

October 19, 2016

Jim Mulvale
Grand Bend Wind Limited Partnership
30 St. Claire Avenue West, Unit 1700
Toronto, Ontario
M4V 3A1

**Re: Acoustic Audit of the Grand Bend Wind Project Transformer Station
Condition E3 of Renewable Energy Approval 5186-9HBJXR**

Dear Jim,

As requested, HGC Engineering visited the Grand Bend Wind Project and the surrounding area on September 22, 2016 to perform acoustical audit measurements of the transformer station associated with the facility. The audit is required as a condition of Renewable Energy Approval (“REA”), number 5186-9HBJXR, granted to the facility by the Ontario Ministry of the Environment and Climate Change (“MOECC”). An Environmental Noise Impact Assessment Report (“ENIA”) was prepared by others, dated April 15, 2014 to support the application for the REA.

Condition E3 in the REA requires an Acoustic Audit – Transformer Substation/Transformer and Reactor, which is defined as “an investigative procedure that is compliant with the IEEE Standard C57.12.90 consisting of measurements and/or acoustic modelling of all noise sources comprising the transformer substation/transformer and reactor, assessed to determine compliance with the Sound Power Level specification of the transformer substation described in the Acoustic Assessment Report.” A separate report, “Determination of Sound Power Levels of a Transformer and a Reactor”, prepared by HGC Engineering, provides the details of the sound power level assessment. This report has been prepared in accordance with MOECC guideline NPC-233 and it details the Acoustic Audit measurements conducted at the most potentially impacted points of reception.

DESCRIPTION OF FACILITY AND SURROUNDING AREA

The equipment at the Grand Bend Wind Farm transformer station includes a transformer manufactured by Prolec and an associated reactor manufactured by ABB. The station is situated approximately 4 km southwest of the town of Zurich, Ontario, next to turbine T20 from the project. The transformer is nominally rated at 75/100/125 MVA, and the reactor is rated at 40 MVAR. The transformer utilizes cooling fans and the reactor utilizes natural cooling, without fans. The equipment operates 24 hours per day, 7 days per week. Site personnel confirmed the transformer station was operating normally during the measurement period with the wind project operating between 5 and 10 MW.

The nearest and most potentially impacted noise sensitive points of reception are non-participating residential dwellings R0827, R0776, and R0805, approximately 1005 metres to the west, 590 metres to the north and 870 metres east of the station, respectively, as depicted in Figure 1.

The area is best characterized as a Class 3 acoustic environment under MOECC guideline NPC-300.

MEASUREMENT METHOD

The transformer station was completely inaudible at the nearest points of reception and therefore, audit measurements were conducted at intermediate locations between the transformer station and the points of reception on September 22, 2016. During the audit measurements, the L_{EQ} was recorded, which is the *energy-equivalent sound level*, and represents the integrated sound exposure level of both steady and time-varying sounds over the duration of the measurement.

The sound level measurements were conducted during daytime hours with low ground level winds, using a Norsonic N-140 Precision Sound Analyser (SN 1403983). The measurements were conducted in accordance with the methods in MOECC procedural guideline NPC-103. All instrumentation was within its annual laboratory calibration period and correct calibration was field-verified using a Brüel & Kjær acoustic calibrator type 4231. Calibration certificates are attached.

SOUND LEVEL CRITERIA

The MOECC noise assessment guidelines draw a distinction between sound produced by traffic sources and that produced by industrial or commercial activities, which are classified as *stationary sources of sound*. In essence, the sound from the stationary sources is evaluated against (i.e. compared to) the typical background sound at any potentially impacted, noise-sensitive points of reception (e.g., residences). Background sound is considered to include road traffic sound and other typical sounds, but excludes the sound of the facility under assessment.

MOECC publication NPC-300 “Environmental Noise Guideline Stationary and Transportation Sources – Approval and Planning” is the relevant guideline to determine the applicable limits.

NPC-300 states that the sound level limit for a stationary source that operates during daytime and nighttime hours in a Class 3 (Rural) environment is the minimum one-hour L_{EQ} ambient (background) sound level at any potentially impacted residential point of reception or the exclusionary minimum limits of 45 dBA during daytime hours (07:00 – 19:00) and 40 dBA during nighttime hours (19:00 – 07:00) if the existing sound levels fall below the exclusionary minimums.

Based on observations and sound level measurements in the area, background sound levels may fall below the exclusionary minimum limits stipulated in NPC-300 for Class 3 Areas, during the quietest hours of the day and night. Therefore, consistent with the ENIA, the exclusionary minima of 45/40 dBA (day/night) were assumed to be the applicable sound level limits at all points of reception for the transformer station.

MEASUREMENT RESULTS & DISCUSSIONS

Table 1 below, lists the measured sound levels, as well as the estimated sound levels of the facility at the nearest points of reception. The estimated sound levels were based on a free field sound attenuation over the distance from the measurement location to the off-site residential receptors. This estimating procedure is conservative, as it does not include the effect of other typical attenuating factors such as ground and air absorption, foliage etc.

Table 1: Summary of Audit Measurements

Location	Measurement Point		Receptor Location		Assessment Criteria (D/N) [dBA]
	Dist ^A [m]	LEQ ^B [dBA]	Dist ^A [m]	LEQ ^C [dBA]	
R0776 / M1	65	45	570	26	45 / 40
R0805 / M1	65	45	860	23	45 / 40
R0827 / M2	95	43	1005	22	45 / 40

A – Distances are relative to the dominant facility noise source closest to the point of reception
 B – As measured sound level
 C – Distance adjusted sound level

A tonality penalty under MOECC guideline NPC-104 applies for sound sources which are tonal in nature. Observations and measurements at the receptors indicate the transformer station was not audible over the surrounding background sound and therefore a tonal penalty has not been applied to the measurements above. Because the transformer was not audible at the surrounding receptors, the measured sound levels represent an upper bounding estimate of the sound level of the transformer station.

The sound levels of the transformer station at the closest non-participating receptor were determined to be less than 30 dBA, which is within the most stringent sound level criteria of NPC-300.

CONCLUSIONS

The results of the Acoustic Audit measurements demonstrate that the sound emissions of the Grand Bend Wind Farm Transformer Station comply with the applicable sound level limits established in accordance with guideline NPC-300 during all hours of the day and night at all noise-sensitive points of reception.

Trusting this information is satisfactory, if you have any questions, please do not hesitate to call.

Yours truly,

Howe Gastmeier & Chapnik Limited


 Ian Bonsma, P.Eng.



Reviewed by


 Corey Kinart, MBA, PEng



Figure 1: Sound Level Measurement Locations
Grand Bend Wind Farm Transformer Station

CERTIFICATE of CALIBRATION

Make : Norsonic

Reference # : 142232

Model : NOR140

Customer : HGC Engineering
Mississauga, ON

Descr. : Sound Level Meter Type 1

Serial # : 1403983

P. Order : Sean Richardson

Asset # : N140-4

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

AE
4 Jan 2016

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 : Dec 24, 2015

By : *As Per Goodewan*
T. Beilin

Cal. Due : Dec 24, 2016

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

Standards used : J-216 J-303 J-512

Navair Technologies

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