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ASSESSMENT REPORT - **Project: 17095.01**

# Belle River Wind LP
# Phase 1 Acoustic Immission Audit

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# Executive Summary

Aercoustics Engineering Limited ("Aercoustics") has been retained by Belle River Wind LP to complete the acoustic immission audit requirements outlined in the Renewable Energy Approval ("REA") for the Belle River Wind Power Project ("BRWPP"). BRWPP operates under REA #2765-A4ER2P, issued on January 13, 2016 [1].

As per the REA, five (5) measurement locations are required to be audited over two (2) separate occasions – or "Phases" – of measurement. The five (5) measurement locations chosen for the BRWPP immission audit are: R1126, R1207, R1170, R1469, and R2299. This report summarises the results of Phase 1 of the I-audit testing at all five (5) measurement locations.

The Phase 1 audit campaign for the five (5) measurement locations spanned the following dates:

| Location | Monitoring Start Date | Monitoring End Date | Monitoring Duration (weeks) |
|---|---|---|---|
| R1126 | March 26, 2019 | June 3, 2019 | 9.5 |
| R1207 | March 26, 2019 | June 3, 2019 | 9.5 |
| R1170 | March 26, 2019 | June 3, 2019 | 9.5 |
| R1469 | October 9, 2019 | January 11, 2020 | 14 |
| R2299 | October 9, 2019 | January 11, 2020 | 14 |

The audit has been completed as per the methodology outlined in Parts D and E5.5 RAM-I (Revised Assessment Methodology) of the "*MECP Compliance Protocol for Wind Turbine Noise*" (Updated April 21, 2017) [2].

Based on the results presented in Section 10.2 of this report, the cumulative sound impact calculated at all five (5) measurement locations complies with the MECP sound level limits at all wind bins having sufficient data for assessment.

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# 1 Introduction

Aercoustics Engineering Limited ("Aercoustics") has been retained by Belle River Wind LP to complete the immission audit ("I-audit") requirement outlined in Section E of the Renewable Energy Approval ("REA") for the Belle River Wind Power Project ("BRWPP"). BRWPP operates under REA #2765-A4ER2P, issued on January 13, 2016 [1].

Measurements were conducted per the Compliance Protocol for Wind Turbine Noise (the "Protocol") [2]. As per the REA, five (5) measurement locations are required. The measurement locations chosen for the BRWPP immission audit are: R1126, R1207, R1170, R1469, and R2299. This report summarises the results of Phase 1 of the I-audit testing at all BRWPP audit measurement locations.

# 2 Facility Description

The Belle River Wind Power Project is located in Lakeshore, Ontario. The site is bound by Essex 42 to the north, Highway 401 to the south, Lakeshore Road 111 to the west, and Comber Side Road to the east.

The BRWPP consists of 40 Siemens SWT-113 wind turbines for power generation, with a total nameplate capacity of 100 MW. Each turbine has a hub height of 99.5 meters, a rotor diameter of 113 meters and an individual nameplate capacity of either 3.2MW, 2.772MW, 2.473MW or 2.37MW. The facility operates 24 hours per day, 7 days per week. A Site Plan of the facility and the surrounding area are provided in Appendix A.1.

There are two wind facilities within 10 kilometres of the BRWPP: Comber Wind Farm ("CWF") and Pointe-Aux-Roches Wind Farm ("PARWF"). With respect to the five audit measurement locations, the nearest CWF turbine is Turbine T48, 3.1 km to the south of monitor R1126; the nearest PARWF turbine is Turbine T220, 2.1 km to the north of monitor R1170.

# 3 Audit Receptor Selection

As per Section E.1(2) of the BRWPP REA, five receptor[1] locations were chosen to execute both phases of the I-audit: R1126, R1207, R1170, R1469, and R2299. Monitoring equipment was erected near each of these receptors for the duration of the Phase 1 monitoring period.

[1] In this report, the term "receptor" refers to the Points of Reception outlined in the REA. The term "monitor" refers to the location of the measurement equipment used to assess the worst-case impact at the associated receptor.

### 3.1 **Receptor Selection Criteria**

Receptor selection criteria are outlined in REA Section E1 and paraphrased below. "Predicted noise impact" refers to the predicted cumulative impact using the sound model outlined in the noise assessment report [3] (Dokouzian, 2015)[2]. "Primary Turbine" refers to the turbine having the highest predicted impact at a given receptor location. "Downwind" refers to the direction from monitor to primary turbine being within +/-45° of the direction of the prevailing winds.

*E1(3):* *- Selected receptors should have the highest possible predicted noise impacts*
*- Selected receptors should be in the direction of the prevailing winds*

The receptors chosen for the BRWPP I-audit are R1126, R1207, R1170, R1469, and R2299. All receptors are situated downwind with respect to the prevailing wind direction. Further details regarding the monitoring position are provided in Section 4.2.

The Receptor Selection Process at the BRWPP was significantly restricted by the BRWPP's close proximity to the two neighbouring wind power projects, CWF and PARWF, and the central location of the BRWPP Transformer. These noise sources limit the locations on the project where the Protocol's requirement for a predicted level below 30 dBA during background measurement can be met.

Further to this, Ontario Highway 401 borders the project to the south, and is a significant source of ambient noise in the area. Noise from Highway 401 was observed to be particularly significant at two (2) measurement locations – R738 and R1141 – which were originally selected for the BRWPP audit campaign and subsequently de-selected. Two new receptors – R1460 and R2299, situated further from the highway – were selected in Fall 2019 for their Phase 1 audit period. Additional information and context regarding the BRWPP receptor selection has been included in Appendix B.

During the receptor selection process, an effort was made to select locations across the entire project as much as possible, and to avoid clusters of measurement locations. The MECP was consulted throughout the receptor selection process and was notified of the final receptors selected prior to the commencement of any measurements.

[2] It is noted that the noise assessment report in [3] included 46 turbines, but only 40 turbines were constructed. As such, the receptor selections for the I-audit measurements in this report were conducted using the predicted sound impact of 40 turbines (as-built), modelled by DNV-GL.

### 3.1.1 Prevailing Wind Direction

The prevailing wind direction used for receptor selection was determined using historical weather data for the site. This data was filtered to isolate for the conditions during which the facility would generate over 85% power, to match the conditions required to fulfill the filtering requirements of the Protocol. A wind rose showing the historical wind direction at the site is included Figure 1. The predominant wind direction is southwest, specifically 220°.

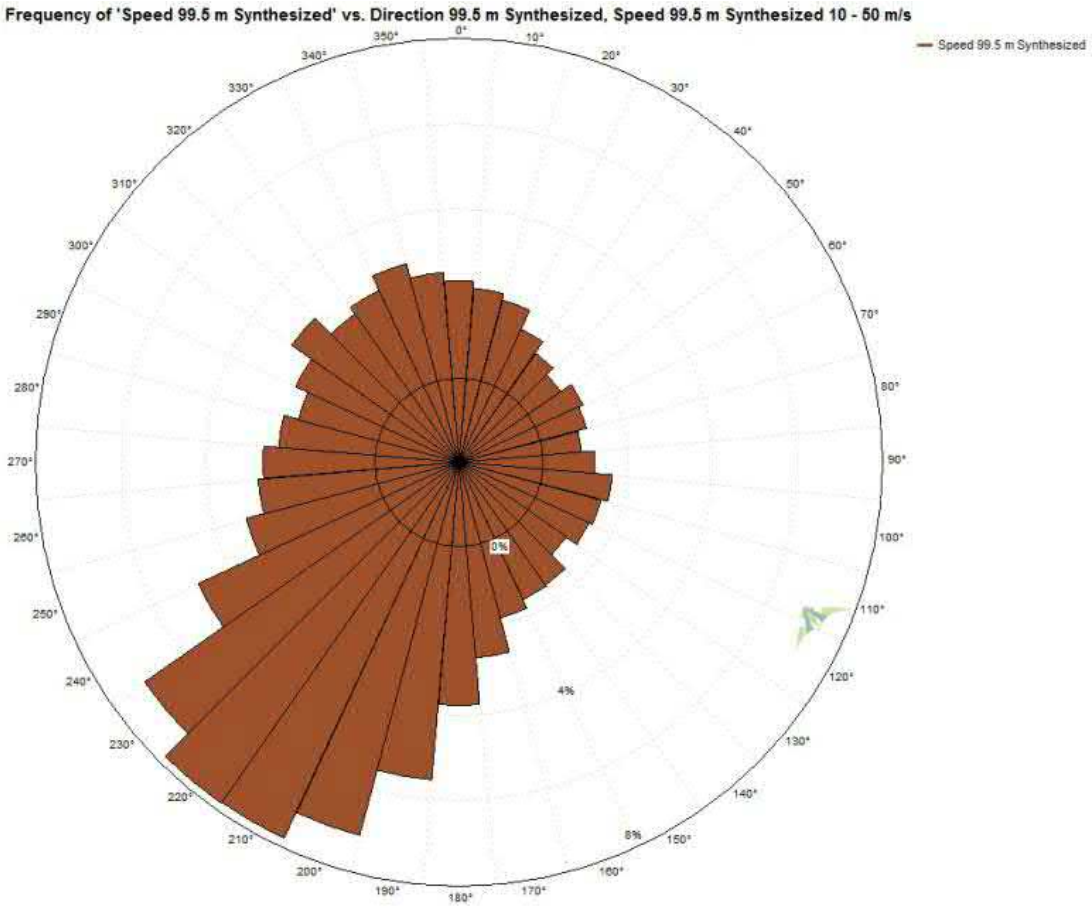



Figure 1: Historical Wind Roses for BRWPP, filtered for hub-height wind speeds above 10 m/s

### 3.1.2 Receptor Selection Table

Receptors that are participants of BRWPP or that are not located in the predominant downwind direction from the closest turbine were automatically excluded during the receptor selection process, in accordance with the guidance in the BRWPP REA and the Protocol. Receptors excluded for other reasons are summarized in Table 1 below, along with the five locations that were selected. A full summary of the results of the receptor selection process is included in Appendix B. Details regarding the land access permission activities for this project are available upon request.

Table 1: I-Audit Receptor Selection Table

| SPL Rank | ID | Height (m) | Distance to Nearest Turbine (m) | Nearest Turbine | Calculated Sound Level (dBA)[1] | Wind Direction[2] | Notes |
|---|---|---|---|---|---|---|---|
| 55 | **R1170** | 4.5 | 574 | T40 | 39.2 | DW | **Selected -** Monitor located such that predicted third-party impact <30 dBA |
| 111 | **R1126** | 4.5 | 626 | T50 | 38.6 | DW | **Selected** |
| 112 | V2717 | 4.5 | 636 | T50 | 38.6 | DW | **Excluded** - Redundant with R1126 |
| 121 | V2485 | 4.5 | 569 | T14 | 38.5 | DW | Land access denied[3] |
| 128 | R1123 | 4.5 | 684 | T50 | 38.5 | DW | **Excluded** - Redundant with R1126 |
| 136 | V2484 | 4.5 | 568 | T14 | 38.4 | DW | Land access denied[3] |
| 137 | R1141 | 4.5 | 580 | T12 | 38.4 | DW | **Initially Selected** and subsequently **De-Selected**[4] due to proximity of Hwy 401. |
| 144 | V2763 | 4.5 | 733 | T50 | 38.4 | DW | **Excluded** - Redundant with R1126 |
| 148 | V2482 | 4.5 | 570 | T14 | 38.3 | DW | Land access denied[3] |
| 149 | V2689 | 4.5 | 633 | T12 | 38.3 | DW | **Excluded** - Redundant with R1141 |
| 153 | V2513 | 4.5 | 683 | T14 | 38.3 | DW | Land access denied[3] |
| 156 | R1125 | 4.5 | 720 | T50 | 38.3 | DW | **Excluded** - Redundant with R1126 |
| 162 | V2539 | 4.5 | 572 | T14 | 38.2 | DW | Land access denied[3] |
| 167 | R1138 | 4.5 | 675 | T12 | 38.2 | DW | **Excluded** - Redundant with R1141 |
| 169 | V2514 | 4.5 | 680 | T14 | 38.2 | DW | Land access denied[3] |
| 186 | V2515 | 4.5 | 681 | T14 | 38.1 | DW | Land access denied[3] |
| 199 | V2516 | 4.5 | 681 | T14 | 38 | DW | Land access denied[3] |
| 215 | V2517 | 4.5 | 683 | T14 | 37.9 | DW | Land access denied[3] |
| 226 | R738 | 1.5 | 568 | T58 | 37.9 | DW | **Initially Selected** and subsequently **De-Selected**[4] due to proximity of Hwy 401. |
| 227 | **R1207** | 1.5 | 620 | T20 | 37.9 | DW | **Selected** |

| SPL Rank | ID | Height (m) | Distance to Nearest Turbine (m) | Nearest Turbine | Calculated Sound Level (dBA)[1] | Wind Direction[2] | Notes |
|---|---|---|---|---|---|---|---|
| 231 | V2518 | 4.5 | 686 | T14 | 37.8 | DW | Land access denied[3] |
| 247 | R737 | 1.5 | 634 | T58 | 37.7 | DW | **Excluded –** within 2500m of Hwy 401 |
| 252 | R1140 | 4.5 | 685 | T12 | 37.6 | DW | **Excluded –** within 2500m of Hwy 401 |
| 260 | V3051 | 4.5 | 754 | T215 | 37.6 | DW | **Excluded –** within 2500m of Hwy 401 |
| 280 | R1124 | 1.5 | 627 | T50 | 37.5 | DW | **Excluded –** redundant with R1126 |
| 325 | R733 | 1.5 | 552 | T57 | 37.2 | DW | **Excluded –** within 2500m of Hwy 401 |
| 345 | **R2299** | 1.5 | 735 | T202 | 37.1 | DW | **Selected** |
| 348 | R1225 | 4.5 | 642 | T51 | 37 | DW | **Excluded –** redundant with R1207 |
| 353 | **R1469** | 1.5 | 598 | T29 | 37 | DW | **Selected** |

[1] Sound Pressure Level at the receptor location determined using an as-built sound model created by DNV-GL
[2] Relative to the prevailing wind direction, +/-45°
[3] Part of sub-divided vacant lot with single land-management authority
[4] Please refer to Appendix B for additional details regarding the Belle River receptor selection process.

# 4 Audit Measurement Locations

The following section describes the measurement location used for each of the five (5) audit receptors and provides context regarding the ambient acoustic environment observed at the BRWPP.

## 4.1 Existing Ambient Environment

The ambient acoustical environment measured at the five (5) BRWPP audit locations was observed to be dominated by wind-related noise and distant highway traffic noise. Noise from the nearby rail line and local roadways, as well as overhead aircraft, was also observed at all monitoring locations. The sources of ambient noise that comprise the ambient acoustical environment at BRWPP are described below.

Data that was found to be influenced significantly by extraneous ambient noise was filtered out either manually by listening analysis or automatically by the transient ($LA_{eq}$-$L_{90}$) filter, described in Section 6.1. Whilst this method significantly reduces the number of contaminated intervals included in the analysis, it is acknowledged that not all contaminated data is guaranteed to be removed from the dataset.

### 4.1.1 Wind-Related Ambient Noise

Wind-related noise is comprised of two sources: self-noise and foliage noise. Self-noise results from wind blowing over objects associated with the monitoring equipment and is similar to what one might observe when wind blows over the ear on a windy day. Self-noise is present in all monitoring campaigns at high wind speeds. Conversely, foliage noise depends on the vegetation in the area surrounding the monitor. Measures to reduce the impact of wind-related noise were employed at the monitor location, as prescribed in the Protocol; a secondary wind screen was installed to reduce self-noise, and the monitoring equipment was located away from trees as much as practically possible. The approximate location and effect of the various sources of wind self-noise are outlined in Table 2.

Table 2: Ambient Noise Sources - Wind Self Noise

| Audit Location | Noise Source | Location of Source | Effect of Source at Audit Location |
|---|---|---|---|
| **All Locations** | Wind Self Noise | Noise Monitor | Increased sound levels at high wind speeds |
| **R1126** | No Nearby Large Foliage or Crops During Phase 1 Audit | | Little-to-no impact on measured sound levels at low to medium wind speeds. Potential for elevated sound level at higher wind speeds. |
| **R1207** | | | |
| **R1170** | | | |
| **R1469** | Coniferous Hedge | 15 m east | Minimal effect on measured sound levels at low to medium wind speeds, elevated sound levels at high wind speeds |
| | Soybean Crop | Surrounding Monitor | |
| **R2299** | Coniferous Hedge | 42 m northeast | Minimal effect on measured sound levels at low to medium wind speeds, elevated sound levels at high wind speeds |
| | Soybean Crop | Surrounding Monitor | |

### 4.1.2 Traffic Noise

Ontario Highway 401, located between 2.7 and 3.5 km to the south of the BRWPP audit locations, was observed to be a distant ambient noise source at all measurement locations, both through listening and spectral analysis of the measured data. It was noted that the contribution of the noise from Ontario Highway 401 varied with the time of night, day of the week, and most significantly, the wind direction. Removal of the Ontario Highway 401 contamination was not possible due to the continuous nature of the source, and so an effort was made to further filter the dataset to control for the variations caused by wind direction. This was done by adding a downwind filter to the background data set. An additional attempt to reduce the influence of noise from Highway 401 was made by analysing periods where the impact of road traffic noise was observed to be less significant. The time filtering and background wind direction filtering methodologies are described in further detail in Section 6.1.

The location of Highway 401 with respect to the audit locations is outlined in Table 3. Similarly, the locations of local road traffic noise sources, as well as their influence on the measured sound levels, are provided for each measurement location in Table 4.

Table 3: Ambient Noise Sources – ON-401

| Audit Location | Noise Source | Location of Source | Effect of Source at Audit Location |
|---|---|---|---|
| **R1126** | ON-401 | 2.7 km south | Elevated sound levels, depending on wind direction and time of day |
| **R1207** | | 3.5 km south | |
| **R1170** | | 2.8 km south | |
| **R1469** | | 3.0 km south | |
| **R2299** | | 2.7 km south | |

Table 4: Ambient Noise Sources - Local Traffic

| Audit Location | Noise Source | Location of Source | Effect of Source at Audit Location |
|---|---|---|---|
| **R1126** | Myers Road | 35 m east | Intermittent high sound levels during local vehicle traffic |
| **R1207** | Lakeshore Rd 123 | 60 m east | |
| **R1170** | Lakeshore Rd 129 | 64 m east | |
| **R1469** | Country Rd 31 | 85 m east | |
| **R2299** | Lakeshore Rd 113 | 115 m east | |

### 4.1.3 Rail Noise

A Canadian Pacific Railway Line, located approximately 2.5 km to the north of the BRWPP audit locations, was observed to be an occasional source of transient contamination at all measurement locations. This was observed during site visits, and through listening and spectral analysis of the measured data. In a similar fashion to the Ontario Highway 401, the contribution of the noise from the Canadian Pacific Railway Line varied with the time of night, day of the week, and wind direction.

Table 5: Ambient Noise Sources - Rail Noise

| Audit Location | Noise Source | Location of Source | Effect of Source at Audit Location |
|---|---|---|---|
| **R1126** | CP Rail Line | 2.6 km north | Elevated sound levels during rail activity |
| **R1207** | | 2.0 km north | |
| **R1170** | | 2.8 km north | |
| **R1469** | | 2.5 km north | |
| **R2299** | | 2.6 km north | |

#### 4.1.4 Aircraft Noise

The Belle River Wind Farm is situated approximately 24 km to the east of Windsor International Airport. Noise from overhead aircraft was observed occasionally during equipment setup on-site and through listening and spectral analysis of the measurement data. This source of transient contamination was observed to occur less frequently than those mentioned above but had a significant impact on the measured sound levels when present.

Table 6: Ambient Noise Sources - Aircraft Noise

| Audit Location | Noise Source | Location of Source | Effect of Source at Audit Location |
|---|---|---|---|
| **R1126** | Overhead Aircraft | Surrounding BRWPP | Elevated sound levels when aircrafts are overhead and nearby |
| **R1207** | | | |
| **R1170** | | | |
| **R1469** | | | |
| **R2299** | | | |

### 4.2 **Monitoring Location**

Table 7 provides specific details of the receptor and monitoring equipment locations. The immediate surroundings of the monitor location are also described below. Photos of the surrounding area and measurement setup are included in Appendix A.

Table 7: Receptor and Monitor Locations

| Audit Receptor | Primary Turbine | Measurement Duration | Location | UTM Coordinates [m] (Zone 17T) | Distance to Primary Turbine [m] | Predicted Level (dBA)† |
|---|---|---|---|---|---|---|
| **R1126** | T50 | *March 26, 2019 – June 3, 2019* | *Receptor* | 360,951 E 4,680,115 N | 626 | 38.6 |
| | | | *Monitor* | 360,934 E 4,680,055 N | 597 | 38.7 |
| **R1207** | T20 | *March 27, 2019 – June 3, 2019* | *Receptor* | 362,309 E 4,680,743 N | 620 | 37.9 |
| | | | *Monitor* | 362,270 E 4,680,678 N | 557 | 38.1 |
| **R1170** | T40 | *March 28, 2019 – June 15, 2019* | *Receptor* | 366,413 E 4,679,720 N | 573 | 39.3 |
| | | | *Monitor* | 366,409 E 4,679,616 N | 548 | 39.4 |
| **R1469** | T29 | *October 9, 2019 – January 11, 2020* | *Receptor* | 365,067 E 4,679,978 N | 599 | 37.0 |
| | | | *Monitor* | 365,026 E 4,679,997 N | 561 | 37.0 |
| **R2299** | T202 | *October 9, 2019 – January 11, 2020* | *Receptor* | 355,381 E 4,680,360 N | 734 | 37.1 |
| | | | *Monitor* | 355,304 E 4,680,328 N | 656 | 37.5 |

† Predicted sound pressure level determined using an as-built sound model created by DNV-GL

# 5 Measurement Methodology

The acoustic audit was conducted at receptors R1126, R1207, R1170, R1469, and R2299 Measurements and data analyses were conducted per the Protocol. Specific details regarding the methodology are presented in this section.

## 5.1 Test Equipment

Measurement equipment used for the I-audit campaign, both acoustic and non-acoustic, is detailed below. Equipment specifications and measurement positions comply with MECP Protocol sections *D2 – Instrumentation* and *D3 – Measurement Procedure*, respectively. Each remote monitoring unit is comprised of the following:

- One (1) Type 1 sound level meter, with microphone and pre-amplifier installed at least 5 meters from any large reflecting surfaces at a height of:
    - 4.5 meters for Receptors R1126 and R1170
    - 1.5 meters for Receptors R1207, R1469, and R2299.
- One (1) primary and one (1) secondary windscreen for the microphone. The 1/3 octave band insertion loss of the secondary windscreen has been tested and was accounted for in the measurement analysis.
- One (1) anemometer, installed 10 metres above ground level ("10-m AGL").

The following table lists the specific model and serial numbers for the equipment used during the measurement campaign for each measurement location.

Table 8: Equipment Details

| Monitor | Equipment | Make/Model | Serial Number |
|---|---|---|---|
| **R1126** | Data Acquisition Card | NI 9234 | 1CAF790 |
| | Signal Conditioner | PCB 480E09 | 33659 |
| | Microphone | PCB 377B02 | 150759 |
| | Pre-Amplifier | PCB 426E01 | 37483 |
| | Weather Anemometer | Vaisala WXT 520 | K0550007 |
| **R1207** | Data Acquisition Card | NI 9234 | 1CAF79A |
| | Signal Conditioner | PCB 480E09 | 35340 |
| | Microphone | PCB 377B02 | 178140 |
| | Pre-Amplifier | PCB 426E01 | 51462 |
| | Weather Anemometer | Vaisala WXT 536 | K0630017 |
| **R1170** | Data Acquisition Card | NI 9234 | 19A4D82 |
| | Signal Conditioner | PCB 480E09 | 35341[1]<br>32473[2] |
| | Microphone | PCB 377B02 | 175777[1]<br>158828[2] |
| | Pre-Amplifier | PCB 426E01 | 49762[1]<br>41165[2] |
| | Weather Anemometer | Vaisala WXT 536 | M4910195 |
| **R1469** | Data Acquisition Card | NI 9234 | 1CAF72D |
| | Signal Conditioner | PCB 480E09 | 35332 |
| | Microphone | PCB 377B02 | 150498 |
| | Pre-Amplifier | PCB 426E01 | 37448 |
| | Weather Anemometer | Vaisala WXT 520 | K0630016 |
| **R2299** | Data Acquisition Card | NI 9234 | 1CAF757 |
| | Signal Conditioner | PCB 480E09 | 34205 |
| | Microphone | PCB 377B02 | 163103 |
| | Pre-Amplifier | PCB 426E01 | 43047 |
| | Weather Anemometer | Vaisala WXT 520 | L3020299 |

[1] Equipment deployed from March 28th, 2019 to April 9th, 2019
[2] Equipment deployed from April 9th, 2019 to June 15th, 2019

Equipment lab calibration follows the guidance provided in Section D2.3 of the Protocol for sound level meters and acoustic calibrators, and Section 6.3 of the IEC 61400-11 Edition 3.0 standard for weather anemometers.

The measurement chain was field calibrated before, during, and after the measurement campaign using a type 4231 Brüel & Kjær acoustic calibrator. Calibration certificates have been included in Appendix F.

### 5.2 Measurement Parameters

During the measurement campaign, acoustic and weather data were logged simultaneously in one-minute intervals.

Measured acoustic data includes A-weighted overall equivalent sound levels ("$LA_{eq}$"), 90$^{th}$ percentile statistical levels ("$L_{90}$")[3], and 1/3$^{rd}$ octave band levels between 20 Hz and 10,000 Hz (inclusive). Raw signal recordings were also stored for listening and post-processing. Measured weather data includes average wind direction, wind speed, temperature, relative humidity, and atmospheric pressure. The maximum and minimum wind speed for each one-minute interval was also stored.

To account for the effect of wind speed on the measured sound level, intervals are sorted into integer wind bins based on their measured 10-m AGL wind speeds. Each wind bin ranges from 0.5 m/s below to 0.5 m/s above each integer wind speed (i.e. the 5 m/s wind bin comprises all intervals having average wind speeds between 4.5 m/s and 5.5 m/s).

# 6 Assessment Methodology

### 6.1 Data Reduction and Filtering

Data reduction procedures have been employed to remove invalid and extraneous data points from the measured datasets to form a refined assessment dataset for each measurement location. Specific filters are described below.

For all measurement locations, a measurement interval is excluded if any of the following criteria are <u>not</u> satisfied:

- The interval occurred between 10pm – 5am
- No precipitation was detected within 60 minutes before or after the interval
- The ambient temperature was above -20˚C
- The measured $LA_{eq}$ was no more than 6 dB greater than the $L_{90}$ value

Significant extraneous transient events are often detectable by comparing the $LA_{eq}$ with the $L_{90}$ level for the same interval. At this location, if the measured $L_{90}$ differed from the $LA_{eq}$ by more than 6 dB, the interval was automatically excluded. If necessary, listening

[3] $L_{90}$ refers to the sound level that is exceeded for 90% of samples in the measurement interval.

tests are conducted to identify contaminated intervals not excluded by the filters listed above.

In order to further reduce the ambient noise contribution from Highway 401, only periods from 12:00 AM - 05:00 AM were analysed. Elevated noise levels were observed at all monitor locations for both Total Noise and Background Noise periods between the 10:00 PM and 05:00 AM time period conventionally prescribed by the Protocol, when compared to the 12:00 AM – 5:00 AM time period used in this assessment. This follows the guidance from the Protocol to assess sound levels without extraneous ambient noise, with periods after 12:00 AM having a reduced degree of extraneous ambient noise.

### 6.2 Manual Exclusion of Data

The application of the filtering methodology outlined in the Protocol and summarized throughout Section 6.1 of this report results in a dataset with significantly less acoustic contamination than is present in the unfiltered dataset. Despite this, it has been found that these automatic filters are not always sufficient to remove all contaminated data intervals. In situations where contamination is suspected in the assessment dataset, listening tests were conducted on the audio recordings to confirm and, if possible, to identify the contamination. Intervals containing significant contamination are manually excluded from the assessment data. This follows the guidance from the Protocol to assess sound levels without extraneous ambient noise.

Data is also manually excluded if it is suspected that any of the measurement equipment is not functioning according to its specification, which may occur during extreme weather conditions such as freezing rain.

### 6.3 Turbine Power & Wind Direction

Intervals that pass the filtering criteria listed above are sorted into Total Noise[4] or Background periods according to the conditions listed below. If neither Total Noise nor Background conditions are met, the data point is excluded.

- **Total Noise:** All facility turbines within 3 km must be rotating and generating power. The list of turbines within 3 km of a given measurement location is provided below:

[4] Total Noise refers to the measured sound level with the turbines running prior to the correction for Background sound (i.e. the total sound level of the turbines plus the ambient).

Table 9: List of Turbines for Total Noise Condition

| Measurement Location | Turbines within 3 km of a Measurement Location |
|---|---|
| **R1126** | T08, T11, T12, T14, T15, T20, T26, T30, T50, T51, T53, T62 |
| **R1207** | T08, T11, T12, T20, T26, T28, T29, T30, T50, T51, T53, T62 |
| **R1170** | T28, T29, T36, T38, T40, T44, T45, T46, T47, T48, T49, T53, T54, T55, T59 |
| **R1469** | T26, T28, T29, T30, T36, T38, T40, T44, T45, T46, T47, T53, T54, T55 |
| **R2299** | T201, T202, T205, T210, T211, T212, T213, T214, T215 |

- **Background:** Facility turbines must be parked and not generating power such that the predicted impact at the measurement location is less than 30 dBA. The list of turbines to be turned off to achieve this criterion is provided for each measurement location in the table below, in addition to the list of turbines which would achieve the background criterion at all five measurement locations simultaneously.

Table 10: List of Turbines for Background Condition

| Measurement Location | Turbines to be parked to achieve <30 dBA at Measurement Location |
|---|---|
| **All Receptors** | T08, T11, T20, T26, T28, T30, T36, T38, T40, T44, T45, T46, T47, T48, T49, T50, T51, T52, T53, T54, T55, T58, T59, T62, T202, T205, T210, T211, T212 |
| **R1126** | T08, T11, T12, T20, T30, T50, T51, T62 |
| **R1207** | T20, T26, T30, T51 |
| **R1170** | T26, T28, T29, T30, T36, T38, T40, T44, T45, T46, T47, T48, T49, T51, T52, T53, T54, T55, T57, T58, T59 |
| **R1469** | T20, T26, T28, T29, T30, T36, T38, T40, T44, T45, T46, T47, T51, T53, T54, T55 |
| **R2299** | T202, T205, T210, T211, T212 |

The Protocol also requires additional criteria be met by each Total Noise data point based on the conditions of the nearest turbine to each monitor location. Specifically,

> "*Only downwind data will be considered in the analysis. With reference to the Turbine location, downwind directions are ±45 degrees from the line of sight between the Turbine and receptor/measurement location.*" *{Section D5.2(4)}*

And

> *"Only data when the turbine's electrical output sound power level is approximately equal to or greater than 85% of its rated electrical power output should be included in the analysis. In addition, the turbine should also be operating at approximately 90% or more of its*

*maximum sound power level; (percentage based on energy/logarithmic calculation)." {Section D5.2(5)}*

In situations where the ambient sound level at a monitor location is heavily influenced by the wind direction, a filter is applied to ensure that the Background measurement conditions are representative of those encountered during Total Noise intervals. This was found to be the case at all five (5) measurement locations, which are located to the north of Ontario Highway 401. As such, a downwind filter was applied to the Background dataset to match the Total Noise measurement conditions, which are also filtered for downwind only in accordance with the Protocol.

Based on the E-Audit test results at BRWPP, the project turbines reach 90% of their maximum measured sound power level at a power output significantly below that which corresponds to 85% of the turbine's rated electrical power. Further to this, the power output corresponding to the maximum sound power level is also below that which corresponds to 85% of rated electrical power for all four turbine variants at BRWPP. For these reasons, using the 85% turbine power threshold alone will not effectively capture the worst-case impact at BRWPP, which was found to occur at an operating condition which corresponds to a lower power output.

For this reason, as a conservative measure, the 90% sound power condition has been selected to determine the power threshold corresponding to the worst-case impact from the turbine-type closest to each measurement location. Table 11 provides, for each audit location, the closest turbine and its rated power output, as well as the power output corresponding to the 90% sound power condition for the turbine of the same type. This is the power threshold that has been used for filtering this dataset. Details regarding the measured sound power levels of the BRWPP turbines and the 90% sound power calculations are included in Appendix G.

Table 11: 90% Sound Power Criterion for BRWPP Audit Receptors

| Audit Location | Closest Turbine | Rated Power Output of Closest Turbine [MW] | BRWPP E-Test Turbine of Same Type | Power Output Corresponding to 90% Sound Power [MW] |
|---|---|---|---|---|
| **R1126** | T50 | 2.37 | T40 | 1.114[1] |
| **R1207** | T20 | | | 1.114[1] |
| **R1170** | T40 | | | 1.114[1] |
| **R1469** | T29 | | | 1.114[1] |
| **R2299** | T202 | 2.772 | T53 | 1.581[2] |

[1] Based on the E-test conducted at T40 [6]
[2] Based on the E-test conducted at T53 [7]

## 6.4 Sample Size Requirements

Section D3.8 of the Protocol requires at least 120 Total Noise intervals and 60 Background intervals in a wind bin for that bin to be deemed complete.

RAM-I analysis, described in Section E5.5 of the Protocol, is employed in cases where insufficient data is collected after an extended monitoring campaign lasting 6-weeks or more. The BRWPP Phase 1 campaign lasted longer than 6-weeks at all monitors and therefore RAM-I analysis was applied. The RAM-I methodologies used in this assessment, in addition to those already mentioned are detailed below. Further details regarding the data analysis methodology are provided in Section 9.1.

Section E5.5(1)

The range of wind bins which may be used to assess compliance is expanded to include a minimum of one of the following conditions:

a. *"three (3) of the wind speed bins between 1 and 7 m/s (inclusive), or*
b. *two (2) of the wind speed bins between 1 and 4 m/s (inclusive)"*

Section E5.5(5)

The RAM-I assessment methodology relaxes the sample size requirements, stating:

> "*The Ministry may accept a reduced number of data points for each wind speed bin with appropriate justification. […] The acceptable number of data points will be influenced by the quality of the data (standard deviation)"*

The threshold of 60 data points for Total Noise measurements and 30 data points for Background measurements is used in this assessment.

## 6.5 Turbine Operating Conditions

Wind facility SCADA information was provided for the duration of the measurement campaign by the Belle River Wind Power Project. This data was used to verify that the BRWPP wind turbines were operational for Total Noise intervals and parked for Background intervals. The turbine operating conditions were verified by the BRWPP for the duration of the campaign; see Appendix D.

## 6.6 Contribution from Adjacent Wind Facilities

The nearest wind facility to BRWPP is Pointe-Aux-Roches Wind Farm followed by the Comber Wind Farm. The closest PARWF turbine to a monitoring location is Turbine T220, 2.1 km to the north of monitor R1170. The closest CWF turbine to a monitoring location is Turbine T48, 3.1 km to the southeast of monitor R1126. At these distances, sound impact from both CWF and PARWF is considered to be negligible and thus no contributions from adjacent wind facilities were considered in this study.

# 7 Sound Level Limits

Sound level limits are set by the MECP and vary based on the classification of the surrounding acoustic environment as well as the measured background sound level (if available). The area surrounding the facility has been deemed in the original Noise Assessment Report to be Class III, having exclusion limits based on 10-m AGL wind speed as noted in Table 12 below.

Table 12: MECP Sound Level Limits for Wind Turbines

| Wind speed at 10m height [m/s] | MECP Sound level limit [dBA] |
|---|---|
| ≤ 6 | 40 |
| 7 | 43 |

Sections D3.5 and D6 of the Protocol state that in wind bins where the measured background sound levels are greater than the applicable exclusion limits, the sound level limit for that wind bin is the background sound level without extraneous noise sources. In effect, the exclusion limits outline the minimum sound level limit by wind bin, with increases in sound level limit permissible if it can be shown through measurements that the existing background sound level is higher than the exclusion limit. Any complete wind bins where the measured background sound level exceeded the exclusion limit are noted in Table 15.

# 8 Audit Results

Acoustic and weather data measured during the I-audit campaign are summarized in the following section.

## 8.1 Weather Conditions

General weather conditions observed in the assessment dataset during the Phase 1 I-audit are summarized in Table 13 for each measurement location.

Table 13: General Weather Conditions – Range of Measured Values

| | | *10-m AGL* | | | | *Hub height* |
|---|---|---|---|---|---|---|
| Measurement Location | Minimum or Maximum Value | Atmospheric Pressure [hPa] | Wind Speed [m/s] | Relative Humidity [%] | Temperature [°C] | Wind speed [m/s] |
| **R1126** | Minimum | 972 | 0 | 15 | -3.4 | 0.1 |
| | Maximum | 1010 | 14.8 | 89 | 23.5 | 21.3 |
| **R1207** | Minimum | 972 | 0 | 16 | -3.7 | 0.1 |
| | Maximum | 1010 | 18.7 | 89 | 23.4 | 21.2 |
| **R1170** | Minimum | 972 | 0.1 | 33 | -3.4 | 0.1 |
| | Maximum | 1006 | 15.6 | 95 | 27.5 | 21.2 |

| Measurement Location | Minimum or Maximum Value | *10-m AGL* | | | | *Hub height* |
|---|---|---|---|---|---|---|
| | | Atmospheric Pressure [hPa] | Wind Speed [m/s] | Relative Humidity [%] | Temperature [°C] | Wind speed [m/s] |
| **R1469** | Minimum | 976 | 2.6 | 52 | -6.7 | 5.6 |
| | Maximum | 1004 | 12.5 | 82 | 23.0 | 17.6 |
| **R2299** | Minimum | 977 | 3.3 | 48 | -6.7 | 5.1 |
| | Maximum | 1004 | 12.0 | 82 | 9.8 | 16.3 |

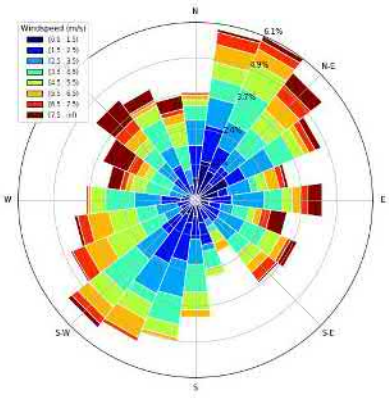
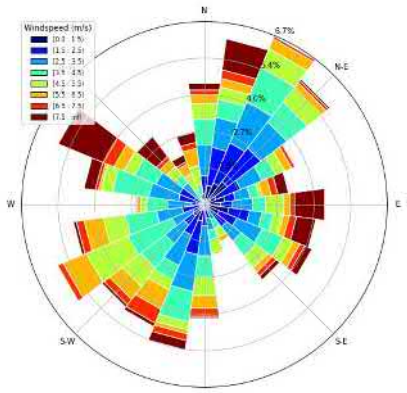
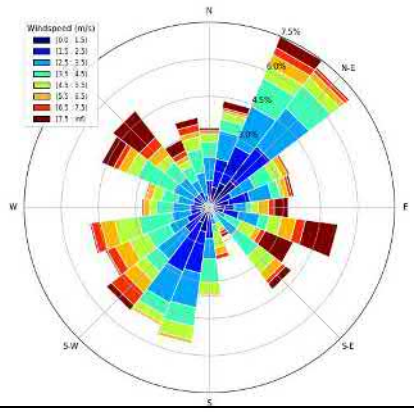
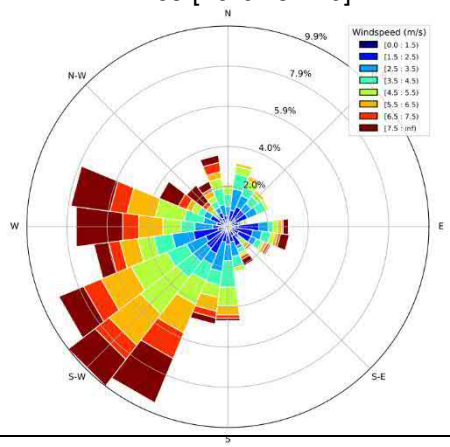
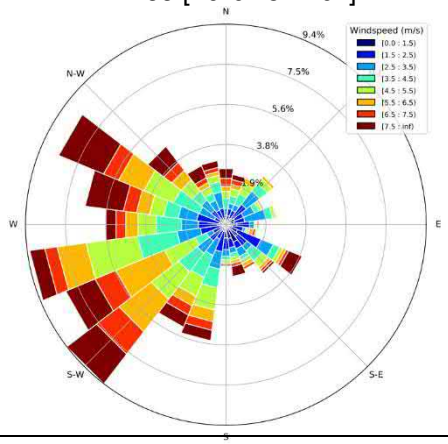
## 8.2 **Wind Direction**

A wind rose was created for each measurement location using the yaw angle from the nearest wind turbine and the wind speeds from the 10-m AGL anemometer. As noted in Section 6.4 of this report, RAM-I methodology is being used, and thus all wind speeds from 1-7 m/s 10-m AGL can be used in the assessment.

