BLACK SPRINGS WIND FARM

INDEPENDENT REVIEW OF NOISE ASSESSMENT

ACOUSTICS AND AIR

REPORT NO. 06290-IP
VERSION C

WILKINSON MURRAY

BLACK SPRINGS WIND FARM

INDEPENDENT REVIEW OF NOISE ASSESSMENT

REPORT NO. 06290-IP
VERSION A

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PREPARED FOR

DEPARTMENT OF PLANNING
GPO BOX 39
SYDNEY NSW 2001

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1 INTRODUCTION

Wilkinson Murray Pty Ltd has been commissioned by the Department of Planning (DoP) to conduct an independent review of the noise impact assessment for the proposed Black Springs Wind Farm Project. The Terms of Reference for the review are presented in Appendix B.

The review of the noise impacts of the project is based on the following information:

- *Environmental Assessment for Black Springs Wiind Farm* (Harper Somers O'Sullivan, November 2006);
- *Black Springs Wind Farm – Noise Study* (Energreen Wind, July 2007);
- *Responses to Public Submissions for Black Springs Wind Farm* (Harper Somers O'Sullivan, June 2007);
- *Responses to DoP comments regarding the Public Submission Report and Responses to the Department Report for Black Springs Wind Farm* (Harper Somers O'Sullivan, August 2007);
- *Wind Farm Environmental Noise Guidelines, South Australian Environment Protection Authority, February 2003*
- *Letter from Black Springs Community Landscape Guardians Inc to Oberon Council, 25 November 2007 (Appendix C);*
- *Letter from Black Springs Community Landscape Guardians Inc to John Wassermann and Peter Haack, 27 November 2007 (Appendix D); and*
- *Suzlon S88 2.1 MW Sound Power Levels* (Suzlon 2007, October 2007).

With regard to policies and guidelines, NSW Government has adopted the South Australian Wind Farm Environmental Noise Guideline (referred as the SA Guideline) which will be used as the major reference document for this review.

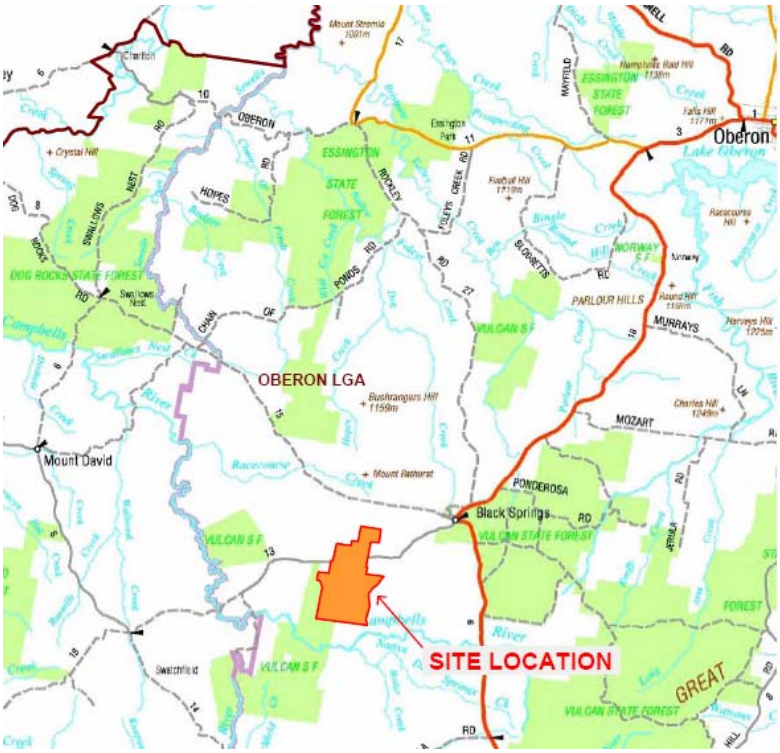
2 THE PROPOSAL

The proposal is classified as a Major Project under State Environmental Planning Policy (Major Projects) 2005 and the Minister of Planning is the approval authority.

The proponent, Wind Corporation Australia Limited, lodged the Major Project Application MP 06_0062 with the Department of Planning on 28 August 2006.

Wind Corporation Australia Limited is requesting approval to construct and operate a wind farm at Black Springs. The proposed Black Springs wind farm is located approximately three kilometres south west of Black Springs, 25 kilometres south west of Oberon. Figure 2-1 shows the location of the proposed Black Spring Wind Farm.

Figure 2-1 Location of the Proposed Black Spring Wind Farm



The proponent originally proposed to:

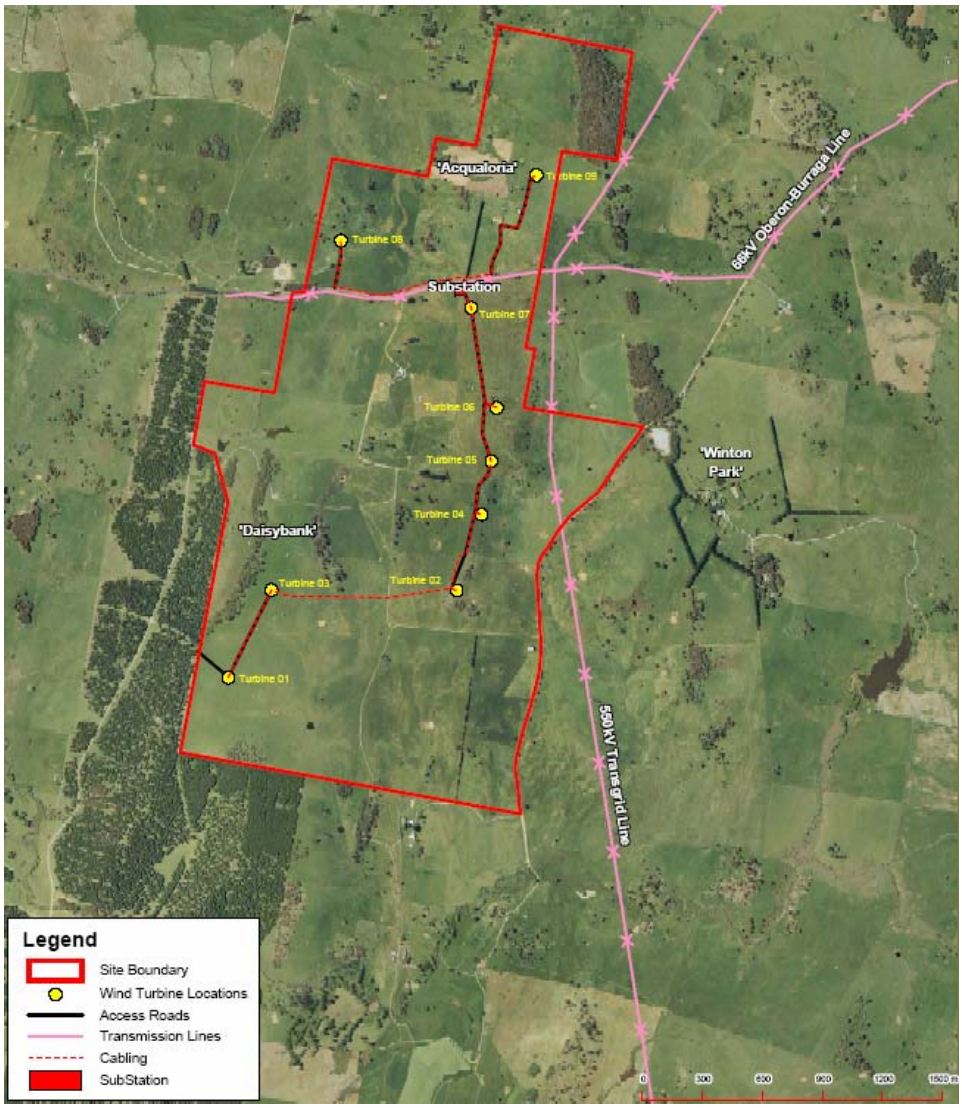
- Construct and operate nine wind turbines each with a hub height of 80m.
- Construct a network of unsealed site tracks to access each turbine;
- Install a transformer unit next to each turbine;
- Construct and operate an electrical substation and control building; and
- Construct and operate a network of underground electrical cables, connecting each turbine to the electrical substation.

