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January 15, 2021 Aercoustics Project #: 17283.03 & 17283.04

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CC: Joshua Vaidhyan, Samsung
Paul Ahn, Samsung
Jonathan Miranda, Pattern
Allan Munro, Aercoustics

Subject: North Kent Wind Power Project
NAAP Verification Audit MECP Responses
REA #5272-A9FHRL

Aercoustics Engineering Limited (Aercoustics) has been retained by North Kent Wind 1 LP to complete the emission audit (E-audit) and immission audit (I-audit) requirements requested by the Ministry of the Environment, Conservation and Parks (MECP) for the North Kent 1 Wind Power Project (NKWPP). NKWPP operates under REA #5272-A9FHRL.

The following letter presents responses to the comments provided by the MECP Approvals Branch in an email dated January 4th, 2021. These comments and responses are related to the following documents:

- **Aercoustics I-Audit Report for R3408**, *"North Kent Wind 1 LP – NAAP Verification Acoustic Immission Audit – R3408"*, dated December 4th, 2020.
- **Aercoustics E-Audit Report for T03**, *"North Kent Wind 1 LP / Turbine T03 – IEC 61400-11 Edition 3.0 Measurement Report"*, dated December 4th, 2020.
- **Aercoustics E-Audit Report for T04**, *"North Kent Wind 1 LP / Turbine T04 – IEC 61400-11 Edition 3.0 Measurement Report",* dated December 4th, 2020.

The MECP comments have been copied below, with responses immediately following each item. The following supporting documents have been included with the submission of this memo:

Package	Document	File Name	File Type
Exhibit A	Report	Aerc022 R1 – NKWPP NAAP I-Audit R3408 17283.04	PDF
	Data Package: All Data	Aerc022a R1 – NKWPP NAAP R3408 MECP Summary	Excel
	Data Package: Narrowband Spectra	Aerc022b R1 – NKWPP NAAP R3408 Narrowband Summary	Excel
Exhibit B	Report	Aerc023 RP2 – 17283.03.T3.RP2 IEC 61400-11 Test Report	PDF
	Data Package: Report Tables in Excel	Aerc023a RP2 – 17283.03.T3.RP2 IEC 61400-11 Report Tables in Excel	Excel
	Data Package: Narrowband Spectra	Aerc023b RP2 – 17283.03.T3.RP2 IEC 61400-11 Narrowband Summary	Excel
	Figure: Aerial View of Measurement Area	Aerc023c – 17283.03.T3.RP2 Aerial View of Measurement Area	PDF
Exhibit C	Report	Aerc024 RP2 – 17283.03.T4.RP2 IEC 61400-11 Test Report	PDF
	Data Package: Report Tables in Excel	Aerc024a RP2 – 17283.03.T4.RP2 IEC 61400-11 Report Tables in Excel	Excel
	Data Package: Narrowband Spectra	Aerc024b RP2 – 17283.03.T4.RP2 IEC 61400-11 Narrowband Summary	Excel

Comments Specific to R3408

1) **Microphone 378B02:** *The calibration certificate for microphone is over one year old before the audit was conducted. This is not acceptable.*

The PCB 378B02 microphone with SN 132195 was listed in Table 2 in error. The correct microphone used throughout audit measurements is PCB 378B02 with SN 122654. The table has been revised and an updated calibration certificate (July 31, 2020) has been included in the revised report. See Exhibit A.

2) **Final I-Audit Report:** *Please confirm if this is an interim report and that a final report will be submitted by February 19, 2021.*

This report is considered final as sufficient data was collected to fulfil RAM I-Audit requirements. No further report will be issued.

3) **Excel Sheet Included Data for Downwind:** *The Excel sheet file does not match with the reported sound levels and data counts in the report. Currently, the downwind data set seems to be the same as the crosswind data set. Provide a revised report and Excel sheet file, a consistent set of data.*

Due to an error during automated compilation of the MECP Summary data package, datapoints were not properly filtered during compilation. Instead, all collected datapoints were included in both the excluded and included datapoint tables for both crosswind and downwind conditions, as noted in the comment above.

A revised MECP Summary data package has been included in Exhibit A.