The wind rose measured across the audit duration at each audit location is provided in It is noted that the wind roses for R1469 and R2299 differ from those of R1126, R1207, and R1170 and illustrate a higher prevalence of strong south-westerly winds. This is likely a result of the noise audit at R1469 and R2299 being conducted at a different time of year than the other three (3) audit locations, as per Table 7. The distribution of wind directions observed during the measurement campaign roughly agrees with the historical wind rose (see Section 3.1.1), especially considering that the historical wind rose in Figure 1 is based on hub-height wind speeds, and is filtered for 10 m/s and greater.

Supplementary wind roses for the specific valid Total Noise and Background datasets are included in Appendix E.

Table 14: Measured Wind Rose for all Measurement Locations

<table>
<tr>
<td>Windspeed (m/s)<br>[0.0 - 1.5)<br>[1.5 - 2.5)<br>[2.5 - 3.5)<br>[3.5 - 4.5)<br>[4.5 - 5.5)<br>[5.5 - 6.5)<br>[6.5 - 7.5)<br>[7.5-INF]<br>Note: The turbine from which the yaw angle information was taken is indicated in brackets for each measurement location.</td>
<td>R1126 [Turbine T50]<br>  </td>
</tr>
<tr>
<td>R1207 [Turbine T20]<br>  </td>
<td>R1170 [Turbine T40]<br>  </td>
</tr>
<tr>
<td>R1469 [Turbine T29]<br>  </td>
<td>R2299 [Turbine T202]<br>  </td>
</tr>
</table>

## 8.3 **Sound Levels**

Table 15 presents the average measured sound levels at monitor each of the five (5) BRWPP I-Audit measurement locations. Results are separated by wind bin into Total Noise and Background periods.

Table 15: Average Measured Sound Levels at Audit Measurement Locations, RAM-I Analysis

| Receptor | Period | Measurement Parameter | I-audit Wind Bins (m/s) | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| **R1126** | *Total Noise* | Number of Samples | 0 | 13 | 92 | 248 | 278 | 327 | 196 |
| | | Average LAeq [dBA] | - | - | 41.5 | 41.0 | 41.6 | 43.7 | 45.7 |
| | | Standard Deviation [dB] | - | - | 1.4 | 1.3 | 1.5 | 1.5 | 1.6 |
| | *Background* | Number of Samples | 0 | 0 | 16 | 52 | 63 | 33 | 37 |
| | | Average LAeq [dBA] | - | - | - | 35.7 | 36.8 | 41.4 | 45.0 |
| | | Standard Deviation [dB] | - | - | - | 1.3 | 1.3 | 1.7 | 1.9 |
| **R1207** | *Total Noise* | Number of Samples | 0 | 4 | 52 | 291 | 621 | 609 | 293 |
| | | Average LAeq [dBA] | - | - | 41.1 | 40.5 | 40.9 | 41.1 | 42.4 |
| | | Standard Deviation [dB] | - | - | 1.7 | 2.0 | 2.0 | 1.5 | 1.4 |
| | *Background* | Number of Samples | 0 | 0 | 17 | 86 | 37 | 60 | 48 |
| | | Average LAeq [dBA] | - | - | - | 35.1 | 35.6 | 37.9 | 40.4 |
| | | Standard Deviation [dB] | - | - | - | 1.7 | 1.3 | 1.8 | 1.6 |
| **R1170** | *Total Noise* | Number of Samples | 0 | 2 | 82 | 201 | 135 | 230 | 185 |
| | | Average LAeq [dBA] | - | - | 41.3 | 41.1 | 42.0 | 43.6 | 46.1 |
| | | Standard Deviation [dB] | - | - | 1.1 | 1.1 | 1.2 | 1.2 | 1.4 |
| | *Background* | Number of Samples | 46 | 16 | 46 | 156 | 109 | 75 | 56 |
| | | Average LAeq [dBA] | 36.3 | - | 37.3 | 36.2 | 37.6 | 41.0 | 45.6 |
| | | Standard Deviation [dB] | 2.7 | - | 2.3 | 1.5 | 1.5 | 2.2 | 2.1 |
| **R1469** | *Total Noise* | Number of Samples | 0 | 0 | 20 | 216 | 439 | 689 | 348 |
| | | Average LAeq [dBA] | - | - | - | 38.5 | 39.0 | 40.0 | 42.5 |
| | | Standard Deviation [dB] | - | - | - | 1.2 | 1.3 | 1.5 | 1.6 |
| | *Background* | Number of Samples | 0 | 0 | 0 | 37 | 135 | 133 | 58 |
| | | Average LAeq [dBA] | - | - | - | 34.9 | 36.9 | 37.9 | 41.9 |
| | | Standard Deviation [dB] | 0 | 0 | 0 | 2.8 | 2.7 | 2.5 | 2.2 |
| **R2299** | *Total Noise* | Number of Samples | 0 | 0 | 5 | 204 | 364 | 391 | 219 |
| | | Average LAeq [dBA] | - | - | - | 40.5 | 41.0 | 41.9 | 43.5 |
| | | Standard Deviation [dB] | - | - | - | 0.8 | 1.5 | 1.6 | 1.4 |
| | *Background* | Number of Samples | 0 | 0 | 0 | 39 | 162 | 146 | 53 |
| | | Average LAeq [dBA] | - | - | - | 35.8 | 38.3 | 40.4 | 42.3 |
| | | Standard Deviation [dB] | - | - | - | 2.7 | 3.0 | 2.4 | 1.7 |

"-"*Significantly* fewer than the minimum data counts outlined in 6.4 were attained in this wind bin.

Visualizations of the assessment datasets for each measurement location are presented in Figure 2 through Figure 6 below.

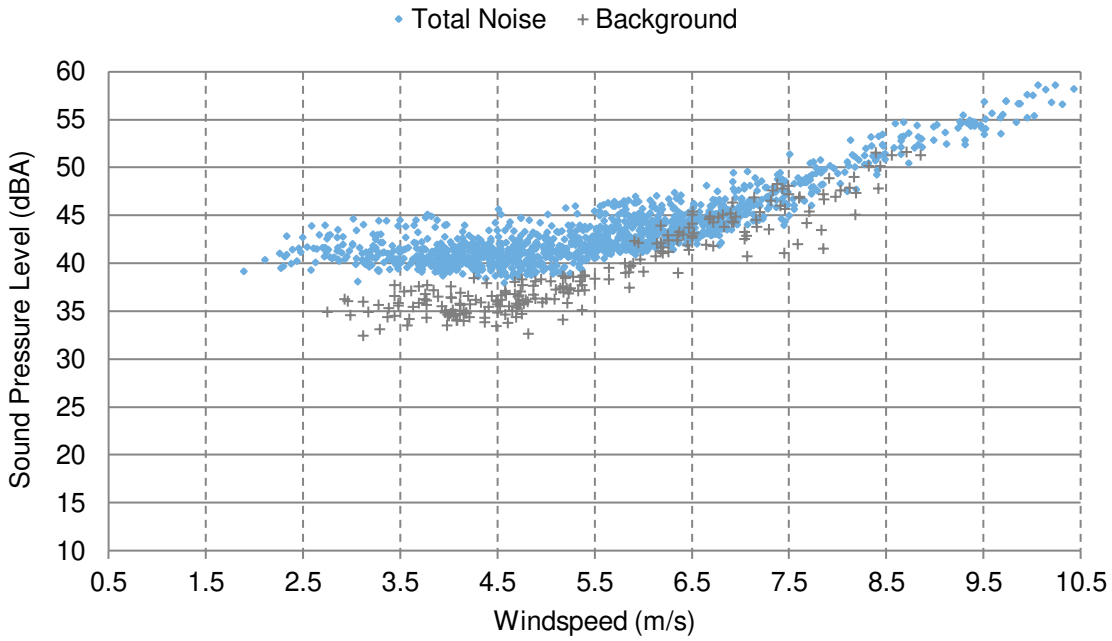



Figure 2: R1126 - Measured Sound Levels for Total Noise and Background vs Wind Speed

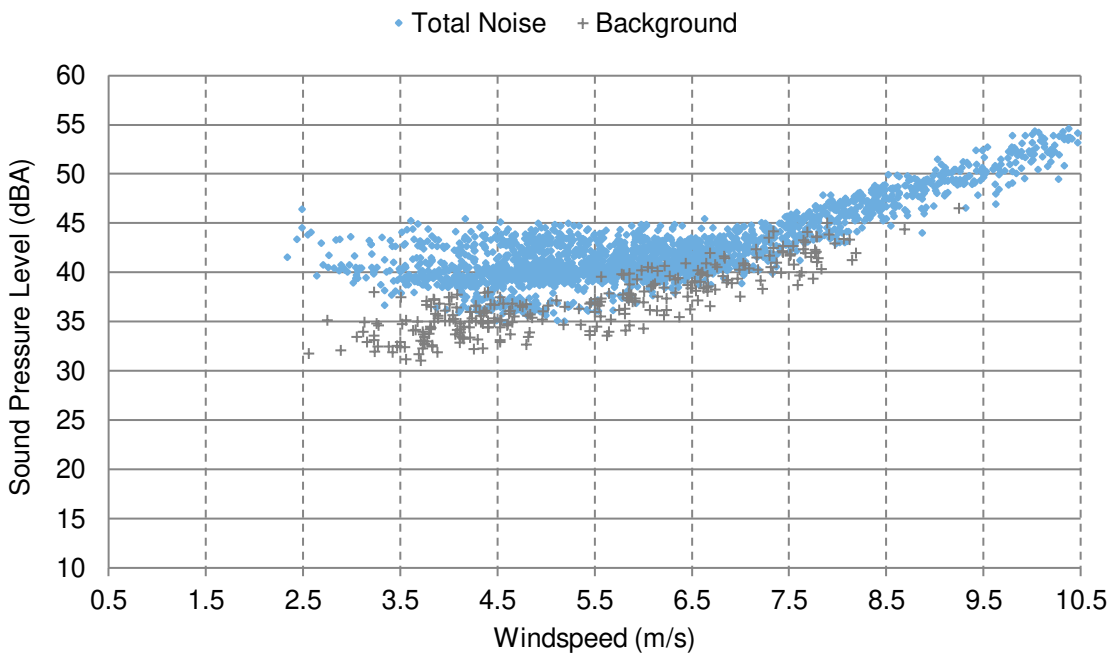



Figure 3: R1207 - Measured Sound Levels for Total Noise and Background vs Wind Speed

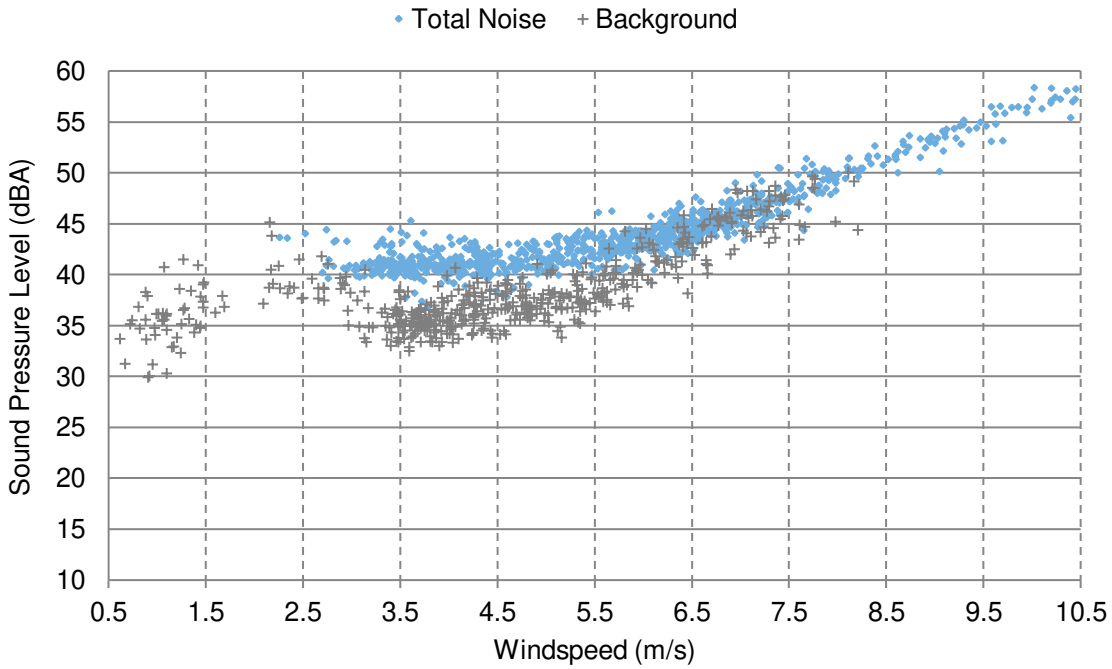



Figure 4: R1170 - Measured Sound Levels for Total Noise and Background vs Wind Speed

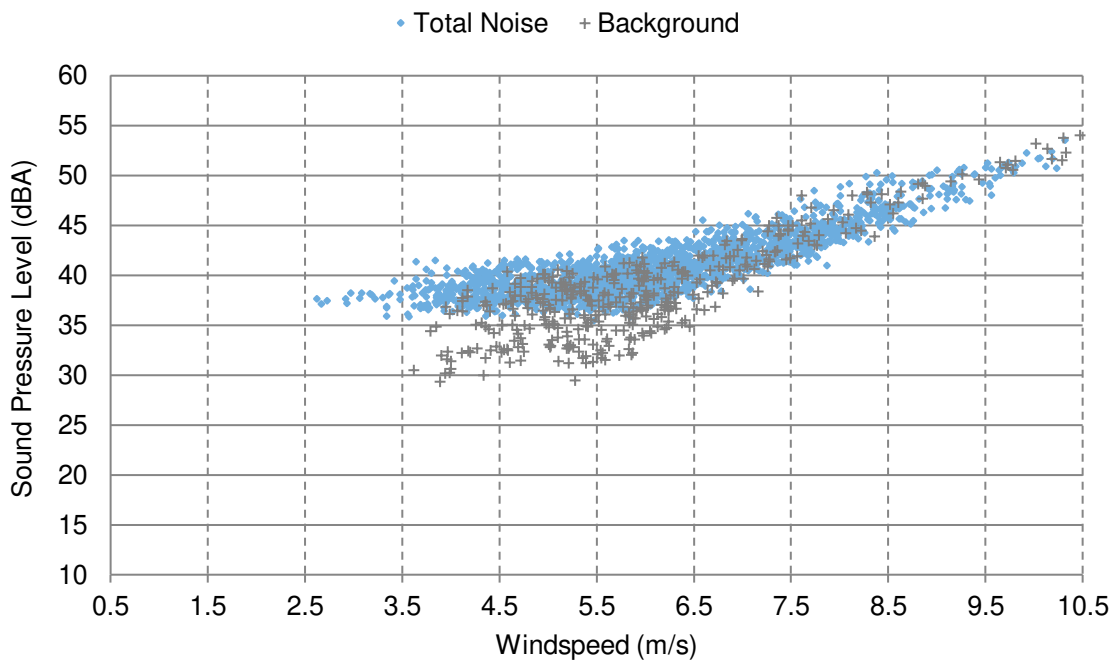



Figure 5: R1469 - Measured Sound Levels for Total Noise and Background vs Wind Speed

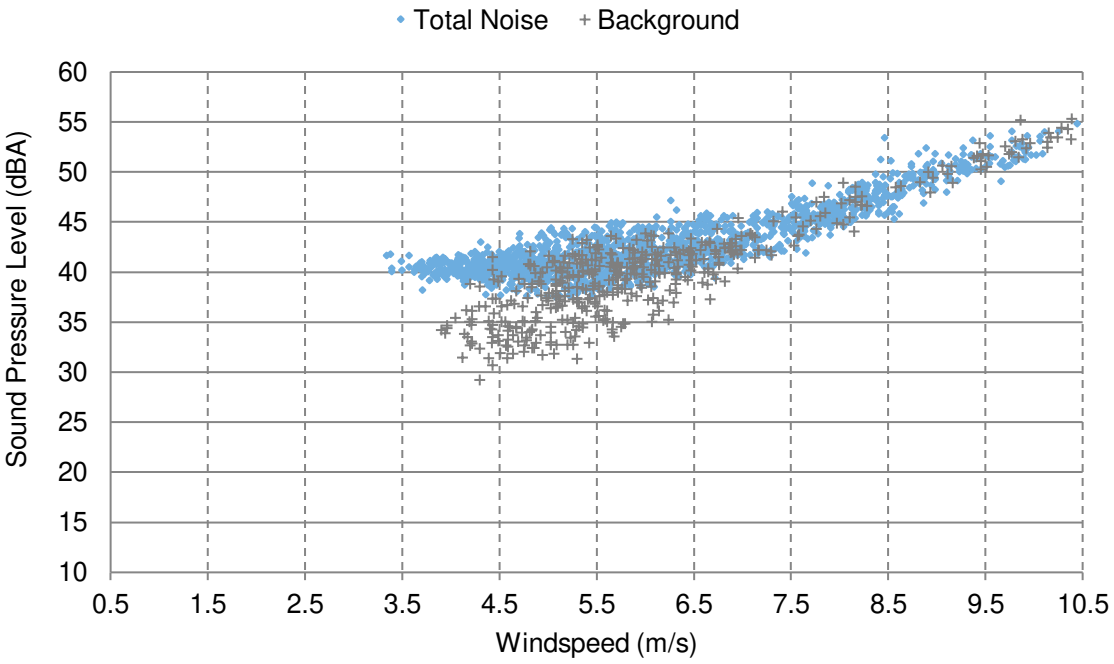



Figure 6: R2299 - Measured Sound Levels for Total Noise and Background vs Wind Speed

# 9 Discussion

## 9.1 Analysis Methodology

Interpretation and discussion of the measured sound levels are provided in this section.

## 9.2 Effect of Filtering

The measurement data was assessed according to Part D of the Protocol with the incorporation of the RAM-I data reduction methodology per Section E5.5 of the Protocol. The effect of each filter on the measurement datasets, as well as the total portion of measurement data excluded from the assessment data, are summarized in Table 16.

Table 16: Effect of Data Filtering on Measurement Dataset

| | *% Data Excluded* | | | | |
|---|---|---|---|---|---|
| Data Filter | R1126 | R1207 | R1170 | R1469 | R2299 |
| Turbine Power Threshold | 76% | 73% | 80% | 77% | 88% |
| Wind Direction | 76% | 65% | 76% | 57% | 53% |
| Rain | 14% | 15% | 13% | 13% | 14% |
| Temperature | 0% | 0% | 0% | 0% | 0% |
| Wind Gust | 0% | 0% | 0% | 0% | 0% |
| Transient Contamination | 18% | 9% | 7% | 13% | 7% |
| Excluded from Total Noise | 96% | 93% | 98% | 96% | 97% |

Table 16 illustrates the proportion of measurement time during the campaign that did not meet the criteria for worst-case noise impact at each receptor. Data not excluded by automatic or manual filters are used in the assessment of compliance. It is important to note that the data remaining after these filters are applied represents the times when the turbines were generating high power output in a downwind condition without significant transient contamination or inclement environmental conditions (such as rain or low temperature). In other words, this remaining data represents the portion of time that the immission impact from the facility is at its highest for the given monitor location.

# 10 Assessment of Compliance

The following section presents an assessment of compliance for the BRWPP based on the results of the Phase 1 Immission Audit.

## 10.1 Tonality Assessment

The tonality analysis results of the Emission audit measurements for T52 [4], T44 [5], T40 [6] and T53 [7] were used as a basis for tones at receptors which were likely to have been generated by the closest turbine rather than an external source.

Based on discussions with Belle River Wind LP., it was determined that to be consistent with Sections 3.8.3 and Section 5.1 of the Compliance protocol, the tonal assessment should be completed using IEC 61400-11 Ed. 3.0, with modifications to adapt the method to immission measurements and the tonal penalty structure taken from ISO 1996-2:2007 Annex C. Namely, Section 5.1 of the compliance protocol states:

> *"If a tonal assessment … indicates a tonal audibility value that exceeds 4 dB, the Ministry will require that a tonal penalty be applied at all Receptors in accordance with the penalties described in Annex C of ISO 1996-2, Reference [2]"{Section D5.1}*

For the tonal assessment, narrowband data was acquired and calculated for each 1-minute interval used in the immission analysis and binned by wind speed. Each minute was analysed in order to detect any tones with tonal audibility values greater than -3 dB at any of the assessed frequencies. Similar to the methodology in IEC 61400-11, a tone would have to be present in at least 20% of the valid measurement intervals to be classified as relevant. This reduces the possibility of intermittent tones related to either the unsteady operation of the turbines, or from other contaminating sources, being attributed to the steady state operation of the turbines. The tonal audibility ($L_{ta}$) for the most prominent tones in each wind bin were then evaluated to determine if a tonal penalty would be applicable. The penalty structure was taken from ISO1996-2 Annex C: namely that the tonal penalty would be a positive number between 0 dB and 6 dB based on the degree of tonal audibility of the worst-case tone. A tonal penalty is calculated as $L_{ta}$ - 4 dB i.e. a tonal audibility of 6.5 would incur a penalty of 2.5 dBA on the overall Turbine Only level.

A 62 Hz and 78 Hz tone were observed to occasionally be present at receptor all measurement locations, however these tones were not prevalent enough nor prominent enough for a tonal penalty to be applicable. A tonal assessment summary table is provided in Appendix E for each measurement location.

No tonal penalty was found to be applicable at any of the five (5) measurement locations based on detailed tonal audibility analysis.

## 10.2 **Assessment Tables**

Cumulative Turbine-Only sound levels are presented in the table below for each audit location. The cumulative noise impact in the table is calculated using the data presented in Table 15. Wind bins having insufficient data with which to determine the cumulative sound impact are marked with a "-". The signal-to-noise for each complete wind bin is also presented. The *Cumulative Sound Impact* is the difference between the average Total Noise and Background sound levels from Table 15, unless otherwise noted.

Table 17: R1126 Assessment Table – Cumulative Turbine-only Sound Impact

| Audited Receptor | Wind speed at 10-m AGL [m/s] | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|---|
| **R1126** | Cumulative Sound Impact - Receptor Location [dBA] | - | - | - | 39 | 40 | 40 | 38 |
| | *Signal-to-noise [dB]* | - | - | - | 5.3 | 4.7 | 2.3† | 0.7† |
| Background Sound Level [dBA] | | - | - | - | 36 | 37 | 41* | 45* |
| MECP Exclusion Limit [dBA] | | 40 | 40 | 40 | 40 | 40 | 40 | 43 |
| Compliance? (Y/N) | | - | - | - | Y | Y | Y | Y |

"-" Significantly fewer than the minimum data counts outlined in 6.4 were attained in this wind bin.
† Signal-to-noise level less than 3 dB (see Table 15). Increased uncertainty in the determination of the Cumulative Sound Impact.
* Background sound level is greater than the applicable exclusion limit.

Table 18: R1207 Assessment Table – Cumulative Turbine-only Sound Impact

| Audited Receptor | Wind speed at 10-m AGL [m/s] | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|---|
| **R1207** | Cumulative Sound Impact - Receptor Location [dBA] | - | - | - | 39 | 39 | 38 | 38 |
| | *Signal-to-noise [dB]* | - | - | - | 5.4 | 5.3 | 3.2 | 2.0† |
| Background Sound Level [dBA] | | - | - | - | 35 | 36 | 38 | 40 |
| MECP Exclusion Limit [dBA] | | 40 | 40 | 40 | 40 | 40 | 40 | 43 |
| Compliance? (Y/N) | | - | - | - | Y | Y | Y | Y |

"-" Significantly fewer than the minimum data counts outlined in 6.4 were attained in this wind bin.
† Signal-to-noise level less than 3 dB (see Table 15). Increased uncertainty in the determination of the Cumulative Sound Impact.

Table 19: R1170 Assessment Table – Cumulative Turbine-only Sound Impact

| Audited Receptor | Wind speed at 10-m AGL [m/s] | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|---|
| **R1170** | Cumulative Sound Impact - Receptor Location [dBA] | - | - | 39 | 39 | 40 | 40 | 36 |
| | *Signal-to-noise [dB]* | - | - | 4.0 | 4.9 | 4.4 | 2.6 | 0.5 |
| Background Sound Level [dBA] | | 36 | - | 37 | 36 | 38 | 41* | 46* |
| MECP Exclusion Limit [dBA] | | 40 | 40 | 40 | 40 | 40 | 40 | 43 |
| Compliance? (Y/N) | | - | - | Y | Y | Y | Y | Y |

"-" Significantly fewer than the minimum data counts outlined in 6.4 were attained in this wind bin.
† Signal-to-noise level less than 3 dB (see Table 15). Increased uncertainty in the determination of the Cumulative Sound Impact.
* Background sound level is greater than the applicable exclusion limit.

Table 20: R1469 Assessment Table – Cumulative Turbine-only Sound Impact

| Audited Receptor | Wind speed at 10-m AGL [m/s] | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|---|
| **R1469** | Cumulative Sound Impact - Receptor Location [dBA] | - | - | - | 36 | 35 | 36 | 33 |
| | *Signal-to-noise [dB]* | - | - | - | 3.6 | 2.1† | 2.1† | 0.6† |
| Background Sound Level [dBA] | | - | - | - | 35 | 37 | 38 | 42 |
| MECP Exclusion Limit [dBA] | | 40 | 40 | 40 | 40 | 40 | 40 | 43 |
| Compliance? (Y/N) | | - | - | - | Y | Y | Y | Y |

"-" Significantly fewer than the minimum data outlined in 6.4 were attained in this wind bin.
† Signal-to-noise level less than 3 dB (see Table 10). Increased uncertainty in the determination of the Cumulative Sound Impact.

Table 21: R2299 Assessment Table – Cumulative Turbine-only Sound Impact

| Audited Receptor | Wind speed at 10-m AGL [m/s] | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|---|
| **R2299** | Cumulative Sound Impact - Receptor Location [dBA] | - | - | - | 39 | 38 | 37 | 37 |
| | *Signal-to-noise [dB]* | - | - | - | 3.6 | 2.7† | 1.5† | 1.2† |
| Background Sound Level [dBA] | | - | - | - | 36 | 38 | 40 | 42 |
| MECP Exclusion Limit [dBA] | | 40 | 40 | 40 | 40 | 40 | 40 | 43 |
| Compliance? (Y/N) | | - | - | - | Y | Y | Y | Y |

"-" Significantly fewer than the minimum data counts outlined in 6.4 were attained in this wind bin.
† Signal-to-noise level less than 3 dB (see Table 10). Increased uncertainty in the determination of the Cumulative Sound Impact.

### 10.3 **Assessment of Compliance**

Based on the results presented in Section 10.2, the cumulative sound impact calculated at all five (5) measurement locations complies with the MECP sound level limits at all wind bins having sufficient data for assessment.

# 11 Conclusion

Aercoustics Engineering Limited has completed the Phase 1 immission audit outlined in Condition E the Renewable Energy Approval #2765-A4ER2P for the Belle River Wind Power Project. Testing was conducted in accordance with the methodology outlined in Part D and Part E of the MECP Compliance Protocol for Wind Turbine Noise. Compliance has been demonstrated at all five (5) audit locations.

# 12 References

[1] M. Keyvani, P.Eng., "Renewable Energy Approval #2765-A4ER2P", Ontario Ministry of the Environment, Toronto, ON, January 13, 2016.

[2] Ministry of the Environment and Climate Change, *"Compliance Protocol for Wind Turbine Noise"*, Ontario Ministry of the Environment, Toronto, ON, April 21, 2017.

[3] S. Dokouzian, A. Nercessian and A. Danaitis, "Belle River Wind Project Renewable Energy Approval Application – Noise Impact Assessment" DNV-GL, Ottawa, ON, November 27, 2015.

[4] P. Ashtiani, A. Denison and S. Sanchez, "Belle River Wind Power Project – Turbine T52 – IEC 61400-11 Edition 3.0 Measurement Report", Aercoustics Engineering Ltd., Mississauga, ON, 4 January 2019.

[5] P. Ashtiani, A. Denison and N. Tam, "Belle River Wind Power Project – Turbine T44 – IEC 61400-11 Edition 3.0 Measurement Report", Aercoustics Engineering Ltd., Mississauga, ON, 21 May 2019.

[6] P. Ashtiani, A. Denison and A. Davidson, "Belle River Wind Power Project – Turbine T40 – IEC 61400-11 Edition 3.0 Measurement Report", Aercoustics Engineering Ltd., Mississauga, ON, 26 November 2018.

[7] P. Ashtiani, A. Denison and A. Davidson, "Belle River Wind Power Project – Turbine T53 – IEC 61400-11 Edition 3.0 Measurement Report", Aercoustics Engineering Ltd., Mississauga, ON, 21 May 2019.

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# Appendix A
# Location Details




## Legend

- Rail Line
- Ontario HWY 401
- Receptor Locations
- Campaign Monitor
- De-Selected Monitor

Belle River Turbines

- Turbines Not Built
- Turbines Built
- Transformer

Third Party Turbines

- Comber
- Comber Transformer
- PAR
- PAR Transformer

N

| | |
|---|---|
| **Project ID:** | 17095.01 |
| **Drawn by:** | MWJ |
| **Reveiwed by:** | KC |
| **Date:** | Aug 5, 2020 |
| **Revision:** | 1 |
| **Scale:** | As Indicated |

Belle River Wind Power Project
Phase 1 I-Audit Report

# Appendix A.1

Site Plan Overview

aercoustics




## Legend

- Campaign Receptor
- Turbines - Built
- Monitor Locations
- Myers Rd

N

| | |
|---|---|
| **Project ID:** | 17095.01 |
| **Drawn by:** | MWJ |
| **Reveiwed by:** | KC |
| **Date:** | Aug 5, 2020 |
| **Revision:** | 1 |
| **Scale:** | As Indicated |

Belle River Wind Power Project
Phase 1 I-Audit Report

# Appendix A.2.i

R1126
Monitor and Receptor Location

aercoustics



| | |
|---|---|
| **Project ID:** | 17095.01 |
| **Drawn by:** | MWJ |
| **Reveiwed by:** | KC |
| **Date:** | Aug 5, 2020 |
| **Revision:** | 1 |
| **Scale:** | NA |

Belle River Wind Power Project
Phase 1 I-Audit Report

# Appendix A.2.ii

R1126
Monitor to T50

aercoustics



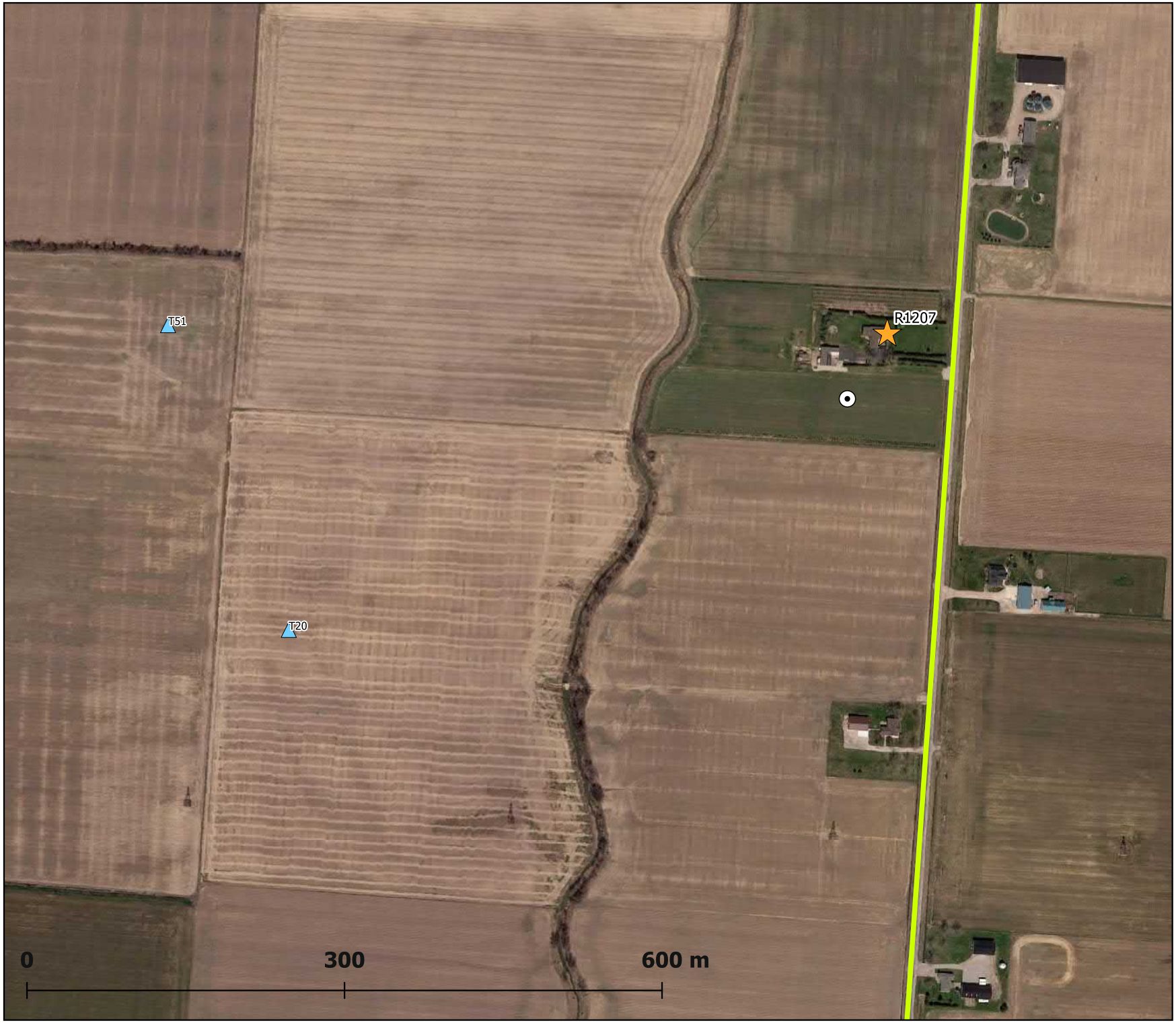
| | |
|---|---|
| **Project ID:** | 17095.01 |
| **Drawn by:** | MWJ |
| **Reveiwed by:** | KC |
| **Date:** | Aug 5, 2020 |
| **Revision:** | 1 |
| **Scale:** | NA |

Belle River Wind Power Project
Phase 1 I-Audit Report

# Appendix A.2.iii

R1126
Monitor to Receptor

aercoustics




## Legend

- Campaign Receptor
- Turbines - Built
- Monitor Locations
- Lakeshore Rd 123

N

| | |
|---|---|
| **Project ID:** | 17095.01 |
| **Drawn by:** | MWJ |
| **Reveiwed by:** | KC |
| **Date:** | Aug 5, 2020 |
| **Revision:** | 1 |
| **Scale:** | As Indicated |

Belle River Wind Power Project
Phase 1 I-Audit Report

# Appendix A.3.i

R1207
Monitor and Receptor Location

aercoustics



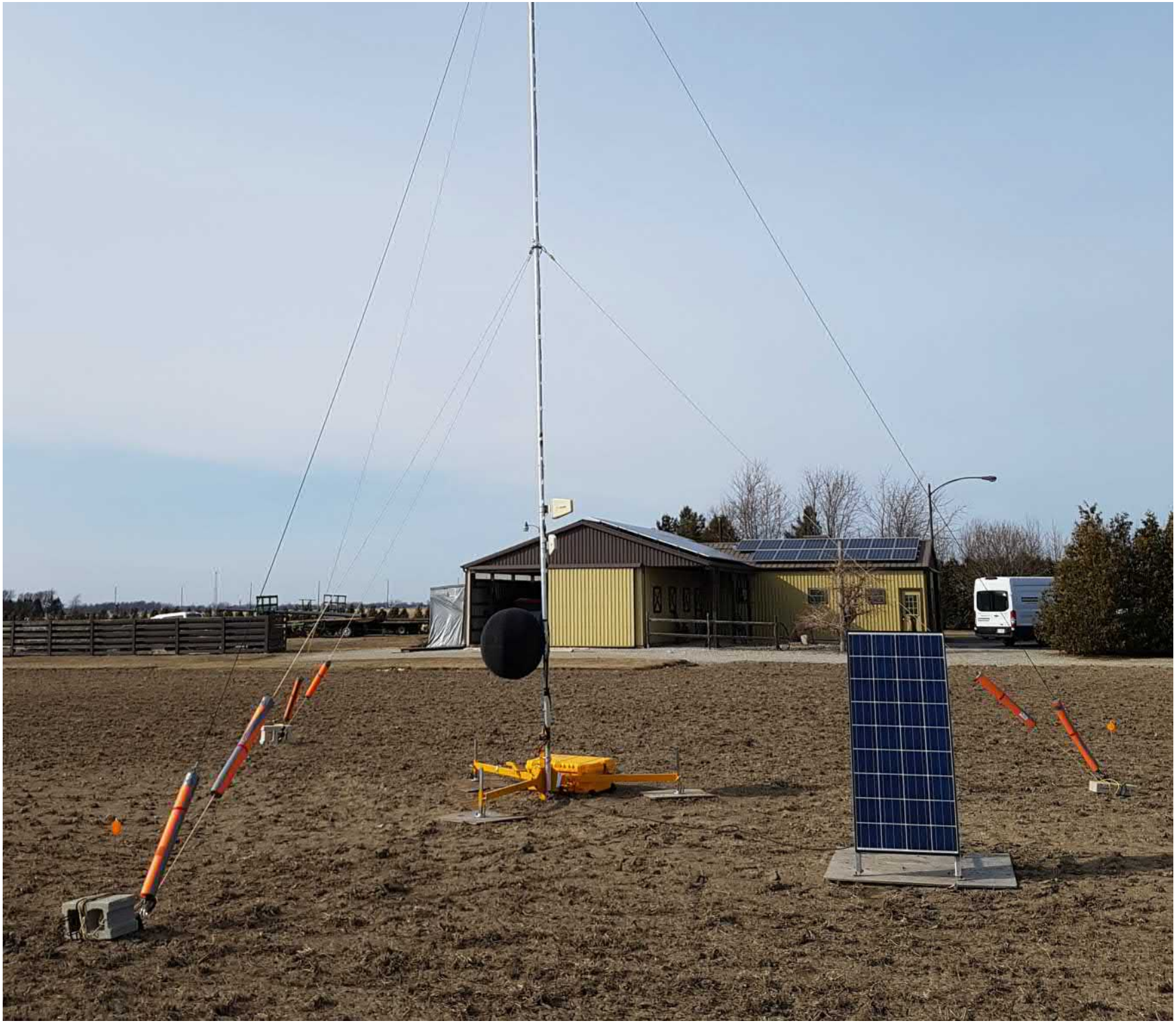
| | |
|---|---|
| **Project ID:** | 17095.01 |
| **Drawn by:** | MWJ |
| **Reveiwed by:** | KC |
| **Date:** | Aug 5, 2020 |
| **Revision:** | 1 |
| **Scale:** | NA |