The proposal is based on the SUZLON S88/2.1 MW turbine or equivalent turbine generators with a hub height of 80m. The rotor has three blades on the vertical axis. The diameter of the blades is 88m and covers a swept area of 6082 m². The highest blade tip height would be 124m AGL.

The full operating output capacity of the turbines is reached with wind speeds greater than 12-13m/s. Each of the turbines has a generating capacity of 2.1 megawatts (MW). Therefore, the wind farm has a total generating capacity of 18.9 MW and an annual generation of approximately 47,000,000 kWh. The turbines will be connected through a 33kV underground cable network to a central substation within the wind farm area. The substation will increase the output voltage to be suitable for connection into the Country Energy 66kV transmission grid, which passes directly adjacent to the proposed substation location, crossing the centre of the wind farm.

Figure 2-2 is a Site Plan illustrating the layout of the wind farm turbines, cabling, substation, plus the location of the 500kva Transgrid power transmission lines, transmission line tower positions and an aerial photograph of the site.

Figure 2-2 Site Plan Showing the Layout of the Wind Farm Turbines



The wind farm will be built along ridgelines that stretch approximately 3 kilometers north to south across two privately owned rural land holdings. These privately owned rural land holdings are described as “contractually involved in the project and have signed noise acceptance agreements with the developer accepting a maximum noise level generated by the wind farm of 50 dBA” (a concept discussed further below).

The associated properties are known locally as:

- Daisybank (28 (Main House) and 27(Shed)); and
- Acqualorea (24).

Additionally a similar contractual agreement has been signed with Forests NSW accepting a maximum noise level generated by the wind farm of 50 dBA at location 25 (Miller Residence).

Wind turbines are proposed to be situated at various locations on these associated properties. The associated properties are largely surrounded by other rural properties. The noise impact assessment has identified 14 buildings located within about 2 km of a turbine with 4 of these dwellings being located on associated properties. Table 2-1 and Figure 2-3 show the locations of the 14 buildings presented in the noise assessment. Figure 2-3 also shows residential dwellings located within 3km of the proposed wind farm, there appears to be an additional 25 to 30 dwelling.

Oberon Council has also provided recent sub-division approvals within the area of the proposed wind farm. There are four approved sub divisions within the area, namely:

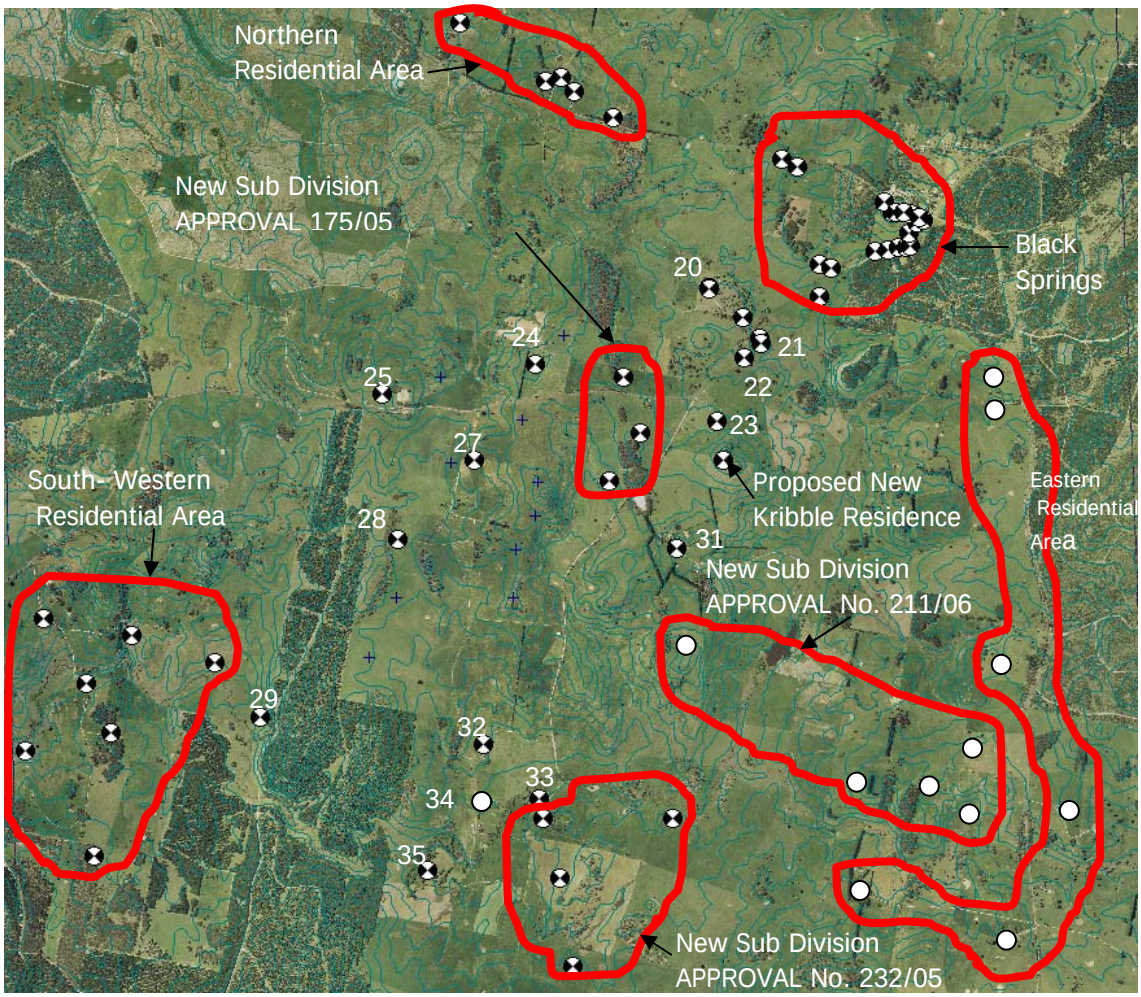
- DA 174/5;
- DA 175/05;
- DA 232.05; and
- DA 211/06.

