicted sound pressure levels by wind speed, at each sensitive receptor within 1 km to the closest turbine, are presented in Table 4.

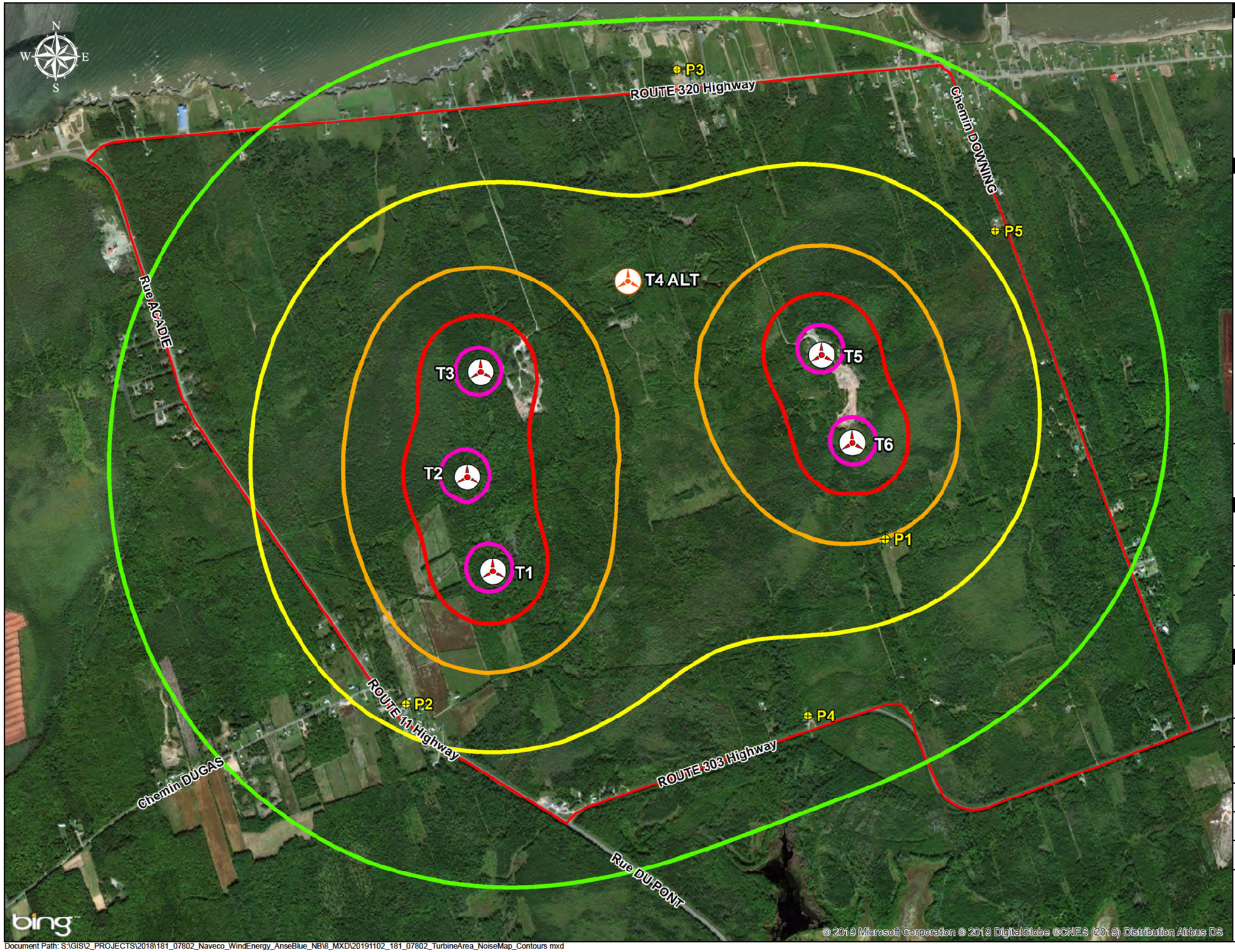
Table 4 Predicted Sound Pressure Levels (dBA) at Sensitive Receptors – 3500 Kw s Operating Condition, Loudest Condition, Wind Speed v_H: 11 m/s