Belle River Wind Power Project
Phase 1 I-Audit Report

# Appendix A.3.ii

R1207
Monitor to T20

aercoustics



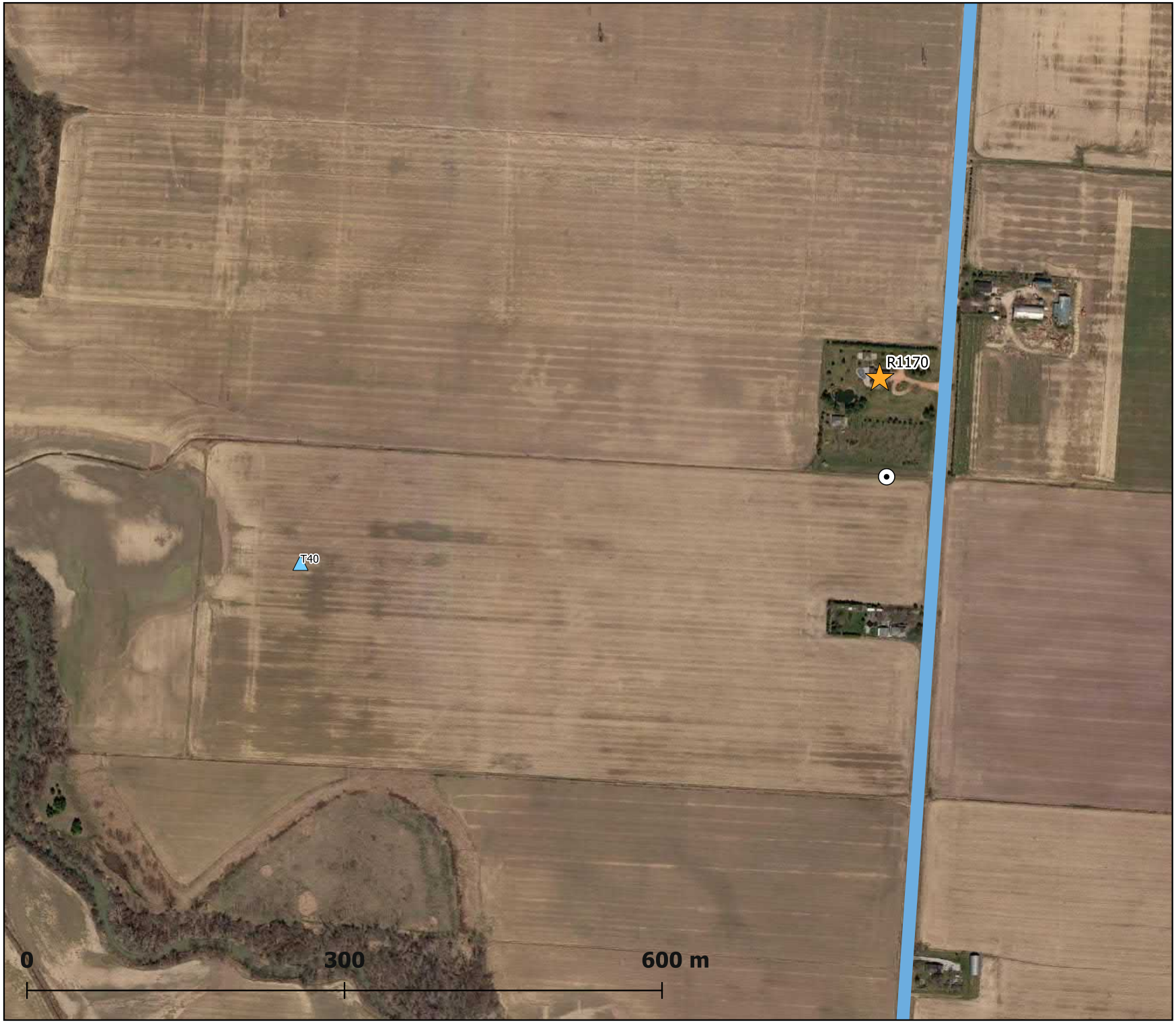
| | |
|---|---|
| **Project ID:** | 17095.01 |
| **Drawn by:** | MWJ |
| **Reveiwed by:** | KC |
| **Date:** | Aug 5, 2020 |
| **Revision:** | 1 |
| **Scale:** | NA |

Belle River Wind Power Project
Phase 1 I-Audit Report

# Appendix A.3.iii

R1207
Monitor to Receptor

aercoustics




## Legend

- Campaign Receptor
- Turbines - Built
- Monitor Locations
- Lakeshore Rd 129

N

| | |
|---|---|
| **Project ID:** | 17095.01 |
| **Drawn by:** | MWJ |
| **Reveiwed by:** | KC |
| **Date:** | Aug 5, 2020 |
| **Revision:** | 1 |
| **Scale:** | As Indicated |

Belle River Wind Power Project
Phase 1 I-Audit Report

# Appendix A.4.i

R1170
Monitor and Receptor Location

aercoustics



| | |
|---|---|
| **Project ID:** | 17095.01 |
| **Drawn by:** | MWJ |
| **Reveiwed by:** | KC |
| **Date:** | Aug 5, 2020 |
| **Revision:** | 1 |
| **Scale:** | NA |

Belle River Wind Power Project
Phase 1 I-Audit Report

# Appendix A.4.ii

R1170
Monitor to T40

aercoustics



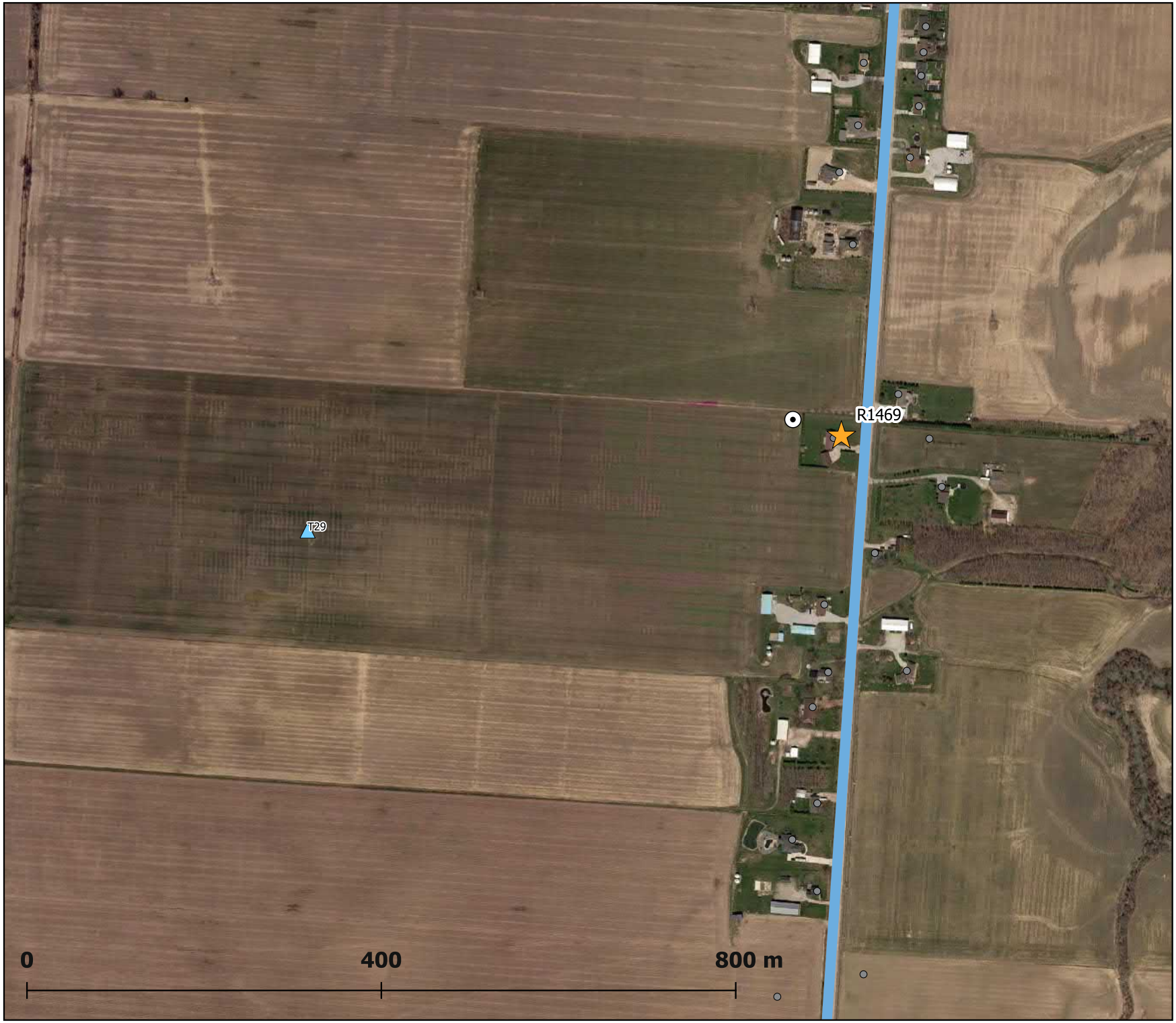
| | |
|---|---|
| **Project ID:** | 17095.01 |
| **Drawn by:** | MWJ |
| **Reveiwed by:** | KC |
| **Date:** | Aug 5, 2020 |
| **Revision:** | 1 |
| **Scale:** | NA |

Belle River Wind Power Project
Phase 1 I-Audit Report

# Appendix A.4.iii

R1170
Monitor to Receptor

aercoustics




## Legend

- Campaign Receptor
- Turbines - Built
- Monitor Locations
- County Road 31

N

| | |
|---|---|
| **Project ID:** | 17095.01 |
| **Drawn by:** | MWJ |
| **Reveiwed by:** | KC |
| **Date:** | Aug 5, 2020 |
| **Revision:** | 1 |
| **Scale:** | As Indicated |

Belle River Wind Power Project
Phase 1 I-Audit Report

# Appendix A.5.i

R1469
Monitor and Receptor Location

aercoustics



| | |
|---|---|
| **Project ID:** | 17095.01 |
| **Drawn by:** | MWJ |
| **Reveiwed by:** | KC |
| **Date:** | Aug 5, 2020 |
| **Revision:** | 1 |
| **Scale:** | NA |

Belle River Wind Power Project
Phase 1 I-Audit Report

# Appendix A.5.ii

R1469
Monitor to T29

aercoustics



| | |
|---|---|
| **Project ID:** | 17095.01 |
| **Drawn by:** | MWJ |
| **Reveiwed by:** | KC |
| **Date:** | Aug 5, 2020 |
| **Revision:** | 1 |
| **Scale:** | NA |

Belle River Wind Power Project
Phase 1 I-Audit Report

# Appendix A.5.iii

R1469
Monitor to Receptor

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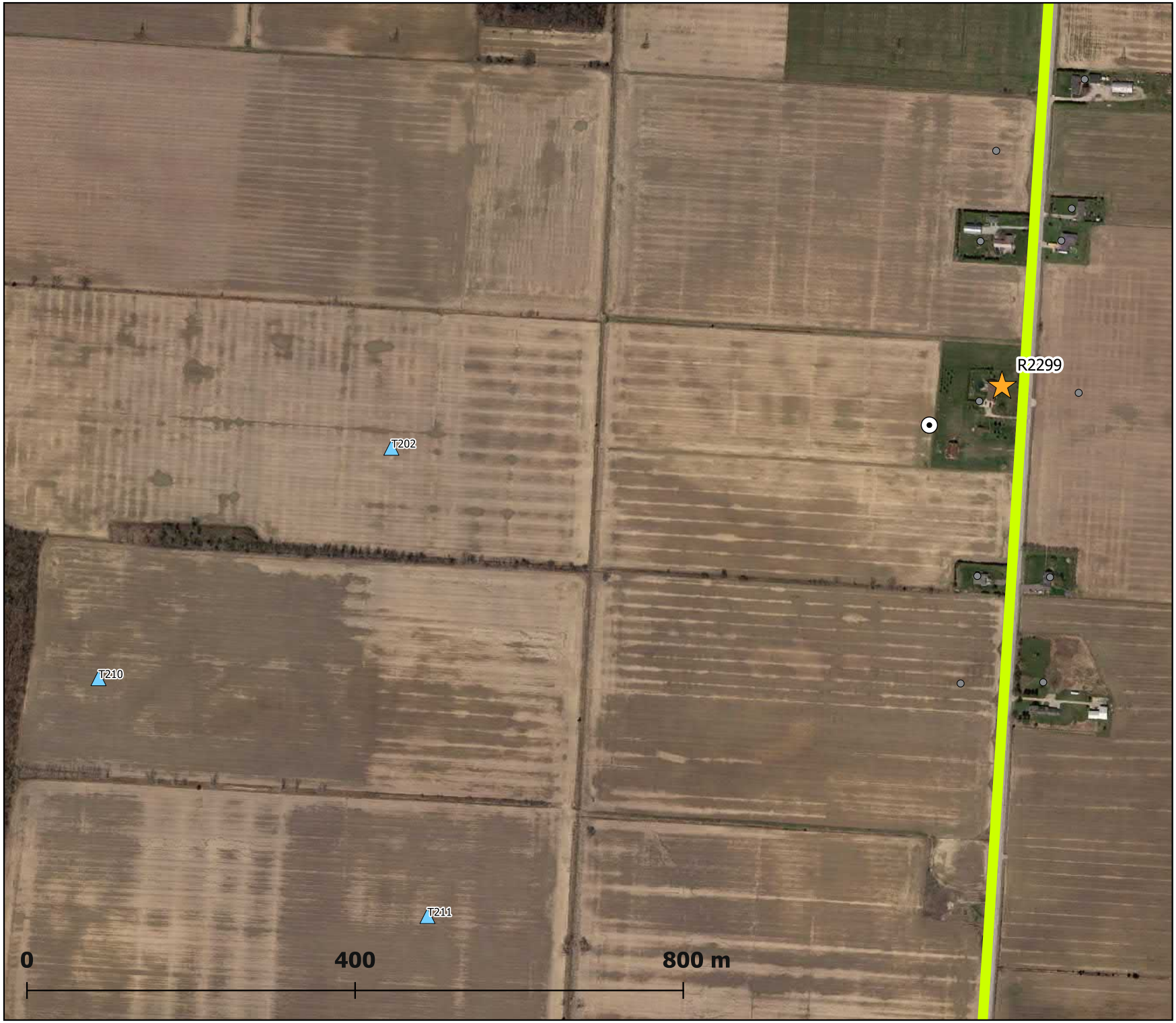


## Legend

- Campaign Receptor
- Turbines - Built
- Monitor Locations
- Lakeshore Road 113

N

| | |
|---|---|
| **Project ID:** | 17095.01 |
| **Drawn by:** | MWJ |
| **Reveiwed by:** | KC |
| **Date:** | Aug 5, 2020 |
| **Revision:** | 1 |
| **Scale:** | As Indicated |

Belle River Wind Power Project
Phase 1 I-Audit Report

# Appendix A.6.i

R2299
Monitor and Receptor Location

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| | |
|---|---|
| **Project ID:** | 17095.01 |
| **Drawn by:** | MWJ |
| **Reveiwed by:** | KC |
| **Date:** | Aug 5, 2020 |
| **Revision:** | 1 |
| **Scale:** | NA |

Belle River Wind Power Project
Phase 1 I-Audit Report

# Appendix A.6.ii

R2299
Monitor to T202

aercoustics



| | |
|---|---|
| **Project ID:** | 17095.01 |
| **Drawn by:** | MWJ |
| **Reveiwed by:** | KC |
| **Date:** | Aug 5, 2020 |
| **Revision:** | 1 |
| **Scale:** | NA |

Belle River Wind Power Project
Phase 1 I-Audit Report

# Appendix A.6.iii

R2299
Monitor to Receptor

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# Appendix B
# Receptor Selection Details

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# Appendix B – Receptor Selection Details

As per the REA, five (5) measurement locations are required to be conducted on two (2) separate occasions, or "Phases" of measurement.

During the initial audit measurement campaign, conducted in Spring 2019, the five measurement locations selected were R1126, R1207, R1170, R1141, and R738. Of these five (5) measurement locations, only three (3) were able to collect complete datasets. The other two (2) locations – R1141 and R738 – were impacted significantly by noise from the nearby Ontario Highway 401, which was situated less than a kilometer from the two affected receptors.

In consultation with the MECP, Receptors R1141 and R738 were not reselected for a subsequent measurement campaign. Instead, two new measurement locations were selected. A buffer of 2500 m from the highway was applied during the selection of the two revised measurement locations. This setback is consistent with that of R1126, R1207, and R1170, where the contribution of Highway 401 was observed to be less significant than was observed at R1141 and R738.

These two new measurement locations – R1469 and R2299 – were visited for the first time in the Fall of 2019, which represented the second audit campaign for Receptors R1126, R1207, and R1170.

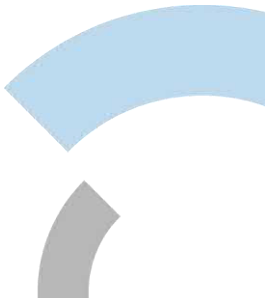
The audit campaigns carried out at BRWPP since the start of the Spring 2019 measurement campaign are outlined in Table B1 below. The monitoring phase indicated for each location represents whether this is the first or second period over which the location has been audited. The full receptor selection table is provided in Table B2.

Table B1: I-Audit Campaign Summary – Phase 1

| Monitoring Phase | Monitoring Season | Location | Measurement Status |
|---|---|---|---|
| Phase 1 | Spring 2019 | R1126 | Complete |
| | | R1207 | Complete |
| | | R1170 | Complete |
| | | R738 | Audit incomplete – location de-selected |
| | | R1141 | Audit incomplete – location de-selected |
| | Fall 2019 | R1469 | Complete |
| | | R2299 | Complete |

Table B2: Receptors Sorted by Sound Level

| SPL Rank | Point of Reception ID | Participating / Predicted Third-Party impact (dBA) | Height (m) | Distance to Nearest Turbine (m) | Nearest Turbine | Predicted Overall Impact (dBA) | Wind Direction | Excluded / Potential | Notes |
|---|---|---|---|---|---|---|---|---|---|
| 1 | V3230 | 0.0 | 4.5 | 97 | T213 | 49.4 | UW | Excluded | Participating |
| 2 | V3055 | 0.0 | 4.5 | 359 | T214 | 43.6 | UW | Excluded | Participating |
| 3 | R1162 | 33.8 | 4.5 | 458 | T53 | 41.4 | **DW** | Excluded | Participating |
| 4 | R1161 | 32.4 | 1.5 | 483 | T53 | 40.2 | **DW** | Excluded | Participating |
| 5 | R1111 | 38.5 | 4.5 | 730 | T55 | 40 | **DW** | Excluded | Third-party + Belle River Transformer impact over 30 dBA |
| 6 | R766 | 36.4 | 4.5 | 570 | T48 | 39.9 | CW | Excluded | Crosswind |
| 7 | V3053 | 14.3 | 4.5 | 587 | T215 | 39.9 | CW | Excluded | Crosswind |
| 8 | V2788 | 37.6 | 4.5 | 747 | T48 | 39.9 | CW | Excluded | Crosswind |
| 9 | R211 | 39.0 | 4.5 | 931 | T15 | 39.9 | CW | Excluded | Crosswind |
| 10 | R1171 | 30.2 | 7.5 | 569 | T40 | 39.8 | CW | Excluded | Crosswind |
| 11 | V3302 | 0.0 | 4.5 | 551 | T210 | 39.7 | CW | Excluded | Crosswind |
| 12 | V2810 | 29.7 | 4.5 | 598 | T45 | 39.7 | CW | Excluded | Crosswind |
| 13 | V2793 | 30.3 | 4.5 | 561 | T59 | 39.7 | **DW** | Excluded | Participating |
| 14 | R742 | 30.3 | 4.5 | 550 | T49 | 39.6 | **DW** | Excluded | Third-party + Belle River Transformer impact over 30 dBA |
| 15 | R741 | 30.8 | 7.5 | 622 | T59 | 39.6 | **DW** | Excluded | Third-party + Belle River Transformer impact over 30 dBA |
| 16 | R2311 | 14.2 | 4.5 | 636 | T215 | 39.6 | CW | Excluded | Crosswind |
| 17 | R206 | 38.9 | 4.5 | 1070 | T15 | 39.6 | CW | Excluded | Crosswind |
| 18 | V2794 | 30.1 | 4.5 | 447 | T49 | 39.6 | CW | Excluded | Crosswind |
| 19 | R736 | 31.2 | 7.5 | 674 | T58 | 39.5 | **DW** | Excluded | Third-party + Belle River Transformer impact over 30 dBA |
| 20 | R214 | 37.8 | 4.5 | 689 | T15 | 39.5 | CW | Excluded | Crosswind |
| 21 | R1110 | 37.8 | 4.5 | 715 | T55 | 39.5 | CW | Excluded | Crosswind |
| 22 | R767 | 36.5 | 4.5 | 748 | T58 | 39.5 | UW | Excluded | Upwind |
| 23 | R213 | 38.1 | 4.5 | 752 | T15 | 39.5 | CW | Excluded | Crosswind |
| 24 | R210 | 38.4 | 4.5 | 887 | T15 | 39.5 | CW | Excluded | Crosswind |
| 25 | R181 | 39.1 | 4.5 | 1462 | T15 | 39.5 | CW | Excluded | Crosswind |
| 26 | R714 | 34.3 | 4.5 | 602 | T52 | 39.5 | **DW** | Excluded | Participating |
| 27 | R2108 | 0.0 | 4.5 | 554 | T214 | 39.4 | UW | Excluded | Upwind |



| SPL Rank | Point of Reception ID | Participating / Predicted Third-Party impact (dBA) | Height (m) | Distance to Nearest Turbine (m) | Nearest Turbine | Predicted Overall Impact (dBA) | Wind Direction | Excluded / Potential | Notes |
|---|---|---|---|---|---|---|---|---|---|
| 28 | R735 | 31.3 | 7.5 | 578 | T57 | 39.4 | CW | Excluded | Crosswind |
| 29 | V2712 | 36.8 | 4.5 | 584 | T15 | 39.4 | CW | Excluded | Crosswind |
| 30 | V2817 | 37.0 | 4.5 | 605 | T55 | 39.4 | **DW** | Excluded | Third-party + Belle River Transformer impact over 30 dBA |
| 31 | V3379 | 30.4 | 4.5 | 618 | T59 | 39.4 | **DW** | Excluded | Third-party + Belle River Transformer impact over 30 dBA |
| 32 | R2313 | 14.1 | 4.5 | 624 | T215 | 39.4 | CW | Excluded | Crosswind |
| 33 | R2312 | 14.0 | 4.5 | 656 | T215 | 39.4 | CW | Excluded | Crosswind |
| 34 | V3216 | 9.1 | 4.5 | 704 | T212 | 39.4 | CW | Excluded | Crosswind |
| 35 | V2734 | 37.8 | 4.5 | 741 | T15 | 39.4 | CW | Excluded | Crosswind |
| 36 | R207 | 38.6 | 4.5 | 971 | T15 | 39.4 | CW | Excluded | Crosswind |
| 37 | V2610 | 38.6 | 4.5 | 996 | T15 | 39.4 | CW | Excluded | Crosswind |
| 38 | V2609 | 38.6 | 4.5 | 1021 | T15 | 39.4 | CW | Excluded | Crosswind |
| 39 | R205 | 38.6 | 4.5 | 1049 | T15 | 39.4 | CW | Excluded | Crosswind |
| 40 | V3363 | 38.7 | 4.5 | 1158 | T15 | 39.4 | CW | Excluded | Crosswind |
| 41 | R175 | 38.7 | 4.5 | 1182 | T15 | 39.4 | CW | Excluded | Crosswind |
| 42 | R176 | 38.8 | 4.5 | 1255 | T15 | 39.4 | CW | Excluded | Crosswind |
| 43 | V2825 | 29.7 | 4.5 | 551 | T40 | 39.4 | CW | Excluded | Crosswind |
| 44 | V2772 | 30.5 | 4.5 | 552 | T49 | 39.3 | UW | Excluded | Upwind |
| 45 | R1172 | 29.5 | 4.5 | 573 | T45 | 39.3 | CW | Excluded | Crosswind |
| 46 | V2792 | 30.4 | 4.5 | 576 | T58 | 39.3 | CW | Excluded | Crosswind |
| 47 | R739 | 31.0 | 7.5 | 635 | T58 | 39.3 | **DW** | Excluded | Third-party + Belle River Transformer impact over 30 dBA |
| 48 | V2786 | 36.4 | 4.5 | 737 | T58 | 39.3 | UW | Excluded | Upwind |
| 49 | R177 | 38.8 | 4.5 | 1373 | T15 | 39.3 | CW | Excluded | Crosswind |
| 50 | R1169 | 30.2 | 4.5 | 561 | T44 | 39.3 | CW | Excluded | Crosswind |
| 51 | R2510 | 29.6 | 4.5 | 573 | T45 | 39.3 | UW | Excluded | Upwind |
| 52 | V2791 | 30.5 | 4.5 | 542 | T58 | 39.3 | **DW** | Excluded | Participating |
| 53 | V3215 | 10.4 | 4.5 | 709 | T211 | 39.3 | **DW** | Excluded | Participating |
| 54 | R740 | 30.4 | 4.5 | 573 | T58 | 39.2 | CW | Excluded | Crosswind |
| **55** | **R1170** | 30.1 | **4.5** | **574** | **T40** | **39.2** | **DW** | **Selected** | **Selected**<br>**Note: monitor was located such that the predicted third-party/transformer impact is less than 30 dBA** |
| 56 | V2777 | 33.0 | 4.5 | 599 | T52 | 39.2 | CW | Excluded | Crosswind |
| 57 | R1121 | 25.6 | 7.5 | 644 | T51 | 39.2 | UW | Excluded | Upwind |

| SPL Rank | Point of Reception ID | Participating / Predicted Third-Party impact (dBA) | Height (m) | Distance to Nearest Turbine (m) | Nearest Turbine | Predicted Overall Impact (dBA) | Wind Direction | Excluded / Potential | Notes |
|---|---|---|---|---|---|---|---|---|---|
| 58 | V3217 | 13.9 | 4.5 | 711 | T215 | 39.2 | CW | Excluded | Crosswind |
| 59 | R2309 | 9.0 | 4.5 | 740 | T212 | 39.2 | CW | Excluded | Crosswind |
| 60 | V3054 | 13.8 | 4.5 | 751 | T212 | 39.2 | CW | Excluded | Crosswind |
| 61 | R768 | 36.5 | 4.5 | 762 | T58 | 39.2 | UW | Excluded | Upwind |
| 62 | V2926 | 38.9 | 4.5 | 1745 | T36 | 39.2 | CW | Excluded | Crosswind |
| 63 | V2768 | 26.0 | 4.5 | 554 | T20 | 39.2 | CW | Excluded | Crosswind |
| 64 | V2495 | 30.0 | 4.5 | 561 | T12 | 39.1 | UW | Excluded | Upwind |
| 65 | V2492 | 30.3 | 4.5 | 609 | T12 | 39.1 | UW | Excluded | Upwind |
| 66 | V2790 | 30.8 | 4.5 | 683 | T57 | 39.1 | CW | Excluded | Crosswind |
| 67 | V2778 | 30.6 | 4.5 | 729 | T58 | 39.1 | **DW** | Excluded | Third-party + Belle River Transformer impact over 30 dBA |
| 68 | R1175 | 29.8 | 4.5 | 643 | T45 | 39.1 | UW | Excluded | Upwind |
| 69 | R1157 | 34.0 | 1.5 | 547 | T15 | 39.1 | CW | Excluded | Crosswind |
| 70 | V2496 | 29.8 | 4.5 | 562 | T12 | 39 | UW | Excluded | Upwind |
| 71 | R763 | 31.5 | 4.5 | 569 | T48 | 39 | UW | Excluded | Upwind |
| 72 | V2491 | 30.4 | 4.5 | 602 | T14 | 39 | **DW** | Excluded | Third-party + Belle River Transformer impact over 30 dBA |
| 73 | V2580 | 25.1 | 4.5 | 615 | T51 | 39 | UW | Excluded | Upwind |
| 74 | V2814 | 30.2 | 4.5 | 645 | T46 | 39 | **DW** | Excluded | Third-party + Belle River Transformer impact over 30 dBA |
| 75 | V2749 | 33.3 | 4.5 | 695 | T26 | 39 | **DW** | Excluded | Third-party + Belle River Transformer impact over 30 dBA |
| 76 | R2310 | 14.0 | 4.5 | 796 | T212 | 39 | CW | Excluded | Crosswind |
| 77 | R770 | 36.9 | 4.5 | 873 | T58 | 39 | CW | Excluded | Crosswind |
| 78 | R1503 | 34.7 | 7.5 | 768 | T38 | 39 | UW | Excluded | Upwind |
| 79 | R1205 | 26.5 | 4.5 | 576 | T20 | 38.9 | CW | Excluded | Crosswind |
| 80 | V2490 | 30.3 | 4.5 | 598 | T14 | 38.9 | **DW** | Excluded | Third-party + Belle River Transformer impact over 30 dBA |
| 81 | R734 | 30.8 | 4.5 | 604 | T57 | 38.9 | **DW** | Excluded | Third-party + Belle River Transformer impact over 30 dBA |
| 82 | V2836 | 29.8 | 4.5 | 669 | T45 | 38.9 | UW | Excluded | Upwind |
| 83 | R2302 | 10.4 | 4.5 | 670 | T205 | 38.9 | UW | Excluded | Upwind |
| 84 | V2751 | 36.8 | 4.5 | 738 | T54 | 38.9 | CW | Excluded | Crosswind |
| 85 | V2747 | 36.6 | 4.5 | 773 | BR_sub | 38.9 | UW | Excluded | Upwind |
| 86 | R1108 | 37.4 | 4.5 | 873 | T55 | 38.9 | CW | Excluded | Crosswind |
| 87 | V2944 | 38.5 | 4.5 | 1445 | T54 | 38.9 | UW | Excluded | Upwind |
| 88 | V2721 | 26.6 | 4.5 | 560 | T50 | 38.9 | CW | Excluded | Crosswind |
| 89 | V2816 | 30.3 | 4.5 | 639 | T40 | 38.9 | **DW** | Excluded | Participating |

| SPL Rank | Point of Reception ID | Participating / Predicted Third-Party impact (dBA) | Height (m) | Distance to Nearest Turbine (m) | Nearest Turbine | Predicted Overall Impact (dBA) | Wind Direction | Excluded / Potential | Notes |
|---|---|---|---|---|---|---|---|---|---|
| 90 | V2822 | 30.9 | 4.5 | 587 | T47 | 38.9 | **DW** | Excluded` | Participating |
| 91 | R2314 | 14.1 | 1.5 | 542 | T215 | 38.9 | UW | Excluded | Upwind |
| 92 | R1128 | 26.5 | 4.5 | 571 | T50 | 38.8 | CW | Excluded | Crosswind |
| 93 | V2489 | 30.2 | 4.5 | 589 | T14 | 38.8 | **DW** | Excluded | Third-party + Belle River Transformer impact over 30 dBA |
| 94 | R1206 | 26.3 | 4.5 | 596 | T30 | 38.8 | UW | Excluded | Upwind |
| 95 | V2497 | 29.8 | 4.5 | 601 | T12 | 38.8 | UW | Excluded | Upwind |
| 96 | R2300 | 10.6 | 4.5 | 644 | T205 | 38.8 | CW | Excluded | Crosswind |
| 97 | V2923 | 38.4 | 4.5 | 1645 | T36 | 38.8 | CW | Excluded | Crosswind |
| 98 | V2722 | 26.3 | 4.5 | 572 | T50 | 38.8 | **DW** | Excluded | Participating |
| 99 | V2737 | 25.9 | 4.5 | 564 | T30 | 38.8 | CW | Excluded | Crosswind |
| 100 | V2487 | 30.1 | 4.5 | 576 | T14 | 38.7 | **DW** | Excluded | Third-party + Belle River Transformer impact over 30 dBA |
| 101 | V2488 | 30.2 | 4.5 | 582 | T14 | 38.7 | **DW** | Excluded | Third-party + Belle River Transformer impact over 30 dBA |
| 102 | V2732 | 34.7 | 4.5 | 594 | T15 | 38.7 | **DW** | Excluded | Third-party + Belle River Transformer impact over 30 dBA |
| 103 | R1155 | 35.1 | 4.5 | 598 | T15 | 38.7 | **DW** | Excluded | Third-party + Belle River Transformer impact over 30 dBA |
| 104 | R1131 | 27.1 | 4.5 | 606 | T50 | 38.7 | CW | Excluded | Crosswind |
| 105 | V2510 | 29.7 | 4.5 | 626 | T12 | 38.7 | UW | Excluded | Upwind |
| 106 | V2769 | 25.5 | 4.5 | 692 | T51 | 38.7 | UW | Excluded | Upwind |
| 107 | V2834 | 35.3 | 4.5 | 734 | T52 | 38.7 | **DW** | Excluded | Third-party + Belle River Transformer impact over 30 dBA |
| 108 | R1109 | 37.6 | 1.5 | 862 | T55 | 38.7 | CW | Excluded | Crosswind |
| 109 | V2782 | 30.8 | 4.5 | 533 | T57 | 38.7 | **DW** | Excluded | Participating |
| 110 | V2486 | 30.1 | 4.5 | 572 | T14 | 38.6 | **DW** | Excluded | Third-party + Belle River Transformer impact over 30 dBA |
| **111** | **R1126** | 26.2 | **4.5** | **626** | **T50** | **38.6** | **DW** | **Selected** | **Selected** |
| 112 | V2717 | 26.0 | 4.5 | 636 | T50 | 38.6 | **DW** | Excluded | Excluded: Redundant with R1126 |
| 113 | V2511 | 29.7 | 4.5 | 652 | T12 | 38.6 | UW | Excluded | Upwind |
| 114 | R1505 | 33.7 | 4.5 | 694 | T36 | 38.6 | CW | Excluded | Crosswind |
| 115 | V2818 | 33.8 | 4.5 | 728 | T36 | 38.6 | CW | Excluded | Crosswind |
| 116 | R1498 | 35.0 | 4.5 | 746 | T38 | 38.6 | CW | Excluded | Crosswind |
| 117 | R1501 | 34.8 | 4.5 | 763 | T38 | 38.6 | CW | Excluded | Crosswind |
| 118 | R1165 | 37.2 | 4.5 | 1018 | T55 | 38.6 | CW | Excluded | Crosswind |
| 119 | R1500 | 34.4 | 4.5 | 695 | T38 | 38.6 | CW | Excluded | Crosswind |
| 120 | R1504 | 34.2 | 4.5 | 780 | T54 | 38.6 | **DW** | Excluded | Participating |

| SPL Rank | Point of Reception ID | Participating / Predicted Third-Party impact (dBA) | Height (m) | Distance to Nearest Turbine (m) | Nearest Turbine | Predicted Overall Impact (dBA) | Wind Direction | Excluded / Potential | Notes |
|---|---|---|---|---|---|---|---|---|---|
| 121 | V2485 | 30.0 | 4.5 | 569 | T14 | 38.5 | **DW** | Excluded | Land access denied, part of sub-divided vacant lot |
| 122 | R1132 | 27.3 | 4.5 | 648 | T50 | 38.5 | CW | Excluded | Crosswind |
| 123 | R2315 | 13.1 | 4.5 | 661 | T215 | 38.5 | UW | Excluded | Upwind |
| 124 | V2711 | 27.6 | 4.5 | 664 | T62 | 38.5 | CW | Excluded | Crosswind |
| 125 | V2744 | 26.9 | 4.5 | 667 | T20 | 38.5 | CW | Excluded | Crosswind |
| 126 | R1173 | 30.0 | 4.5 | 669 | T40 | 38.5 | CW | Excluded | Crosswind |
| 127 | V2578 | 34.6 | 4.5 | 681 | T38 | 38.5 | CW | Excluded | Crosswind |
| 128 | R1123 | 25.9 | 4.5 | 684 | T50 | 38.5 | **DW** | Excluded | Excluded: Redundant with R1126 |
| 129 | V2603 | 33.6 | 4.5 | 703 | T36 | 38.5 | CW | Excluded | Crosswind |
| 130 | V2564 | 35.3 | 4.5 | 795 | T38 | 38.5 | CW | Excluded | Crosswind |
| 131 | V2762 | 35.6 | 4.5 | 802 | BR_sub | 38.5 | CW | Excluded | Crosswind |
| 132 | R1495 | 35.4 | 4.5 | 810 | T38 | 38.5 | CW | Excluded | Crosswind |
| 133 | R1492 | 35.2 | 7.5 | 842 | BR_sub | 38.5 | CW | Excluded | Crosswind |
| 134 | R715 | 32.4 | 1.5 | 576 | T52 | 38.5 | **DW** | Excluded | Third-party + Belle River Transformer impact over 30 dBA |
| 135 | V2815 | 31.5 | 4.5 | 543 | T55 | 38.5 | CW | Excluded | Crosswind |
| 136 | V2484 | 30.0 | 4.5 | 568 | T14 | 38.4 | **DW** | Excluded | Land access denied, part of sub-divided vacant lot |
| **137** | **R1141** | 29.4 | **4.5** | **580** | **T12** | **38.4** | **DW** | **No longer selected** | **Initially selected and subsequently de-selected due to impact from the 401** |
| 138 | R731 | 31.4 | 7.5 | 628 | T57 | 38.4 | **DW** | Excluded | Third-party + Belle River Transformer impact over 30 dBA |
| 139 | V3213 | 0.0 | 4.5 | 654 | T202 | 38.4 | CW | Excluded | Crosswind |
| 140 | V2512 | 29.7 | 4.5 | 678 | T12 | 38.4 | UW | Excluded | Upwind |
| 141 | R2426 | 30.9 | 4.5 | 692 | T38 | 38.4 | CW | Excluded | Crosswind |
| 142 | R1176 | 30.0 | 4.5 | 708 | T46 | 38.4 | CW | Excluded | Crosswind |
| 143 | V2565 | 33.8 | 4.5 | 714 | T54 | 38.4 | CW | Excluded | Crosswind |
| 144 | V2763 | 26.0 | 4.5 | 733 | T50 | 38.4 | **DW** | Excluded | Excluded: Redundant with R1126 |
| 145 | R1494 | 35.5 | 4.5 | 801 | BR_sub | 38.4 | CW | Excluded | Crosswind |
| 146 | V2781 | 35.6 | 4.5 | 816 | T58 | 38.4 | CW | Excluded | Crosswind |
| 147 | R732 | 30.9 | 4.5 | 552 | T57 | 38.3 | **DW** | Excluded | Third-party + Belle River Transformer impact over 30 dBA |
| 148 | V2482 | 29.9 | 4.5 | 570 | T14 | 38.3 | **DW** | Excluded | Land access denied, part of sub-divided vacant lot |
| 149 | V2689 | 29.0 | 4.5 | 633 | T12 | 38.3 | **DW** | Excluded | Excluded: Within 2500 meters of the 401 |
| 150 | R1477 | 33.2 | 4.5 | 649 | T29 | 38.3 | CW | Excluded | Crosswind |
| 151 | V2774 | 32.1 | 4.5 | 655 | T48 | 38.3 | UW | Excluded | Upwind |