Refer to Appendix E for the Sub division plans. Oberon Council has noted that Winton Park has recently changed ownership and it would be unlikely that DA 211/06 would not proceed as the new owner is interested in agricultural activities.

Table 2-1 Closest Residential Receivers Identified in the Noise Assessment.

ID		Closest Turbine	Approx Distance from closest Turbine	Easting (m)	Northing (m)	Relevant Receivers
20	House Near the Church	9	1,228	751880	6250600	Yes
21	House	9	1,561	752275	6250190	Yes
22	House	9	1,447	752151	6250042	Yes
23	House	9	1,402	751941	6249533	Yes
24	House Acqualorea	9	316	750492	6249986	No
25	House Miller Residence	8	484	749270	6249750	No
27	Daisybank Shed	7	504	750004	6249216	No
28	Daisybank Main House	3	467	749393	6248591	No
29	House South West	1	1,072	748320	6247030	Yes
31	House Winton Park	5	1,156	751614	6248514	Yes
32	House Kringis	1	1,162	750080	6246960	Yes
33	House Baxter Caretaker	2	1,615	750520	6246520	Yes
34	Baxter Sheds	1	1,533	750120	6246480	Yes
35	House Main Baxter Residence	1	1,793	749630	6245950	Yes

Figure 2-3 Site Plan showing the Closest Residential Receivers



3 COMMUNITY CONCERNS

A variety of noise issues were raised by the community through the EA process and were re-iterated to me during my meeting with Oberon Councillors and the Black Springs Community Landscape Guardians Inc. These issues can be summarised to be concerns with:

- Background noise monitoring, concerns with regard to location of measurement sites and duration of monitoring (seasonal effects). It should be noted that background noise monitoring is important, particularly for wind farm noise assessments, as it provides the base line for deriving noise criteria according to the SA Guideline;
- Validity of the noise prediction, temperature inversion conditions ; and
- Acceptability of potential noise impacts.

These issues are consistent with the terms of reference for this review and will be dealt with separately in the next chapter.

4 OPERATIONAL NOISE REVIEW

4.1 Background Noise Monitoring

In order to assess the potential impacts from the wind farm it is essential to know the relationship between background noise levels at the residences and the wind speed at the proposed wind farm.

The SA Guideline requires that background noise measurements be undertaken at locations that are relevant for assessing the impact of the wind farm noise on nearby premises. Additionally the Director General's Requirements requested that consideration be given to the effect of temperature inversions and seasonal variations in background noise levels.

This Guideline defines relevant receiver locations as premises:

- on which someone resides;
- at which the predicted noise level is likely to exceed the relevant base noise level for wind speeds of 10m/s or less; and
- that are representative of the worst case situation when considering the range of premises.

Background noise levels have been measured at three locations, namely:

- Baxter Residence (Caretaker House);
- House 24; and
- Miller Residence.

As is common in noise assessments the remaining receiver locations have been divided up to be represented by the noise monitoring locations. Approximately one month of monitoring was conducted at each site between 11 February 2005 and 11 March 2005.

4.1.1 Background Noise Level Measurement Locations

The location of the monitoring sites were spread around the wind farm site with the Baxter location being used to represent the southern end of the project, House 24 (which in fact was measured in a paddock on Swatchfield Road) representing houses east of the project and the Miller Residence representing residences north of the project and along Oberon-Burraga Road.

The locations of the monitoring would not appear to be ideal and may have been selected based on easy access arrangements. From a technical perspective the specific locations would appear reasonable, however I would have recommended identifying the nearest residences which were not part of the proposed wind farm site and undertaken measurements at those locations and also considered groups of residences which represented the likely most affected receiver based on the combination of proximity to the wind farm and lowest background noise levels. Additional noise monitoring at the Kringis residence (32) as it is the most affected residence with regard to noise and appears from inspection to have less vegetation (therefore potentially less background noise) and a measurement at location 29 (south west) would have supported the noise assessment well.

4.1.2 **Review of Background Noise Level Measurement Results**

The SA Guidelines rely on measurement of background noise levels at representative receivers in order to set appropriate noise criteria. This presumes the background noise is directly related to wind speed. At low speeds or at low background noise levels (<30dBA) the SA Guideline adopt a criterion of 35dBA. This criterion would apply even if background noise levels are as low as 20-25dBA which can be experienced in rural areas, particularly at night time. As wind speeds increase, in most situations, surrounding background noise levels also increase and the criteria are based on a best fit polynomial through the data points +5dB.

This means that for a noise level which meets the criteria, at least 50% of the time could be more than background + 5dB and 50% of the time less than background + 5dB. A review of the background data indicates that the scatter of points around the best fit polynomial at almost all wind speeds is + 40dBA and -10dBA. Hence, complying with the background + 5dB criterion could for some 10 minute intervals mean noise levels as much as background + 15dB. At night time this could be highly annoying, depending on total duration. Such variations could also occur at different times of the year, for example background noise levels in winter can often be affected by temperature inversion conditions which results in very still conditions at residential receiver locations and result in low background noise levels.