RECEPTOR POINT	DESCRIPTION	HUB HEIGHT (m)		NOISE CRITERIA (dBA)
		116	135	
P1	Abandoned farm	40	40	53
P2	Residence [redacted]	36	36	
P3	Residence [redacted]	31	31	
P4	Residence [redacted]	33	33	
P5	Residence [redacted]	34	34	

From the results of Table 4, it can be concluded that:

- These predicted sound pressure levels are below the recommended sound criteria for WECs presented in Table 2, at wind speed of 11 m/s, for all sensitive receptors.
- A maximum noise level of 36 dBA is predicted at noise sensitive receptor P2. Because this is the loudest condition, the noise levels predicted are below the recommended criteria (the most severe being 40 dBA) at all other wind speeds (Table 2).

A noise map is presented on Figure 3, for the loudest condition (wind speed of 11 m/s).



KEY MAP:

LEGEND:

- TURBINE LAYOUT
- ALTERNATE TURBINE LAYOUT
- NOISE RECEPTOR LOCATIONS
- WEC SITE STUDY AREA

SOUND PRESSURE LEVEL
LAeq, 1h (dBA)

- 30
- 35
- 40
- 45
- 50

PROJECT:

PROJECT:
CHALEUR VENTUS
WIND ENERGY PROJECT

PROJECT NO.: 181-07802

CL ENT:
CHALEUR VENTUS
LIMITED PARTNERSHIP

FIGURE:

TITLE:
NOISE MAP
3500 Kw s OPERATING CONDITION,
LOUDEST CONDITION WIND SPEED vH: 11m/s

FIGURE NO.:	REVISION NO.:
2	0

SCALE: 0 100 200 400 600 800 Metres

DATUM:	PROJECTION:
NAD 83 CSRS	NB Stereographic
DRAWN BY:	CHECKED BY:
T. MOREHOUSE	T. MacAULAY
CREATED DATE: (YYYY-MM-DD) 2019-09-24	REVISION DATE: (YYYY-MM-DD) 2019-11-03

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5 CONCLUSIONS

In the assessed scenario, considering five Enercon E-126 EP3 – 4.0 MW WECs with 116 m and 135m hub height, all sensitive receptors are expected to receive sound pressure levels from the Project that are in compliance with the recommended criteria from the Department of Environment and Local Government Additional Information Requirements for Wind Turbines document.

Given the results of this assessment, no additional mitigations have been identified for the Project.

A ENVIRONMENT CANADA METEOROLOGICAL REPORTS

Government of Canada Gouvernement du Canada

Hourly Data Report for October 22, 2018

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

BAS CARAQUET
NEW BRUNSWICK
Current Station Operator: ECCC - MSC

Latitude:	47°48'08 000" N	**Longitude:**	64°50'00 000" W	**Elevation:**	5 00 m
Climate ID:	8100467	**WMO ID:**	71598	**TC ID:**	WXS