| SPL Rank | Point of Reception ID | Participating / Predicted Third-Party impact (dBA) | Height (m) | Distance to Nearest Turbine (m) | Nearest Turbine | Predicted Overall Impact (dBA) | Wind Direction | Excluded / Potential | Notes |
|---|---|---|---|---|---|---|---|---|---|
| 152 | R1154 | 35.0 | 4.5 | 680 | T15 | 38.3 | **DW** | Excluded | Third-party + Belle River Transformer impact over 30 dBA |
| 153 | V2513 | 29.6 | 4.5 | 683 | T14 | 38.3 | **DW** | Excluded | Land access denied, part of sub-divided vacant lot |
| 154 | V2813 | 29.4 | 4.5 | 714 | T45 | 38.3 | CW | Excluded | Crosswind |
| 155 | V2829 | 31.1 | 4.5 | 715 | T38 | 38.3 | CW | Excluded | Crosswind |
| 156 | R1125 | 26.2 | 4.5 | 720 | T50 | 38.3 | **DW** | Excluded | Excluded: Redundant with R1126 |
| 157 | V2761 | 35.4 | 4.5 | 788 | BR_sub | 38.3 | **DW** | Excluded | Third-party + Belle River Transformer impact over 30 dBA |
| 158 | R1491 | 35.3 | 4.5 | 797 | BR_sub | 38.3 | CW | Excluded | Crosswind |
| 159 | R1382 | 37.8 | 4.5 | 1552 | T36 | 38.3 | CW | Excluded | Crosswind |
| 160 | V2731 | 34.1 | 4.5 | 636 | T15 | 38.3 | **DW** | Excluded | Participating |
| 161 | V2831 | 33.5 | 4.5 | 714 | T36 | 38.3 | CW | Excluded | Crosswind |
| 162 | V2539 | 29.9 | 4.5 | 572 | T14 | 38.2 | **DW** | Excluded | Land access denied, part of sub-divided vacant lot |
| 163 | R1474 | 32.1 | 4.5 | 606 | T29 | 38.2 | CW | Excluded | Crosswind |
| 164 | R1107 | 30.8 | 4.5 | 630 | T55 | 38.2 | CW | Excluded | Crosswind |
| 165 | R1118 | 25.0 | 4.5 | 654 | T51 | 38.2 | CW | Excluded | Crosswind |
| 166 | V3056 | 0.0 | 4.5 | 660 | T214 | 38.2 | UW | Excluded | Upwind |
| 167 | R1138 | 28.8 | 4.5 | 675 | T12 | 38.2 | **DW** | Excluded | Excluded: Within 2500 meters of the 401 |
| 168 | R1130 | 27.1 | 4.5 | 677 | T50 | 38.2 | CW | Excluded | Crosswind |
| 169 | V2514 | 29.5 | 4.5 | 680 | T14 | 38.2 | **DW** | Excluded | Land access denied, part of sub-divided vacant lot |
| 170 | R1478 | 33.4 | 4.5 | 703 | T29 | 38.2 | CW | Excluded | Crosswind |
| 171 | V2590 | 31.5 | 4.5 | 712 | T44 | 38.2 | CW | Excluded | Crosswind |
| 172 | R2514 | 33.7 | 4.5 | 715 | T54 | 38.2 | CW | Excluded | Crosswind |
| 173 | V2759 | 34.1 | 4.5 | 748 | T29 | 38.2 | CW | Excluded | Crosswind |
| 174 | R1112 | 36.0 | 4.5 | 762 | T55 | 38.2 | **DW** | Excluded | Third-party + Belle River Transformer impact over 30 dBA |
| 175 | R1489 | 35.2 | 4.5 | 798 | BR_sub | 38.2 | CW | Excluded | Crosswind |
| 176 | R1493 | 34.9 | 4.5 | 808 | T38 | 38.2 | CW | Excluded | Crosswind |
| 177 | V2760 | 35.0 | 4.5 | 866 | BR_sub | 38.2 | **DW** | Excluded | Third-party + Belle River Transformer impact over 30 dBA |
| 178 | V2557 | 34.7 | 4.5 | 885 | T29 | 38.2 | CW | Excluded | Crosswind |
| 179 | R1383 | 37.6 | 4.5 | 1509 | T36 | 38.2 | CW | Excluded | Crosswind |
| 180 | R461 | 37.2 | 1.5 | 1457 | T28 | 38.2 | **DW** | Excluded | Third-party + Belle River Transformer impact over 30 dBA |
| 181 | R822 | 28.8 | 4.5 | 550 | T206 | 38.1 | CW | Excluded | Crosswind |
| 182 | V2538 | 29.8 | 4.5 | 576 | T14 | 38.1 | CW | Excluded | Crosswind |
| 183 | R1208 | 25.1 | 4.5 | 594 | T30 | 38.1 | CW | Excluded | Crosswind |

| SPL Rank | Point of Reception ID | Participating / Predicted Third-Party impact (dBA) | Height (m) | Distance to Nearest Turbine (m) | Nearest Turbine | Predicted Overall Impact (dBA) | Wind Direction | Excluded / Potential | Notes |
|---|---|---|---|---|---|---|---|---|---|
| 184 | V2757 | 24.5 | 4.5 | 599 | T51 | 38.1 | CW | Excluded | Crosswind |
| 185 | V3206 | 11.1 | 4.5 | 647 | T205 | 38.1 | CW | Excluded | Crosswind |
| 186 | V2515 | 29.5 | 4.5 | 681 | T14 | 38.1 | **DW** | Excluded | Land access denied, part of sub-divided vacant lot |
| 187 | V2820 | 31.8 | 4.5 | 703 | T36 | 38.1 | **DW** | Excluded | Third-party + Belle River Transformer impact over 30 dBA |
| 188 | R1487 | 34.9 | 4.5 | 838 | BR_sub | 38.1 | CW | Excluded | Crosswind |
| 189 | R1484 | 35.0 | 4.5 | 839 | BR_sub | 38.1 | **DW** | Excluded | Third-party + Belle River Transformer impact over 30 dBA |
| 190 | R1386 | 37.3 | 4.5 | 1361 | T36 | 38.1 | CW | Excluded | Crosswind |
| 191 | R212 | 37.0 | 1.5 | 861 | T15 | 38.1 | CW | Excluded | Crosswind |
| 192 | R1508 | 33.7 | 4.5 | 731 | T54 | 38.1 | CW | Excluded | Crosswind |
| 193 | V2765 | 26.9 | 4.5 | 683 | T50 | 38.1 | CW | Excluded | Crosswind |
| 194 | R730 | 31.0 | 4.5 | 577 | T57 | 38 | **DW** | Excluded | Third-party + Belle River Transformer impact over 30 dBA |
| 195 | V2537 | 29.7 | 4.5 | 582 | T14 | 38 | CW | Excluded | Crosswind |
| 196 | R761 | 30.0 | 4.5 | 623 | T49 | 38 | CW | Excluded | Crosswind |
| 197 | R1471 | 31.6 | 4.5 | 643 | T29 | 38 | CW | Excluded | Crosswind |
| 198 | V3048 | 16.3 | 4.5 | 666 | T215 | 38 | UW | Excluded | Upwind |
| 199 | V2516 | 29.4 | 4.5 | 681 | T14 | 38 | **DW** | Excluded | Land access denied, part of sub-divided vacant lot |
| 200 | V2698 | 27.4 | 4.5 | 689 | T11 | 38 | UW | Excluded | Upwind |
| 201 | R1467 | 30.7 | 7.5 | 689 | T29 | 38 | **DW** | Excluded | Third-party + Belle River Transformer impact over 30 dBA |
| 202 | V2582 | 33.0 | 4.5 | 693 | T48 | 38 | UW | Excluded | Upwind |
| 203 | V2811 | 32.3 | 4.5 | 722 | T55 | 38 | CW | Excluded | Crosswind |
| 204 | V2571 | 33.4 | 4.5 | 780 | T40 | 38 | UW | Excluded | Upwind |
| 205 | V2809 | 33.5 | 4.5 | 787 | T40 | 38 | UW | Excluded | Upwind |
| 206 | R1480 | 34.1 | 4.5 | 873 | T40 | 38 | UW | Excluded | Upwind |
| 207 | R1385 | 37.3 | 4.5 | 1420 | T36 | 38 | CW | Excluded | Crosswind |
| 208 | R1369 | 37.4 | 7.5 | 1673 | T36 | 38 | CW | Excluded | Crosswind |
| 209 | R1507 | 33.4 | 4.5 | 746 | T36 | 38 | UW | Excluded | Upwind |
| 210 | R1119 | 22.8 | 1.5 | 594 | T51 | 38 | UW | Excluded | Upwind |
| 211 | V2536 | 29.7 | 4.5 | 589 | T14 | 37.9 | CW | Excluded | Crosswind |
| 212 | V2823 | 32.7 | 4.5 | 621 | T47 | 37.9 | CW | Excluded | Crosswind |
| 213 | R760 | 30.0 | 4.5 | 638 | T49 | 37.9 | CW | Excluded | Crosswind |
| 214 | V2718 | 25.0 | 4.5 | 675 | T51 | 37.9 | CW | Excluded | Crosswind |
| 215 | V2517 | 29.4 | 4.5 | 683 | T14 | 37.9 | **DW** | Excluded | Land access denied, part of sub-divided vacant lot |

| SPL Rank | Point of Reception ID | Participating / Predicted Third-Party impact (dBA) | Height (m) | Distance to Nearest Turbine (m) | Nearest Turbine | Predicted Overall Impact (dBA) | Wind Direction | Excluded / Potential | Notes |
|---|---|---|---|---|---|---|---|---|---|
| 216 | V3049 | 20.3 | 4.5 | 723 | T215 | 37.9 | CW | Excluded | Crosswind |
| 217 | V3050 | 20.3 | 4.5 | 727 | T215 | 37.9 | CW | Excluded | Crosswind |
| 218 | R1152 | 34.5 | 4.5 | 738 | T15 | 37.9 | **DW** | Excluded | Third-party + Belle River Transformer impact over 30 dBA |
| 219 | R1134 | 27.7 | 4.5 | 758 | T62 | 37.9 | CW | Excluded | Crosswind |
| 220 | V2812 | 34.9 | 4.5 | 807 | T55 | 37.9 | CW | Excluded | Crosswind |
| 221 | V2830 | 34.6 | 4.5 | 878 | BR_sub | 37.9 | CW | Excluded | Crosswind |
| 222 | R1481 | 34.2 | 4.5 | 897 | T40 | 37.9 | UW | Excluded | Upwind |
| 223 | R1482 | 34.2 | 4.5 | 901 | T40 | 37.9 | UW | Excluded | Upwind |
| 224 | R1483 | 34.3 | 4.5 | 936 | BR_sub | 37.9 | **DW** | Excluded | Third-party + Belle River Transformer impact over 30 dBA |
| 225 | V2483 | 37.1 | 4.5 | 1828 | T8 | 37.9 | CW | Excluded | Crosswind |
| **226** | **R738** | 28.3 | **1.5** | **568** | **T58** | **37.9** | **DW** | **Selected** | **Initially selected and subsequently de-selected due to impact from the 401** |
| **227** | **R1207** | 23.8 | **1.5** | **620** | **T20** | **37.9** | **DW** | **Selected** | **Selected** |
| 228 | R1163 | 31.5 | 1.5 | 660 | T26 | 37.9 | DW | Excluded | Third-party + Belle River Transformer impact over 30 dBA |
| 229 | R1367 | 37.5 | 1.5 | 1848 | T36 | 37.9 | CW | Excluded | Crosswind |
| 230 | V2535 | 29.6 | 4.5 | 597 | T14 | 37.8 | CW | Excluded | Land access denied, part of subdivided vacant lot |
| 231 | V2518 | 29.3 | 4.5 | 686 | T14 | 37.8 | DW | Excluded | Land access denied, part of subdivided vacant lot |
| 232 | V2743 | 34.3 | 4.5 | 750 | T15 | 37.8 | DW | Excluded | Third-party + Belle River Transformer impact over 30 dBA |
| 233 | V2754 | 35.0 | 4.5 | 914 | T53 | 37.8 | UW | Excluded | Upwind |
| 234 | R1127 | 24.2 | 1.5 | 569 | T50 | 37.8 | CW | Excluded | Crosswind |
| 235 | R2301 | 7.8 | 1.5 | 726 | T205 | 37.8 | CW | Excluded | Crosswind |
| 236 | V2534 | 29.6 | 4.5 | 607 | T14 | 37.7 | CW | Excluded | Land access denied, part of subdivided vacant lot |
| 237 | R1117 | 24.8 | 4.5 | 659 | T51 | 37.7 | CW | Excluded | Crosswind |
| 238 | V2758 | 31.1 | 4.5 | 704 | T28 | 37.7 | CW | Excluded | Crosswind |
| 239 | R1470 | 31.1 | 4.5 | 719 | T29 | 37.7 | CW | Excluded | Crosswind |
| 240 | V2874 | 34.8 | 4.5 | 728 | T14 | 37.7 | UW | Excluded | Upwind |
| 241 | V2701 | 32.5 | 4.5 | 798 | T12 | 37.7 | CW | Excluded | Crosswind |
| 242 | R1509 | 33.5 | 4.5 | 809 | T36 | 37.7 | UW | Excluded | Upwind |
| 243 | R1396 | 36.6 | 4.5 | 1246 | T36 | 37.7 | CW | Excluded | Crosswind |
| 244 | V2752 | 36.7 | 4.5 | 1972 | T53 | 37.7 | UW | Excluded | Upwind |
| 245 | R764 | 29.4 | 1.5 | 592 | T48 | 37.7 | UW | Excluded | Upwind |

| SPL Rank | Point of Reception ID | Participating / Predicted Third-Party impact (dBA) | Height (m) | Distance to Nearest Turbine (m) | Nearest Turbine | Predicted Overall Impact (dBA) | Wind Direction | Excluded / Potential | Notes |
|---|---|---|---|---|---|---|---|---|---|
| 246 | R1129 | 24.7 | 1.5 | 595 | T50 | 37.7 | CW | Excluded | Crosswind |
| 247 | R737 | 28.4 | 1.5 | 634 | T58 | 37.7 | DW | Excluded | Excluded: Within 2500 meters of the 401 |
| 248 | R1174 | 28.0 | 1.5 | 669 | T45 | 37.7 | UW | Excluded | Upwind |
| 249 | R1368 | 37.3 | 1.5 | 1814 | T36 | 37.7 | CW | Excluded | Crosswind |
| 250 | V2533 | 29.5 | 4.5 | 619 | T14 | 37.6 | CW | Excluded | Land access denied, part of subdivided vacant lot |
| 251 | R759 | 29.7 | 4.5 | 674 | T49 | 37.6 | CW | Excluded | Crosswind |
| 252 | R1140 | 29.5 | 4.5 | 685 | T12 | 37.6 | DW | Excluded | Excluded: Within 2500 meters of the 401 |
| 253 | V2519 | 29.3 | 4.5 | 691 | T14 | 37.6 | CW | Excluded | Land access denied, part of subdivided vacant lot |
| 254 | R2515 | 31.1 | 4.5 | 698 | T40 | 37.6 | CW | Excluded | Crosswind |
| 255 | R1145 | 31.8 | 4.5 | 708 | T12 | 37.6 | CW | Excluded | Crosswind |
| 256 | V2586 | 31.0 | 4.5 | 710 | T29 | 37.6 | DW | Excluded | Third-party + Belle River Transformer impact over 30 dBA |
| 257 | R2513 | 30.3 | 4.5 | 713 | T29 | 37.6 | DW | Excluded | Third-party + Belle River Transformer impact over 30 dBA |
| 258 | V2771 | 30.7 | 4.5 | 714 | T55 | 37.6 | CW | Excluded | Crosswind |
| 259 | V2694 | 32.0 | 4.5 | 732 | T12 | 37.6 | CW | Excluded | Crosswind |
| 260 | V3051 | 19.9 | 4.5 | 754 | T215 | 37.6 | DW | Excluded | Excluded: Within 2500 meters of the 401 |
| 261 | V2783 | 34.7 | 4.5 | 785 | T57 | 37.6 | UW | Excluded | Upwind |
| 262 | V2785 | 34.2 | 4.5 | 832 | T52 | 37.6 | DW | Excluded | Third-party + Belle River Transformer impact over 30 dBA |
| 263 | V2838 | 31.8 | 4.5 | 839 | T55 | 37.6 | CW | Excluded | Crosswind |
| 264 | R394 | 36.3 | 4.5 | 1486 | T48 | 37.6 | UW | Excluded | Upwind |
| 265 | R782 | 34.3 | 1.5 | 723 | T58 | 37.6 | UW | Excluded | Upwind |
| 266 | R2303 | 7.1 | 1.5 | 770 | T211 | 37.6 | CW | Excluded | Crosswind |
| 267 | R209 | 36.5 | 1.5 | 917 | T15 | 37.6 | CW | Excluded | Crosswind |
| 268 | R208 | 36.5 | 1.5 | 949 | T15 | 37.6 | CW | Excluded | Crosswind |
| 269 | R1177 | 28.2 | 1.5 | 630 | T46 | 37.6 | UW | Excluded | Upwind |
| 270 | R821 | 22.2 | 4.5 | 669 | T219 | 37.5 | CW | Excluded | Crosswind |
| 271 | V2577 | 30.4 | 4.5 | 679 | T12 | 37.5 | CW | Excluded | Crosswind |
| 272 | V2736 | 30.0 | 4.5 | 690 | T12 | 37.5 | CW | Excluded | Crosswind |
| 273 | V2520 | 29.2 | 4.5 | 697 | T14 | 37.5 | CW | Excluded | Crosswind |
| 274 | R1267 | 21.4 | 4.5 | 749 | T219 | 37.5 | CW | Excluded | Crosswind |
| 275 | R1203 | 28.0 | 4.5 | 751 | T20 | 37.5 | CW | Excluded | Crosswind |
| 276 | R2293 | 21.4 | 4.5 | 775 | T219 | 37.5 | CW | Excluded | Crosswind |
| 277 | R1511 | 33.7 | 4.5 | 798 | T54 | 37.5 | CW | Excluded | Crosswind |

| SPL Rank | Point of Reception ID | Participating / Predicted Third-Party impact (dBA) | Height (m) | Distance to Nearest Turbine (m) | Nearest Turbine | Predicted Overall Impact (dBA) | Wind Direction | Excluded / Potential | Notes |
|---|---|---|---|---|---|---|---|---|---|
| 278 | V2601 | 32.7 | 4.5 | 816 | T55 | 37.5 | CW | Excluded | Crosswind |
| 279 | V2827 | 34.6 | 4.5 | 901 | T55 | 37.5 | CW | Excluded | Crosswind |
| 280 | R1124 | 23.9 | 1.5 | 627 | T50 | 37.5 | DW | Excluded | Excluded: Redundant with R1126 |
| 281 | R769 | 35.2 | 1.5 | 854 | T58 | 37.5 | CW | Excluded | Crosswind |
| 282 | R174 | 36.7 | 1.5 | 1188 | T15 | 37.5 | CW | Excluded | Crosswind |
| 283 | R1001 | 17.6 | 4.5 | 611 | T205 | 37.5 | DW | Excluded | Participating |
| 284 | V2740 | 30.0 | 4.5 | 567 | T28 | 37.5 | CW | Potential | Crosswind |
| 285 | R1280 | 30.0 | 4.5 | 583 | T28 | 37.4 | CW | Potential | Crosswind |
| 286 | R1279 | 30.0 | 4.5 | 595 | T28 | 37.4 | CW | Potential | Crosswind |
| 287 | R1299 | 29.9 | 4.5 | 595 | T28 | 37.4 | CW | Potential | Crosswind |
| 288 | R1275 | 30.0 | 4.5 | 611 | T28 | 37.4 | CW | Excluded | Crosswind |
| 289 | R1411 | 30.0 | 4.5 | 628 | T28 | 37.4 | CW | Excluded | Crosswind |
| 290 | V2532 | 29.4 | 4.5 | 631 | T14 | 37.4 | CW | Excluded | Crosswind |
| 291 | V2690 | 32.6 | 4.5 | 635 | T14 | 37.4 | UW | Excluded | Upwind |
| 292 | V2521 | 29.2 | 4.5 | 704 | T14 | 37.4 | CW | Excluded | Crosswind |
| 293 | R2334 | 22.1 | 4.5 | 717 | T219 | 37.4 | CW | Excluded | Crosswind |
| 294 | V2819 | 33.3 | 4.5 | 720 | T36 | 37.4 | CW | Excluded | Crosswind |
| 295 | V2775 | 33.0 | 4.5 | 730 | T47 | 37.4 | CW | Excluded | Crosswind |
| 296 | V3091 | 33.2 | 4.5 | 859 | T15 | 37.4 | DW | Excluded | Third-party + Belle River Transformer impact over 30 dBA |
| 297 | R440 | 36.3 | 4.5 | 1494 | T28 | 37.4 | DW | Excluded | Third-party + Belle River Transformer impact over 30 dBA |
| 298 | R468 | 36.2 | 7.5 | 1496 | T28 | 37.4 | DW | Excluded | Third-party + Belle River Transformer impact over 30 dBA |
| 299 | R1502 | 32.6 | 1.5 | 704 | T38 | 37.4 | UW | Excluded | Upwind |
| 300 | R1281 | 30.0 | 4.5 | 584 | T28 | 37.3 | CW | Potential | Crosswind |
| 301 | V2531 | 29.3 | 4.5 | 645 | T14 | 37.3 | CW | Excluded | Land access denied, part of subdivided vacant lot |
| 302 | R1116 | 24.8 | 4.5 | 689 | T51 | 37.3 | CW | Excluded | Crosswind |
| 303 | V2551 | 29.0 | 4.5 | 713 | T14 | 37.3 | CW | Excluded | Land access denied, part of subdivided vacant lot |
| 304 | R758 | 29.7 | 4.5 | 757 | T49 | 37.3 | CW | Excluded | Crosswind |
| 305 | R1202 | 28.5 | 4.5 | 801 | T26 | 37.3 | CW | Excluded | Crosswind |
| 306 | R1146 | 32.7 | 4.5 | 862 | T12 | 37.3 | CW | Excluded | Crosswind |
| 307 | V2789 | 34.6 | 4.5 | 1015 | T48 | 37.3 | UW | Excluded | Upwind |
| 308 | R396 | 35.2 | 4.5 | 1190 | T48 | 37.3 | UW | Excluded | Upwind |
| 309 | R775 | 34.6 | 1.5 | 673 | T15 | 37.3 | CW | Excluded | Crosswind |

| SPL Rank | Point of Reception ID | Participating / Predicted Third-Party impact (dBA) | Height (m) | Distance to Nearest Turbine (m) | Nearest Turbine | Predicted Overall Impact (dBA) | Wind Direction | Excluded / Potential | Notes |
|---|---|---|---|---|---|---|---|---|---|
| 310 | R1167 | 29.6 | 1.5 | 675 | T44 | 37.3 | CW | Excluded | Crosswind |
| 311 | R1499 | 33.0 | 1.5 | 687 | T38 | 37.3 | CW | Excluded | Crosswind |
| 312 | R1122 | 23.7 | 1.5 | 737 | T20 | 37.3 | UW | Excluded | Upwind |
| 313 | R1284 | 30.1 | 4.5 | 593 | T28 | 37.2 | DW | Excluded | Third-party + Belle River Transformer impact over 30 dBA |
| 314 | R823 | 29.3 | 4.5 | 637 | T206 | 37.2 | CW | Excluded | Crosswind |
| 315 | V2530 | 29.2 | 4.5 | 660 | T14 | 37.2 | CW | Excluded | Land access denied, part of subdivided vacant lot |
| 316 | V3207 | 18.9 | 4.5 | 667 | T205 | 37.2 | CW | Excluded | Crosswind |
| 317 | R269 | 30.0 | 7.5 | 715 | T206 | 37.2 | CW | Excluded | Crosswind |
| 318 | V2552 | 29.0 | 4.5 | 722 | T14 | 37.2 | CW | Excluded | Land access denied, part of subdivided vacant lot |
| 319 | V2779 | 34.3 | 4.5 | 762 | T57 | 37.2 | UW | Excluded | Upwind |
| 320 | V2566 | 31.8 | 4.5 | 773 | T12 | 37.2 | CW | Excluded | Crosswind |
| 321 | V2764 | 28.3 | 4.5 | 807 | T20 | 37.2 | CW | Excluded | Crosswind |
| 322 | R1512 | 33.5 | 4.5 | 871 | T36 | 37.2 | UW | Excluded | Upwind |
| 323 | V2824 | 34.5 | 4.5 | 881 | T47 | 37.2 | CW | Excluded | Crosswind |
| 324 | R1113 | 35.5 | 4.5 | 1044 | T55 | 37.2 | DW | Excluded | Third-party + Belle River Transformer impact over 30 dBA |
| 325 | R733 | 28.4 | 1.5 | 552 | T57 | 37.2 | DW | Excluded | Excluded: Within 2500 meters of the 401 |
| 326 | R1475 | 31.0 | 1.5 | 601 | T29 | 37.2 | CW | Excluded | Crosswind |
| 327 | R1497 | 33.8 | 1.5 | 761 | T38 | 37.2 | CW | Excluded | Crosswind |
| 328 | R1472 | 30.4 | 1.5 | 586 | T29 | 37.2 | CW | Excluded | Crosswind |
| 329 | R1301 | 30.1 | 4.5 | 597 | T28 | 37.1 | DW | Excluded | Third-party + Belle River Transformer impact over 30 dBA |
| 330 | V2770 | 31.1 | 4.5 | 654 | T57 | 37.1 | DW | Excluded | Third-party + Belle River Transformer impact over 30 dBA |
| 331 | R1273 | 30.1 | 4.5 | 693 | T28 | 37.1 | CW | Excluded | Crosswind |
| 332 | R1115 | 24.6 | 4.5 | 695 | T51 | 37.1 | CW | Excluded | Crosswind |
| 333 | V2729 | 24.8 | 4.5 | 710 | T51 | 37.1 | CW | Excluded | Crosswind |
| 334 | V2802 | 31.0 | 4.5 | 728 | T57 | 37.1 | DW | Excluded | Third-party + Belle River Transformer impact over 30 dBA |
| 335 | V2553 | 28.9 | 4.5 | 733 | T14 | 37.1 | CW | Excluded | Land access denied, part of subdivided vacant lot |
| 336 | R2306 | 15.9 | 4.5 | 768 | T215 | 37.1 | UW | Excluded | Upwind |
| 337 | V2581 | 29.8 | 4.5 | 783 | T49 | 37.1 | CW | Excluded | Crosswind |
| 338 | V2617 | 35.5 | 4.5 | 1067 | T36 | 37.1 | CW | Excluded | Crosswind |
| 339 | V2883 | 35.8 | 4.5 | 1437 | T28 | 37.1 | DW | Excluded | Third-party + Belle River Transformer impact over 30 dBA |
| 340 | R1156 | 34.3 | 1.5 | 691 | T15 | 37.1 | CW | Excluded | Crosswind |
| 341 | R1135 | 26.0 | 1.5 | 693 | T62 | 37.1 | CW | Excluded | Crosswind |

| SPL Rank | Point of Reception ID | Participating / Predicted Third-Party impact (dBA) | Height (m) | Distance to Nearest Turbine (m) | Nearest Turbine | Predicted Overall Impact (dBA) | Wind Direction | Excluded / Potential | Notes |
|---|---|---|---|---|---|---|---|---|---|
| 342 | R1120 | 23.0 | 1.5 | 717 | T51 | 37.1 | UW | Excluded | Upwind |
| 343 | R1496 | 33.5 | 1.5 | 722 | T38 | 37.1 | CW | Excluded | Crosswind |
| 344 | R1506 | 31.9 | 1.5 | 733 | T36 | 37.1 | CW | Excluded | Crosswind |
| **345** | **R2299** | 8.1 | **1.5** | **735** | **T202** | **37.1** | **DW** | **Selected** | **Selected** |
| 346 | R442 | 36.1 | 1.5 | 1429 | T28 | 37.1 | DW | Excluded | Third-party + Belle River Transformer impact over 30 dBA |
| 347 | V3071 | 28.3 | 4.5 | 628 | T206 | 37.1 | CW | Excluded | Crosswind |
| 348 | R1225 | 22.6 | 4.5 | 642 | T51 | 37 | DW | Excluded | Excluded: Redundant with R1207 |
| 349 | V3058 | 29.1 | 4.5 | 659 | T206 | 37 | CW | Excluded | Crosswind |
| 350 | R1276 | 30.1 | 4.5 | 674 | T28 | 37 | CW | Excluded | Crosswind |
| 351 | V2548 | 29.0 | 4.5 | 676 | T14 | 37 | CW | Excluded | Crosswind |
| 352 | V2554 | 28.8 | 4.5 | 745 | T14 | 37 | CW | Excluded | Crosswind |
| **353** | **R1469** | 29.6 | **1.5** | **598** | **T29** | **37** | **DW** | **Selected** | **Selected** |
| 354 | R762 | 27.8 | 1.5 | 612 | T49 | 37 | CW | Excluded | Crosswind |
| 355 | R1139 | 27.3 | 1.5 | 616 | T12 | 37 | DW | Excluded | Excluded: Within 2500 meters of the 401 |
| 356 | R1476 | 31.6 | 1.5 | 650 | T29 | 37 | CW | Excluded | Crosswind |
| 357 | R1168 | 29.3 | 1.5 | 709 | T44 | 37 | CW | Excluded | Crosswind |
| 358 | R1137 | 26.2 | 1.5 | 715 | T62 | 37 | CW | Excluded | Crosswind |
| 359 | R716 | 33.7 | 1.5 | 757 | T52 | 37 | DW | Excluded | Third-party + Belle River Transformer impact over 30 dBA |
| 360 | R1486 | 34.2 | 1.5 | 786 | BR_sub | 37 | DW | Excluded | Third-party + Belle River Transformer impact over 30 dBA |
| 361 | R1488 | 34.3 | 1.5 | 774 | BR_sub | 37 | CW | Excluded | Crosswind |

aercoustics

Aercoustics Engineering Ltd.
1004 Middlegate Road, Suite 1100
Mississauga, ON L4Y 0G1

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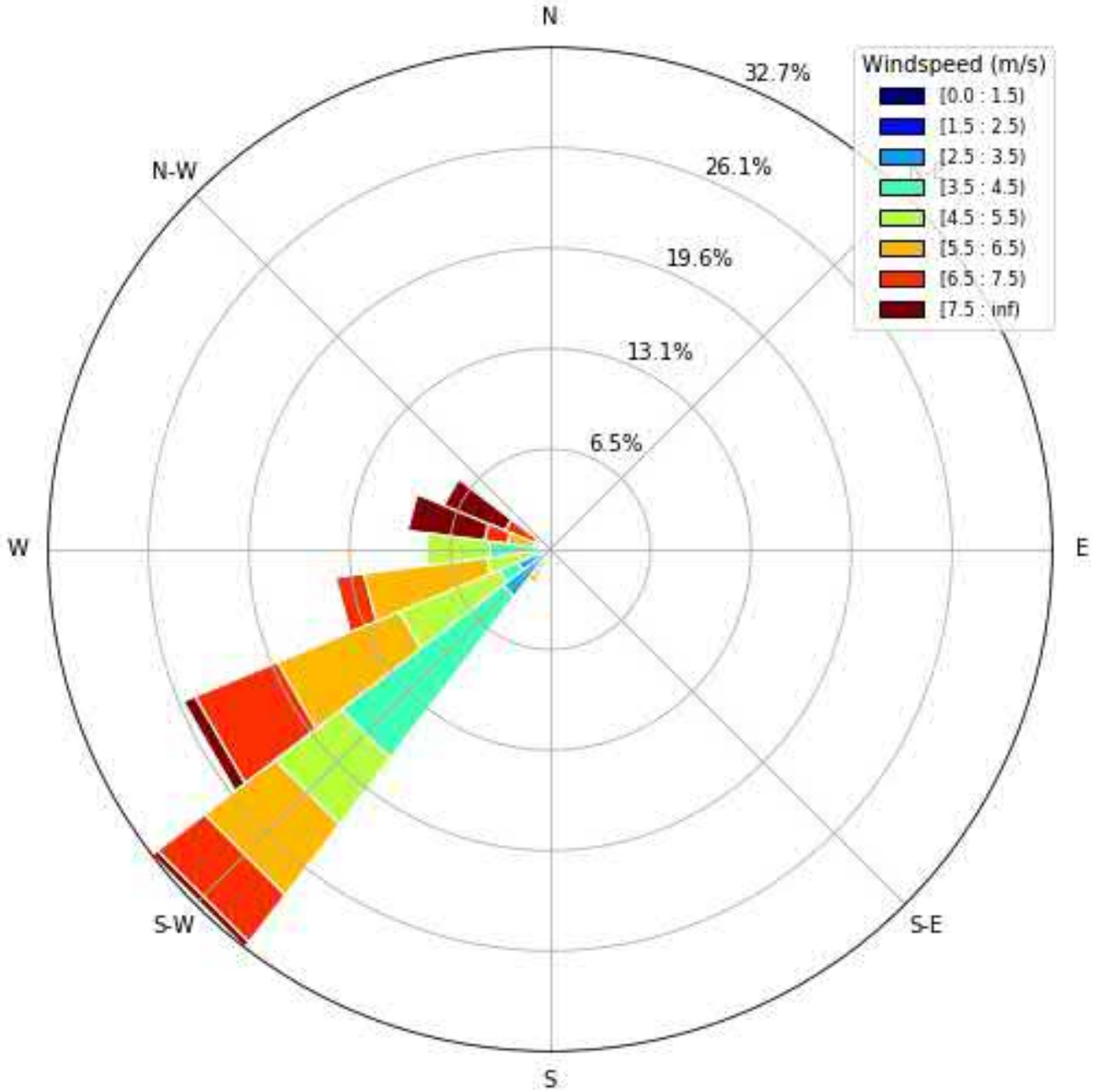
Fax 416-249-3613
aercoustics.com

# Appendix C
# Wind Roses



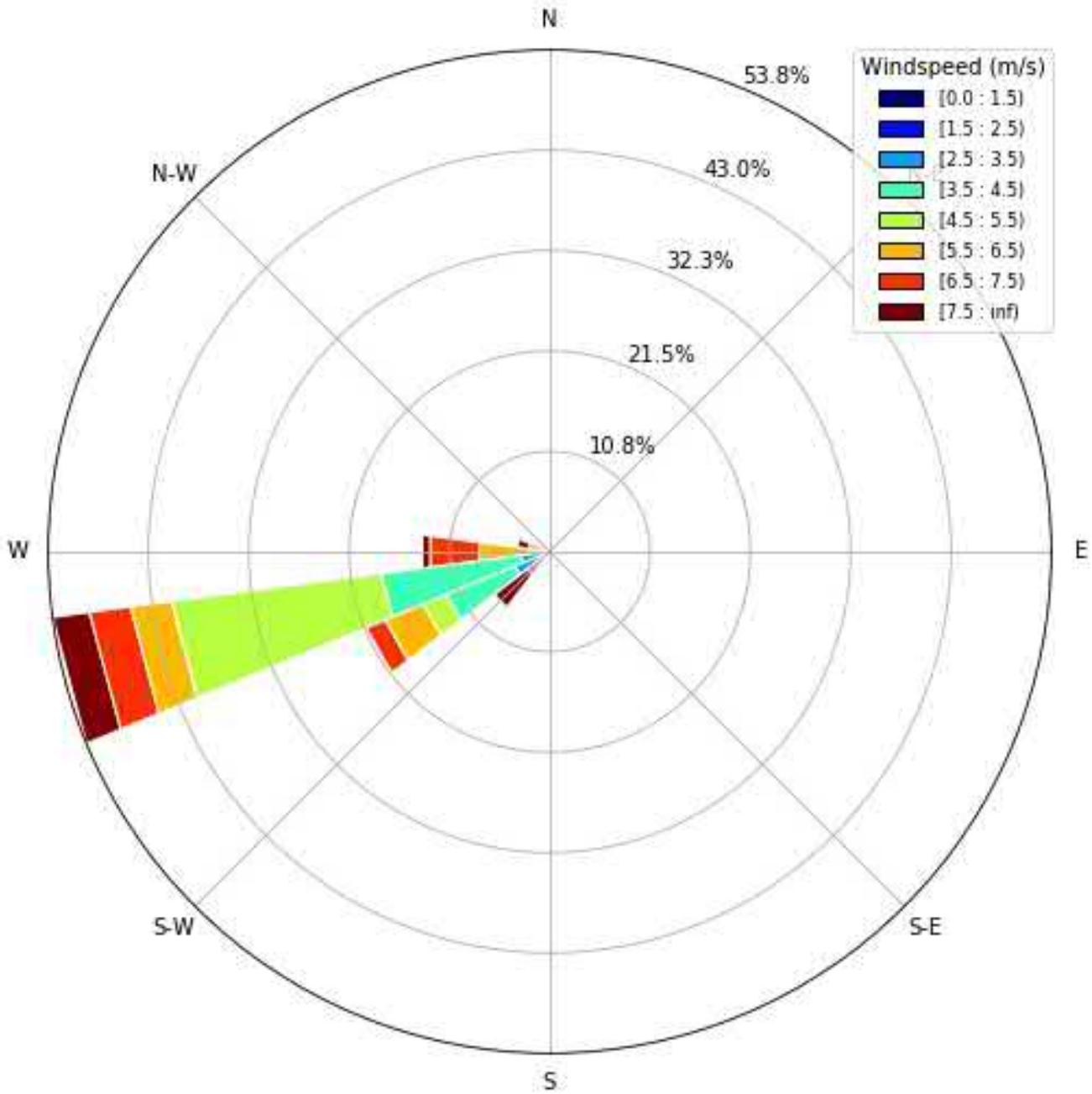

| | |
|---|---|
| **Project ID:** | 17095.01 |
| **Drawn by:** | MWJ |
| **Reveiwed by:** | KC |
| **Date:** | Aug 5, 2020 |
| **Revision:** | 1 |
| **Scale:** | NA |

