15 April 2013

40-1952 SLR Response to Flynt 20130412.docx

Union Fenosa Wind Pty Ltd
Suite 403, 68 York St
Sydney NSW 2000

Attention: Shaq Mohajerani

Dear Shaq

Crookwell 3 Wind Farm
Response to Flynt

SLR Consulting Australia Pty Ltd (SLR Consulting) has reviewed the Flynt letter in relation the Crookwell 3 Noise Impact Assessment (NIA). We have prepared the following is response.

Wayne and Rita Flynt – Windellee – 23 January 2013

Issue 1
The letter refers to the noise limit being *"35 db A + 5 % background noise"* and states that this level will not be achievable *"on any tower within 1.25 kms"* and that using the NSW guidelines a tower at 860 m would result in a "*noise limit of 42 dBA".*

Response 1

There appears to be some confusion about the difference between a noise limit (based on measured background noise levels) and a predicted noise level (based on computer model predictions).

The noise limit for Windellee (based on background noise measurements monitored at nearby Valdarmon Hill) is 46.3 dBA, at the reference wind speed of 8 m/s @10 m AGL[1] (= 10.9 m/s @ 80m AGL).

The predicted worst case noise level for the Windellee residence (referred to as H65 in the Crookwell 3 Wind Farm NIA) from all 3 wind farms operating continuously in un-mitigated mode is between 38.5 dBA and 41.1 dBA (depending on the WTG model chosen) , at the reference wind speed of 8 m/s @10 m AGL. All turbine models are predicted to comply at this wind speed, however, some marginal exceedances are predicted at lower wind speeds

The predicted worst case noise level for the Windellee residence whilst eleven (11) turbines on Crookwell 2 wind farm and four (4) turbines Crookwell 3 wind farm are operated in mitigated 'low noise' operation and a single turbine on Crookwell 3 is turned off is 37 dBA, which easily complies with the limit. Furthermore, the mitigated 'low noise' operation complies for all wind speeds. This assessment is presented in graphically in **Appendix B5** of the NIA.

[1] AGL = Above Ground Level

It should be noted that the noise predictions allow for downwind noise propagation enhancement from all turbines at once. This is likely to be an overly conservative prediction for the Windellee residence as the nearest turbines from Crookwell 2 wind farm are located to the north-west, west and south-west of the residence and as the nearest turbines from Crookwell 3 wind farm are located to the north-east and east of the residence.

Issue 2

The resident has some concerns over temperature inversions in the area, which is referred to in the letter as *"cold air inversion"* and the frequency of cloudy conditions in winter. The resident gives examples of audible noise sources which are especially audible under such conditions e.g. distant traffic and lawn mower.

Response 2

The phenomenon of enhanced noise propagation from temperature inversion is well known to acousticians, and our noise model uses the algorithms of the international standard ISO 9613 which assumes either a mild temperature inversion or favourably propagating wind .

The accuracy of the various noise prediction standards, has been recently examined in a correlation study[2]. It was found that ISO 9613 using a 'hard ground' assumption was the generally most conservative calculation standard for wind farm noise propagation predictions and correlated very well for 'worst case' propagation and terrain and therefore is preferred over other prediction standards.

There is no requirement under SA EPA assessment methodology to determine the number of days that temperature inversions occur, however, we note that a the most common form of temperature inversion typically requires clear night sky (i.e. no clouds) in order to form as cloud cover provides insulation which prevents rapid radiative cooling of the earth that leads to colder ground level temperatures.

Examples of particular sources being audible during temperature inversions at various distances such as the distant traffic or the lawnmower mentioned in the letter are not necessarily indicative for highly elevated noise sources such as wind turbines. Most radiative temperature inversions prevail only in the lower part of the atmosphere, where the negative temperature lapse rate is highest ie where the greatest cooling occurs close to ground level. Highly elevated noise sources that are above the temperature inversion layer or in a region that has a more uniform temperature profile will not experience the same degree of propagation enhancement as noise sources located at ground level. It should also be noted that ground based noise sources are often shielded by topography and when the effect of shielding is negated by temperature inversions their subjective change in noise level is more pronounced. Elevated wind turbines are not likely to be shielded by topography and hence unlikely to experience the same level of subjective change in noise level due to a temperature inversion.