TIME	Temp °C	Dew Point °C	Rel Hum %	Wind Dir 10's deg	Wind Spd km/h	Visibility km	Stn Press kPa	Hmdx	Wind Chill	Weather
00:00	1.9	-6.1	56	30	27		100.45			NA
01:00	1.3	-6.1	58	29	25		100.50			NA
02:00	1.4	-6.2	57	30	32		100.51			NA
03:00	0.8	-4.4	68	26	18		100.54			NA
04:00	1.0	-6.0	60	27	23		100.61			NA
05:00	0.5	-6.6	59	26	21		100.63			NA
06:00	0.5	-6.2	61	26	22		100.65			NA
07:00	0.4	-5.7	63	27	22		100.71			NA
08:00	0.1	-7.1	58	26	17		100.80			NA
09:00	0.2	-6.8	59	25	18		100.84			NA
10:00	0.6	-6.7	58	26	23		100.89			NA
11:00	1.1	-6.6	57	26	19		100.94			NA
12:00	1.4	-6.8	54	26	21		100.96			NA
13:00	2.6	-6.1	53	26	22		100.99			NA
14:00	2.7	-6.3	51	27	21		101.03			NA
15:00	2.8	-6.5	50	27	19		101.09			NA
16:00	2.4	-6.4	52	27	22		101.16			NA
17:00	2.3	-5.7	56	27	21		101.23			NA
18:00	2.3	-6.1	54	26	18		101.33			NA
19:00	2.1	-6.3	54	26	16		101.40			NA
20:00	1.9	-6.6	54	26	14		101.48			NA
21:00	1.8	-5.8	57	26	17		101.56			NA
22:00	1.6	-5.2	60	26	16		101.60			NA
23:00	1.3	-5.2	62	26	18		101.61			NA

Government of Canada Gouvernement du Canada

Hourly Data Report for October 23, 2018

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

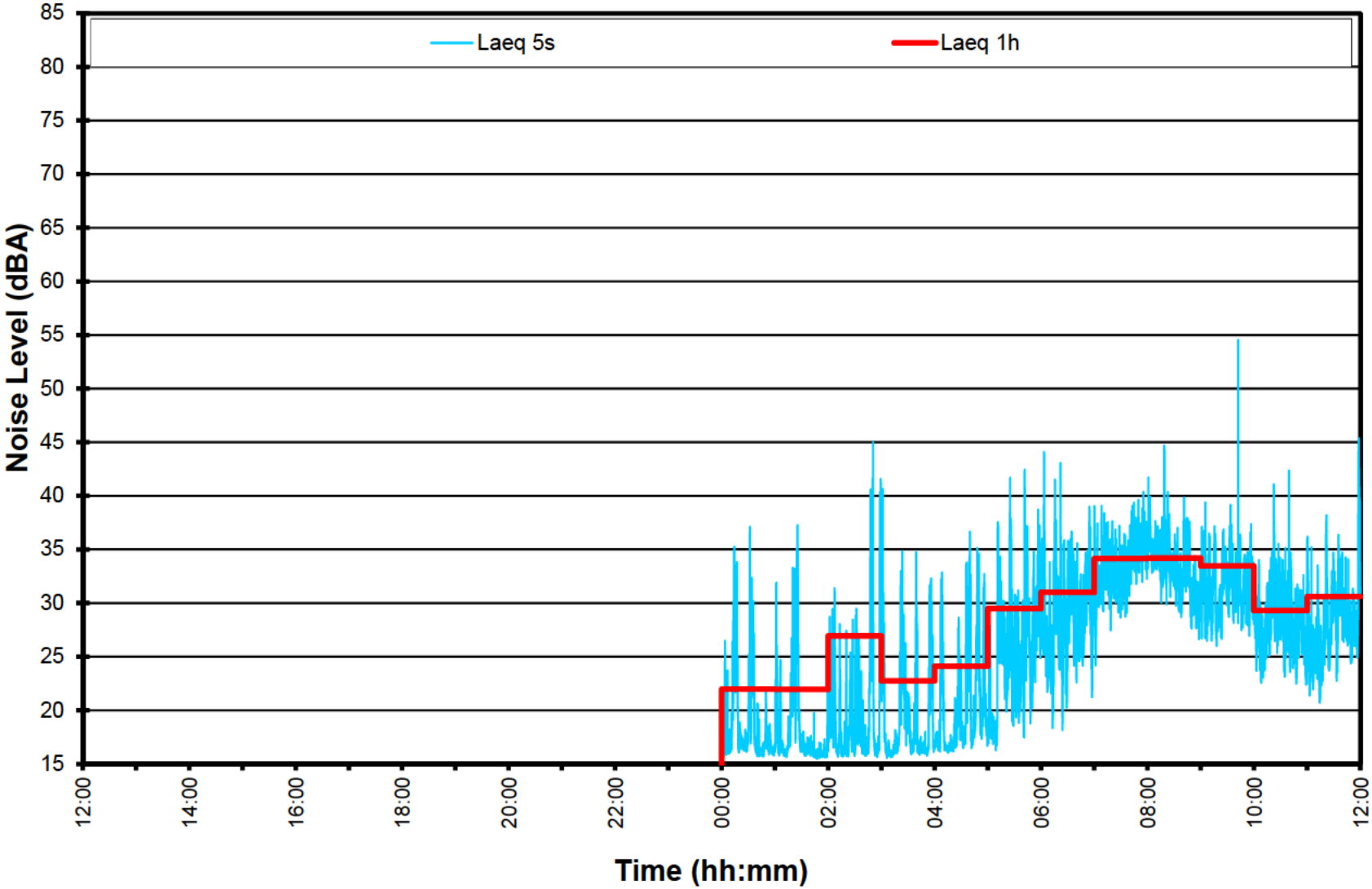
BAS CARAQUET
NEW BRUNSWICK
Current Station Operator: ECCC - MSC