Belle River Wind Power Project
Phase 1 I-Audit Report

# Appendix C.1.i

R1126
Supplementary Wind Rose
based on Assessment Data
Total Noise

aercoustics

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|---|---|
| **Project ID:** | 17095.01 |
| **Drawn by:** | MWJ |
| **Reveiwed by:** | KC |
| **Date:** | Aug 5, 2020 |
| **Revision:** | 1 |
| **Scale:** | NA |

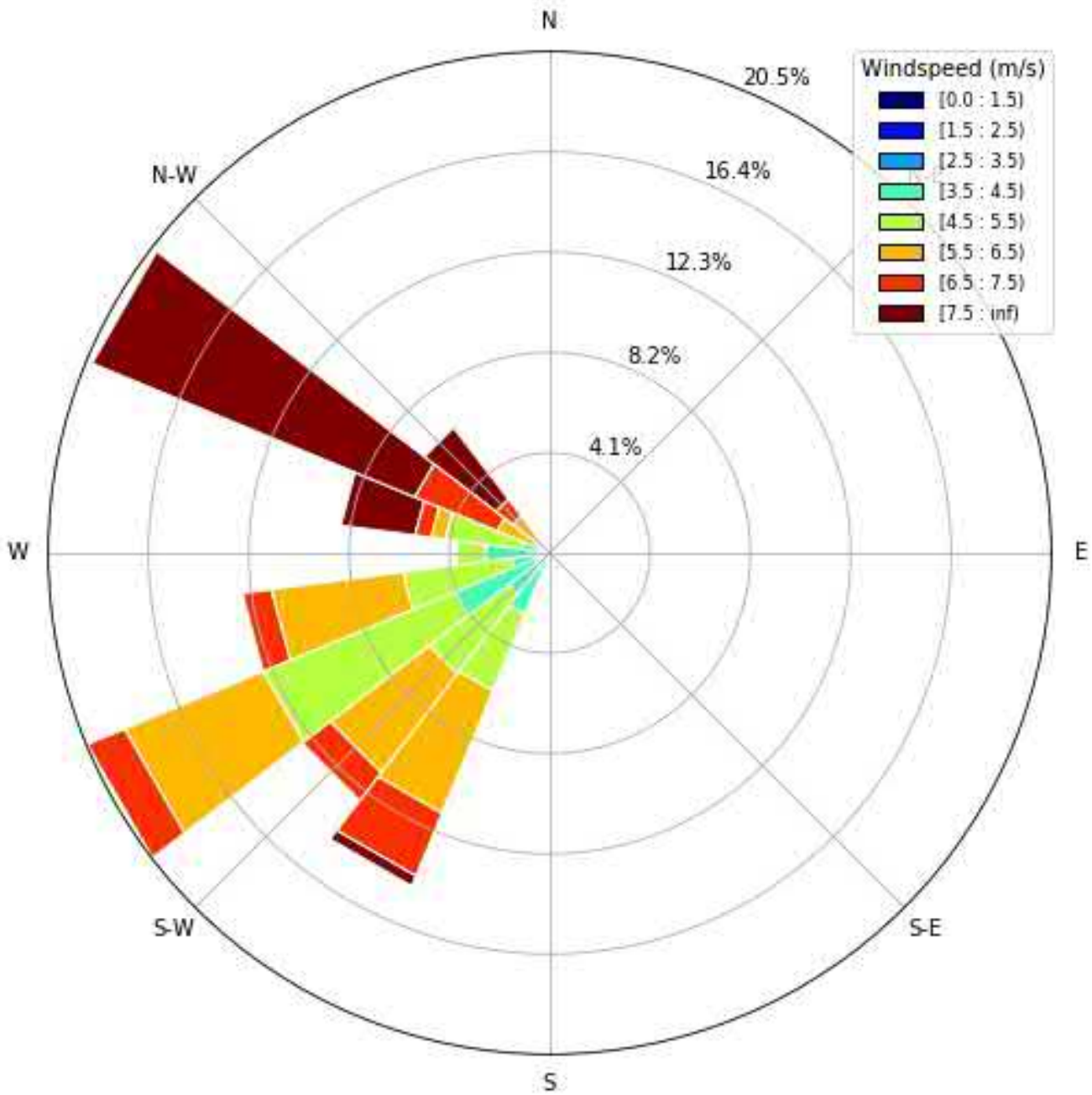
Belle River Wind Power Project
Phase 1 I-Audit Report

# Appendix C.1.ii

R1126
Supplementary Wind Rose
based on Assessment Data

Background Noise

aercoustics

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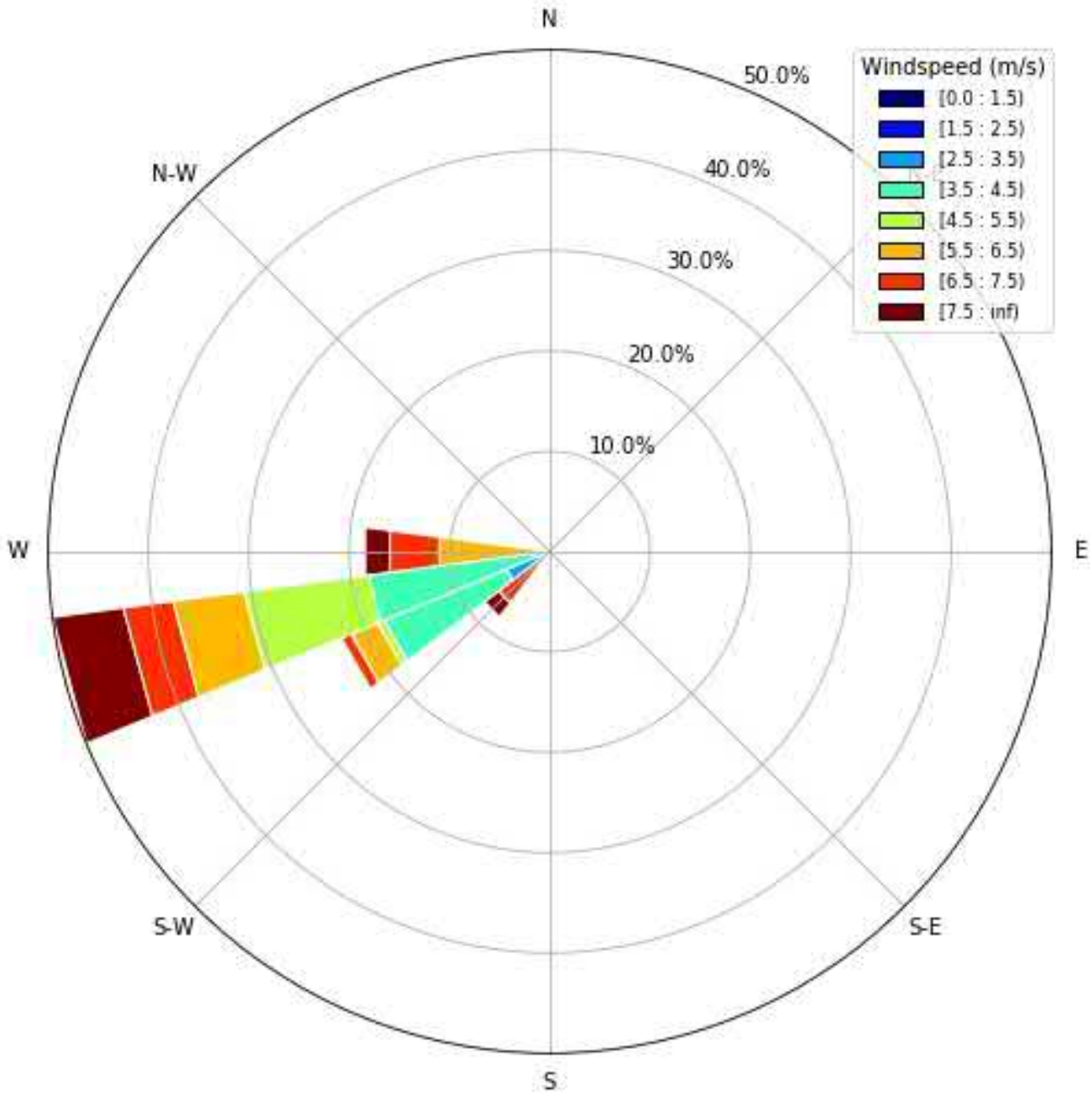
|---|---|
| **Project ID:** | 17095.01 |
| **Drawn by:** | MWJ |
| **Reveiwed by:** | KC |
| **Date:** | Aug 5, 2020 |
| **Revision:** | 1 |
| **Scale:** | NA |

Belle River Wind Power Project
Phase 1 I-Audit Report

# Appendix C.2.i

R1207
Supplementary Wind Rose
based on Assessment Data
Total Noise

aercoustics




| | |
|---|---|
| **Project ID:** | 17095.01 |
| **Drawn by:** | MWJ |
| **Reveiwed by:** | KC |
| **Date:** | Aug 5, 2020 |
| **Revision:** | 1 |
| **Scale:** | NA |

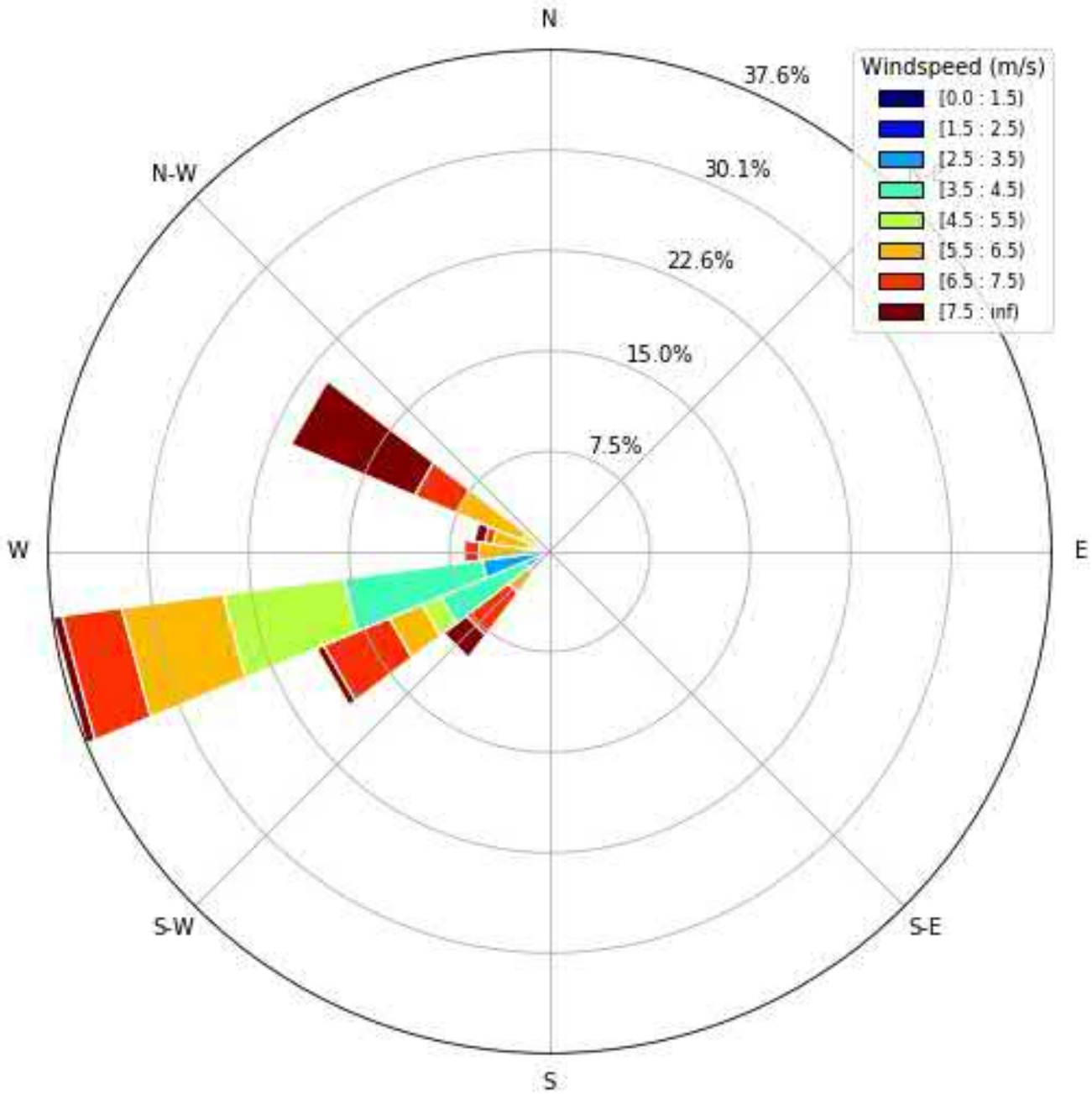
Belle River Wind Power Project
Phase 1 I-Audit Report

# Appendix C.2.ii

R1207
Supplementary Wind Rose
based on Assessment Data

Background Noise

aercoustics

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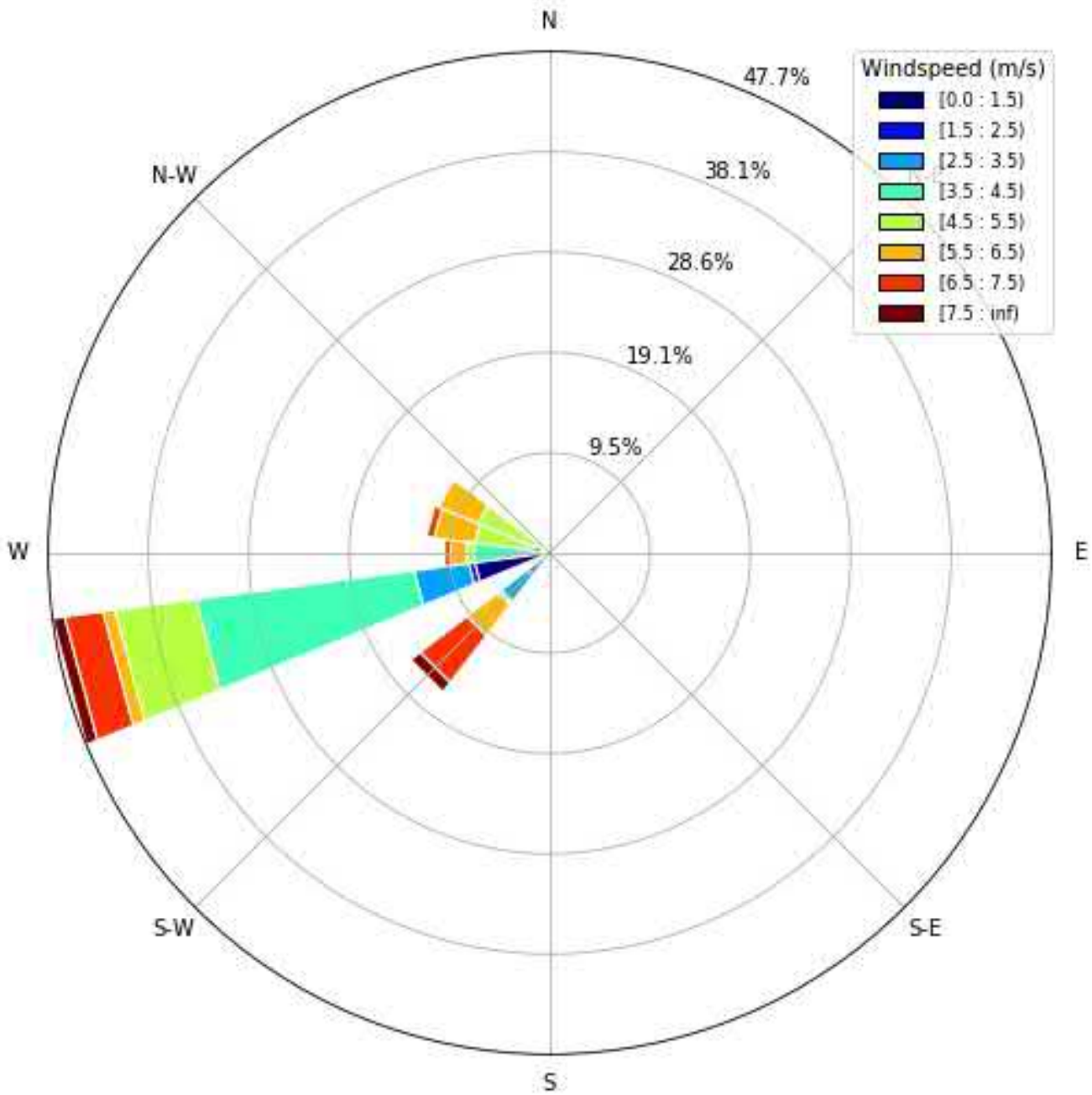
|---|---|
| **Project ID:** | 17095.01 |
| **Drawn by:** | MWJ |
| **Reveiwed by:** | KC |
| **Date:** | Aug 5, 2020 |
| **Revision:** | 1 |
| **Scale:** | NA |

Belle River Wind Power Project
Phase 1 I-Audit Report

# Appendix C.3.i

R1170
Supplementary Wind Rose
based on Assessment Data
Total Noise

aercoustics

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|---|---|
| **Project ID:** | 17095.01 |
| **Drawn by:** | MWJ |
| **Reveiwed by:** | KC |
| **Date:** | Aug 5, 2020 |
| **Revision:** | 1 |
| **Scale:** | NA |

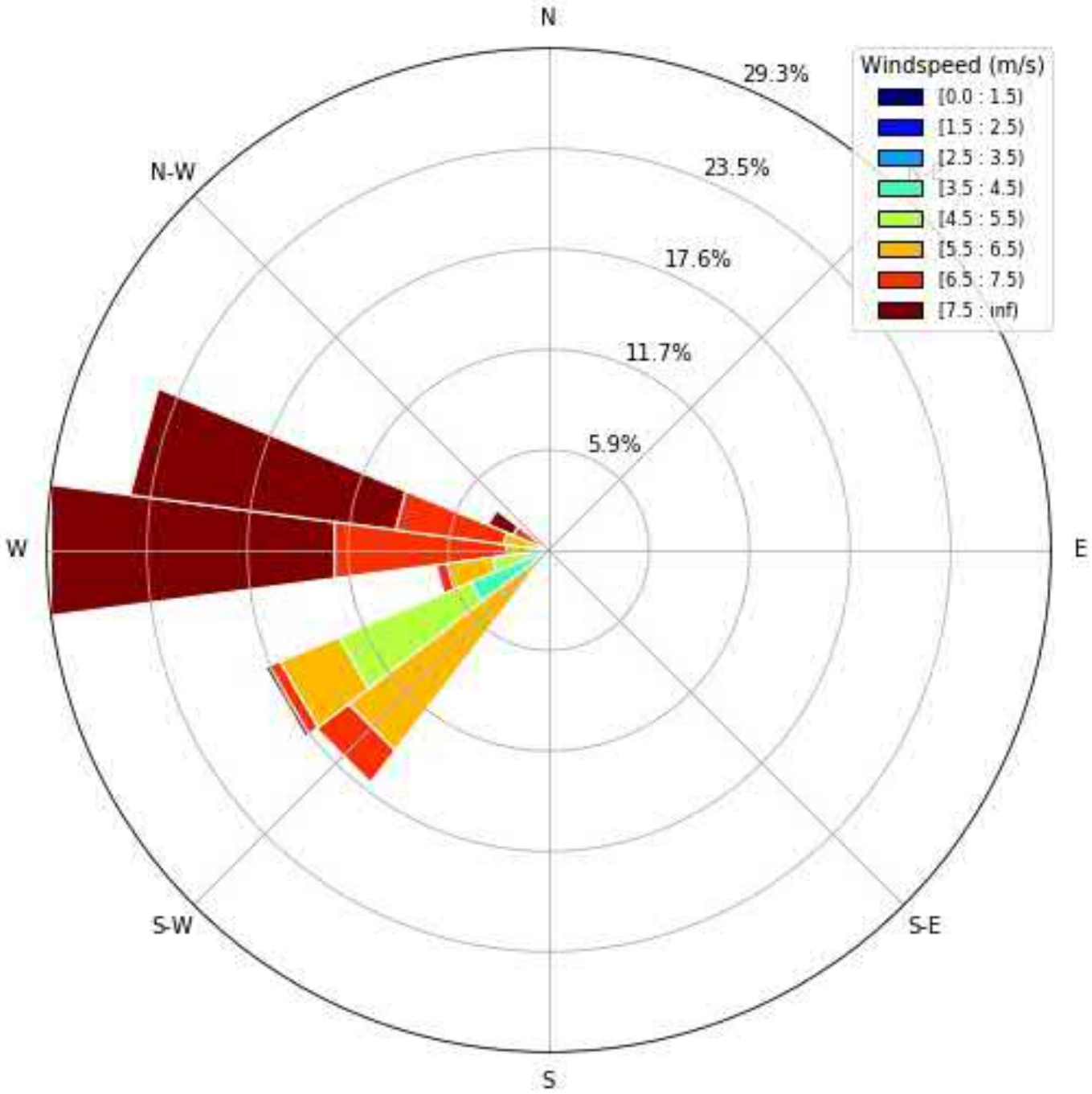
Belle River Wind Power Project
Phase 1 I-Audit Report

# Appendix C.3.ii

R1170
Supplementary Wind Rose
based on Assessment Data

Background Noise

aercoustics

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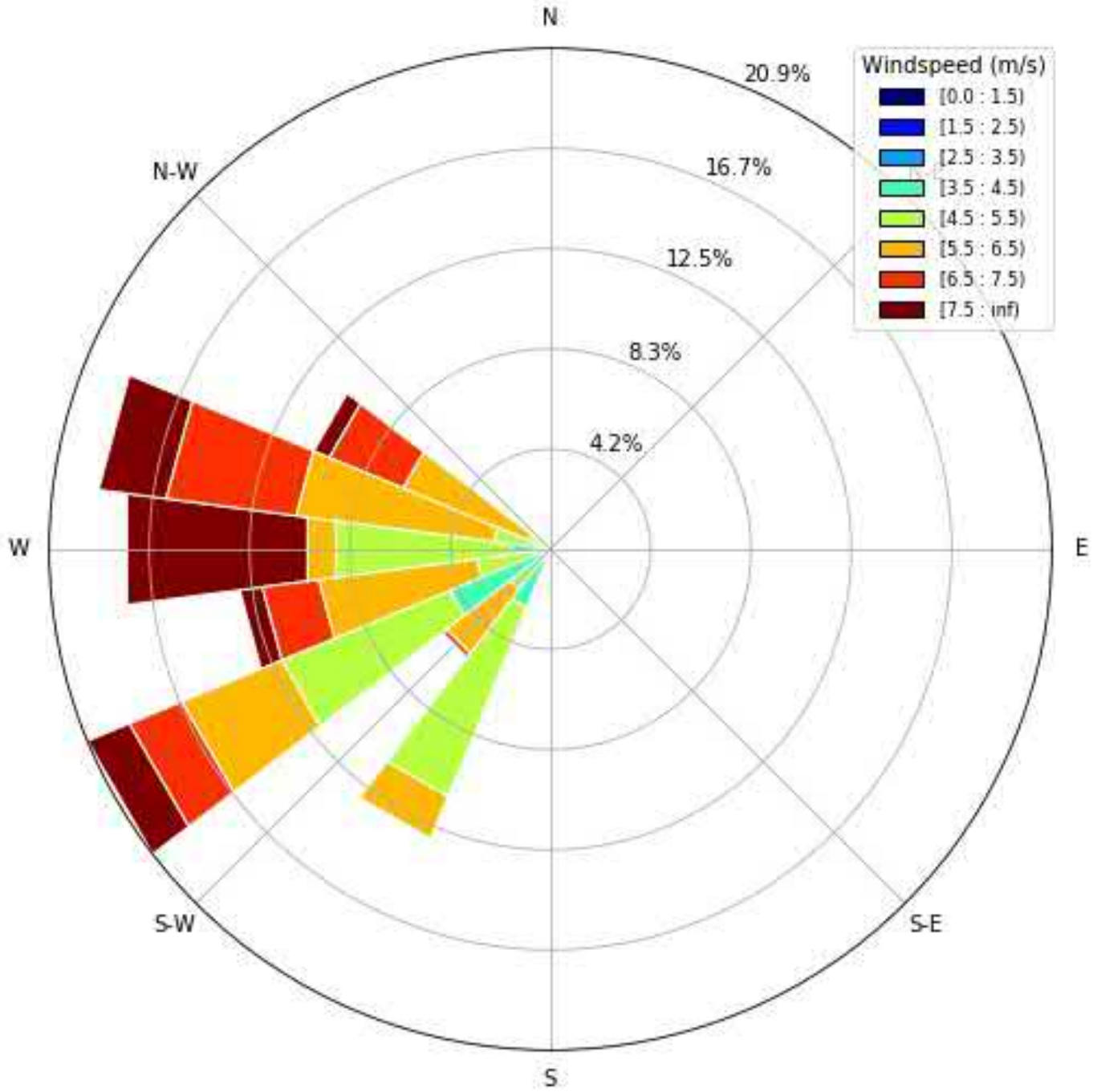
| **Project ID:** | 17095.01 |
| **Drawn by:** | MWJ |
| **Reveiwed by:** | KC |
| **Date:** | Aug 5, 2020 |
| **Revision:** | 1 |
| **Scale:** | NA |

Belle River Wind Power Project
Phase 1 I-Audit Report

# Appendix C.4.i

R1469
Supplementary Wind Rose
based on Assessment Data
Total Noise

aercoustics




| | |
|---|---|
| **Project ID:** | 17095.01 |
| **Drawn by:** | MWJ |
| **Reveiwed by:** | KC |
| **Date:** | Aug 5, 2020 |
| **Revision:** | 1 |
| **Scale:** | NA |

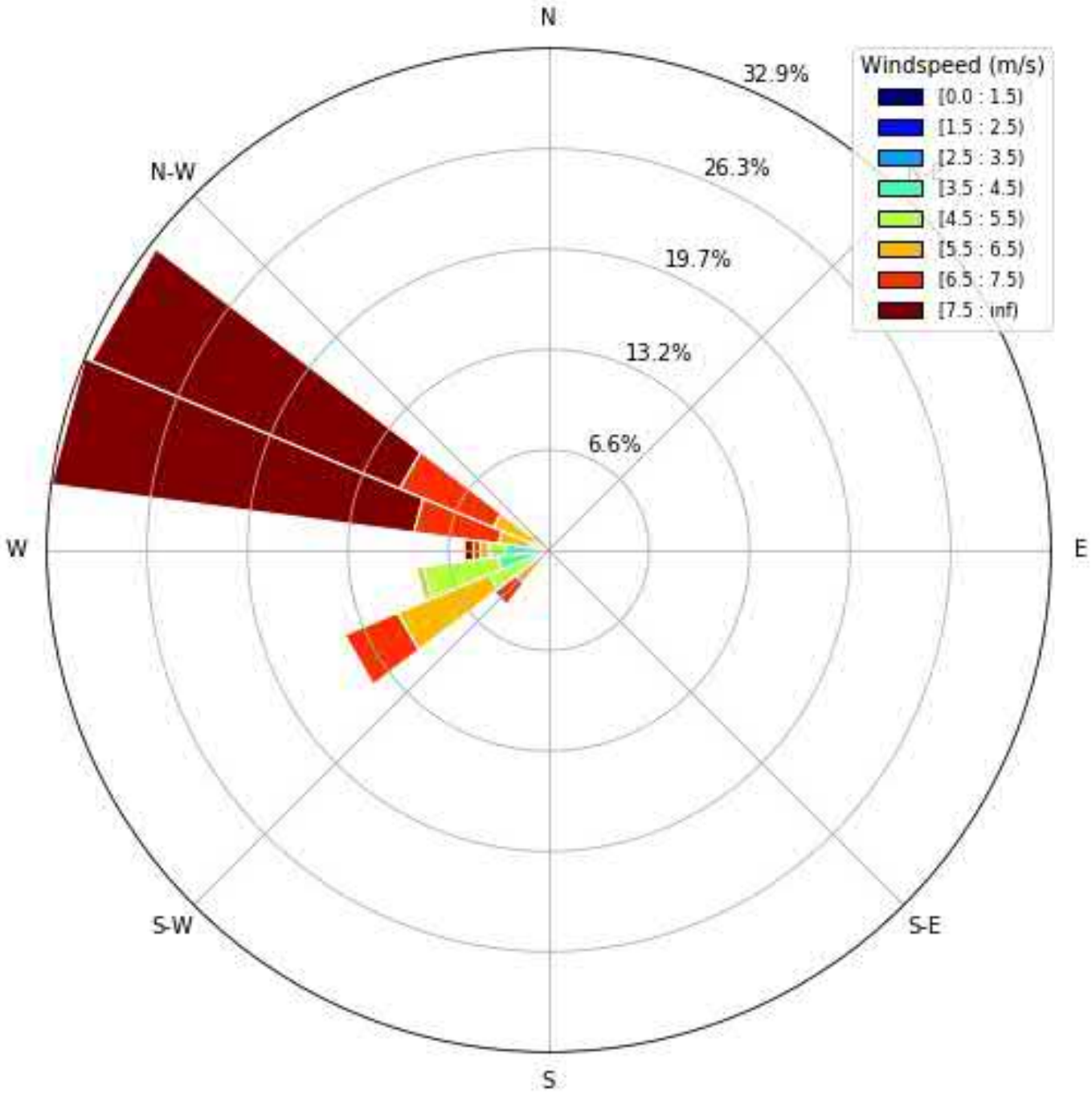
Belle River Wind Power Project
Phase 1 I-Audit Report

# Appendix C.4.ii

R1469
Supplementary Wind Rose
based on Assessment Data

Background Noise

aercoustics



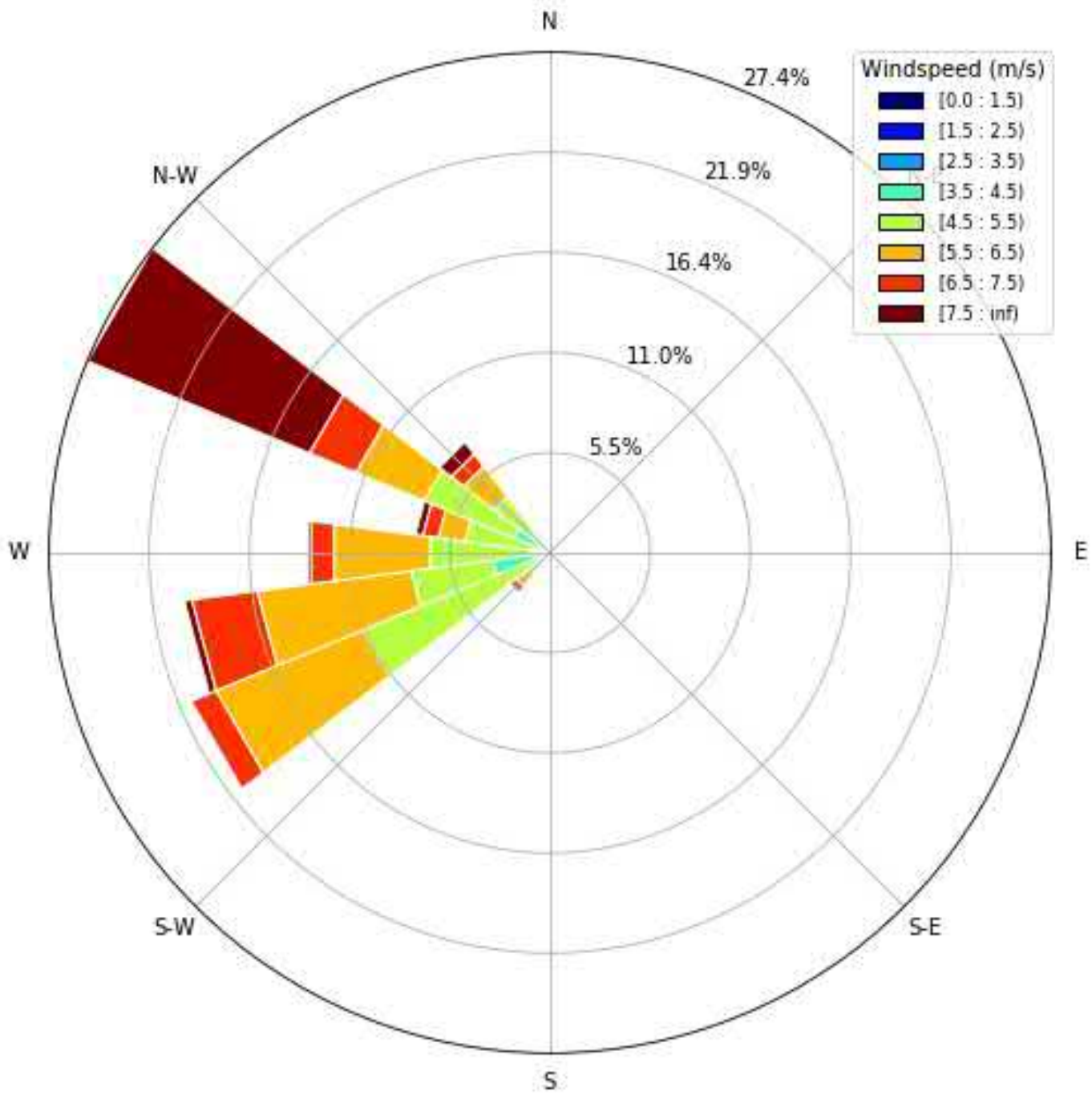

| | |
|---|---|
| **Project ID:** | 17095.01 |
| **Drawn by:** | MWJ |
| **Reveiwed by:** | KC |
| **Date:** | Aug 5, 2020 |
| **Revision:** | 1 |
| **Scale:** | NA |

Belle River Wind Power Project
Phase 1 I-Audit Report

# Appendix C.5.i

R2299
Supplementary Wind Rose
based on Assessment Data
Total Noise

aercoustics




| | |
|---|---|
| **Project ID:** | 17095.01 |
| **Drawn by:** | MWJ |
| **Reveiwed by:** | KC |
| **Date:** | Aug 5, 2020 |
| **Revision:** | 1 |
| **Scale:** | NA |

Belle River Wind Power Project
Phase 1 I-Audit Report

# Appendix C.5.ii

R2299
Supplementary Wind Rose
based on Assessment Data

Background Noise

aercoustics

aercoustics

Aercoustics Engineering Ltd.
1004 Middlegate Road, Suite 1100
Mississauga, ON L4Y 0G1

Tel: 416-249-3361
Fax 416-249-3613
aercoustics.com

# Appendix D
# Turbine Operational Statement from Operator

SP Belle River Wind LP
2050 Derry Road West
2nd Floor
Mississauga, ON L5N 0B9
www.belleriverwind.com

September 24, 2019

Director, Environmental Approvals Access and Service
Integration Branch Ministry of Environment
2 St. St Clair Avenue West, Floor 12A
Toronto ON M4V 1L5

Subject: SP Belle River Wind LP Renewable Energy Approval Number 2765-A4ER2P Condition Receptor "Phase 1 Receptor I-Audit".

Dear Director

Please accept this letter as confirmation that all turbines tested during the spring audit of 2019 acoustics measurement campaign conducted by Aercoustics LTD. From March 26, 2019 to June 30, 2019 were operating normally for the duration of the campaign, with the exception of specific time periods during which the turbines were placed in remote owner stop to facilitate ambient noise measurements.

The turbines placed in remote owner stop for ambient measurements were different depending on the receptor targeted, and were as follows:

- **R1126: T08, T11, T12, T20, T30, T50, T51 and T62**
- **R1170: T26, T28, T29, T30, T36, T38, T40, T44, T45, T46, T47, T48, T49, T51, T52, T53, T54, T55, T57, T58, T59**
- **R1207: T20, T26, T30, and T51**

The turbines verified for operational measurements across R1126, R1170 and R1207 were:

- **T08, T11, T12, T14, T15, T20, T26, T28, T29, T30, T36, T38, T40, T44, T45, T46, T47, T48, T49, T50, T51, T53, T54, T55, T59 and T62"**

Sincerely,

**Jonathan Miranda**
Facility Manager
Belle River Wind Project
C: 289-407-8387

Operations & Maintenance Building Belle River
1624 Lakeshore road 125
Belle River Ontario, N0R 1A0
Canada

SP Belle River Wind LP
2050 Derry Road West
2nd Floor
Mississauga, ON L5N 0B9
www.belleriverwind.com

January 21, 2020

Director, Environmental Approvals Access and Service
Integration Branch Ministry of Environment
2 St. St Clair Avenue West, Floor 12A
Toronto ON M4V 1L5

Subject: SP Belle River Wind LP Renewable Energy Approval Number 2765-A4ER2P Condition Receptor "Phase 1 Receptor I-Audit".

Dear Director

Please accept this letter as confirmation that all turbines tested during the fall audit of 2019 acoustics measurement campaign conducted by Aercoustics LTD. From September 9, 2019 to January 11, 2020 were operating normally for the duration of the campaign, with the exception of specific time periods during which the turbines were placed in remote owner stop to facilitate ambient noise measurements.