This compilation error did not affect the reported I-Audit results nor the Narrowband Spectra data package.

4) **Excel Sheet Included Data for Downwind/Crosswind:** *What is meaning of "mix" label in included data for Downwind/Crosswind?*

The "mix" label is an artifact of an error during automated compilation of the MECP Summary data package, as described in response to comment 3) above. This has been resolved in the updated MECP Summary data package included in Exhibit A.

5) **Included Data:** *Some of data points listed in Excel sheet are not filtered as per the requirements of the Compliance Protocol. For example, in the Downwind angle data, there are data points during 9 PM which is an invalid time for the data.*

The unfiltered data points are an artifact of an error during automated compilation of the MECP Summary data package, as described in the response to comment 3) above. This has been resolved in the updated MECP Summary data package included in Exhibit A.

6) **Downwind and Crosswind comparisons:** *Please compare downwind and crosswind results, provide your professional opinion for the collected data (both sound levels and tonal audibility). Confirm if the audit results are in-agreement with your expectation. Compare downwind sound levels and crosswind sound levels for all bins and provide your professional opinion. Compare downwind tonal audibility and crosswind sound levels for all bins and provide your professional opinion.*

Based on the results presented and the data collected, the cumulative sound impact calculated at R3408 complies with the MECP sound level limits during both crosswind and downwind conditions.

It is noted that the reported sound levels under both wind conditions are very similar. This is likely due to overlapping acceptable wind directions which result from the combination of crosswind analysis and downwind analysis with aggregate angle applied. These overlapping wind directions can be seen in Figure 2 of the report. A significant portion of the assessment data used for analysis qualifies as both downwind and crosswind data.

Comments Specific to T03

1) **FFT Data:** *Please provide Fast Fourier Transform (FFT) data in Excel sheet and sample calculation for bin 8.5 m/s (hub height bin 8.5).*

See Exhibit B for the Narrowband Spectra data package (Aerc023b) and tonality sample calculation for bin 8.5 m/s (Aerc023a, D.01-16 Tonality Assessment).

2) **Insertion Loss of Secondary Wind Screen:** *With reference to section 3.1.5 of the report, please clarify how the secondary wind screen correction was applied. Provide an Excel sheet to account for this correction (sound levels before secondary wind screen which is the sound levels used for calculation).*

A secondary wind screen correction was applied spectrally to the measured sound pressure level in each 1/3-octave band. This correction was applied to account for the insertion loss of the secondary wind screen, which has been measured per Annex E of IEC 61400-11 Edition 3.0.

The secondary windscreen insertion loss spectrum is included in the revised Report Tables in Excel data package included in Exhibit B.

3) **Microphone:** *Calibration certificate for microphone (listed in Table 6) is over one year old and this is not acceptable.*

Per Section 6.3 of IEC 61400-11 Edition 3.0, the maximum time from last calibration for microphones is 24 months. The B&K 4189 and B&K 2671 microphone/pre-amplifier pair utilized is acceptable as it was calibrated within 15 months of measurements.

4) **Reference:** *There are three references listed as [1], Acoustic Assessment report and IEC61400-11 Ed.3.0 and Noise Abatement Action Plan (NAAP). Please correct it in the report.*

The Compliance Statement included in Appendix F.02 has been revised to remove the reference to the NAAP and improve clarity. There are no references to the Acoustic Assessment Report. See Exhibit B.

5) **Microphone Location:** *Explain why microphone was not placed at the reference distance as stated in the IEC61400-11 Ed.3.0 standard, i.e. R0=H+D/2=156 metres instead of a closer measured location of R0=134 metres. Please see the quote below from Ed. 3.1*

   Section 7.1. "The measurement distance should be as close as possible to R0. the allowed tolerance should only be used where it is essential to obtain valid data, where this is done, clear evidence shall be reported to justify the decision made"

   Please explain the effect of this deviation. Provide your rationale for why this deviation was made.

Due to site specific constraints on the microphone placement a reduced R_0 measurement distance was used.

The topography of the area surrounding the turbine, combined with the dominant wind direction in the area, allowed only a limited measurement region. Specifically, this acceptable region is bounded by a water canal which reduces the practical measurement positions.