Latitude:	47°48'08 000" N	**Longitude:**	64°50'00 000" W	**Elevation:**	5 00 m
Climate ID:	8100467	**WMO ID:**	71598	**TC ID:**	WXS

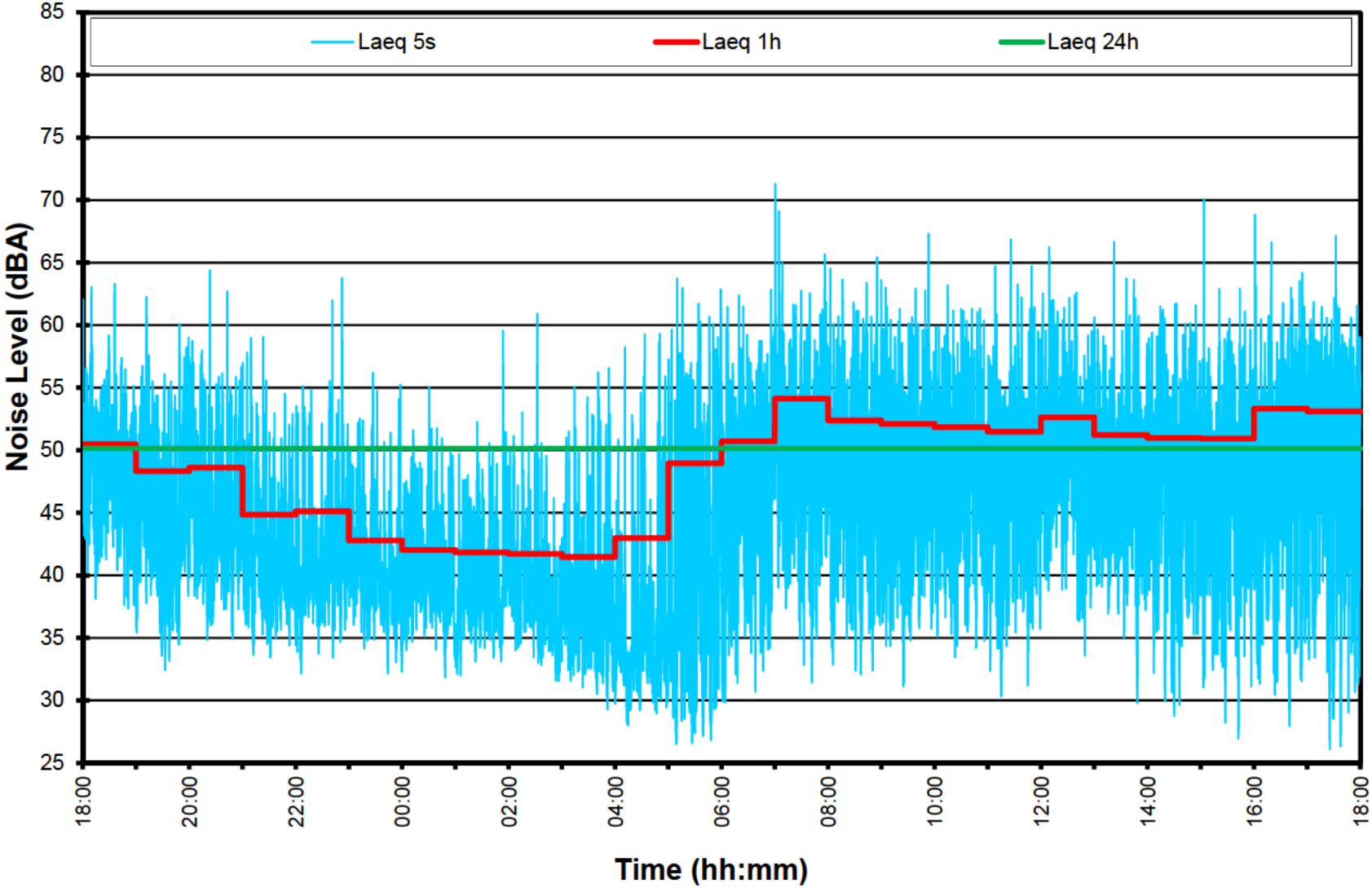
TIME	Temp °C	Dew Point °C	Rel Hum %	Wind Dir 10's deg	Wind Spd km/h	Visibility km	Stn Press kPa	Hmdx	Wind Chill	Weather
00:00	1.0	-4.7	66	26	18		101.65			NA
01:00	1.0	-4.3	68	26	18		101.69			NA
02:00	0.9	-3.9	70	27	20		101.74			NA
03:00	0.7	-3.6	72	27	16		101.77			NA
04:00	0.7	-3.2	75	27	16		101.81			NA
05:00	0.3	-3.3	77	26	12		101.88			NA
06:00	0.3	-3.1	78	26	13		101.96			NA
07:00	0.1	-2.9	80	26	13		102.04			NA
08:00	1.5	-2.2	76	26	12		102.10			NA
09:00	3.2	-2.3	67	28	15		102.16			NA
10:00	4.6	-1.8	63	28	14		102.21			NA
11:00	4.7	-2.4	60	28	14		102.23			NA
12:00	5.1	-2.3	59	29	16		102.22			NA
13:00	4.6	-2.7	59	29	15		102.24			NA
14:00	4.9	-2.0	61	29	12		102.25			NA
15:00	4.1	-2.2	64	29	9		102.29			NA
16:00	3.6	-3.4	60	30	3		102.31			NA
17:00	1.6	-3.2	70	9	4		102.33			NA
18:00	0.5	-2.7	79	8	5		102.37			NA
19:00	-1.2	-3.3	85	10	4		102.38		-3	NA
20:00	-2.0	-3.5	89	8	4		102.40		-3	NA
21:00	-1.2	-2.7	90	12	4		102.41		-3	NA
22:00	-0.6	-2.2	89	10	3		102.40		-2	NA
23:00	0.8	-0.8	89	10	4		102.36			NA