The proponent should understand the likelihood of this occurring and the percentage of time it may occur, before determining whether the current procedure in the SA Guidelines are most appropriate for assessing the potential noise impacts at the site. The background noise data provided by the proponents shows quiet a number of night time periods where night time levels are between 30 -25dBA.

The SA guideline also requires collection of background noise level data at 10 minute intervals for a minimum of 2000 data points at representative receivers surrounding the proposed wind farm. All data points below the cut-in wind speed of the proposed turbines and any adversely affected data (rain, external extraneous noise, etc) should be excluded. The noise monitoring data would appear to comply with these requirements apart from the exclusion of extraneous noise. Figures 5.2, 5.3 and 5.4 of the noise assessment show a large variation in noise level at all locations. The proponent has suggested that this could be due to birds. It is my opinion that these levels should have been excluded from the data set as this would not occur for all seasons.

As required by the SA guideline, noise data below wind turbine cut off velocity does not appears to be included in the calculation of the polynomial equation. The correlation coefficients for the regression lines appear to be quiet low which would suggest low correlation between wind speeds and background noise levels. This could be a function of other extraneous noise being present for example birds, insect noise, etc.

Table 4-1 presents the proponents calculated background noise level at 6m/s (10m AGL) and 10m/s (10m AGL) calculated from the polynomial. The measured data appears reasonably consist between the measurement sites.

Table 4-1 Proponent Analysed Background Noise Levels versus Wind Speed

Location	10m Wind Speed (m/s)	
	6	10
	Noise Level L_{A90} (dBA)	
Baxter	34	42
House 23	34	43
Miller	35	45

The DGR requested consideration of seasonal variations in background noise levels. In response, the proponent has stated "that seasonal variation of background noise would be bird life which is highest during spring periods and as the measurement was during the peak summer period, the measured background noise is deemed representative". I consider that this argument to be less than convincing as it is my experience that background noise levels, particularly measured in summer, can have extraneous noise such as insect that can elevate background noise levels and that background noise levels measured in autumn and winter can be lower as the cool air provides for less turbulent weather conditions, lower winds and therefore lower background noise levels. If there is no certainty about variation in background noise levels at different times of year then background noise levels should be collected at different times of the year to represent the various weather conditions. The simple assumption that in a rural area background noise level through for a whole year is only a function of wind speed is not sufficient. I consider background noise levels need to be broken down by season and by time of day, i.e. night time or daytime that represent the occurrence of particular weather patterns and conditions. Background noise levels for other seasons have <u>not</u> been conducted for this project.

I have re-analysed the background noise data and split the data between day (7.00am to 10.00pm) and night (10.00pm to 7.00am) the wind speed verses background noise levels graphs are presented in Appendix F. Table 4-2 presents the my calculated background noise level at 6m/s (10m AGL) and 10m/s (10m AGL) calculated from new polynomials.

Table 4-2 Re-Analysed Background Noise Levels versus Wind Speed

Location	Noise Level L_{A90} (dBA)			
	Day		Night	
	10m Wind Speed (m/s)			
	6	10	6	10
Baxter	36	42	30	42
House 23	36	43	32	43
Miller	36	45	33	42

The analysed data from the proponent for a 24 hour period and my data are comparable for daytime with my data being slightly higher since it excludes low background levels at night. There is a substantial difference between daytime and night background noise levels, which is concern to me as the use of the 24 hour data could underestimate potential night time noise impacts.

From my experience from other wind farm noise assessments, background noise in rural environments are generally less than 32dBA at wind speeds of less than 6m/s (10m AGL) and approximately 40-43dBA between for wind speeds up to 10m/s (10m AGL). It should be noted that the daytime noise levels are substantially higher than what I would expect in such a rural environment.

Given that background noise levels were not measured at the specific closest residences likely to be affected by the proposed wind farm, the proponent has not (in my opinion) adequately considered seasonal variations in background noise levels and that my analysis of the background noise levels has indicted that night time noise levels are approximately 5dB lower at wind speeds less than 6m/s (10m AGL), then I consider the adoption of the lowest measured night background noise levels measured at the three residences should be used as a precautionary approach to apply at all residences surrounding the wind farm to gauge impacts.

4.2 The Contractually Involved Residences

A wind farm developer can not absolve themselves of their responsibility for noise under of the POEO Act as a result of a formal agreement. However, the existence of an agreement may affect the consideration by the appropriate regulatory body of whether the level of noise is offensive. The SA guideline recommends the following process:

- That a formal agreement is document between the parties;
- The agreement clearly outlines to the landowner the expected impact of the noise from the wind farm and it's effect upon the landowners amenity; and
- The likely impact of exposure will not result in adverse health impacts (eg. The level does not result in sleep disturbance).

Typically for wind farms the noise agreements outline World Health Organisation (WHO) noise guidelines, namely:

- Outdoor living are – Moderate annoyance, daytime & evening – 50 $L_{Aeq\ (16hours)}$; and
- Outside bedroom – Sleep disturbance – windows open, night time - 45 $L_{Aeq\ (8hours)}$.

The contractually involved residences have signed noise acceptance agreements with the proponent accepting a maximum noise level generated by the wind farm of 50dBA. This level is 5dB higher than I would recommend, however, the risk associated with relying on the agreements remain with the proponent. This is because the interpretation of offensive noise under the POEO Act would be required in any further assessment of the noise impact of wind farm noise initiated by a complaint from the landowner (or future landowner).

4.3 Noise Predictions

4.3.1 Wind Turbine Sound Power Levels

The noise assessment uses manufactures data from the Suzlon S88, 2.1MW wind turbine for its source noise data. When quoting performance data in relation to wind turbine operation, all wind speeds relate to a point 10m above ground level. The sound power levels used for the noise assessment are presented in Table 4-3.

Table 4-3 Sound Power Levels for Suzlon S88 2.1MW wind turbine used for the noise assessment.

Wind speed (m/s)	Sound Power Level (dBA)
3	103.4
4	104.1
5	104.7
6	105.2
7	105.6
8	105.9
9	106.1
10	106.2

Suzlon have recently conducted noise tests that have indicated that the new guaranteed emissions are substantial lower than previously expected. New manufactures noise data is presented in Appendix E and summarised in Table 4-4.

Table 4-4 New Sound Power Levels for Suzlon S88 2.1 MW wind turbine.