As such, the measurement distance was intentionally reduced to maximize the turbine yaw angle range which could be accommodated without changing the measurement distance. See the figure included in Exhibit B.

It should be noted that this is not considered to be a deviation from IEC-61400-11 Edition 3.0 or Edition 3.1 and the measurement distance is within the allowable range.

6) **Background:** *It seems that some of data points for OFF status (background measurement) attribute with high sound levels (Figure C.01). Please correct these data points.*

An additional detailed review of background data points with high sound levels, including manual verification through listening to the data points, has been completed. The datasets and associated measurement results have been updated accordingly. See Exhibit B.

It should be noted that after further data validation and removal of background data points with high sound levels, the maximum apparent sound power level of T03 operating in its 2.628 MW reduced noise emission (-3 dB) mode are still considered acceptable and compliant with the maximum turbine emission levels in the proposed NAAP.

Comments Specific to T04

7) **Background:** *It seems that some of data points for OFF status (background measurement) attribute with high sound levels (Figure C.01). These difference between ON and OFF at some data points are below 1 dB. Please correct these data points.*

An additional detailed review of background data points with high sound levels, including manual verification through listening to the data points, has been completed. The datasets and associated measurement results have been updated accordingly. See Exhibit C.

It should be noted that after further data validation and removal of background data points with high sound levels, the maximum apparent sound power level of T04 operating in its 2.628 MW reduced noise emission (-3 dB) mode are still considered acceptable and compliant with the maximum turbine emission levels in the proposed NAAP.

8) **Microphone:** *Calibration certificate for microphone (listed in Table 6) is over one year old and this is not acceptable.*

Per Section 6.3 of IEC 61400-11 Edition 3.0, the maximum time from last calibration for microphones is 24 months. The B&K 4189 and B&K 2671 microphone/pre-amplifier pair utilized is acceptable as it was calibrated within 15 months of measurements.

9) **Reference:** *There are three references listed as [1], Acoustic Assessment report and IEC61400-11 Ed.3.0 and Noise Abatement Action Plan NAAP. Please correct it in the report.*

The Compliance Statement included in Appendix F.02 has been revised to remove the reference to the NAAP and improve clarity. There are no references to the Acoustic Assessment Report. See Exhibit C.

10) **Insertion loss of secondary wind screen:** *With reference to section 3.1.5 of the report, please clarify how the secondary wind screen correction was applied. Please provide an Excel sheet to account for this correction (sound levels before secondary wind screen). (sound levels in Excel sheet is the result of measurement, however, sound levels in calculation of sound power levels are different).*

A secondary wind screen correction was applied spectrally to the measured sound pressure level in each 1/3-octave band. This correction was applied to account for the insertion loss of the secondary wind screen, which has been measured per Annex E of IEC 61400-11 Edition 3.0.

The secondary windscreen insertion loss spectrum is included in the revised Report Tables in the Excel data package included in Exhibit C.

11) **Frequency of tone:** *Please explain as to why the frequency of tone is not an integer number. The numbers listed in table F6 of the report (for example 64.8 Hz) are not integer, what is the resolution of frequency in Fast Fourier Transform (FFT) data. Please confirm if this meets the requirement of IEC-61400-11 Ed. 3.0 standard.*

The non-integer tone frequencies included in Table 14 were reported in error. The table has been revised to indicate the correct integer tone frequencies in the revised report. See Exhibit C.

The FFT frequency resolution used for calculations is 1 Hz which meets the requirements of IEC 61400-11 Edition 3.0. The non-integer values previously reported are a result of averaging the centre frequencies of all reported tones of the same origin. For example, ten tones with centre frequencies of 65 Hz and two tones with centre frequencies of 64 Hz would result in an average of 64.8 Hz. This is reported as 65 Hz.

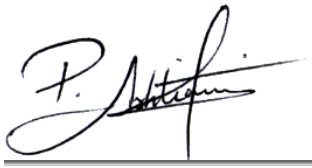
Closure

Please do not hesitate to contact us should you have any questions or require anything further.

Sincerely,

AERCOUSTICS ENGINEERING LIMITED

Christopher Bosyj, M.A.Sc., P.Eng.



Payam Ashtiani, B.A.Sc., P.Eng.