It should be noted that Noise Impact Assessments do not evaluate the likelihood of audibility of a noise source, rather the noise limits have been determined in accordance with the SA EPA Guideline and represent an objective cut-off beyond which there may be an unreasonable impact on acoustic amenity. In reality any noise assessment standard sets a noise limit which is a balance between maintaining a reasonable level of amenity and allowing development to occur.

[2] *Comparison of predicted and measured wind farm noise levels and implications for assessments of new wind farms*, Tom Evans and Jonathan Cooper, Acoustics Australia Vol. 40 No. 1

Issue 3
The resident states that in the US under heavy winds at night noise can exceed 52 dB.

Response 3

It should be noted that noise limits for wind farms in the US are typically higher than those allowed in Australia and as a result the minimum set-back distances between wind turbines and houses are generally much closer. Sustained wind farm noise exceeding 52 dBA would not comply with the appropriate limits in Australia.

Issue 4
The resident has some concerns in relation to the character of noise produced by wind turbines as having a mechanical rather than natural sound with distinct swoosh, swoosh, swoosh modulation with its own rhythm.

Response 4

The dominant source of noise produced by modern wind turbines is aerodynamic and broadband in spectrum. Gearbox, generator and other mechanical sources are generally inaudible within a short distance of the base of the tower. The SA EPA Guideline has developed the 35 dBA or background + 5 dBA criteria with the fundamental characteristics of wind farms taken into account, including aerodynamic noise from passing blades, swish etc. Where excessive levels of a special audible characteristic (e.g. tonality, modulation, low frequency etc.) are identified from a wind farm then the noise level shall be penailsed by a further 5 dBA to account for the more subjectively annoying character.

Issue 5
The resident has raised some findings published by van den Berg, being that the wind speed at hub height at "*night is up to 2.6 times LOUDER than expected causing up to 15 dB higher wind sound levels"*.

Response 5

The van den Berg paper *'The sounds of high winds'* presents some measurements and findings of the Rhede Wind Farm on the German-Dutch border. The study showed that during certain night time conditions very stable atmospheric conditions prevailed and higher than expected noise levels from the wind farm were produced. This was due to the higher wind shear experienced under such conditions and that the common practice of relating all measurements to a wind speed derived at 10 metres AGL meant hub height wind speeds were under-estimated for these conditions e.g. the turbine was operating in higher wind speeds than what had been assumed for any given 10 metre wind speed and therefore producing greater noise than what had been predicted using the 10 metre wind speed.

The Noise Impact Assessment for Crookwell 3 Wind Farm has addressed this concern by correlating all baseline noise data and completing all wind farm noise predictions to a hub height wind speed rather than 10 metres.

High wind shear and temperature inversions, resulting from atmospheric stability have been addressed in the NIA report, in **Section 10.3** and **Section 10.4.**

Issue 6
The resident has raised some concerns with regards to the effect of turbulence and that such conditions "*acts as a carrier for noise".*

Response 6

Turbulence does not enhance noise propagation. Turbulence in the atmosphere reduces atmospheric stability and therefore may reduce enhanced noise propagation conditions.

Issue 7
The resident states that "an upper limit of 50 dBA is not an acceptable noise limit in anyone's house".

Response 7

It is not clear where this value has come from. The external noise limit defined by the SA EPA Guideline is significantly lower than this level. Properties with Noise Agreements in place would still need to comply with World Health Organisation limits, the minimum external criteria being 45 dBA, which equates to an internal criteria (inside a habitable room) of 30 dBA.

If you require any further information about our analysis, please feel free to contact us at any time.

Yours sincerely

GUSTAF REUTERSWARD
MELBOURNE OFFICE MANAGER