Wind speed (m/s)	Sound Power Level (dBA)
4.2	100.4
5.6	101.5
7.0	102.4
8.4	103.0
9.7	103.7
11.1	104.3
12.5	103.6

A comparison between the new and the old data indicates a reduction of approximately 3dB to 4dB at relevant wind speeds. This reduction would translate to a 3dB to 4dB reduction in the predicted noise levels presented in the noise assessment. It should be noted that these differences could be greater as the new sound power level data is valid for a wind shear of 0.16 as the previous data was corrected to a standardised 0.05 wind shear as required by IEC 61400-11.

4.3.2 **The Van Den Berg Effect**

The Van Den Berg effect can be summarised as a scenario where the hub sits in the mixing layer where wind speeds are high enough for the turbine to operate at or close to maximum noise levels, whereas residences nearby, are subjected to very low background noise levels, possibly much less than 30dBA. The significant emergence of turbine noise above the background could potentially cause annoyance. This combination of location, topography and meteorological conditions is most common under temperature inversion conditions which would occur most often during the more sensitive night time period. Fundamentally it relates to the wind shear profile at the turbine site and how stable this wind shear remains at different times.

The noise assessment has conducted an assessment of wind shear. A daily wind shear profile as roughness length was calculated from the wind monitoring conducted at 10 metres and at 50 metres (Table 4-1 of the noise assessment). The surface roughness varied at night from approximately 0.1 to 0.00001 during the day. For a range of surface roughness hub hight wind speeds (Table 4-2 of the noise assessment) were calculated from the 10m wind speeds and then turbine sound emissions (Table 4-3 of the noise assessment) at various roughness lengths were calculated.

It was concluded that the difference in noise emissions between the lowest roughness length and the highest roughness length was 0.3dB at critical wind speeds and therefore was not considered a significant effect in this region. I consider this assessment of the “Van den Berg effect” and the conclusions provided in the noise assessment to be appropriate.

4.3.3 **Noise Prediction Model**

Noise predictions were conducted by the “Wind Farmer” software package which uses ISO 9613 noise prediction algorithms. It is stated in the noise assessment that the ISO9613 algorithms are typically more conservative than other models. Additionally the noise assessment states that it has used the simpler ISO9613 method that uses the overall dB(A) sound power level which is aditionally more conservative.

It should be noted that the ISO9613 algorithm typically uses octave band frequency source data to calculate resultant environmental noise levels. It is clear that calculations based on octave band frequency data would give greater accuracy.

It would appear that ISO9613 is a widely used prediction model internationally without being commonly used in Australia. The model assumes a 1.5m/s down wind or moderate temperature inversion. The accuracy of the model was reviewed by a UK research project contract number ETSU W13-00385-REP 200 “Critical appraisal of wind farm noise propagation”. The review concluded that barrier screening should be limited to no more than 3dB and that 3dB should get added to the calculated sound pressure level if the ground falls away significantly between source and receiver, such that the mean propagation height is at least 1.5 times that over flat ground. This accounts for a reduction in ground attenuation due to the increase height above ground of the source to receiver line.

I have reviewed the noise predictions in the noise assessment using the ISO9613 algorithm and consider them to be marginally conservative as suggested in the noise assessment.

4.3.4 **Approved Sub-Division or Further Development of Existing Land Holdings**

Oberon Council and the Black Springs Community Landscape Guardians Inc have identified a number of subdivisions recently approved around the proposed wind farm. There are four approved sub divisions within the area, namely:

- DA 174/5;
- DA 175/05;
- DA 232.05; and
- DA 211/06.

While I understand the proponent has identified the residences surrounding the development which currently exist, they should have identified approved subdivisions in the noise assessment. Particularly DA175/05 which is closer to the proposed wind farm than any of the existing non-contracted identified residences. It is clear that at any residential area closer to the wind turbines than those identified in the EIS, noise levels would be higher. Potential noise impacts at these approved subdivisions have not been presented in the noise assessment. Noise impacts for DA175/05 are likely to exceed SA Guideline noise criteria.

4.3.5 **Acceptability of the Noise Impacts**

Although each of the aspects discussed above may not be significant in isolation the combination of the various issues could be quite significant and should be reviewed holistically. To be able to provide some comment on the acceptability of the noise impacts I have therefore had to conducted noise predictions for the proposed wind farm myself using the CADNA “A” noise prediction software package using the ISO9613 noise prediction algorithms (modified) and compared the predictions to noise criteria developed from the SA guideline using the lowest measured night background noise levels measured at the three residences.

The SA Guideline noise criteria rely on measurement of background noise levels at representative receivers in order to set appropriate criteria. This presumes the background noise is directly related to wind speed. At low speeds or at low background noise levels (<30dBA) the Guidelines adopt a criterion of 35dBA at higher winds it adopts a criterion of +5dBA above the best fit polynomial at each integer wind speed from the cut-in to rated power. Table 4-5 presents my precautionary noise criteria based on the lowest measured night background noise levels measured at the three residences.

Table 4-5 Precautionary Noise Criteria Based on the Lowest Measured Night Background Noise Levels

Wind speed (m/s)	Background Noise Level, L_{A90}	Criteria $L_{Aeq, 10minutes}$
3	25	35
4	26	35
5	27	35
6	30	35
7	32	37
8	35	40
9	37	43
10	42	47
11	-	47*
12	-	47*

* Based on 10m/s wind speed data as no data exists.

With regard to the noise predictions resented in Section 7 of the noise assessment it is stated that there are minor exceedance of 2.3dB at residence 32 and 1.6dB exceedance at residence 31. The Noise Study does investigate any noise mitigation to reduce noise levels. Residences 24 and 27 have quiet high predicted noise levels, in the order of 49.9 and 48.6dBA, respectively. These residences are contractually involved residences.

Table 4-6 presents predicted noise levels from my modelling of the proposed wind farm compared with my precautionary noise criteria based on the lowest measured night background noise levels.

Overall the predicted noise levels from my modelling are 4 to 6dB lower than those predicted in the noise assessment. This was the result of using the new wind turbine sound power levels and conducting the calculations using the more accurate octave band calculations. However, when comparing the new predicted noise levels with my precautionary noise criteria, a noise criteria exceedance of 1.4dB at residence 32 is predicted. At the sub-division DA175/5 significant exceedances of up to 7dB are predicted.