The turbines placed in remote owner stop for ambient measurements are as follows:

T8, T11, T20, T26, T28, T29, T30, T36, T38, T40, T44, T45, T46, T47, T48, T49, T50, T51, T52, T53, T54, T55, T58, T59, T62, T202, T205, T210, T211, T212

Sincerely,

**Jonathan Miranda**
Facility Manager
Belle River Wind Project
C: 289-407-8387

Operations & Maintenance Building Belle River
1624 Lakeshore road 125
Belle River Ontario, N0R 1A0
Canada

aercoustics

Aercoustics Engineering Ltd.
1004 Middlegate Road, Suite 1100
Mississauga, ON L4Y 0G1

Tel: 416-249-3361
Fax 416-249-3613
aercoustics.com

# Appendix E
# Tonality Assessment

# Appendix E - Tonality Assessment Summary

Project: Belle River Wind Power Project - 1st Acoustic Immission Audit R1126



Report ID: 17095.01

Created on: 2019-07-12

| R1126 62 Hz (36 - 88 Hz) Tonality Summary | | | | | | | |
|---|---|---|---|---|---|---|---|
| Wind Speed (m/s) | Data Count | Tone Count | Tonal Presence (%) | Turbine ONLY (dBA) | MECP Sound Level Limit (dBA) | Average Tonal Audability (dB) | Applicable Tonal Penalty (dB) |
| 0 | 0 | 0 | ** | ** | 40 | ** | ** |
| 1 | 0 | 0 | ** | ** | 40 | ** | ** |
| 2 | 13 | 3 | 23% | * | 40 | 0.5 | 0.0 |
| 3 | 92 | 14 | 15% | 40 | 40 | -0.6 | 0.0 |
| 4 | 248 | 41 | 17% | 40 | 40 | 0.3 | 0.0 |
| 5 | 278 | 79 | 28% | 40 | 40 | 1.6 | 0.0 |
| 6 | 327 | 26 | 8% | 40 | 40 | -0.5 | 0.0 |
| 7 | 196 | 4 | 2% | * | 43 | -1.0 | 0.0 |

* Insufficient amount of data points as per RAM-I protocol

** No data points at wind speed

| R1126 78 Hz (52 - 104 Hz) Tonality Summary | | | | | | | |
|---|---|---|---|---|---|---|---|
| Wind Speed (m/s) | Data Count | Tone Count | Tonal Presence (%) | Turbine ONLY (dBA) | MECP Sound Level Limit (dBA) | Average Tonal Audability (dB) | Applicable Tonal Penalty (dB) |
| 0 | 0 | 0 | ** | ** | 40 | ** | ** |
| 1 | 0 | 0 | ** | ** | 40 | ** | ** |
| 2 | 13 | 3 | 23% | * | 40 | 0.5 | 0.0 |
| 3 | 92 | 14 | 15% | 40 | 40 | -0.6 | 0.0 |
| 4 | 248 | 41 | 17% | 40 | 40 | 0.3 | 0.0 |
| 5 | 278 | 80 | 29% | 40 | 40 | 1.7 | 0.0 |
| 6 | 327 | 27 | 8% | 40 | 40 | -0.5 | 0.0 |
| 7 | 196 | 4 | 2% | * | 43 | -1.0 | 0.0 |

* Insufficient amount of data points as per RAM-I protocol

** No data points at wind speed

| R1207 62 Hz (36 - 88 Hz) Tonality Summary | | | | | | | |
|---|---|---|---|---|---|---|---|
| Wind Speed (m/s) | Data Count | Tone Count | Tonal Presence (%) | Turbine ONLY (dBA) | MECP Sound Level Limit (dBA) | Average Tonal Audability (dB) | Applicable Tonal Penalty (dB) |
| 0 | 0 | 0 | ** | ** | 40 | ** | ** |
| 1 | 0 | 0 | ** | ** | 40 | ** | ** |
| 2 | 4 | 1 | 25% | * | 40 | * | 0.0 |
| 3 | 52 | 21 | 40% | * | 40 | -0.5 | 0.0 |
| 4 | 291 | 86 | 30% | 39 | 40 | 2.9 | 0.0 |
| 5 | 621 | 135 | 22% | 39 | 40 | 3.1 | 0.0 |
| 6 | 609 | 111 | 18% | 38 | 40 | 1.0 | 0.0 |
| 7 | 293 | 34 | 12% | 38 | 43 | -0.1 | 0.0 |

* Insufficient amount of data points as per RAM-I protocol
** No data points at wind speed

| R1207 78 Hz (52 - 104 Hz) Tonality Summary | | | | | | | |
|---|---|---|---|---|---|---|---|
| Wind Speed (m/s) | Data Count | Tone Count | Tonal Presence (%) | Turbine ONLY (dBA) | MECP Sound Level Limit (dBA) | Average Tonal Audability (dB) | Applicable Tonal Penalty (dB) |
| 0 | 0 | 0 | ** | ** | 40 | ** | ** |
| 1 | 0 | 0 | ** | ** | 40 | ** | ** |
| 2 | 4 | 1 | 25% | * | 40 | * | 0.0 |
| 3 | 52 | 21 | 40% | * | 40 | -0.5 | 0.0 |
| 4 | 291 | 86 | 30% | 39 | 40 | 2.9 | 0.0 |
| 5 | 621 | 135 | 22% | 39 | 40 | 3.2 | 0.0 |
| 6 | 609 | 111 | 18% | 38 | 40 | 1.0 | 0.0 |
| 7 | 293 | 34 | 12% | 38 | 43 | -0.1 | 0.0 |

* Insufficient amount of data points as per RAM-I protocol
** No data points at wind speed

| R1170 62 Hz (36 - 88 Hz) Tonality Summary | | | | | | | |
|---|---|---|---|---|---|---|---|
| Wind Speed (m/s) | Data Count | Tone Count | Tonal Presence (%) | Turbine ONLY (dBA) | MECP Sound Level Limit (dBA) | Average Tonal Audability (dB) | Applicable Tonal Penalty (dB) |
| 0 | 0 | 0 | ** | ** | 40 | ** | ** |
| 1 | 0 | 0 | ** | ** | 40 | ** | ** |
| 2 | 2 | 0 | 0% | * | 40 | * | 0.0 |
| 3 | 82 | 19 | 23% | 39 | 40 | -1.8 | 0.0 |
| 4 | 201 | 45 | 22% | 39 | 40 | 0.3 | 0.0 |
| 5 | 135 | 22 | 16% | 40 | 40 | -0.3 | 0.0 |
| 6 | 230 | 16 | 7% | 40 | 40 | -0.8 | 0.0 |
| 7 | 185 | 7 | 4% | 36 | 43 | -1.2 | 0.0 |

* Insufficient amount of data points as per RAM-I protocol
** No data points at wind speed

| R1170 78 Hz (52 - 104 Hz) Tonality Summary | | | | | | | |
|---|---|---|---|---|---|---|---|
| Wind Speed (m/s) | Data Count | Tone Count | Tonal Presence (%) | Turbine ONLY (dBA) | MECP Sound Level Limit (dBA) | Average Tonal Audability (dB) | Applicable Tonal Penalty (dB) |
| 0 | 0 | 0 | ** | ** | 40 | ** | ** |
| 1 | 0 | 0 | ** | ** | 40 | ** | ** |
| 2 | 2 | 0 | 0% | * | 40 | * | 0.0 |
| 3 | 82 | 19 | 23% | 39 | 40 | -1.8 | 0.0 |
| 4 | 201 | 43 | 21% | 39 | 40 | 0.0 | 0.0 |
| 5 | 135 | 22 | 16% | 40 | 40 | 0.2 | 0.0 |
| 6 | 230 | 16 | 7% | 40 | 40 | -0.8 | 0.0 |
| 7 | 185 | 7 | 4% | 36 | 43 | -1.2 | 0.0 |

* Insufficient amount of data points as per RAM-I protocol
** No data points at wind speed

| R1469 62 Hz Tonality Summary - IEC 61400-11 Edition 3.0 Analysis | | | | | | | |
|---|---|---|---|---|---|---|---|
| Wind Speed (m/s) | Data Count | Tone Count | Tonal Presence (%) | Turbine ONLY (dBA) | MECP Sound Level Limit (dBA) | Average Tonal Audability (dB) | Applicable Tonal Penalty (dB) |
| 0 | 0 | 0 | ** | * | 40 | ** | ** |
| 1 | 0 | 0 | ** | * | 40 | ** | ** |
| 2 | 0 | 0 | ** | * | 40 | ** | ** |
| 3 | 20 | 20 | 100% | * | 40 | 2.7 | 0.0 |
| 4 | 216 | 211 | 98% | 36 | 40 | 1.0 | 0.0 |
| 5 | 439 | 424 | 97% | 35 | 40 | 1.5 | 0.0 |
| 6 | 689 | 664 | 96% | 36 | 40 | 1.7 | 0.0 |
| 7 | 348 | 320 | 92% | 33 | 40 | 0.7 | 0.0 |

* Insufficient amount of data points as per RAM-I protocol
** No tonal data points at wind speed

| R1469 78 Hz Tonality Summary - IEC 61400-11 Edition 3.0 Analysis | | | | | | | |
|---|---|---|---|---|---|---|---|
| Wind Speed (m/s) | Data Count | Tone Count | Tonal Presence (%) | Turbine ONLY (dBA) | MECP Sound Level Limit (dBA) | Average Tonal Audability (dB) | Applicable Tonal Penalty (dB) |
| 0 | 0 | 0 | ** | * | 40 | ** | ** |
| 1 | 0 | 0 | ** | * | 40 | ** | ** |
| 2 | 0 | 0 | ** | * | 40 | ** | ** |
| 3 | 20 | 20 | 100% | * | 40 | 2.7 | 0.0 |
| 4 | 216 | 211 | 98% | 36 | 40 | 1.1 | 0.0 |
| 5 | 439 | 424 | 97% | 35 | 40 | 1.5 | 0.0 |
| 6 | 689 | 658 | 96% | 36 | 40 | 1.7 | 0.0 |
| 7 | 348 | 318 | 91% | 33 | 40 | 0.6 | 0.0 |

* Insufficient amount of data points as per RAM-I protocol
** No tonal data points at wind speed

| R2299 62 Hz Tonality Summary - IEC 61400-11 Edition 3.0 Analysis | | | | | | | |
|---|---|---|---|---|---|---|---|
| Wind Speed (m/s) | Data Count | Tone Count | Tonal Presence (%) | Turbine ONLY (dBA) | MECP Sound Level Limit (dBA) | Average Tonal Audability (dB) | Applicable Tonal Penalty (dB) |
| 0 | 0 | 0 | ** | * | 40 | ** | ** |
| 1 | 0 | 0 | ** | * | 40 | ** | ** |
| 2 | 0 | 0 | ** | * | 40 | ** | ** |
| 3 | 5 | 5 | 100% | * | 40 | -1.1 | 0.0 |
| 4 | 204 | 197 | 97% | 39 | 40 | -1.4 | 0.0 |
| 5 | 364 | 296 | 81% | 38 | 40 | -0.8 | 0.0 |
| 6 | 391 | 325 | 83% | 37 | 40 | -1.3 | 0.0 |
| 7 | 219 | 153 | 70% | 37 | 40 | -2.2 | 0.0 |

* Insufficient amount of data points as per RAM-I protocol
** No tonal data points at wind speed

| R2299 78 Hz Tonality Summary - IEC 61400-11 Edition 3.0 Analysis | | | | | | | |
|---|---|---|---|---|---|---|---|
| Wind Speed (m/s) | Data Count | Tone Count | Tonal Presence (%) | Turbine ONLY (dBA) | MECP Sound Level Limit (dBA) | Average Tonal Audability (dB) | Applicable Tonal Penalty (dB) |
| 0 | 0 | 0 | ** | * | 40 | ** | ** |
| 1 | 0 | 0 | ** | * | 40 | ** | ** |
| 2 | 0 | 0 | ** | * | 40 | ** | ** |
| 3 | 5 | 5 | 100% | * | 40 | -1.1 | 0.0 |
| 4 | 204 | 198 | 97% | 39 | 40 | -1.4 | 0.0 |
| 5 | 364 | 299 | 82% | 38 | 40 | -0.8 | 0.0 |
| 6 | 391 | 324 | 83% | 37 | 40 | -1.3 | 0.0 |
| 7 | 219 | 155 | 71% | 37 | 40 | -2.2 | 0.0 |

* Insufficient amount of data points as per RAM-I protocol
** No tonal data points at wind speed

aercoustics

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Mississauga, ON L4Y 0G1

Tel: 416-249-3361
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# Appendix F
# Calibration Certificates

## Calibration Certificates –

Details are disclosed in the table below regarding the calibration of the equipment used for the Phase 1 I-Audit campaign at R1126. The associated calibration certificates are provided in this appendix.

Please note that the serial number displayed on the microphone system calibration certificate encompasses both the microphone and the pre-amplifier which are submitted for calibration as a pair. The calibration certificate is valid for both the microphone and preamplifier, and their individual model and serial numbers are displayed on the page following the certificate as well as denoted in the table below.

| Equipment | Make/ Model | Serial Number | Date Calibrated [YYYY-MM-DD] | Measurement Interval | Confirmation of Validity for Measurement Interval? |
|---|---|---|---|---|---|
| Sound Level Meter | NI 9234 | 1CAF790 | 2018-10-24 | Mar 26 – June 3 | Yes |
| Microphone/Pre-Amplifier Pair | PCB 378B02 | 118497 | 2018-08-14 | Mar 26 – June 3 | Yes |
| Microphone | PCB 377B02 | 150759 | 2018-08-14 | Mar 26 – June 3 | Yes |
| Pre-amplifier | PCB 426E01 | 37483 | 2018-08-14 | Mar 26 – June 3 | Yes |
| Signal Conditioner | PCB 480E09 | 33659 | 2018-10-23 | Mar 26 – June 3 | Yes |
| Weather Anemometer | Vaisala WXT520 | K0550007 | 2019-03-13 | Mar 26 – June 3 | Yes |

# Compliant Calibration Certificate

Template Revision: Feb2018

| | | | |
|---|---|---|---|
| **Certificate Number:** | 5798958.1 | **OE Number:** | 21523335 |
| **Date Printed:** | 24-OCT-2018 | **Page:** | 1 of 14 |
| **Customer:** | Aercoustics Engineering LTD (CA)<br>1004 Middlegate Road<br>Suite 1100<br>MISSISSAUGA, L4Y 0G1<br>CANADA | | |
| **Manufacturer:** | National Instruments | **Model:** | NI 9234 |
| **Serial Number:** | 1CAF790 | | |
| **Part Number:** | 195551C-01L | **Description:** | MODULE ASSY,NI 9234, 4 AI CONFIGURABLE |
| **Calibration Date:** | 24-OCT-2018 | **Recommended Calibration Due:** | 24-OCT-2019 |
| **Procedure Name:** | NI 9234 | **Verification Results:** | As Found: Passed<br>As Left: Passed |
| **Procedure Version:** | 3.6.1.0 | **Calibration Executive Version:** | 4.5.1.0 |
| **Lab Technician:** | Rodolfo Maldonado | **Driver Info:** | NI-DAQmx:17.1.0 |
| **Temperature:** | 23.0° C | **Humidity:** | 45.2% RH |

NATIONAL INSTRUMENTS
CALIBRATED
SN/ID 1CAF790
DATE 24-OCT-2018
DUE 24-OCT-2019
ni.com/calibration

The data found in this certificate must be interpreted as:

**As Found** The calibration data of the unit as received by National Instruments.

**As Left** The calibration data of the unit when returned from National Instruments.

The As Found and As Left readings are identical for units not adjusted or repaired.

This calibration conforms to ANSI/NCSL Z540.1-1994 (R2002) requirements.

The TUR (Test Uncertainty Ratio) of this calibration is maintained at a ratio of 4:1 or greater, unless otherwise indicated in the measurements. A TUR determination is not possible for singled sided specification limits and therefore the absence of a value should not be interpreted as a TUR of 4:1 or greater, but rather undetermined. When provided, the expanded measurement uncertainty is calculated according to the Guide to the Expression of Uncertainty in Measurement (GUM) for a confidence level of approximately 95%. The uncertainty is calculated at time of calibration and does not include the object long-term stability and different environmental and operational conditions.

Results are reviewed to establish where any measurement results exceeded the manufacturer's specifications. Measured values greater than the Manufacturer's specification limits are marked as 'Failed', measured values within the Manufacturer's specifications are marked as 'Passed'.

This certificate applies exclusively to the item identified above and shall not be reproduced except in full, without National Instruments written authorization. Calibration certificates without signatures are not valid.

The Calibration Certificate can be viewed or downloaded online at www.ni.com/calibration/. To request a hard copy, contact NI Customer Service at Tel:(800) 531-5066 or E-mail customer.service@NI.com

Victor Peña
Technical Manager

National Instruments Calibration Services Austin
Building A
11500 N MoPac Expwy
AUSTIN, TX 78759-3504
USA
Tel: (800) 531-5066

NATIONAL INSTRUMENTS

# *CERTIFICATE of CALIBRATION*

| | | | |
|---|---|---|---|
| Make : | PCB Piezotronics | Reference # : | 153771 |
| Model : | 378B02 | Customer : | Aercoustics Engineering Ltd<br>Mississauga, ON |
| Descr. : | Microphone System 1/2" Free Field | | |
| Serial # : | 118497 | P. Order : | 2018.08.10C |
| Asset # : | 00183 | | |

Cal. status : Received in spec's, no adjustment made.

*Navair Technologies certifies that the above listed instrument was calibrated on date noted and was released from this laboratory performing in accordance with the specifications set forth by the manufacturer.*

*Unless otherwise noted in the calibration report a 4:1 accuracy ratio was maintained for this calibration.*

*Our calibration system complies with the requirements of ISO-9001-2008 and is registered under certificate CA96/269, working standards used for calibration are certified by or traceable to the National Research Council of Canada or the National Institute of Standards and Technology.*

Calibrated : Aug 14, 2018 By : Petro Onasko

Cal. Due : Aug 14, 2020

Temperature : 23 °C ± 2 °C Relative Humidity : 30% to 70%

Standards used : J-216 J-325 J-333 J-420 J-512

## *Navair Technologies*

REPAIR AND CALIBRATION TRACEABLE TO NRC AND NIST

6375 Dixie Rd. Mississauga, ON, L5T 2E7 http: // www.navair.com

Phone : 905 565 1584 Fax: 905 565 8325 e-Mail: service @ navair.com

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# *CERTIFICATE of CALIBRATION*

Make : PCB Piezotronics

Model : 480E09

Descr. : Conditioning Amplifier

Serial # : 00033659

Asset # : 00209

Reference # : 154526

Customer : Aercoustics Engineering Ltd
Mississauga, ON

P. Order : 2018.10.15C

Cal. status : Received in spec's, no adjustment made.

*Navair Technologies certifies that the above listed instrument was calibrated on date noted and was released from this laboratory performing in accordance with the specifications set forth by the manufacturer.*

*Unless otherwise noted in the calibration report a 4:1 accuracy ratio was maintained for this calibration.*

*Our calibration system complies with the requirements of ISO-17025 standard, working standards used for calibration are certified by or traceable to the National Research Council of Canada or the National Institute of Standards and Technology.*

Calibrated : Oct 23, 2018

By : Petro Onasko

Cal. Due : Oct 23, 2020

Temperature : 23 °C ± 2 °C Relative Humidity : 30% to 70%

Standards used : J-255 J-301 J-512


## *Navair Technologies*

REPAIR AND CALIBRATION TRACEABLE TO NRC AND NIST

6375 Dixie Rd. Mississauga, ON, L5T 2E7
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**SOH Wind Engineering LLC**
141 Leroy Road · Williston, VT 05495 · USA
Tel 802.316.4368 · Fax 802.735.9106 · www.sohwind.com

# CERTIFICATE FOR CALIBRATION OF SONIC ANEMOMETER

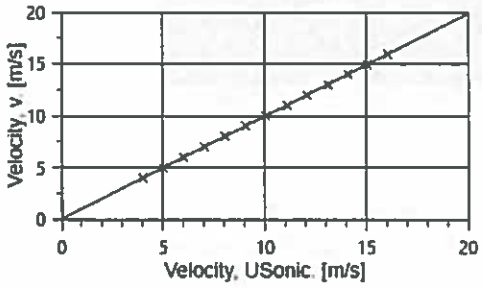
**Certificate number:** 19.US1.00214 **Date of issue:** March 13, 2019
**Type:** Vaisala Weather Transmitter, WXT520 **Serial number:** K0550007
**Manufacturer:** Vaisala, Oyj, Pl 26, FIN-00421 Helsinki, Finland
**Client:** Aercoustics Engineering Ltd., 1004 Middlegate RD, Suite 1100, S.Tower, Mississauga, ON L4Y 1M4, Canada

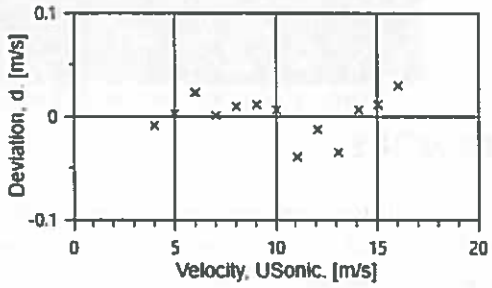
**Anemometer received:** March 08, 2019 **Anemometer calibrated:** March 13, 2019
**Calibrated by:** MEJ **Procedure:** MEASNET, IEC 61400-12-1:2017 Annex F
**Certificate prepared by:** EJF **Approved by:** Calibration engineer, EJF

**Calibration equation obtained:** $v$ [m/s] = 0.99158 · U [m/s] + 0.01946

**Standard uncertainty, slope:** 0.00156 **Standard uncertainty, offset:** 0.85103
**Covariance:** -0.0000239 (m/s)²/m/s **Coefficient of correlation:** ρ = 0.999987
**Absolute maximum deviation:** -0.040 m/s at 10.980 m/s
**Barometric pressure:** 1013.7 hPa **Relative humidity:** 11.6%

| Succession | Velocity pressure, q. [Pa] | Temperature in wind tunnel [°C] | d.p. box [°C] | Wind velocity, $v$. [m/s] | Anemometer Output, U. [m/s] | Deviation, d. [m/s] | Uncertainty $u_c$ (k=2) [m/s] |
|---|---|---|---|---|---|---|---|
| 2 | 9.44 | 23.5 | 26.2 | 3.983 | 4.0067 | -0.009 | 0.023 |
| 4 | 14.74 | 23.5 | 26.3 | 4.980 | 5.0000 | 0.002 | 0.026 |
| 6 | 21.37 | 23.5 | 26.3 | 5.995 | 6.0033 | 0.023 | 0.030 |
| 8 | 29.09 | 23.5 | 26.3 | 6.996 | 7.0350 | 0.000 | 0.035 |
| 10 | 38.12 | 23.5 | 26.3 | 8.007 | 8.0467 | 0.009 | 0.039 |
| 12 | 48.33 | 23.5 | 26.4 | 9.017 | 9.0633 | 0.011 | 0.043 |
| 13-last | 59.31 | 23.5 | 26.4 | 9.989 | 10.0483 | 0.006 | 0.048 |
| 11 | 71.66 | 23.5 | 26.3 | 10.980 | 11.0933 | -0.040 | 0.052 |
| 9 | 85.32 | 23.5 | 26.3 | 11.981 | 12.0767 | -0.013 | 0.056 |
| 7 | 100.19 | 23.5 | 26.3 | 12.984 | 13.1100 | -0.035 | 0.061 |
| 5 | 116.72 | 23.5 | 26.3 | 14.013 | 14.1067 | 0.006 | 0.065 |
| 3 | 132.75 | 23.5 | 26.2 | 14.944 | 15.0400 | 0.011 | 0.069 |
| 1-first | 151.39 | 23.4 | 26.2 | 15.957 | 16.0433 | 0.029 | 0.074 |




AC-1746

## EQUIPMENT USED

| Serial Number | Description |
|---|---|
| Njord1 | Wind tunnel, blockage factor = 1.0035 |
| 2254 | Control cup anemometer |
| - | Mounting tube, D = 19 mm |
| TT002 | Summit Electronics, 1XPT100, 0-10V Output, wind tunnel temp. |
| TP001 | PR Electronics 5102, 0-10V Output, differential pressure box temp. |
| DP004 | Setra Model 239, 0-1inWC, differential pressure transducer |
| HY003 | Dwyer RHP-2D20, 0-10V Output, humidity transmitter |
| BP002 | Setra M278, 0-5VDC Output, barometer |
| PL8 | Pitot tube |
| XB002 | Computer Board, 16 bit A/D data acquisition board |
| LAB1-PC | PC dedicated to data acquisition |

Traceable calibrations of the equipment are carried out by external accredited institutions: Atlantic Scale, Essco Calibration Labs & Furness Controls. A real-time analysis module within the data acquisition software detects pulse frequency.



*Photo of the wind tunnel setup. The cross-sectional area is 2.5m x 2.5m.*

## UNCERTAINTIES

The documented uncertainty is the total combined uncertainty at 95% confidence level (k=2) in accordance with EA-4/02. The uncertainty at 10 m/s comply with the requirements in the IEC 61400-12-1:2005 procedure. See Document US.12.01.004 for further details.

## COMMENTS

This sensor was calibrated at the 0° position.

**Certificate number:** 19.US1.00214

All calibrations are done in the "As Left" condition unless otherwise noted.
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141 Leroy Road · Williston, VT 05495 · USA
Tel 802.316.4368 · Fax 802.735.9106 · www.sohwind.com

# CERTIFICATE FOR CALIBRATION OF SONIC ANEMOMETER

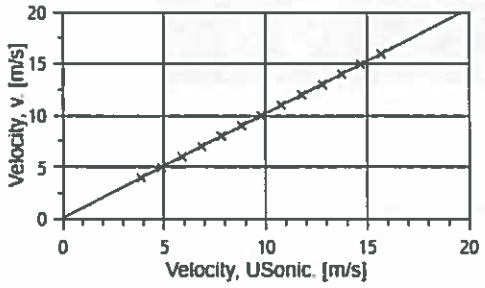
**Certificate number:** 19.US1.00215 **Date of issue:** March 13, 2019
**Type:** Vaisala Weather Transmitter, WXT520 **Serial number:** K0550007
**Manufacturer:** Vaisala, Oyj, PI 26, FIN-00421 Helsinki, Finland
**Client:** Aercoustics Engineering Ltd., 1004 Middlegate RD, Suite 1100, S.Tower, Mississauga, ON L4Y 1M4, Canada

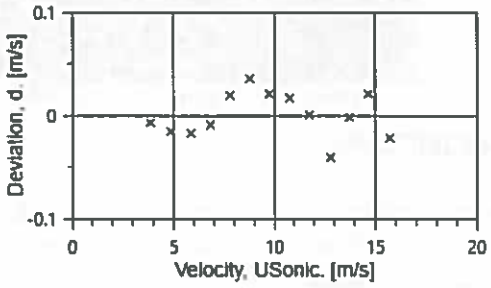
**Anemometer received:** March 08, 2019 **Anemometer calibrated:** March 13, 2019
**Calibrated by:** MEJ **Procedure:** MEASNET, IEC 61400-12-1:2017 Annex F
**Certificate prepared by:** EJF **Approved by:** Calibration engineer, EJF

**Calibration equation obtained:** $v$ [m/s] = 1.01323 · U [m/s] + 0.06252

**Standard uncertainty, slope:** 0.00167 **Standard uncertainty, offset:** 0.28409
**Covariance:** -0.0000282 (m/s)²/m/s **Coefficient of correlation:** ρ = 0.999985
**Absolute maximum deviation:** -0.041 m/s at 13.001 m/s
**Barometric pressure:** 1013.5 hPa **Relative humidity:** 11.6%

| Succession | Velocity pressure, q. [Pa] | Temperature in wind tunnel [°C] | d.p. box [°C] | Wind velocity, v. [m/s] | Anemometer Output, U. [m/s] | Deviation, d. [m/s] | Uncertainty $u_c$ (k=2) [m/s] |
|---|---|---|---|---|---|---|---|
| 2 | 9.35 | 23.7 | 26.4 | 3.966 | 3.8600 | -0.007 | 0.023 |
| 4 | 14.72 | 23.7 | 26.4 | 4.977 | 4.8655 | -0.016 | 0.026 |
| 6 | 21.34 | 23.7 | 26.5 | 5.993 | 5.8700 | -0.017 | 0.030 |
| 8 | 29.03 | 23.7 | 26.5 | 6.991 | 6.8467 | -0.009 | 0.035 |
| 10 | 38.10 | 23.7 | 26.5 | 8.009 | 7.8233 | 0.019 | 0.039 |
| 12 | 48.27 | 23.7 | 26.5 | 9.015 | 8.8000 | 0.036 | 0.043 |
| 13-last | 59.26 | 23.7 | 26.5 | 9.989 | 9.7759 | 0.021 | 0.048 |
| 11 | 71.89 | 23.7 | 26.5 | 11.002 | 10.7800 | 0.017 | 0.052 |
| 9 | 85.51 | 23.7 | 26.5 | 11.999 | 11.7800 | 0.000 | 0.057 |
| 7 | 100.39 | 23.7 | 26.5 | 13.001 | 12.8100 | -0.041 | 0.061 |
| 5 | 116.39 | 23.7 | 26.5 | 13.999 | 13.7567 | -0.002 | 0.065 |
| 3 | 132.93 | 23.7 | 26.4 | 14.961 | 14.6833 | 0.021 | 0.070 |
| 1-first | 151.28 | 23.6 | 26.4 | 15.959 | 15.7100 | -0.022 | 0.074 |




AC-1746

## EQUIPMENT USED

| Serial Number | Description |
|---|---|
| Njord1 | Wind tunnel, blockage factor = 1.0035 |
| 2254 | Control cup anemometer |
| - | Mounting tube, D = 19 mm |
| TT002 | Summit Electronics, 1XPT100, 0-10V Output, wind tunnel temp. |
| TP001 | PR Electronics 5102, 0-10V Output, differential pressure box temp. |
| DP004 | Setra Model 239, 0-1inWC, differential pressure transducer |
| HY003 | Dwyer RHP-2D20, 0-10V Output, humidity transmitter |
| BP002 | Setra M278, 0-5VDC Output, barometer |
| PL8 | Pitot tube |
| XB002 | Computer Board, 16 bit A/D data acquisition board |
| LAB1-PC | PC dedicated to data acquisition |

Traceable calibrations of the equipment are carried out by external accredited institutions: Atlantic Scale, Essco Calibration Labs & Furness Controls. A real-time analysis module within the data acquisition software detects pulse frequency.



*Photo of the wind tunnel setup. The cross-sectional area is 2.5m x 2.5m.*

## UNCERTAINTIES

The documented uncertainty is the total combined uncertainty at 95% confidence level (k=2) in accordance with EA-4/02. The uncertainty at 10 m/s comply with the requirements in the IEC 61400-12-1:2005 procedure. See Document US.12.01.004 for further details.

## COMMENTS

This sensor was calibrated at the 90° position.

**Certificate number:** 19.US1.00215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## Calibration Certificates –

Details are disclosed in the table below regarding the calibration of the equipment used for the Phase 1 I-Audit campaign at R1207. The associated calibration certificates are provided in this appendix.

Please note that the serial number displayed on the microphone system calibration certificate encompasses both the microphone and the pre-amplifier which are submitted for calibration as a pair. The calibration certificate is valid for both the microphone and preamplifier, and their individual model and serial numbers are displayed on the page following the certificate as well as denoted in the table below.

| Equipment | Make/ Model | Serial Number | Date Calibrated [YYYY-MM-DD] | Measurement Interval | Confirmation of Validity for Measurement Interval? |
|---|---|---|---|---|---|
| Sound Level Meter | NI 9234 | 1CAF79A | 2018-08-06 | Mar 26 – June 3 | Yes |
| Microphone/Pre-Amplifier Pair | PCB 378B02 | 132191 | 2018-08-08 | Mar 26 – June 3 | Yes |
| Microphone | PCB 377B02 | 178140 | 2018-08-08 | Mar 26 – June 3 | Yes |
| Pre-amplifier | PCB 426E01 | 51462 | 2018-08-08 | Mar 26 – June 3 | Yes |
| Signal Conditioner | PCB 480E09 | 35340 | 2018-07-25 | Mar 26 – June 3 | Yes |
| Weather Anemometer | Vaisala WXT520 | K0630017 | 2018-08-23 | Mar 26 – June 3 | Yes |

# Compliant Calibration Certificate

Template Revision: Feb2018

| | | | |
|---|---|---|---|
| **Certificate Number:** | 5705188.1 | **OE Number:** | 21460701 |
| **Date Printed:** | 06-AUG-2018 | **Page:** | 1 of 14 |
| **Customer:** | Aercoustics Engineering LTD (CA)<br>1004 Middlegate Road<br>Suite 1100<br>MISSISSAUGA, L4Y 0G1<br>CANADA | | |
| **Manufacturer:** | National Instruments | **Model:** | NI 9234 |
| **Serial Number:** | 1CAF79A | | |
| **Part Number:** | 195551C-01L | **Description:** | MODULE ASSY,NI 9234, 4 AI CONFIGURABLE |
| **Calibration Date:** | 06-AUG-2018 | **Recommended Calibration Due:** | 06-AUG-2019 |
| **Procedure Name:** | NI 9234 | **Verification Results:** | As Found: Passed<br>As Left: Passed |
| **Procedure Version:** | 3.6.1.0 | **Calibration Executive Version:** | 4.5.0.0 |
| **Lab Technician:** | Spenser Jones | **Driver Info:** | NI-DAQmx:17.1.0 |
| **Temperature:** | 23.0° C | **Humidity:** | 45.0% RH |

NATIONAL INSTRUMENTS
CALIBRATED
SN/ID 1CAF79A
DATE 06-AUG-2018
DUE 06-AUG-2019
ni.com/calibration

The data found in this certificate must be interpreted as:

**As Found** The calibration data of the unit as received by National Instruments.

**As Left** The calibration data of the unit when returned from National Instruments.

The As Found and As Left readings are identical for units not adjusted or repaired.

This calibration conforms to ANSI/NCSL Z540.1-1994 (R2002) requirements.

The TUR (Test Uncertainty Ratio) of this calibration is maintained at a ratio of 4:1 or greater, unless otherwise indicated in the measurements. A TUR determination is not possible for singled sided specification limits and therefore the absence of a value should not be interpreted as a TUR of 4:1 or greater, but rather undetermined. When provided, the expanded measurement uncertainty is calculated according to the Guide to the Expression of Uncertainty in Measurement (GUM) for a confidence level of approximately 95%. The uncertainty is calculated at time of calibration and does not include the object long-term stability and different environmental and operational conditions.

Results are reviewed to establish where any measurement results exceeded the manufacturer's specifications. Measured values greater than the Manufacturer's specification limits are marked as 'Failed', measured values within the Manufacturer's specifications are marked as 'Passed'.

This certificate applies exclusively to the item identified above and shall not be reproduced except in full, without National Instruments written authorization. Calibration certificates without signatures are not valid.

The Calibration Certificate can be viewed or downloaded online at www.ni.com/calibration/. To request a hard copy, contact NI **Customer Service at Tel:(800) 531-5066 or E-mail customer.service@NI.com**

**Victor Peña**
**Technical Manager**

**National Instruments Calibration Services Austin**
**Building A**
**11500 N MoPac Expwy**
**AUSTIN, TX 78759-3504**
**USA**
**Tel: (800) 531-5066**

NATIONAL INSTRUMENTS

# *CERTIFICATE of CALIBRATION*

Make : PCB Piezotronics

Model : 378B02

Descr. : Microphone System 1/2" Free Field

Serial # : 132191

Asset # : 01160

Reference # : 153590

Customer : Aercoustics Engineering Ltd
Mississauga, ON

P. Order : 2018.08.03C

Cal. status : Received in spec's, no adjustment made.

*Navair Technologies certifies that the above listed instrument was calibrated on date noted and was released from this laboratory performing in accordance with the specifications set forth by the manufacturer.*

*Unless otherwise noted in the calibration report a 4:1 accuracy ratio was maintained for this calibration.*

*Our calibration system complies with the requirements of ISO-9001-2008 and is registered under certificate CA96/269, working standards used for calibration are certified by or traceable to the National Research Council of Canada or the National Institute of Standards and Technology.*

Calibrated : Aug 08, 2018

By : Petro Onasko

Cal. Due : Aug 08, 2020

Temperature : 23 °C ± 2 °C Relative Humidity : 30% to 70%

Standards used : J-216 J-325 J-333 J-420 J-512


## *Navair Technologies*

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# *CERTIFICATE of CALIBRATION*

| | | | |
|---|---|---|---|
| Make : | PCB Piezotronics | Reference # : | 153400 |
| Model : | 480E09 | Customer : | Aercoustics Engineering Ltd<br>Mississauga, ON |
| Descr. : | Conditioning Amplifier | | |
| Serial # : | 00035340 | P. Order : | 2018.07.18C |
| Asset # : | 01222 | | |

Cal. status : Received in spec's, no adjustment made.

*Navair Technologies certifies that the above listed instrument was calibrated on date noted and was released from this laboratory performing in accordance with the specifications set forth by the manufacturer.*

*Unless otherwise noted in the calibration report a 4:1 accuracy ratio was maintained for this calibration.*

*Our calibration system complies with the requirements of ISO-9001-2008 and is registered under certificate CA96/269, working standards used for calibration are certified by or traceable to the National Research Council of Canada or the National Institute of Standards and Technology.*

Calibrated : Jul 25, 2018 By : Petro Onasko

Cal. Due : Jul 25, 2020

Temperature : 23 °C ± 2 °C Relative Humidity : 30% to 70%

Standards used : J-255 J-367 J-512

## *Navair Technologies*

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# CERTIFICATE FOR CALIBRATION OF SONIC ANEMOMETER

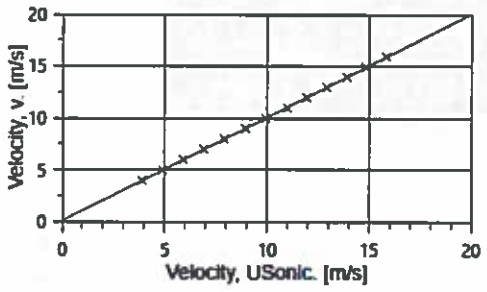
**Certificate number:** 18.US1.04602 **Date of issue:** August 23, 2018
**Type:** Vaisala Weather Transmitter, WXT520 **Serial number:** K0630017
**Manufacturer:** Vaisala, Oyj, Pl 26, FIN-00421 Helsinki, Finland
**Client:** Aercoustics Engineering Ltd., 1004 Middlegate RD, Suite 1100, S.Tower, Mississauga, ON L4Y 1M4, Canada

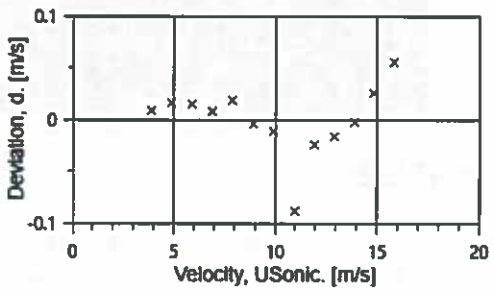
**Anemometer received:** August 21, 2018 **Anemometer calibrated:** August 23, 2018
**Calibrated by:** MEJ **Procedure:** MEASNET, IEC 61400-12-1:2017 Annex F
**Certificate prepared by:** RDS **Approved by:** Calibration engineer, RDS

**Calibration equation obtained:** $v$ [m/s] = 0.99810 · f [m/s] + 0.07426

**Standard uncertainty, slope:** 0.00261 **Standard uncertainty, offset:** 0.37096
**Covariance:** -0.0000671 (m/s)²/m/s **Coefficient of correlation:** ρ = 0.999963
**Absolute maximum deviation:** -0.088 m/s at 10.958 m/s
**Barometric pressure:** 998.6 hPa **Relative humidity:** 42.8%

| Succession | Velocity pressure, q. [Pa] | Temperature in wind tunnel [°C] | Temperature in d.p. box [°C] | Wind velocity, $v$. [m/s] | Anemometer Output, f. [m/s] | Deviation, d. [m/s] | Uncertainty $u_c$ (k=2) [m/s] |
|---|---|---|---|---|---|---|---|
| 2 | 9.09 | 26.2 | 26.2 | 3.966 | 3.8900 | 0.009 | 0.021 |
| 4 | 14.30 | 26.2 | 26.2 | 4.974 | 4.8931 | 0.016 | 0.023 |
| 6 | 20.66 | 26.2 | 26.2 | 5.978 | 5.9000 | 0.015 | 0.026 |
| 8 | 28.13 | 26.2 | 26.3 | 6.976 | 6.9067 | 0.008 | 0.029 |
| 10 | 36.76 | 26.2 | 26.3 | 7.974 | 7.8967 | 0.019 | 0.033 |
| 12 | 46.67 | 26.2 | 26.3 | 8.986 | 8.9333 | -0.004 | 0.037 |
| 13-last | 57.47 | 26.2 | 26.3 | 9.972 | 9.9276 | -0.011 | 0.041 |
| 11 | 69.40 | 26.2 | 26.3 | 10.958 | 10.9933 | -0.088 | 0.045 |
| 9 | 82.76 | 26.2 | 26.3 | 11.967 | 11.9400 | -0.024 | 0.049 |
| 7 | 97.01 | 26.2 | 26.3 | 12.957 | 12.9233 | -0.016 | 0.053 |
| 5 | 112.54 | 26.2 | 26.2 | 13.956 | 13.9100 | -0.002 | 0.057 |
| 3 | 128.54 | 26.2 | 26.2 | 14.915 | 14.8433 | 0.026 | 0.061 |
| 1-first | 146.75 | 26.1 | 26.2 | 15.936 | 15.8367 | 0.055 | 0.065 |




AC-1746

## EQUIPMENT USED

| Serial Number | Description |
|---|---|
| Njord1 | Wind tunnel, blockage factor = 1.0035 |
| 2254 | Control cup anemometer |
| - | Mounting tube, D = 19 mm |
| TT002 | Summit Electronics, 1XPT100, 0-10V Output, wind tunnel temp. |
| TP001 | PR Electronics 5102, 0-10V Output, differential pressure box temp. |
| DP005 | Setra Model 239, 0-1inWC, differential pressure transducer |
| HY003 | Dwyer RHP-2D20, 0-10V Output, humidity transmitter |
| BP003 | Setra M278, 0-5VDC Output, barometer |
| PL8 | Pitot tube |
| XB002 | Computer Board. 16 bit A/D data acquisition board |
| 9PRZRW1 | PC dedicated to data acquisition |

Traceable calibrations of the equipment are carried out by external accredited institutions: Atlantic Scale, Essco Calibration Labs & Furness Controls. A real-time analysis module within the data acquisition software detects pulse frequency.