B MEASURED AMBIENT SOUND LEVELS

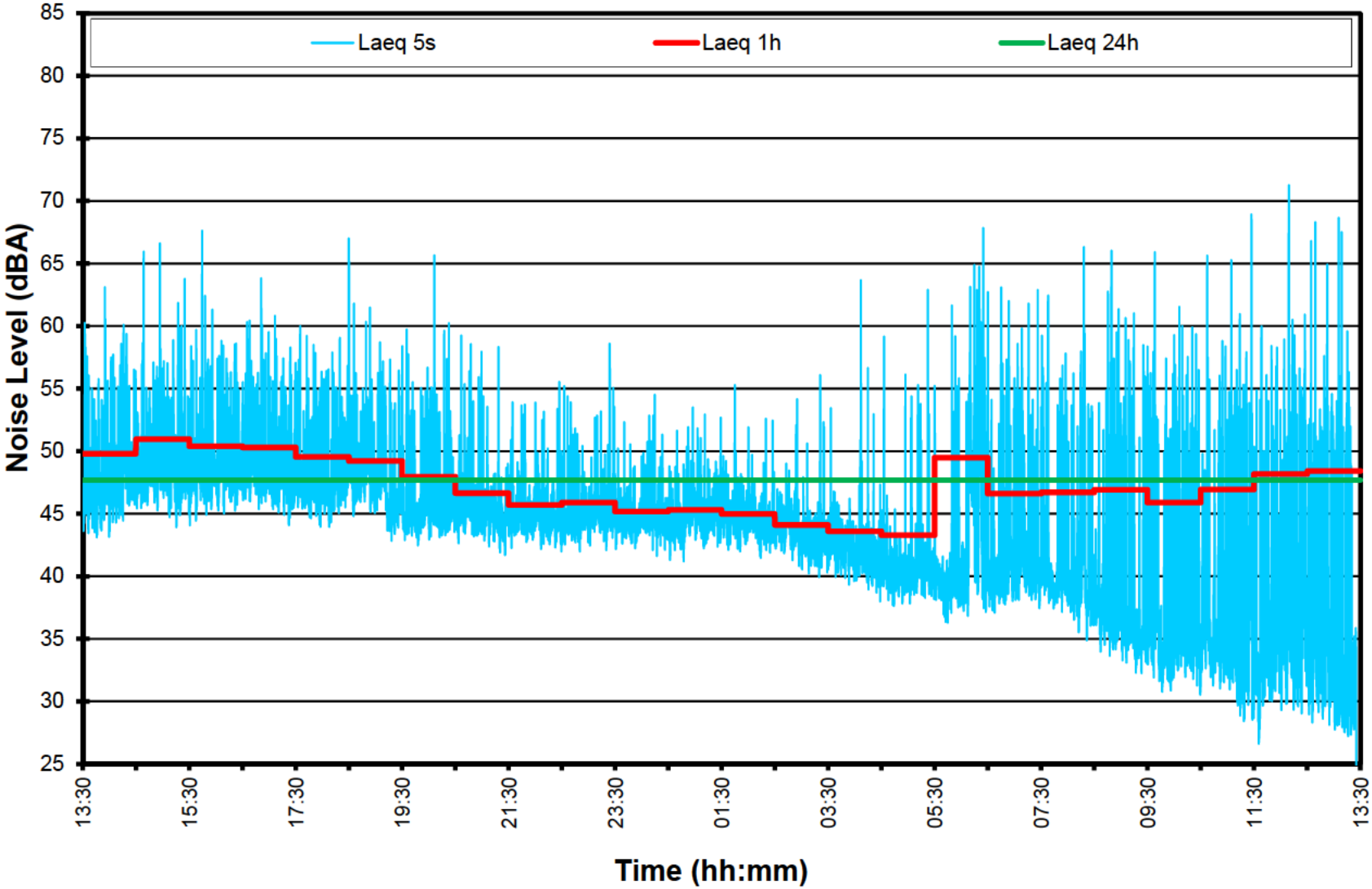
Baseline Measurements – Project 181-07802-00 (P1)
2018/11/05 to 2018/11/06