There would seem to be three ways of mitigating the noise exceedance at residence 32, namely:

- removing wind turbine 1 from the project;
- moving wind turbine 1 from its current position and moving it to around Daisybank Shed (27); or
- using sector manager and switching wind turbine 1 off at wind speeds less than 6m/s during the night.

Table 4-7 presents predicted noise levels with wind turbine 1 being relocated to the Daisybank shed area. It should be noted that all the predicted noise levels comply with the night time pre-cautionary noise criteria.

It is recommended that the proposed noise mitigation options be discussed with the proponent and conditioned if the project were to be Approved.

Table 4-6 New Predicted Noise levels at Receivers

ID	Predicted Sound Pressure Level at Residence (L_{aeq}) at Wind Speed							
	10m Wind Speed							
	3m/s	4m/s	5m/s	6m/s	7m/s	8m/s	9m/s	10m/s
20	30.6	31.7	32.6	33.2	33.9	34.5	33.8	33.1
Church	30	31.1	32	32.6	33.3	33.9	33.2	32.5
21	26.6	27.7	28.6	29.2	29.9	30.5	29.8	29.1
22	30.5	31.6	32.5	33.1	33.8	34.4	33.7	33
23	32.2	33.3	34.2	34.8	35.5	36.1	35.4	34.7
24 Acqualoria	**43.3**	**44.4**	**45.3**	**45.9**	**46.6**	**47.2**	**46.5**	45.8
25 Miller House	**38.3**	**39.4**	**40.3**	**40.9**	**41.6**	**42.2**	**41.5**	40.8
27 Daisybank Shed	**41.9**	**43**	**43.9**	**44.5**	**45.2**	**45.8**	**45.1**	44.4
28 Daisybank House	**40**	**41.1**	**42**	**42.6**	**43.3**	**43.9**	**43.2**	42.5
29	27	28.1	29	29.6	30.3	30.9	30.2	29.5
31 Winton Park	32.4	33.5	34.4	35.0	35.7	36.3	35.6	34.9
32 Kringis	33.8	34.9	**35.8**	**36.4**	37.0	37.7	37	36.3
33 Baxter Caretaker House	30.5	31.6	32.5	33.1	33.8	34.4	33.7	33
35 Baxter Main House	28.5	29.6	30.5	31.1	31.8	32.4	31.7	31
Black Springs	21-26	22-24	23-28	24-29	24-29	25-30	24-29	24-29
Northern Residential Area	21-25	22-26	23-27	24-28	24-28	25-29	24-28	24-28
Eastern Residential Area	23	24	25	26	26	27	26	26
South Western Residential Area	23-30	22-31	25-32	26-33	26-33	27-34	26--33	26-33
Proposed Kribble Residence	32.3	33.4	34.3	34.9	35.6	36.2	35.5	34.8
DA 175/05 1	**36.4**	**37.5**	**38.4**	**39**	**39.7**	**40.3**	39.6	38.9
DA 175/05 2	**38**	**39.1**	**40**	**40.6**	**41.3**	**41.9**	41.2	40.5
DA 175/05 3	**39.7**	**40.8**	**41.7**	**42.3**	**43**	**43.6**	42.9	42.2
DA 232/05 / 1	29.8	30.9	31.8	32.4	33.1	33.7	33	32.3
DA 232/05 / 2	27.5	28.6	29.5	30.1	30.8	31.4	30.7	30
DA 232/05/ 3	25	26.1	27	27.6	28.3	28.9	28.2	27.5
DA 232/05 /4	21.6	22.7	23.6	24.2	24.9	25.5	24.8	24.1
DA 232/05 / 5	27.6	28.7	29.6	30.2	30.9	31.5	30.8	30.1
DA 211/06 - 1	32	33.1	34	34.6	35.3	35.9	35.2	34.5
DA 211/06 - 2	24.8	25.9	26.8	27.4	28.1	28.7	28	27.3
DA 211/06 - 3	21.5	22.6	23.5	24.1	24.8	25.4	24.7	24
DA 211/06 - 4	23.8	24.9	25.8	26.4	27.1	27.7	27	26.3
DA 211/06 - 5	18.8	19.9	20.8	21.4	22.1	22.7	22	21.3
DA 174/05 1	23.8	24.9	25.8	26.4	27.1	27.7	27	26.3
Criteria	**35**	**35**	**35**	**35**	**37**	**40**	**43**	**47**

Table 4-7 New Predicted Noise Levels at Receivers with Wind Turbine 1 being Relocated near the Daisybank Shed.

ID	Predicted Sound Pressure Level at Residence (L_{aeq}) at Wind Speed 10m Wind Speed							
	3m/s	4m/s	5m/s	6m/s	7m/s	8m/s	9m/s	10m/s
20	30.5	31.6	32.5	33.1	33.8	34.4	33.7	33.7
Church	29.9	31	31.9	32.5	33.2	33.8	33.1	33.1
21	26.5	27.6	28.5	29.1	29.8	30.4	29.7	29.7
22	30.4	31.5	32.4	33	33.7	34.3	33.6	33.6
23	32.1	33.2	34.1	34.7	35.4	36	35.3	35.3
24 Acqualoria	**43.3**	**44.4**	**45.3**	**45.9**	**46.6**	**47.2**	**46.5**	46.5
25 Miller House	**38.9**	**40**	**40.9**	**41.5**	**42.2**	**42.8**	**42.1**	42.1
27 Daisybank Shed	**47**	**48.1**	**49**	**49.6**	**50.3**	**50.9**	**50.2**	**50.2**
28 Daisybank House	**40.2**	**41.3**	**42.2**	**42.8**	**43.5**	**44.1**	**43.4**	43.4
29	25.2	26.3	27.2	27.8	28.5	29.1	28.4	28.4
31 Winton Park	32.3	33.4	34.3	35.0	35.6	36.2	35.5	35.5
32 Kringis	32.5	33.6	34.5	35.0	35.8	36.4	35.7	35.7
33 Baxter Caretaker House	29.7	30.8	31.7	32.3	33	33.6	32.9	32.9
35 Baxter Main House	27.2	28.3	29.2	29.8	30.5	31.1	30.4	30.4
Black Springs	20-24	21-25	23-27	24-28	24-28	25-29	24-28	24-28
Northern Residential Area	21-24	21-25	23-26	24-27	24-27	25-28	24-27	24-27
Eastern Residential Area	23.1	24.2	25.1	25.7	26.4	27	26.3	26.3
South Western Residential Area	22-28	23-29	24-30	25-31	25-31	26-32	25-31	25-31
Proposed Kribble Residence	32.4	33.5	34.4	35.0	35.7	36.3	35.6	35.6
DA 175/05 1	**36.4**	**37.5**	**38.4**	**39**	**39.7**	**40.3**	39.6	39.6
DA 175/05 2	**38**	**39.1**	**40**	**40.6**	**41.3**	**41.9**	41.2	41.2
DA 175/05 3	**39.6**	**40.7**	**41.6**	**42.2**	**42.9**	**43.5**	42.8	42.8
DA 232/05 / 1	29	30.1	31	31.6	32.3	32.9	32.2	32.2
DA 232/05 / 2	26.8	27.9	28.8	29.4	30.1	30.7	30	30
DA 232/05/ 3	24.4	25.5	26.4	27	27.7	28.3	27.6	27.6
DA 232/05 /4	21	22.1	23	23.6	24.3	24.9	24.2	24.2
DA 232/05 / 5	26.9	28	28.9	29.5	30.2	30.8	30.1	30.1
DA 211/06 - 1	31.8	32.9	33.8	34.4	35.1	35.7	35	34.3
DA 211/06 - 2	24.6	25.7	26.6	27.2	27.9	28.5	27.8	27.1
DA 211/06 - 3	21.3	22.4	23.3	23.9	24.6	25.2	24.5	23.8
DA 211/06 - 4	23.6	24.7	25.6	26.2	26.9	27.5	26.8	26.1
DA 211/06 - 5	18.6	19.7	20.6	21.2	21.9	22.5	21.8	21.1
DA 174/05 1	23.8	24.9	25.8	26.4	27.1	27.7	27	26.3
Criteria	**35**	**35**	**35**	**35**	**37**	**40**	**43**	**47**