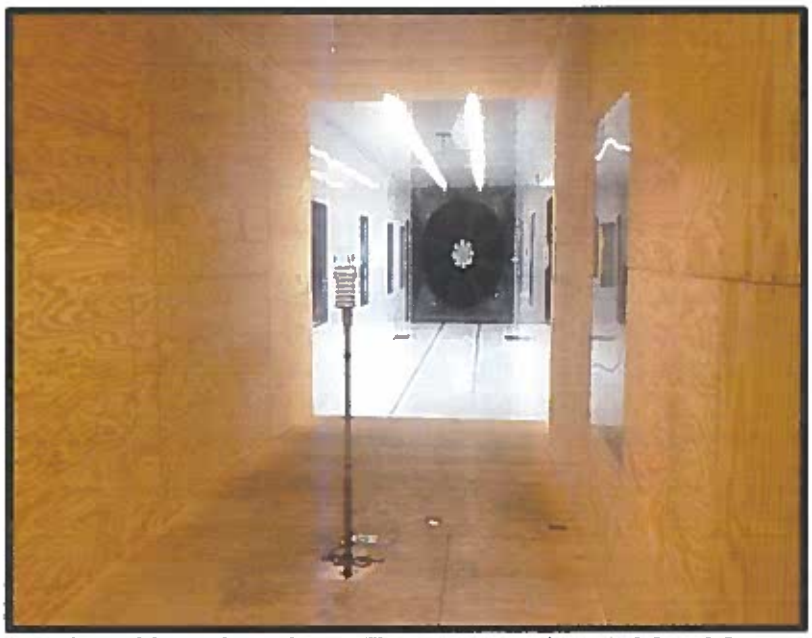


*Photo of the wind tunnel setup. The cross-sectional area is 2.5m x 2.5m.*

## UNCERTAINTIES

The documented uncertainty is the total combined uncertainty at 95% confidence level (k=2) in accordance with EA-4/02. The uncertainty at 10 m/s comply with the requirements in the IEC 61400-12-1:2005 procedure. See Document US.12.01.004 for further details.

## COMMENTS

This sensor was calibrated at the 0° position.

**Certificate number:** 18.US1.04602

All calibrations are done in the "As Left" condition unless otherwise noted.
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# CERTIFICATE FOR CALIBRATION OF SONIC ANEMOMETER

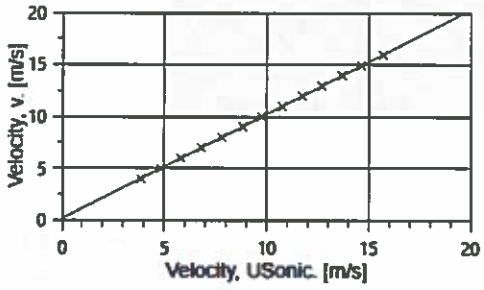
**Certificate number:** 18.US1.04601 **Date of issue:** August 23, 2018
**Type:** Vaisala Weather Transmitter, WXT520 **Serial number:** K0630017
**Manufacturer:** Vaisala, Oyj, PI 26, FIN-00421 Helsinki, Finland
**Client:** Aercoustics Engineering Ltd., 1004 Middlegate RD, Suite 1100, S.Tower, Mississauga, ON L4Y 1M4, Canada

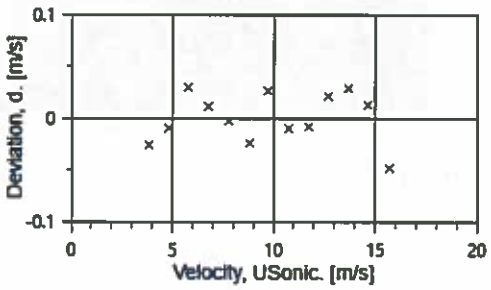
**Anemometer received:** August 21, 2018 **Anemometer calibrated:** August 23, 2018
**Calibrated by:** MEJ **Procedure:** MEASNET, IEC 61400-12-1:2017 Annex F
**Certificate prepared by:** RDS **Approved by:** Calibration engineer, RDS

**Calibration equation obtained:** $v$ [m/s] = 1.01089 · f [m/s] + 0.10592

**Standard uncertainty, slope:** 0.00188 **Standard uncertainty, offset:** 0.18708
**Covariance:** -0.0000352 (m/s)²/m/s **Coefficient of correlation:** ρ = 0.999981
**Absolute maximum deviation:** -0.048 m/s at 15.925 m/s
**Barometric pressure:** 998.7 hPa **Relative humidity:** 42.5%

| Succession | Velocity pressure, q. [Pa] | Temperature in wind tunnel [°C] | d.p. box [°C] | Wind velocity, $v$. [m/s] | Anemometer Output, f. [m/s] | Deviation, d. [m/s] | Uncertainty $u_c$ (k=2) [m/s] |
|---|---|---|---|---|---|---|---|
| 2 | 9.09 | 26.3 | 26.3 | 3.965 | 3.8433 | -0.026 | 0.021 |
| 4 | 14.27 | 26.3 | 26.3 | 4.969 | 4.8207 | -0.010 | 0.023 |
| 6 | 20.68 | 26.3 | 26.3 | 5.982 | 5.7833 | 0.030 | 0.026 |
| 8 | 28.16 | 26.3 | 26.3 | 6.981 | 6.7900 | 0.011 | 0.029 |
| 10 | 36.78 | 26.3 | 26.3 | 7.978 | 7.7900 | -0.003 | 0.033 |
| 12 | 46.75 | 26.3 | 26.3 | 8.994 | 8.8167 | -0.024 | 0.037 |
| 13-last | 57.43 | 26.3 | 26.3 | 9.969 | 9.7310 | 0.026 | 0.041 |
| 11 | 69.44 | 26.3 | 26.3 | 10.963 | 10.7500 | -0.010 | 0.045 |
| 9 | 82.66 | 26.3 | 26.3 | 11.962 | 11.7367 | -0.008 | 0.049 |
| 7 | 97.06 | 26.3 | 26.3 | 12.962 | 12.6967 | 0.021 | 0.053 |
| 5 | 112.73 | 26.3 | 26.3 | 13.970 | 13.6867 | 0.029 | 0.057 |
| 3 | 128.54 | 26.3 | 26.3 | 14.918 | 14.6400 | 0.013 | 0.061 |
| 1-first | 146.50 | 26.2 | 26.3 | 15.925 | 15.6967 | -0.048 | 0.065 |




AC-1746

## EQUIPMENT USED

| Serial Number | Description |
|---|---|
| Njord1 | Wind tunnel, blockage factor = 1.0035 |
| 2254 | Control cup anemometer |
| - | Mounting tube, D = 19 mm |
| TT002 | Summit Electronics, 1XPT100, 0-10V Output, wind tunnel temp. |
| TP001 | PR Electronics 5102, 0-10V Output, differential pressure box temp. |
| DP005 | Setra Model 239, 0-1inWC, differential pressure transducer |
| HY003 | Dwyer RHP-2D20, 0-10V Output, humidity transmitter |
| BP003 | Setra M278, 0-5VDC Output, barometer |
| PL8 | Pitot tube |
| XB002 | Computer Board. 16 bit A/D data acquisition board |
| 9PRZRW1 | PC dedicated to data acquisition |

Traceable calibrations of the equipment are carried out by external accredited institutions: Atlantic Scale, Essco Calibration Labs & Furness Controls. A real-time analysis module within the data acquisition software detects pulse frequency.



*Photo of the wind tunnel setup. The cross-sectional area is 2.5m x 2.5m.*

## UNCERTAINTIES

The documented uncertainty is the total combined uncertainty at 95% confidence level (k=2) in accordance with EA-4/02. The uncertainty at 10 m/s comply with the requirements in the IEC 61400-12-1:2005 procedure. See Document US.12.01.004 for further details.

## COMMENTS

This sensor was calibrated at the 90° position.

**Certificate number:** 18.US1.04601

All calibrations are done in the "As Left" condition unless otherwise noted.
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## Calibration Certificates –

Details are disclosed in the table below regarding the calibration of the equipment used for the Phase 1 I-Audit campaign at R1170. The associated calibration certificates are provided in this appendix.

Please note that the serial number displayed on the microphone system calibration certificate encompasses both the microphone and the pre-amplifier which are submitted for calibration as a pair. The calibration certificate is valid for both the microphone and preamplifier, and their individual model and serial numbers are displayed on the page following the certificate as well as denoted in the table below.

| Equipment | Make/ Model | Serial Number | Date Calibrated [YYYY-MM-DD] | Measurement Interval | Confirmation of Validity for Measurement Interval? |
|---|---|---|---|---|---|
| Sound Level Meter | NI 9234 | 19A4D82 | 2018-07-16 | Mar 28 – June 15 | Yes |
| Microphone/Pre-Amplifier Pair | PCB 378B02 | 132221 | 2018-08-08 | Mar 28 – Apr 9 | Yes |
| Microphone | PCB 377B02 | 175777 | 2018-08-08 | Mar 28 – Apr 9 | Yes |
| Pre-amplifier | PCB 426E01 | 49762 | 2018-08-08 | Mar 28 – Apr 9 | Yes |
| Signal Conditioner | PCB 480E09 | 35341 | 2018-07-25 | Mar 28 – Apr 9 | Yes |
| Microphone/Pre-Amplifier Pair | PCB 378B02 | 123031 | 2019-01-14 | Apr 9 – June 15 | Yes |
| Microphone | PCB 377B02 | 158828 | 2019-01-14 | Apr 9 – June 15 | Yes |
| Pre-amplifier | PCB 426E01 | 41165 | 2019-01-14 | Apr 9 – June 15 | Yes |
| Signal Conditioner | PCB 480E09 | 32473 | 2018-06-19 | Apr 9 – June 15 | Yes |
| Weather Anemometer | Vaisala WXT536 | M4910195 | 2018-08-23 | Mar 28 – June 15 | Yes |

# Compliant Calibration Certificate

| | | | |
|---|---|---|---|
| **Certificate Number:** | 5685079.1 | **OE Number:** | 21440541 |
| **Date Printed:** | 16-JUL-2018 | **Page:** | 1 of 14 |
| **Customer:** | Aercoustics Engineering LTD (CA)<br>1004 Middlegate Road<br>Suite 1100<br>MISSISSAUGA, L4Y 0G1<br>CANADA | | |
| **Manufacturer:** | National Instruments | **Model:** | NI 9234 |
| **Serial Number:** | 19A4D82 | | |
| **Part Number:** | 195551B-01L | **Description:** | MODULE ASSY,NI 9234, 4 AI CONFIGURABLE |
| **Calibration Date:** | 16-JUL-2018 | **Recommended Calibration Due:** | 16-JUL-2019 |
| **Procedure Name:** | NI 9234 | **Verification Results:** | As Found: Passed<br>As Left: Passed |
| **Procedure Version:** | 3.6.1.0 | **Calibration Executive Version:** | 4.5.0.0 |
| **Lab Technician:** | Carlos Perez | **Driver Info:** | NI-DAQmx:17.1.0 |
| **Temperature:** | 23.1° C | **Humidity:** | 43.8% RH |




The data found in this certificate must be interpreted as:

**As Found** The calibration data of the unit as received by National Instruments.

**As Left** The calibration data of the unit when returned from National Instruments.

The As Found and As Left readings are identical for units not adjusted or repaired.

This calibration conforms to ANSI/NCSL Z540.1-1994 (R2002) requirements.

The TAR (Test Accuracy Ratio) of this calibration is maintained at a ratio of 4:1 or greater, unless otherwise indicated in the measurements. A TAR determination is not possible for singled sided specification limits and therefore the absence of a value should not be interpreted as a TAR of 4:1 or greater, but rather undetermined. When provided, the expanded measurement uncertainty is calculated according to the Guide to the Expression of Uncertainty in Measurement (GUM) for a confidence level of approximately 95%. The uncertainty is calculated at time of calibration and does not include the object long-term stability and different environmental and operational conditions.

Results are reviewed to establish where any measurement results exceeded the manufacturer's specifications. Measured values greater than the Manufacturer's specification limits are marked as 'Failed', measured values within the Manufacturer's specifications are marked as 'Passed'.

This certificate applies exclusively to the item identified above and shall not be reproduced except in full, without National Instruments written authorization. Calibration certificates without signatures are not valid.

The Calibration Certificate can be viewed or downloaded online at www.ni.com/calibration/. To request a hard copy, contact NI **Customer Service at Tel:(800) 531-5066 or E-mail customer.service@NI.com**

DEKRA

**ISO 9001:2008- Quality Management System (QMS) Certification**
Applicable scope and other certifications can be found at ni.com/certifications

Victor Peña
**Technical Manager**

**National Instruments Calibration Services Austin**
**Building A**
**11500 N MoPac Expwy**
**AUSTIN, TX 78759-3504**
**USA**
**Tel: (800) 531-5066**

NATIONAL INSTRUMENTS

# *CERTIFICATE of CALIBRATION*

| | | | |
|---|---|---|---|
| Make : | PCB Piezotronics | Reference # : | 153594 |
| Model : | 378B02 | Customer : | Aercoustics Engineering Ltd<br>Mississauga, ON |
| Descr. : | Microphone System 1/2" Free Field | | |
| Serial # : | 132221 | P. Order : | 2018.08.03C |
| Asset # : | 01166 | | |

Cal. status : Received in spec's, no adjustment made.

*Navair Technologies certifies that the above listed instrument was calibrated on date noted and was released from this laboratory performing in accordance with the specifications set forth by the manufacturer.*

*Unless otherwise noted in the calibration report a 4:1 accuracy ratio was maintained for this calibration.*

*Our calibration system complies with the requirements of ISO-9001-2008 and is registered under certificate CA96/269, working standards used for calibration are certified by or traceable to the National Research Council of Canada or the National Institute of Standards and Technology.*

Calibrated : Aug 08, 2018 By : Petro Onasko

Cal. Due : Aug 08, 2020

Temperature : 23 °C ± 2 °C Relative Humidity : 30% to 70%

Standards used : J-216 J-325 J-333 J-420 J-512


## *Navair Technologies*

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# *CERTIFICATE of CALIBRATION*

Make : PCB Piezotronics

Reference # : 155057

Model : 378B02

Customer : Aercoustics Engineering Ltd
Mississauga, ON

Descr. : Microphone System 1/2" Free Field

Serial # : 123031

P. Order : 2019.01.10C

Asset # : 00815

Cal. status : Received in spec's, no adjustment made.

*Navair Technologies certifies that the above listed instrument was calibrated on date noted and was released from this laboratory performing in accordance with the specifications set forth by the manufacturer.*

*Unless otherwise noted in the calibration report a 4:1 accuracy ratio was maintained for this calibration.*

*Our calibration system complies with the requirements of ISO-17025 standard, working standards used for calibration are certified by or traceable to the National Research Council of Canada or the National Institute of Standards and Technology.*

Calibrated : Jan 14, 2019

By : Petro Onasko

Cal. Due : Jan 14, 2021

Temperature : 23 °C ± 2 °C Relative Humidity : 30% to 70%

Standards used : J-216 J-324 J-333 J-420 J-512

## *Navair Technologies*

REPAIR AND CALIBRATION TRACEABLE TO NRC AND NIST

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# *CERTIFICATE of CALIBRATION*

| | | | |
|---|---|---|---|
| Make : | PCB Piezotronics | Reference # : | 152967 |
| Model : | 480E09 | Customer : | Aercoustics Engineering Ltd<br>Mississauga, ON |
| Descr. : | Conditioning Amplifier | | |
| Serial # : | 00032473 | P. Order : | 2018.06.15C |
| Asset # : | 01086 | | |

Cal. status : Received in spec's, no adjustment made.

*Navair Technologies certifies that the above listed instrument was calibrated on date noted and was released from this laboratory performing in accordance with the specifications set forth by the manufacturer.*

*Unless otherwise noted in the calibration report a 4:1 accuracy ratio was maintained for this calibration.*

*Our calibration system complies with the requirements of ISO-9001-2008 and is registered under certificate CA96/269, working standards used for calibration are certified by or traceable to the National Research Council of Canada or the National Institute of Standards and Technology.*

Calibrated : Jun 19, 2018 By : Petro Onasko

Cal. Due : Jun 19, 2019

Temperature : 23 °C ± 2 °C Relative Humidity : 30% to 70%

Standards used : J-255 J-367 J-512


## *Navair Technologies*

REPAIR AND CALIBRATION TRACEABLE TO NRC AND NIST

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# CERTIFICATE FOR CALIBRATION OF SONIC ANEMOMETER

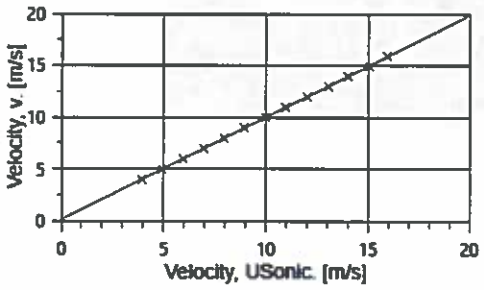
**Certificate number:** 18.US1.04605 **Date of issue:** August 23, 2018
**Type:** Vaisala Weather Transmitter, WXT536 **Serial number:** M4910195
**Manufacturer:** Vaisala, Oyj, Pl 26, FIN-00421 Helsinki, Finland
**Client:** Aercoustics Engineering Ltd., 1004 Middlegate RD, Suite 1100, S.Tower, Mississauga, ON L4Y 1M4, Canada

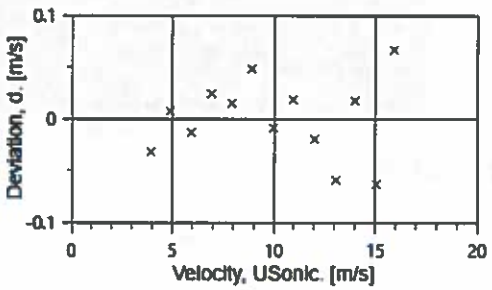
**Anemometer received:** August 21, 2018 **Anemometer calibrated:** August 23, 2018
**Calibrated by:** MEJ **Procedure:** MEASNET, IEC 61400-12-1:2017 Annex F
**Certificate prepared by:** RDS **Approved by:** Calibration engineer, RDS

**Calibration equation obtained:** $v\,[m/s] = 0.98798 \cdot f\,[m/s] + 0.11112$

**Standard uncertainty, slope:** 0.00296 **Standard uncertainty, offset:** 0.28088
**Covariance:** -0.0000855 $(m/s)^2/m/s$ **Coefficient of correlation:** $\rho = 0.999952$
**Absolute maximum deviation:** 0.067 m/s at 15.913 m/s
**Barometric pressure:** 999.1 hPa **Relative humidity:** 42.2%

| Succession | Velocity pressure, q. [Pa] | Temperature in wind tunnel [°C] | Temperature in d.p. box [°C] | Wind velocity, *v*. [m/s] | Anemometer Output, f. [m/s] | Deviation, d. [m/s] | Uncertainty $u_c$ (k=2) [m/s] |
|---|---|---|---|---|---|---|---|
| 2 | 9.10 | 26.4 | 26.3 | 3.968 | 3.9367 | -0.032 | 0.021 |
| 4 | 14.29 | 26.5 | 26.3 | 4.973 | 4.9138 | 0.007 | 0.023 |
| 6 | 20.61 | 26.5 | 26.3 | 5.973 | 5.9467 | -0.013 | 0.026 |
| 8 | 28.19 | 26.4 | 26.3 | 6.985 | 6.9333 | 0.024 | 0.029 |
| 10 | 36.74 | 26.4 | 26.3 | 7.974 | 7.9433 | 0.015 | 0.033 |
| 12 | 46.58 | 26.4 | 26.3 | 8.979 | 8.9267 | 0.048 | 0.037 |
| 13-last | 57.46 | 26.4 | 26.3 | 9.972 | 9.9897 | -0.009 | 0.041 |
| 11 | 69.42 | 26.4 | 26.3 | 10.961 | 10.9633 | 0.018 | 0.045 |
| 9 | 82.60 | 26.4 | 26.3 | 11.957 | 12.0100 | -0.020 | 0.049 |
| 7 | 96.97 | 26.4 | 26.3 | 12.957 | 13.0617 | -0.059 | 0.053 |
| 5 | 112.51 | 26.4 | 26.3 | 13.957 | 13.9967 | 0.017 | 0.057 |
| 3 | 128.46 | 26.4 | 26.3 | 14.914 | 15.0467 | -0.063 | 0.061 |
| 1-first | 146.26 | 26.4 | 26.3 | 15.913 | 15.9267 | 0.067 | 0.065 |




AC-1746

## EQUIPMENT USED

| Serial Number | Description |
|---|---|
| Njord1 | Wind tunnel, blockage factor = 1.0035 |
| 2254 | Control cup anemometer |
| - | Mounting tube, D = 19 mm |
| TT002 | Summit Electronics, 1XPT100, 0-10V Output, wind tunnel temp. |
| TP001 | PR Electronics 5102, 0-10V Output, differential pressure box temp. |
| DP005 | Setra Model 239, 0-1inWC, differential pressure transducer |
| HY003 | Dwyer RHP-2D20, 0-10V Output, humidity transmitter |
| BP003 | Setra M278, 0-5VDC Output, barometer |
| PL8 | Pitot tube |
| XB002 | Computer Board. 16 bit A/D data acquisition board |
| 9PRZRW1 | PC dedicated to data acquisition |

Traceable calibrations of the equipment are carried out by external accredited institutions: Atlantic Scale, Essco Calibration Labs & Furness Controls. A real-time analysis module within the data acquisition software detects pulse frequency.



*Photo of the wind tunnel setup. The cross-sectional area is 2.5m x 2.5m.*

## UNCERTAINTIES

The documented uncertainty is the total combined uncertainty at 95% confidence level (k=2) in accordance with EA-4/02. The uncertainty at 10 m/s comply with the requirements in the IEC 61400-12-1:2005 procedure. See Document US.12.01.004 for further details.

## COMMENTS

This sensor was calibrated at the 0° position.

**Certificate number:** 18.US1.04605

All calibrations are done in the "As Left" condition unless otherwise noted.
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# CERTIFICATE FOR CALIBRATION OF SONIC ANEMOMETER

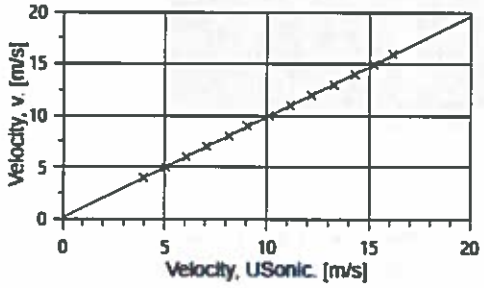
**Certificate number:** 18.US1.04606 **Date of issue:** August 23, 2018
**Type:** Vaisala Weather Transmitter, WXT536 **Serial number:** M4910195
**Manufacturer:** Vaisala, Oyj, Pl 26, FIN-00421 Helsinki, Finland
**Client:** Aercoustics Engineering Ltd., 1004 Middlegate RD, Suite 1100, S.Tower, Mississauga, ON L4Y 1M4, Canada

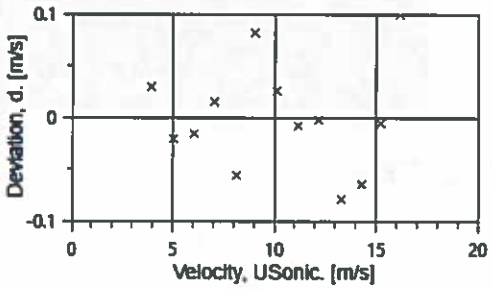
**Anemometer received:** August 21, 2018 **Anemometer calibrated:** August 23, 2018
**Calibrated by:** MEJ **Procedure:** MEASNET, IEC 61400-12-1:2017 Annex F
**Certificate prepared by:** RDS **Approved by:** Calibration engineer, RDS

**Calibration equation obtained:** $v$ [m/s] = 0.97380 · f [m/s] + 0.10153

**Standard uncertainty, slope:** 0.00405 **Standard uncertainty, offset:** 0.42105
**Covariance:** -0.0001578 (m/s)²/m/s **Coefficient of correlation:** ρ = 0.999910
**Absolute maximum deviation:** 0.099 m/s at 15.934 m/s
**Barometric pressure:** 998.9 hPa **Relative humidity:** 42.4%

| Succession | Velocity pressure, q. [Pa] | Temperature in wind tunnel [°C] | d.p. box [°C] | Wind velocity, $v$. [m/s] | Anemometer Output, f. [m/s] | Deviation, d. [m/s] | Uncertainty $u_c$ (k=2) [m/s] |
|---|---|---|---|---|---|---|---|
| 2 | 9.13 | 26.4 | 26.3 | 3.974 | 3.9467 | 0.030 | 0.021 |
| 4 | 14.33 | 26.4 | 26.3 | 4.980 | 5.0310 | -0.021 | 0.023 |
| 6 | 20.67 | 26.4 | 26.3 | 5.980 | 6.0533 | -0.016 | 0.026 |
| 8 | 28.24 | 26.4 | 26.3 | 6.992 | 7.0600 | 0.015 | 0.029 |
| 10 | 36.85 | 26.4 | 26.3 | 7.985 | 8.1533 | -0.056 | 0.033 |
| 12 | 46.70 | 26.4 | 26.3 | 8.990 | 9.0433 | 0.082 | 0.037 |
| 13-last | 57.47 | 26.3 | 26.3 | 9.973 | 10.1103 | 0.026 | 0.041 |
| 11 | 69.42 | 26.4 | 26.3 | 10.961 | 11.1600 | -0.008 | 0.045 |
| 9 | 82.60 | 26.4 | 26.3 | 11.957 | 12.1767 | -0.002 | 0.049 |
| 7 | 97.14 | 26.4 | 26.3 | 12.968 | 13.2933 | -0.079 | 0.053 |
| 5 | 112.65 | 26.4 | 26.3 | 13.965 | 14.3033 | -0.065 | 0.057 |
| 3 | 128.63 | 26.3 | 26.3 | 14.924 | 15.2267 | -0.005 | 0.061 |
| 1-first | 146.65 | 26.3 | 26.3 | 15.934 | 16.1567 | 0.099 | 0.065 |




AC-1746

## EQUIPMENT USED

| Serial Number | Description |
|---|---|
| Njord1 | Wind tunnel, blockage factor = 1.0035 |
| 2254 | Control cup anemometer |
| - | Mounting tube, D = 19 mm |
| TT002 | Summit Electronics, 1XPT100, 0-10V Output, wind tunnel temp. |
| TP001 | PR Electronics 5102, 0-10V Output, differential pressure box temp. |
| DP005 | Setra Model 239, 0-1inWC, differential pressure transducer |
| HY003 | Dwyer RHP-2D20, 0-10V Output, humidity transmitter |
| BP003 | Setra M278, 0-5VDC Output, barometer |
| PL8 | Pitot tube |
| XB002 | Computer Board. 16 bit A/D data acquisition board |
| 9PRZRW1 | PC dedicated to data acquisition |

Traceable calibrations of the equipment are carried out by external accredited institutions: Atlantic Scale, Essco Calibration Labs & Furness Controls. A real-time analysis module within the data acquisition software detects pulse frequency.



*Photo of the wind tunnel setup. The cross-sectional area is 2.5m x 2.5m.*

## UNCERTAINTIES

The documented uncertainty is the total combined uncertainty at 95% confidence level (k=2) in accordance with EA-4/02. The uncertainty at 10 m/s comply with the requirements in the IEC 61400-12-1:2005 procedure. See Document US.12.01.004 for further details.

## COMMENTS

This sensor was calibrated at the 90° position.

**Certificate number:** 18.US1.04606

All calibrations are done in the "As Left" condition unless otherwise noted.
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## Calibration Certificates –

Details are disclosed in the table below regarding the calibration of the equipment used for the Phase 1 I-Audit campaign at R1469. The associated calibration certificates are provided in this appendix.

Please note that the serial number displayed on the microphone system calibration certificate encompasses both the microphone and the pre-amplifier which are submitted for calibration as a pair. The calibration certificate is valid for both the microphone and preamplifier, and their individual model and serial numbers are displayed on the page following the certificate as well as denoted in the table below.

| Equipment | Make/ Model | Serial Number | Date Calibrated [YYYY-MM-DD] | Measurement Interval | Confirmation of Validity for Measurement Interval? |
|---|---|---|---|---|---|
| Sound Level Meter | NI 9234 | 1CAF72D | 2019-07-22 | Oct 9 – Jan 11 | Yes |
| Microphone/Pre-Amplifier Pair | PCB 377B02 | 118498 | 2019-06-26 | Oct 9 – Jan 11 | Yes |
| Microphone | PCB 377B02 | 150498 | 2019-06-26 | Oct 9 – Jan 11 | Yes |
| Pre-amplifier | PCB 426E01 | 37448 | 2019-06-26 | Oct 9 – Jan 11 | Yes |
| Signal Conditioner | PCB 480E09 | 35332 | 2018-07-25 | Oct 9 – Jan 11 | Yes |
| Weather Anemometer | Vaisala WXT520 | K0630016 | 2018-09-27 | Oct 9 – Jan 11 | Yes |

# Compliant Calibration Certificate

Template Revision: Feb2018

| | | | |
|---|---|---|---|
| **Certificate Number:** | 6095062.1 | **OE Number:** | 21719015 |
| **Date Printed:** | 22-JUL-2019 | **Page:** | 1 of 14 |
| **Customer:** | Aercoustics Engineering LTD (CA)<br>1004 Middlegate Rd<br>No 1100<br>ONTARIO MISSISSAUGA, L4Y 1M4<br>CANADA | | |
| **Manufacturer:** | National Instruments | **Model:** | NI 9234 |
| **Serial Number:** | 1CAF72D | | |
| **Part Number:** | 195551C-01L | **Description:** | MODULE ASSY,NI 9234, 4 AI CONFIGURABLE |
| **Calibration Date:** | 22-JUL-2019 | **Recommended Calibration Due:** | 22-JUL-2020 |
| **Procedure Name:** | NI 9234 | **Verification Results:** | As Found: Passed<br>As Left: Passed |
| **Procedure Version:** | 3.6.1.0 | **Calibration Executive Version:** | 4.6.2.0 |
| **Lab Technician:** | Rachel McKinnon | **Driver Info:** | NI-DAQmx:17.6.0 |
| **Temperature:** | 23.1° C | **Humidity:** | 44.4% RH |

NATIONAL INSTRUMENTS
CALIBRATED
S/N/ID 1CAF72D
DATE 22-JUL-2019
DUE 22-JUL-2020
ni.com/calibration

The data found in this certificate must be interpreted as:

**As Found** The calibration data of the unit as received by National Instruments.

**As Left** The calibration data of the unit when returned from National Instruments.

The As Found and As Left readings are identical for units not adjusted or repaired.

This calibration conforms to ANSI/NCSL Z540.1-1994 (R2002) requirements.

The TUR (Test Uncertainty Ratio) of this calibration is maintained at a ratio of 4:1 or greater, unless otherwise indicated in the measurements. A TUR determination is not possible for singled sided specification limits and therefore the absence of a value should not be interpreted as a TUR of 4:1 or greater, but rather undetermined. When provided, the expanded measurement uncertainty is calculated according to the Guide to the Expression of Uncertainty in Measurement (GUM) for a confidence level of approximately 95%. The uncertainty is calculated at time of calibration and does not include the object long-term stability and different environmental and operational conditions.

Results are reviewed to establish where any measurement results exceeded the manufacturer's specifications. Measured values greater than the Manufacturer's specification limits are marked as 'Failed', measured values within the Manufacturer's specifications are marked as 'Passed'.

This certificate applies exclusively to the item identified above and shall not be reproduced except in full, without National Instruments written authorization. Calibration certificates without signatures are not valid.

The Calibration Certificate can be viewed or downloaded online at www.ni.com/calibration/. To request a hard copy, contact **NI Customer Service at Tel:(800) 531-5066 or E-mail customer.service@NI.com**

**Ted Talley**
**Technical Manager**

**National Instruments Calibration Services Austin**
**Building A**
**11500 N MoPac Expwy**
**AUSTIN, TX 78759-3504**
**USA**
**Tel: (800) 531-5066**

NATIONAL INSTRUMENTS

# *CERTIFICATE of CALIBRATION*

Make : PCB Piezotronics

Reference # : 158130

Model : 378B02

Customer : Aercoustics Engineering Ltd
Mississauga, ON

Descr. : Microphone System 1/2" Free Field

Serial # : 118498

P. Order : 2019.07.24C

Asset # : 00234

Cal. status : Received in spec's, no adjustment made.
Preamp System with Mic 377B02 s/n 150498

*Navair Technologies certifies that the above listed instrument was calibrated on date noted and was released from this laboratory performing in accordance with the specifications set forth by the manufacturer.*

*Unless otherwise noted in the calibration report a 4:1 accuracy ratio was maintained for this calibration.*

*Our Quality System system complies with the requirements of ISO-9001-2015 and is registered under certificate CA96/269, working standards used for calibration are certified by or traceable to the National Research Council of Canada or the National Institute of Standards and Technology.*

Calibrated : Jul 26, 2019

By :

Cal. Due : Jul 26, 2021

Petro Onasko

Temperature : 23 °C ± 2 °C  Relative Humidity : 30% to 70%

Standards used : J-216 J-324 J-333 J-420 J-512

## *Navair Technologies*

REPAIR AND CALIBRATION TRACEABLE TO NRC AND NIST

6375 Dixie Rd. Mississauga, ON, L5T 2E7
Phone : 800-668-7440  Fax: 905 565 8325
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e-Mail: service @ navair.com

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# *CERTIFICATE of CALIBRATION*

| | | | |
|---|---|---|---|
| Make : | PCB Piezotronics | Reference # : | 153405 |
| Model : | 480E09 | Customer : | Aercoustics Engineering Ltd<br>Mississauga, ON |
| Descr. : | Conditioning Amplifier | | |
| Serial # : | 00035332 | P. Order : | 2018.07.18C |
| Asset # : | 01197 | | |

Cal. status : Received in spec's, no adjustment made.

*Navair Technologies certifies that the above listed instrument was calibrated on date noted and was released from this laboratory performing in accordance with the specifications set forth by the manufacturer.*

*Unless otherwise noted in the calibration report a 4:1 accuracy ratio was maintained for this calibration.*

*Our calibration system complies with the requirements of ISO-9001-2008 and is registered under certificate CA96/269, working standards used for calibration are certified by or traceable to the National Research Council of Canada or the National Institute of Standards and Technology.*

Calibrated : Jul 25, 2018 By : Petro Onasko

Cal. Due : Jul 25, 2020

Temperature : 23 °C ± 2 °C Relative Humidity : 30% to 70%

Standards used : J-255 J-367 J-512

## *Navair Technologies*

REPAIR AND CALIBRATION TRACEABLE TO NRC AND NIST
6375 Dixie Rd. Mississauga, ON, L5T 2E7
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# CERTIFICATE FOR CALIBRATION OF SONIC ANEMOMETER

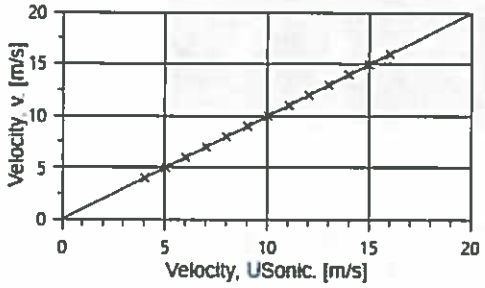
**Certificate number:** 18.US1.05008 **Date of issue:** September 28, 2018
**Type:** Vaisala Weather Transmitter, WXT520 **Serial number:** K0630016
**Manufacturer:** Vaisala, Oyj, Pl 26, FIN-00421 Helsinki, Finland
**Client:** Aercoustics Engineering Ltd., 1004 Middlegate RD, Suite 1100, S.Tower, Mississauga, ON L4Y 1M4, Canada

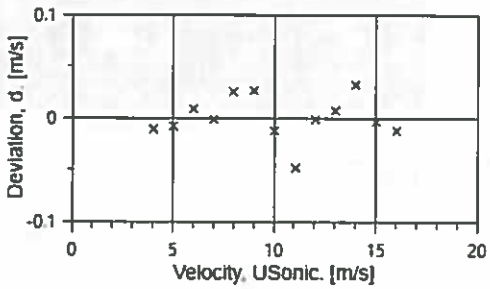
**Anemometer received:** September 25, 2018 **Anemometer calibrated:** September 27, 2018
**Calibrated by:** MEJ **Procedure:** MEASNET, IEC 61400-12-1:2017 Annex F
**Certificate prepared by:** EJF **Approved by:** Calibration engineer, EJF

**Calibration equation obtained:** $v$ [m/s] = 0.99600 · f [m/s] + -0.01530

**Standard uncertainty, slope:** 0.00163 **Standard uncertainty, offset:** -1.13705
**Covariance:** -0.0000265 (m/s)²/m/s **Coefficient of correlation:** $\rho = 0.999985$
**Absolute maximum deviation:** -0.048 m/s at 10.969 m/s
**Barometric pressure:** 1006.5 hPa **Relative humidity:** 49.0%

| Succession | Velocity pressure, q. [Pa] | Temperature in wind tunnel [°C] | d.p. box [°C] | Wind velocity, v. [m/s] | Anemometer Output, f. [m/s] | Deviation, d. [m/s] | Uncertainty $u_c$ (k=2) [m/s] |
|---|---|---|---|---|---|---|---|
| 2 | 9.23 | 25.6 | 26.7 | 3.978 | 4.0200 | -0.011 | 0.020 |
| 4 | 14.47 | 25.7 | 26.7 | 4.981 | 5.0241 | -0.008 | 0.023 |
| 6 | 20.81 | 25.7 | 26.7 | 5.973 | 6.0033 | 0.009 | 0.026 |
| 8 | 28.35 | 25.7 | 26.7 | 6.972 | 7.0167 | -0.002 | 0.029 |
| 10 | 37.09 | 25.7 | 26.7 | 7.974 | 7.9967 | 0.025 | 0.033 |
| 12 | 47.19 | 25.7 | 26.7 | 8.995 | 9.0200 | 0.026 | 0.037 |
| 13-last | 57.82 | 25.7 | 26.7 | 9.956 | 10.0241 | -0.012 | 0.041 |
| 11 | 70.17 | 25.7 | 26.7 | 10.969 | 11.0767 | -0.048 | 0.045 |
| 9 | 83.56 | 25.7 | 26.7 | 11.970 | 12.0350 | -0.001 | 0.049 |
| 7 | 97.94 | 25.7 | 26.7 | 12.960 | 13.0200 | 0.007 | 0.053 |
| 5 | 113.70 | 25.7 | 26.7 | 13.964 | 14.0033 | 0.032 | 0.057 |
| 3 | 129.99 | 25.6 | 26.7 | 14.931 | 15.0100 | -0.004 | 0.061 |
| 1-first | 148.17 | 25.6 | 26.7 | 15.941 | 16.0333 | -0.012 | 0.065 |




AC-1746

## EQUIPMENT USED

| Serial Number | Description |
|---|---|
| Njord1 | Wind tunnel, blockage factor = 1.0035 |
| 2254 | Control cup anemometer |
| - | Mounting tube, D = 19 mm |
| TT002 | Summit Electronics, 1XPT100, 0-10V Output, wind tunnel temp. |
| TP001 | PR Electronics 5102, 0-10V Output, differential pressure box temp. |
| DP005 | Setra Model 239, 0-1inWC, differential pressure transducer |
| HY003 | Dwyer RHP-2D20, 0-10V Output, humidity transmitter |
| BP003 | Setra M278, 0-5VDC Output, barometer |
| PL8 | Pitot tube |
| XB002 | Computer Board, 16 bit A/D data acquisition board |
| 9PRZRW1 | PC dedicated to data acquisition |

Traceable calibrations of the equipment are carried out by external accredited institutions: Atlantic Scale, Essco Calibration Labs & Furness Controls. A real-time analysis module within the data acquisition software detects pulse frequency.