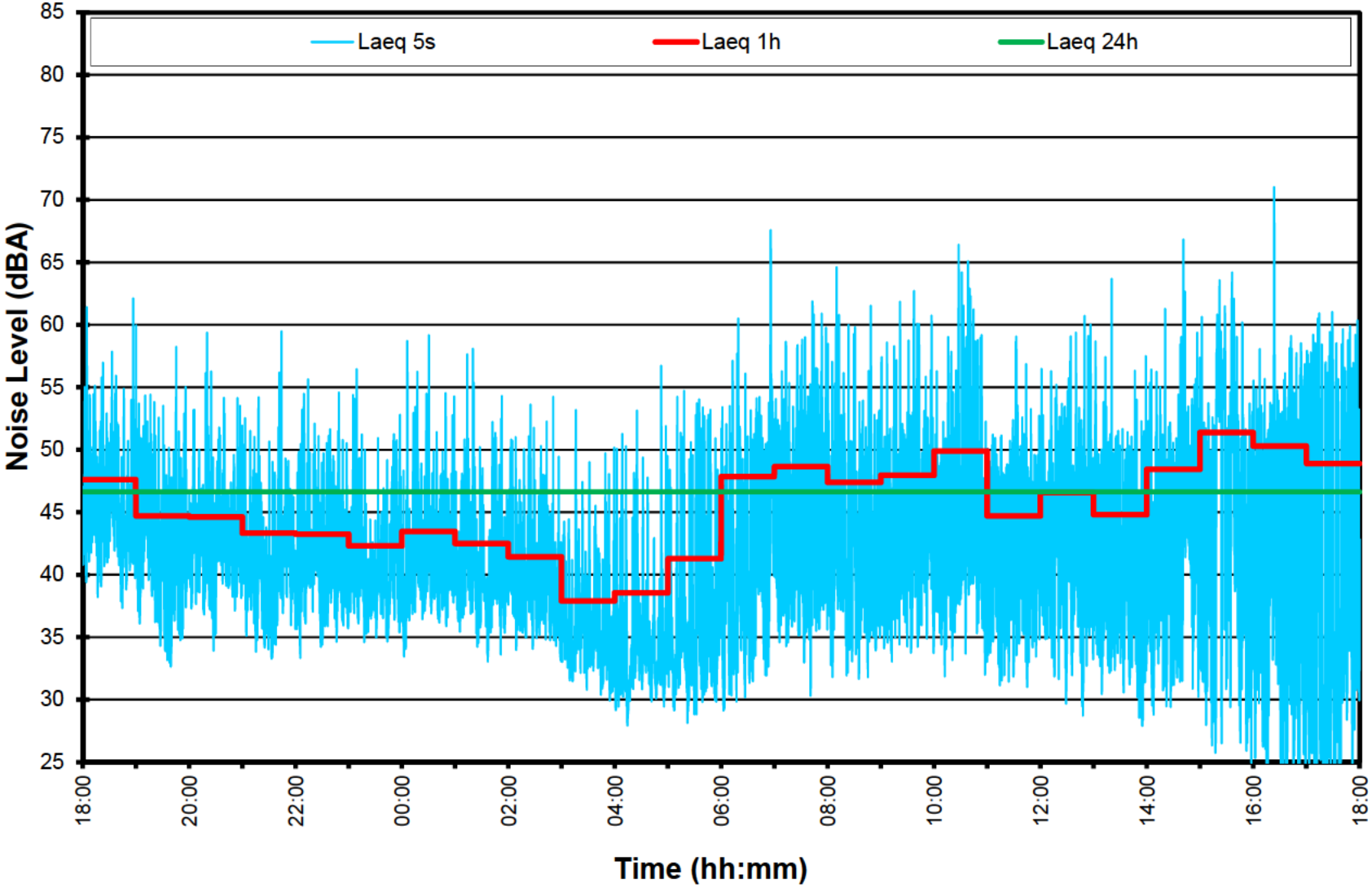
Baseline Measurements – Project 181-07802-00 (P2)
2018/10/22 to 2018/10/23



Baseline Measurements – Project 181-07802-00 (P3)
2018/10/22 to 2018/10/23



Baseline Measurements – Project 181-07802-00 (P4)
2018/10/22 to 2018/10/23



Baseline Measurements – Project 181-07802-00 (P5)
2018/11/05 to 2018/11/06