For sub division DA 175/05 significant noise criteria exceedances are predicted. The SA guideline implies that the criteria of 35dBA and background +5dBA only apply for existing dwellings. Additionally the SA guideline implies that the relevant Council should include planning controls so that any dwellings constructed in any sub division where the noise criteria are exceeded that additional noise mitigation be included in the design of the dwelling at the cost of the building developer.

The recent court case regarding the Taralga Wind Farm proposal has provided precedence that the proponent of a wind farm should provide "reasonable and feasible" noise mitigation measures for no more than one new dwelling, built on any vacant land where the SA guideline noise criteria is exceeded. I recommended that if the wind farm was to be approved that previsions be made to incorporate a condition requiring the proponent to provide "reasonable and feasible" noise mitigation measures for no more than one new dwelling, built on any vacant land where the SA guideline noise criteria is exceeded.

4.4 Appropriateness of SA Guidelines

I assume that the SA Guidelines have been established to recognise the importance of wind farms in the renewable energy sector and are therefore a compromise between the need for energy and the desire for quiet.

The Black Spring community has stated that it enjoys the tranquillity of the surrounding area that is far away from highways and industry. According to the noise levels predicted for the closest non-contracted residences, there will is no doubt that if the proposal proceeds, wind turbine noise will be audible especially when ambient noise is at its lowest (ie night).

I am only aware of one noise response study on wind turbine noise conducted in Sweden. The study has found that at a level of 35 L_{Aeq} the corresponding percentage of highly annoyed is 6 percent *(Pedersen & Waye, Annoyance of wind Turbine Noise, 2004, JASA, 116(6))*. This noise response relationship is similar to research for industrial noise sources and therefore is consist with outcomes from the DECC Industrial Noise Policy which aims at protecting a reasonable person for 10 percent of the time.

I have also conducted a quick review of other noise criteria around the world and compared them to the SA Guidelines. The results of the review are presented in Table 4-8.

Table 4-8 Wind Farm Noise Criteria from Around the World.

Country	Criteria	Comparison with SA Guideline
New Zealand	40dBA or L_{A90} +5dB L_{Aeq}	Less stringent than SA Guideline
UK	40dBA Day 43dBA Night or L_{A90} +5dB L_{A90}	Less stringent than SA Guideline
Denmark	40dBA L_{Aeq} at 8m/s	Less stringent than SA Guideline
Illinois (USA)	55dBA Day L_{Aeq} 51dBA Night L_{Aeq}	Less stringent than SA Guideline

From Table 4-8 it would appear that the SA Guideline is one of the more stringent wind farm noise criteria around the world and as such in my opinion is an appropriate noise criteria to judge potential noise impact. I do not believe there should be an expectation that wind farms would be inaudible at surrounding residences. However, I do believe that the SA Guideline is only a guideline and that any proponent needs to consider all aspects of noise at their proposed site to address potential noise impacts at different times of day or year. Depending on the proportion of times various weather conditions exists and therefore a better understanding of noise impacts over a typical day, week, month or year be understood. For a proposed wind farm site which due to its location and surrounding topography would have no change in background noise levels over the year and does not suffer from temperature inversions such that there can be a big difference between day and night time operation, the procedures outlined in the SA Guideline are quite appropriate. At another site the approach in the SA Guidelines may not be appropriate and more extensive and detailed analysis may be required. The proponent needs to assess this risk, as Approval should be granted on the basis of minimising annoyance not just satisfying the technical requirements of the current SA Guidelines.

However, it should be noted that ultimately, if a community is against a wind farm development then it is quite possible that audibility will annoy people and any “standard” noise criteria would not be relevant. At that stage the debate is no longer a purely acoustic debate but a regional or national debate about the relative importance of renewable energy as part of Australia’s future.

5 CONCLUSION

Wilkinson Murray Pty Ltd has been commissioned by the Department of Planning (DoP) to conduct an independent review of the noise impact assessment for the proposed Black Springs Wind Farm Project.

I have reviewed the:

- Background noise monitoring;
- Validity of the noise prediction; and
- Acceptability of potential noise impacts.

In summary my analysis has concluded the following:

- The locations of the background noise monitoring would not appear to be ideal. Additional noise monitoring at the Kringis residence (32) as it is the most affected residence with regard to noise and at measurement at location 29 (south west) would have supported the noise assessment well.

- The analysed data from the proponent for a 24 hour period and my data are comparable for daytime with my data being slightly higher since it excludes low background levels at night. There is a substantial difference between daytime and night background noise levels, which is concern to me as the use of the 24 hour data could underestimate potential night time noise impacts. Therefore I consider the adoption of the lowest measured night background noise levels measured at the three residences should be used as a precautionary approach to apply at all residences surrounding the wind farm to gauge impacts.