*Photo of the wind tunnel setup. The cross-sectional area is 2.5m x 2.5m.*

## UNCERTAINTIES

The documented uncertainty is the total combined uncertainty at 95% confidence level (k=2) in accordance with EA-4/02. The uncertainty at 10 m/s comply with the requirements in the IEC 61400-12-1:2005 procedure. See Document US.12.01.004 for further details.

## COMMENTS

This sensor was calibrated at 0°.

**Certificate number:** 18.US1.05008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# CERTIFICATE FOR CALIBRATION OF SONIC ANEMOMETER

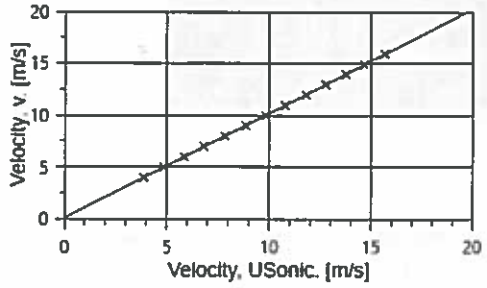
**Certificate number:** 18.US1.05009 **Date of issue:** September 28, 2018
**Type:** Vaisala Weather Transmitter, WXT520 **Serial number:** K0630016
**Manufacturer:** Vaisala, Oyj, Pl 26, FIN-00421 Helsinki, Finland
**Client:** Aercoustics Engineering Ltd., 1004 Middlegate RD, Suite 1100, S.Tower, Mississauga, ON L4Y 1M4, Canada

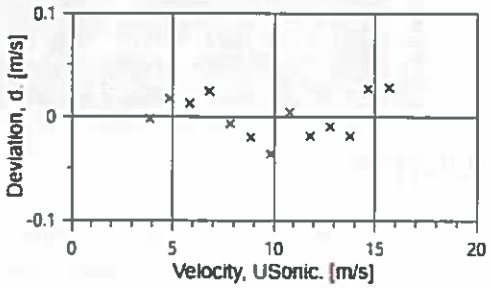
**Anemometer received:** September 25, 2018 **Anemometer calibrated:** September 27, 2018
**Calibrated by:** MEJ **Procedure:** MEASNET, IEC 61400-12-1:2017 Annex F
**Certificate prepared by:** EJF **Approved by:** Calibration engineer, EJF

**Calibration equation obtained:** $v$ [m/s] = 1.01021 · f [m/s] + 0.06780

**Standard uncertainty, slope:** 0.00161 **Standard uncertainty, offset:** 0.25078
**Covariance:** -0.0000258 (m/s)²/m/s **Coefficient of correlation:** ρ = 0.999986
**Absolute maximum deviation:** -0.036 m/s at 9.966 m/s
**Barometric pressure:** 1006.6 hPa **Relative humidity:** 48.7%

| Succession | Velocity pressure, q. [Pa] | Temperature in wind tunnel [°C] | Temperature in d.p. box [°C] | Wind velocity, v. [m/s] | Anemometer Output, f. [m/s] | Deviation, d. [m/s] | Uncertainty $u_c$ (k=2) [m/s] |
|---|---|---|---|---|---|---|---|
| 2 | 9.23 | 25.7 | 26.7 | 3.978 | 3.8733 | -0.002 | 0.020 |
| 4 | 14.46 | 25.8 | 26.7 | 4.979 | 4.8448 | 0.017 | 0.023 |
| 6 | 20.81 | 25.8 | 26.7 | 5.974 | 5.8333 | 0.013 | 0.026 |
| 8 | 28.37 | 25.8 | 26.7 | 6.975 | 6.8133 | 0.024 | 0.029 |
| 10 | 37.11 | 25.8 | 26.7 | 7.977 | 7.8367 | -0.007 | 0.033 |
| 12 | 47.15 | 25.7 | 26.7 | 8.991 | 8.8533 | -0.020 | 0.037 |
| 13-last | 57.93 | 25.7 | 26.6 | 9.966 | 9.8345 | -0.036 | 0.041 |
| 11 | 70.12 | 25.7 | 26.7 | 10.965 | 10.7833 | 0.004 | 0.045 |
| 9 | 83.59 | 25.7 | 26.7 | 11.973 | 11.8033 | -0.019 | 0.049 |
| 7 | 98.00 | 25.7 | 26.7 | 12.965 | 12.7767 | -0.009 | 0.053 |
| 5 | 113.49 | 25.7 | 26.7 | 13.953 | 13.7633 | -0.019 | 0.057 |
| 3 | 129.60 | 25.7 | 26.7 | 14.911 | 14.6667 | 0.027 | 0.061 |
| 1-first | 148.11 | 25.7 | 26.7 | 15.939 | 15.6833 | 0.028 | 0.065 |




AC-1746

## EQUIPMENT USED

| Serial Number | Description |
|---|---|
| Njord1 | Wind tunnel, blockage factor = 1.0035 |
| 2254 | Control cup anemometer |
| - | Mounting tube, D = 19 mm |
| TT002 | Summit Electronics, 1XPT100, 0-10V Output, wind tunnel temp. |
| TP001 | PR Electronics 5102, 0-10V Output, differential pressure box temp. |
| DP005 | Setra Model 239, 0-1inWC, differential pressure transducer |
| HY003 | Dwyer RHP-2D20, 0-10V Output, humidity transmitter |
| BP003 | Setra M278, 0-5VDC Output, barometer |
| PL8 | Pitot tube |
| XB002 | Computer Board, 16 bit A/D data acquisition board |
| 9PRZRW1 | PC dedicated to data acquisition |

Traceable calibrations of the equipment are carried out by external accredited institutions: Atlantic Scale, Essco Calibration Labs & Furness Controls. A real-time analysis module within the data acquisition software detects pulse frequency.

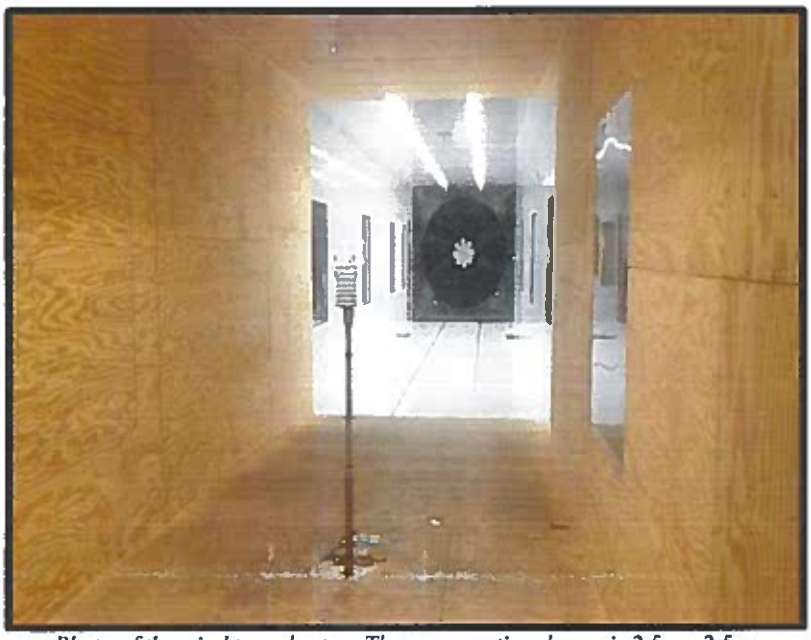


*Photo of the wind tunnel setup. The cross-sectional area is 2.5m x 2.5m.*

## UNCERTAINTIES

The documented uncertainty is the total combined uncertainty at 95% confidence level (k=2) in accordance with EA-4/02. The uncertainty at 10 m/s comply with the requirements in the IEC 61400-12-1:2005 procedure. See Document US.12.01.004 for further details.

## COMMENTS

This sensor was calibrated at 90°.

**Certificate number:** 18.US1.05009

All calibrations are done in the "As Left" condition unless otherwise noted.
This certificate must not be reproduced, except in full, without the approval of SOH Wind Engineering LLC

## Calibration Certificates –

Details are disclosed in the table below regarding the calibration of the equipment used for the Phase 1 I-Audit campaign at R2299. The associated calibration certificates are provided in this appendix.

Please note that the serial number displayed on the microphone system calibration certificate encompasses both the microphone and the pre-amplifier which are submitted for calibration as a pair. The calibration certificate is valid for both the microphone and preamplifier, and their individual model and serial numbers are displayed on the page following the certificate as well as denoted in the table below.

| Equipment | Make/ Model | Serial Number | Date Calibrated [YYYY-MM-DD] | Measurement Interval | Confirmation of Validity for Measurement Interval? |
|---|---|---|---|---|---|
| Sound Level Meter | NI 9234 | 1CAF757 | 2019-06-27 | Oct 9 – Jan 11 | Yes |
| Microphone/Pre-Amplifier Pair | PCB 377B02 | 124690 | 2019-06-28 | Oct 9 – Jan 11 | Yes |
| Microphone | PCB 377B02 | 163103 | 2019-06-28 | Oct 9 – Jan 11 | Yes |
| Pre-amplifier | PCB 426E01 | 43047 | 2019-06-28 | Oct 9 – Jan 11 | Yes |
| Signal Conditioner | PCB 480E09 | 34205 | 2019-06-18 | Oct 9 – Jan 11 | Yes |
| Weather Anemometer | Vaisala WXT520 | L3020299 | 2019-07-08 | Oct 9 – Jan 11 | Yes |

# Compliant Calibration Certificate

Template Revision: Feb2018

| | | | |
|---|---|---|---|
| **Certificate Number:** | 6073295.1 | **OE Number:** | 21702351 |
| **Date Printed:** | 27-JUN-2019 | **Page:** | 1 of 14 |
| **Customer:** | Aercoustics Engineering LTD (CA)<br>1004 Middlegate Road<br>Suite 1100<br>ONTARIO MISSISSAUGA, L4Y 0G1<br>CANADA | | |
| **Manufacturer:** | National Instruments | **Model:** | NI 9234 |
| **Serial Number:** | 1CAF757 | | |
| **Part Number:** | 195551C-01L | **Description:** | MODULE ASSY,NI 9234, 4 AI CONFIGURABLE |
| **Calibration Date:** | 27-JUN-2019 | **Recommended Calibration Due:** | 27-JUN-2020 |
| **Procedure Name:** | NI 9234 | **Verification Results:** | As Found: Passed<br>As Left: Passed |
| **Procedure Version:** | 3.6.1.0 | **Calibration Executive Version:** | 4.6.2.0 |
| **Lab Technician:** | Rogelio Gaytan | **Driver Info:** | NI-DAQmx:17.6.0 |
| **Temperature:** | 23.0° C | **Humidity:** | 44.9% RH |

NATIONAL INSTRUMENTS
CALIBRATED
SN/ID 1CAF757
DATE 27-JUN-2019
DUE 27-JUN-2020
ni.com/calibration

The data found in this certificate must be interpreted as:

**As Found** The calibration data of the unit as received by National Instruments.

**As Left** The calibration data of the unit when returned from National Instruments.

The As Found and As Left readings are identical for units not adjusted or repaired.

This calibration conforms to ANSI/NCSL Z540.1-1994 (R2002) requirements.

The TUR (Test Uncertainty Ratio) of this calibration is maintained at a ratio of 4:1 or greater, unless otherwise indicated in the measurements. A TUR determination is not possible for singled sided specification limits and therefore the absence of a value should not be interpreted as a TUR of 4:1 or greater, but rather undetermined. When provided, the expanded measurement uncertainty is calculated according to the Guide to the Expression of Uncertainty in Measurement (GUM) for a confidence level of approximately 95%. The uncertainty is calculated at time of calibration and does not include the object long-term stability and different environmental and operational conditions.

Results are reviewed to establish where any measurement results exceeded the manufacturer's specifications. Measured values greater than the Manufacturer's specification limits are marked as 'Failed', measured values within the Manufacturer's specifications are marked as 'Passed'.

This certificate applies exclusively to the item identified above and shall not be reproduced except in full, without National Instruments written authorization. Calibration certificates without signatures are not valid.

The Calibration Certificate can be viewed or downloaded online at www.ni.com/calibration/. To request a hard copy, contact **NI Customer Service at Tel:(800) 531-5066 or E-mail customer.service@NI.com**



**Ted Talley**
**Technical Manager**

**National Instruments Calibration Services Austin**
**Building A**
**11500 N MoPac Expwy**
**AUSTIN, TX 78759-3504**
**USA**
**Tel: (800) 531-5066**

NATIONAL INSTRUMENTS

# *CERTIFICATE of CALIBRATION*

| | | | |
|---|---|---|---|
| Make : | PCB Piezotronics | Reference # : | 157706 |
| Model : | 378B02 | Customer : | Aercoustics Engineering Ltd<br>Mississauga, ON |
| Descr. : | Microphone System 1/2" Free Field | | |
| Serial # : | 124690 | P. Order : | 2019.06.26C |
| Asset # : | 00771 | | |

Cal. status : Received in spec's, no adjustment made.
Preamp System with Mic 377B02 s/n 163103

*Navair Technologies certifies that the above listed instrument was calibrated on date noted and was released from this laboratory performing in accordance with the specifications set forth by the manufacturer.*

*Unless otherwise noted in the calibration report a 4:1 accuracy ratio was maintained for this calibration.*

*Our Quality System system complies with the requirements of ISO-9001-2015 and is registered under certificate CA96/269, working standards used for calibration are certified by or traceable to the National Research Council of Canada or the National Institute of Standards and Technology.*

Calibrated : Jun 28, 2019 By : Petro Onasko

Cal. Due : Jun 28, 2021

Temperature : 23 °C ± 2 °C Relative Humidity : 30% to 70%

Standards used : J-216 J-324 J-333 J-420 J-512

## *Navair Technologies*

REPAIR AND CALIBRATION TRACEABLE TO NRC AND NIST
6375 Dixie Rd. Mississauga, ON, L5T 2E7 http: // www.navair.com
Phone : 800-668-7440 Fax: 905 565 8325 e-Mail: service @ navair.com

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# *CERTIFICATE of CALIBRATION*

| | | | |
|---|---|---|---|
| Make : | PCB Piezotronics | Reference # : | 157554 |
| Model : | 480E09 | Customer : | Aercoustics Engineering Ltd<br>Mississauga, ON |
| Descr. : | Conditioning Amplifier | | |
| Serial # : | 00034205 | P. Order : | 2019.06.14C |
| Asset # : | 00908 | | |

Cal. status : Received in spec's, no adjustment made.

*Navair Technologies certifies that the above listed instrument was calibrated on date noted and was released from this laboratory performing in accordance with the specifications set forth by the manufacturer.*

*Unless otherwise noted in the calibration report a 4:1 accuracy ratio was maintained for this calibration.*

*Our Quality System system complies with the requirements of ISO-9001-2015 and is registered under certificate CA96/269, working standards used for calibration are certified by or traceable to the National Research Council of Canada or the National Institute of Standards and Technology.*

Calibrated : Jun 18, 2019 By : Petro Onasko

Cal. Due : Jun 18, 2021

Temperature : 23 °C ± 2 °C Relative Humidity : 30% to 70%

Standards used : J-233 J-255 J-367 J-512

## *Navair Technologies*

REPAIR AND CALIBRATION TRACEABLE TO NRC AND NIST

6375 Dixie Rd. Mississauga, ON, L5T 2E7 http: // www.navair.com
Phone : 800-668-7440 Fax: 905 565 8325 e-Mail: service @ navair.com

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**SOH Wind Engineering LLC**

141 Leroy Road · Williston, VT 05495 · USA

Tel 802.316.4368 · Fax 802.735.9106 · www.sohwind.com

# CERTIFICATE FOR CALIBRATION OF SONIC ANEMOMETER

**Certificate number:** 19.US2.06157 **Date of issue:** July 08, 2019

**Type:** Vaisala Weather Transmitter, WXT520 **Serial number:** L3020299

**Manufacturer:** Vaisala, Oyj, Pl 26, FIN-00421 Helsinki, Finland

**Client:** Aercoustics Engineering Ltd., 1004 Middlegate RD, Suite 1100, S.Tower, Mississauga, ON L4Y 1M4, Canada

**Anemometer received:** July 11, 2019 **Anemometer calibrated:** July 08, 2019

**Calibrated by:** MEJ **Procedure:** MEASNET, IEC 61400-12-1:2017 Annex F

**Certificate prepared by:** EJF **Approved by:** Calibration engineer, EJF

**Calibration equation obtained:** $v$ [m/s] = 0.99633 · U [m/s] + -0.05302

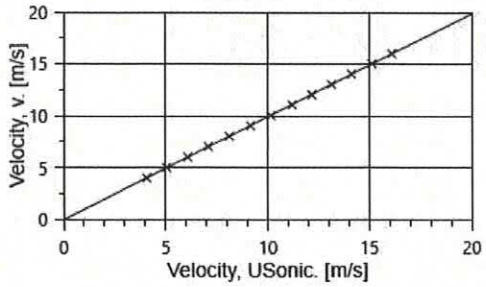
**Standard uncertainty, slope:** 0.00194 **Standard uncertainty, offset:** -0.39371

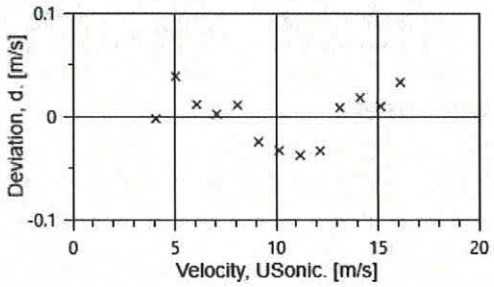
**Covariance:** -0.0000378 (m/s)²/m/s **Coefficient of correlation:** ρ = 0.999979

**Absolute maximum deviation:** 0.039 m/s at 5.005 m/s

**Barometric pressure:** 1004.3 hPa **Relative humidity:** 49.0%

| Succession | Velocity pressure, q. [Pa] | Temperature in wind tunnel [°C] | d.p. box [°C] | Wind velocity, $v$. [m/s] | Anemometer Output, U. [m/s] | Deviation, d. [m/s] | Uncertainty $u_c$ (k=2) [m/s] |
|---|---|---|---|---|---|---|---|
| 2 | 9.35 | 24.5 | 28.5 | 4.000 | 4.0700 | -0.003 | 0.023 |
| 4 | 14.64 | 24.6 | 28.5 | 5.005 | 5.0379 | 0.039 | 0.026 |
| 6 | 21.13 | 24.6 | 28.5 | 6.013 | 6.0767 | 0.011 | 0.030 |
| 8 | 28.74 | 24.6 | 28.4 | 7.013 | 7.0900 | 0.002 | 0.034 |
| 10 | 37.62 | 24.6 | 28.6 | 8.025 | 8.0967 | 0.011 | 0.038 |
| 12 | 47.73 | 24.6 | 28.7 | 9.039 | 9.1500 | -0.025 | 0.043 |
| 13-last | 58.83 | 24.6 | 28.7 | 10.035 | 10.1586 | -0.033 | 0.047 |
| 11 | 71.48 | 24.6 | 28.7 | 11.061 | 11.1933 | -0.038 | 0.051 |
| 9 | 84.67 | 24.6 | 28.4 | 12.039 | 12.1700 | -0.033 | 0.056 |
| 7 | 99.33 | 24.6 | 28.5 | 13.040 | 13.1333 | 0.008 | 0.060 |
| 5 | 115.14 | 24.6 | 28.5 | 14.040 | 14.1267 | 0.018 | 0.064 |
| 3 | 132.22 | 24.5 | 28.6 | 15.044 | 15.1433 | 0.010 | 0.069 |
| 1-first | 150.03 | 24.5 | 28.6 | 16.024 | 16.1033 | 0.033 | 0.073 |




AC-1746

## EQUIPMENT USED

| Serial Number | Description |
|---|---|
| Njord2 | Wind tunnel, blockage factor = 1.0035 |
| 13924 | Control cup anemometer |
| - | Mounting tube, D = 19 mm |
| TT003 | Summit Electronics, 1XPT100, 0-10V Output, wind tunnel temp. |
| TP001 | PR Electronics 5102, 0-10V Output, differential pressure box temp. |
| DP008 | Setra Model 239, 0-1inWC, differential pressure transducer |
| HY002 | Dwyer RHP-2D20, 0-10V Output, humidity transmitter |
| BP003 | Setra M278, 0-5VDC Output, barometer |
| PL3 | Pitot tube |
| XB001 | Computer Board. 16 bit A/D data acquisition board |
| Njord2-PC | PC dedicated to data acquisition |

The accuracies of all measurements were traceable to the SI through NIST or CIPM recognized NMI's.

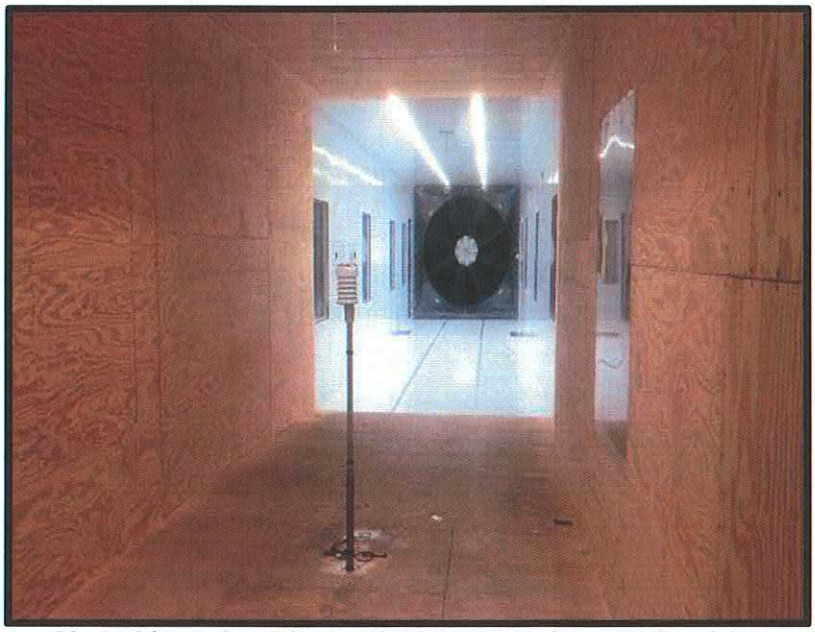


*Photo of the wind tunnel setup. The cross-sectional area is 2.5m x 2.5m.*

## UNCERTAINTIES

The documented uncertainty is the total combined uncertainty at 95% confidence level (k=2) in accordance with EA-4/02. The uncertainty at 10 m/s comply with the requirements in the IEC 61400-12-1:2005 procedure. See Document US.12.01.004 for further details.

## COMMENTS

This sensor was positioned at the 0° orientation during calibration.

**Certificate number:** 19.US2.06157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**SOH Wind Engineering LLC**

141 Leroy Road · Williston, VT 05495 · USA

Tel 802.316.4368 · Fax 802.735.9106 · www.sohwind.com

# CERTIFICATE FOR CALIBRATION OF SONIC ANEMOMETER

**Certificate number:** 19.US2.06158 **Date of issue:** July 08, 2019

**Type:** Vaisala Weather Transmitter, WXT520 **Serial number:** L3020299

**Manufacturer:** Vaisala, Oyj, Pl 26, FIN-00421 Helsinki, Finland

**Client:** Aercoustics Engineering Ltd., 1004 Middlegate RD, Suite 1100, S.Tower, Mississauga, ON L4Y 1M4, Canada

**Anemometer received:** July 11, 2019 **Anemometer calibrated:** July 08, 2019

**Calibrated by:** MEJ **Procedure:** MEASNET, IEC 61400-12-1:2017 Annex F

**Certificate prepared by:** EJF **Approved by:** Calibration engineer, EJF

**Calibration equation obtained:** $v$ [m/s] = 1.00930 · U [m/s] + 0.13558

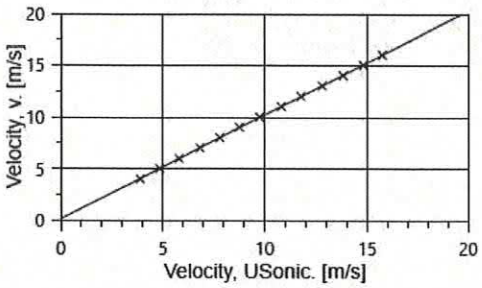
**Standard uncertainty, slope:** 0.00221 **Standard uncertainty, offset:** 0.17289

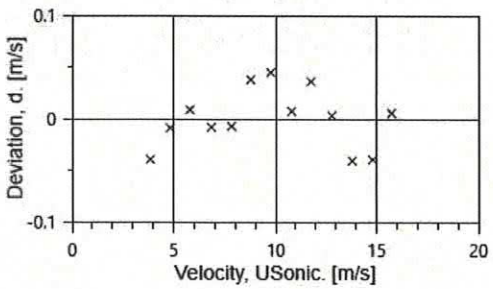
**Covariance:** -0.0000490 (m/s)²/m/s **Coefficient of correlation:** ρ = 0.999973

**Absolute maximum deviation:** 0.045 m/s at 10.033 m/s

**Barometric pressure:** 1004.3 hPa **Relative humidity:** 48.4%

| Succession | Velocity pressure, q. [Pa] | Temperature in wind tunnel [°C] | d.p. box [°C] | Wind velocity, $v$. [m/s] | Anemometer Output, U. [m/s] | Deviation, d. [m/s] | Uncertainty $u_c$ (k=2) [m/s] |
|---|---|---|---|---|---|---|---|
| 2 | 9.37 | 24.7 | 28.5 | 4.005 | 3.8733 | -0.039 | 0.023 |
| 4 | 14.68 | 24.8 | 28.4 | 5.013 | 4.8414 | -0.009 | 0.026 |
| 6 | 21.01 | 24.8 | 28.2 | 5.998 | 5.8000 | 0.009 | 0.030 |
| 8 | 28.81 | 24.8 | 28.1 | 7.024 | 6.8333 | -0.008 | 0.034 |
| 10 | 37.60 | 24.8 | 27.8 | 8.025 | 7.8233 | -0.007 | 0.038 |
| 12 | 47.62 | 24.8 | 27.7 | 9.032 | 8.7767 | 0.038 | 0.043 |
| 13-last | 58.77 | 24.8 | 27.7 | 10.033 | 9.7621 | 0.045 | 0.047 |
| 11 | 71.28 | 24.8 | 27.8 | 11.050 | 10.8067 | 0.007 | 0.051 |
| 9 | 84.69 | 24.8 | 28.0 | 12.045 | 11.7633 | 0.036 | 0.056 |
| 7 | 99.51 | 24.8 | 28.1 | 13.056 | 12.7983 | 0.003 | 0.060 |
| 5 | 115.14 | 24.8 | 28.3 | 14.044 | 13.8200 | -0.041 | 0.064 |
| 3 | 132.19 | 24.7 | 28.4 | 15.047 | 14.8133 | -0.040 | 0.069 |
| 1-first | 150.07 | 24.7 | 28.8 | 16.031 | 15.7433 | 0.006 | 0.073 |




AC-1746

## EQUIPMENT USED

| Serial Number | Description |
|---|---|
| Njord2 | Wind tunnel, blockage factor = 1.0035 |
| 13924 | Control cup anemometer |
| - | Mounting tube, D = 19 mm |
| TT003 | Summit Electronics, 1XPT100, 0-10V Output, wind tunnel temp. |
| TP001 | PR Electronics 5102, 0-10V Output, differential pressure box temp. |
| DP008 | Setra Model 239, 0-1inWC, differential pressure transducer |
| HY002 | Dwyer RHP-2D20, 0-10V Output, humidity transmitter |
| BP003 | Setra M278, 0-5VDC Output, barometer |
| PL3 | Pitot tube |
| XB001 | Computer Board. 16 bit A/D data acquisition board |
| Njord2-PC | PC dedicated to data acquisition |

The accuracies of all measurements were traceable to the SI through NIST or CIPM recognized NMI's.

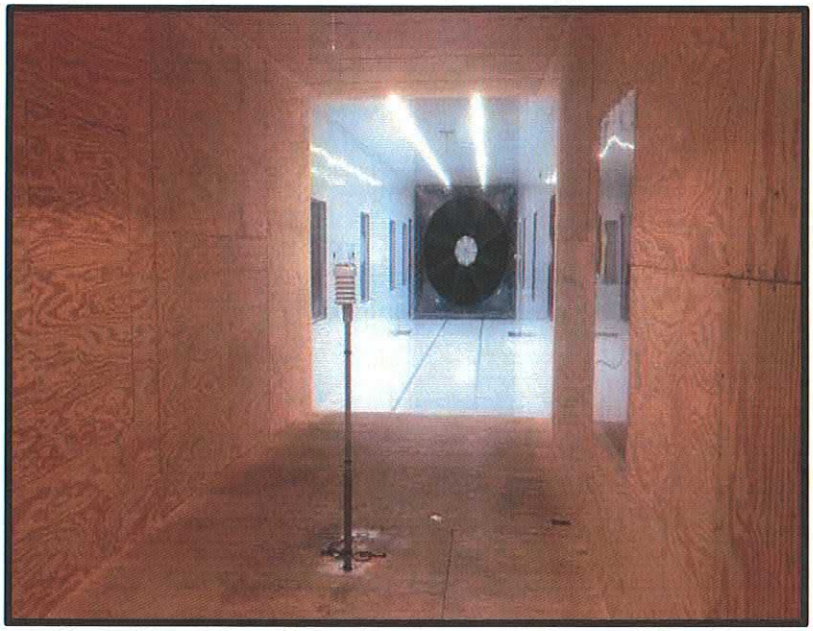


*Photo of the wind tunnel setup. The cross-sectional area is 2.5m x 2.5m.*

## UNCERTAINTIES

The documented uncertainty is the total combined uncertainty at 95% confidence level (k=2) in accordance with EA-4/02. The uncertainty at 10 m/s comply with the requirements in the IEC 61400-12-1:2005 procedure. See Document US.12.01.004 for further details.

## COMMENTS

This sensor was positioned at the 90° orientation during calibration.

**Certificate number:** 19.US2.06158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aercoustics

Aercoustics Engineering Ltd.
1004 Middlegate Road, Suite 1100
Mississauga, ON L4Y 0G1

Tel: 416-249-3361
Fax 416-249-3613
aercoustics.com

# Appendix G
# Power Thresholds for 90% Sound Power

# Appendix G - Power Thresholds for 90% Sound Power

Project: Belle River Wind Power Project - 1st Acoustic Immission Audit

Report ID: 17095.01



Created on: 30/01/2020

*Wind bins for interpolation are highlighted in light blue

**Table G.1: BRWPP 3.2 MW Turbine - Measured Power and Sound Power**

| T52 (3.2 MW) E-Audit Test Results Summary [4] | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| IEC 61400-11 Test | 7 | 7.5 | 8 | 8.5 | 9 | 9.5 | 10 | 10.5 | 11 | 11.5 | 12 | 12.5 | 13 |
| Power (kW) | #N/A | #N/A | 1487 | 1788 | 2089 | 2388 | 2687 | 2881 | 3075 | 3131 | 3186 | 3193 | 3199 |
| SPL (dBA) | #N/A | #N/A | 103.6 | 105.1 | 105.8 | 105.8 | 105.7 | 105.6 | 105.5 | 105.4 | 105.3 | 105.2 | 105.1 |

**Table G.2: BRWPP 2.473 MW Turbine - Measured Power and Sound Power**

| T44 (2.473 MW) E-Audit Test Results Summary [5] | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| IEC 61400-11 Test | 7 | 7.5 | 8 | 8.5 | 9 | 9.5 | 10 | 10.5 | 11 | 11.5 | 12 | 12.5 | 13 |
| Power (kW) | 990 | 1226 | 1461 | 1708 | 1954 | 2136 | 2317 | 2382 | 2447 | 2459 | 2470 | #N/A | #N/A |
| SPL (dBA) | 100.8 | 101.7 | 101.9 | 101.9 | 101.7 | 101.7 | 101.6 | 101.6 | 101.7 | 101.8 | 102.1 | #N/A | #N/A |

*Outside reportable range but sufficient data was collected

**Table G.3: BRWPP 2.37 MW Turbine - Measured Power and Sound Power**

| T40 (2.37 MW) E-Audit Test Results Summary [6] | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| IEC 61400-11 Test | 7 | 7.5 | 8 | 8.5 | 9 | 9.5 | 10 | 10.5 | 11 | 11.5 | 12 | 12.5 | 13 |
| Power (kW) | 987 | 1215 | 1443 | 1671 | 1899 | 2061 | 2222 | 2283 | 2344 | 2356 | 2367 | #N/A | #N/A |
| SPL (dBA) | 100.5 | 101.5 | 101.2 | 101.1 | 101.0 | 100.8 | 100.9 | 101.0 | 100.9 | 101.3 | 101.2 | #N/A | #N/A |

**Table G.3: BRWPP 2.772 MW Turbine - Measured Power and Sound Power**

| T53 (2.773 MW) E-Audit Test Results Summary [7] | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| IEC 61400-11 Test | 7 | 7.5 | 8 | 8.5 | 9 | 9.5 | 10 | 10.5 | 11 | 11.5 | 12 | 12.5 | 13 |
| Power (kW) | #N/A | 1238 | 1484 | 1770 | 2055 | 2294 | 2533 | 2631 | 2728 | 2748 | 2768 | 2770 | #N/A |
| SPL (dBA) | #N/A | 102.3 | 103.7 | 104.3 | 104.4 | 104.3 | 104.2 | 103.9 | 103.8 | 104.0 | 103.6 | 103.8 | #N/A |

**Table G.4: Power Thresholds for 90% Sound Power**

| | maximum sound | 90% sound power | electrical power at | percentage of rated |
|---|---|---|---|---|
| 3.2 MW | 105.8 | 105.4 | 1914 | 60% |
| 2.473 MW | 102.1 | 101.6 | 1191 | 48% |
| 2.37 MW | 101.5 | 101.1 | 1113 | 47% |
| 2.773 MW | 104.4 | 103.9 | 1581 | 57% |

aercoustics

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Tel: 416-249-3361
Fax 416-249-3613
aercoustics.com

# Appendix H
# I-Audit Checklist

## Appendix H7: I-Audit checklist

**Wind Energy Project – Screening Document – Acoustic Audit Report – Immission**

Information Required in the Acoustic Audit Report – Immission

| Item # | Description | Complete? | Comment |
|---|---|---|---|
| 1 | Did the Sound level Meter meet the Type 1 Sound level meter requirements according to the IEC standard 61672-1 Sound level Meters, Part 1: Specifications? Section D2.1.1 | ✓ | |
| 2 | Was the complete sound measurement system, including any recording, data logging or computing systems calibrated immediately before and after the measurement session at one or more frequencies using an acoustic calibrator on the microphone (must not exceed ±0.5dB)? Section D2.1.3 | ✓ | |
| 3 | Are valid calibration certificate(s) of the noise monitoring equipment and calibration traceable to a qualified laboratory? Is the validity duration of the calibration stated for each item of equipment? Section D2.3 | ✓ | |
| 4 | Was the predictable worst case parameters such as high wind shear and wind direction toward the Receptor considered? Section D3.2 | ✓ | |
| 5 | Is there a Wind Rose showing the wind directions at the site? Section D7 (1e) | ✓ | |
| 6 | Did the results cover a wind speed range of at least 4-7 m/s as outlined in section D 3.8.? | ✓ | |
| 7 | Was the weather report during the measurement campaign included in the report? Section D7 (1c) | ✓ | |
| 8 | Did the audit state there was compliance with the limits at each wind speed category? Section D6 | ✓ | |
| 9 | Are pictures of the noise measurement setup near Point of reception provided? Section D3.3.2 & D3.4 | ✓ | |
| 10 | Was there justification of the Receptor location choice(s) prior to commencement of the I-Audit? Section D4.1 | ✓ | |
| 11 | Was there sufficient valid data for different wind speeds? Section D5.2 # 3 | ✓ | |
| 12 | Was the turbine (operational) specific information during the measurement campaign in tabular form (i.e. wind speed at hub height, anemometer wind speed at 10 m height, air temperature and pressure and relative humidity) Section D3.7 | ✓ | |
| 13 | Were all the calculated standard deviations at all relevant integer wind speeds provided? Section D7 (2d) | ✓ | |
| 14 | Compliance statement | ✓ | |
| 15 | All data included in an Excel spreadsheet | ✓ | |
| 16 | If deviations from standard; was justification of the deviations provided | ✓ | To ensure conservative results, 90% Sound Power filter was used in place of 85% Power filter: See Section 6.3 and Appendix G for justification. |