- The contractually involved residences have signed noise acceptance agreements with the proponent accepting a maximum noise level generated by the wind farm of 50dBA. This level is 5dB higher than I would recommend, however, the risk associated with relying on the agreements remain with the proponent.

- Suzlon have recently conducted noise tests that have indicated that the new guaranteed emissions are substantial lower than previously expected. A comparison between the new and the old data indicates a reduction of approximately 3 to 4dB at relevant wind speeds. This reduction would translate to a 3 to 4dB reduction in the predicted noise levels presented in the noise assessment.

- I considered the potential for the “Van den Berg effect” and consider it not to be an issue at this site.

- I have reviewed the noise predictions in the noise assessment using the ISO9613 algorithm and consider them to be marginally conservative as suggested in the noise assessment.

- Oberon Council and the Black Springs Community Landscape Guardians Inc have identified a number of subdivisions recently approved around the proposed wind farm which have not been assessed in the noise assessment.

With regard to the acceptability of the noise impact of the proposed wind farm I have conducted noise predictions for the proposed wind farm myself using the CADNA "A" noise prediction software package using the ISO9613 noise prediction algorithms (modified) and compared the predictions to noise criteria developed from the SA guideline using the lowest measured night background noise levels measured at the three residences. The conclusion of my assessment was that the overall the predicted noise levels from my modelling are 4 to 6dB lower than those predicted in the noise assessment. This was the result of using the new wind turbine sound power levels and conducting the calculations using the more accurate octave band calculations. However, when comparing the new predicted noise levels with my precautionary noise criteria, a noise criteria exceedance of 1.4dB at residence 32 is predicted. At the sub-division DA175/5 significant exceedances of up to 7dB are predicted.

I have identified three potential noise mitigation options that would reduce noise levels to achieve the precautionary noise criteria applied. The mitigation options are:

- removing wind turbine 1 from the project;
- moving wind turbine 1 from its current position and moving it to around Daisybank Shed (27); or
- using sector manager and switching wind turbine 1 off at wind speeds less than 6m/s during the night.

It is recommended that the proposed noise mitigation options be discussed with the proponent and conditioned if the project were to be Approved.

Additionally I recommend that if the wind farm was to be approved that previsions be made to incorporate a condition requiring the proponent to provide "reasonable and feasible" noise mitigation measures for no more than one new dwelling, built on any vacant land where the SA guideline noise criteria is exceeded.

Version	Status	Date	Prepared by	Checked by
A	Draft	25 January 2008	John Wasserman	Neil Gross

APPENDIX A

GLOSSARY OF TERMS

GLOSSARY

Most environments are affected by environmental noise which continuously varies, largely as a result of road traffic. To describe the overall noise environment, a number of noise descriptors have been developed and these involve statistical and other analysis of the varying noise over sampling periods, typically taken as 15 minutes. These descriptors, which are demonstrated in the graph overleaf, are here defined.

Maximum Noise Level (L_{Amax}) – The maximum noise level over a sample period is the maximum level, measured on fast response, during the sample period.

L_{A1} – The L_{A1} level is the noise level which is exceeded for 1% of the sample period. During the sample period, the noise level is below the L_{A1} level for 99% of the time.

L_{A10} – The L_{A10} level is the noise level which is exceeded for 10% of the sample period. During the sample period, the noise level is below the L_{A10} level for 90% of the time. The L_{A10} is a common noise descriptor for environmental noise and road traffic noise.

L_{Aeq} – The equivalent continuous sound level (L_{Aeq}) is the energy average of the varying noise over the sample period and is equivalent to the level of a constant noise which contains the same energy as the varying noise environment. This measure is also a common measure of environmental noise and road traffic noise.

L_{A50} – The L_{A50} level is the noise level which is exceeded for 50% of the sample period. During the sample period, the noise level is below the L_{A50} level for 50% of the time.

L_{A90} – The L_{A90} level is the noise level which is exceeded for 90% of the sample period. During the sample period, the noise level is below the L_{A90} level for 10% of the time. This measure is commonly referred to as the background noise level.

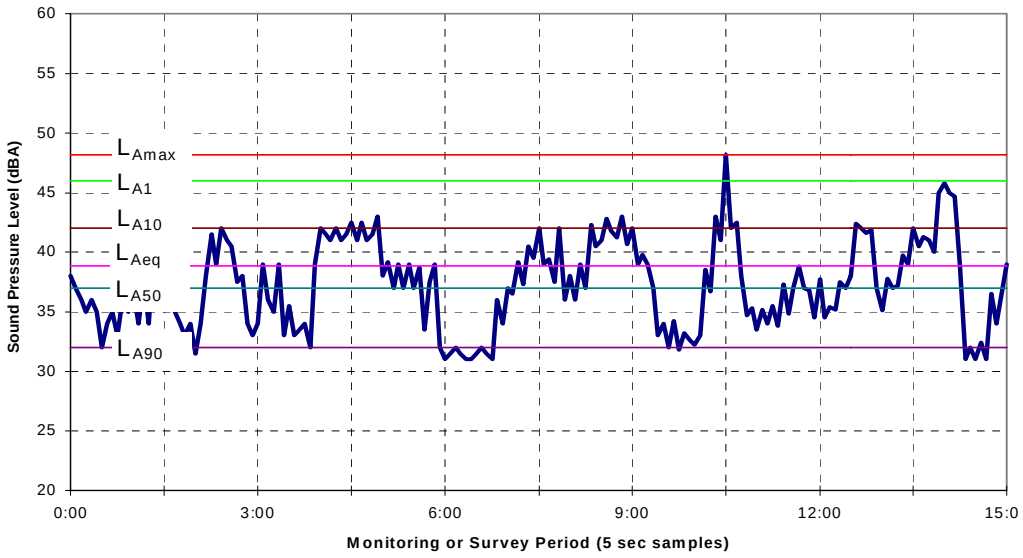
ABL – The Assessment Background Level is the single figure background level representing each assessment period (daytime, evening and night time) for each day. It is determined by calculating the 10^{th} percentile (lowest 10^{th} percent) background level (L_{A90}) for each period.

RBL – The Rating Background Level for each period is the median value of the ABL values for the period over all of the days measured. There is therefore an RBL value for each period **–** daytime, evening and night time.

DECC – NSW Department of Environment & Climate Change

INP – NSW Industrial Noise Policy

ECRTN – Environmental Criteria for Road Traffic Noise


60
55
50
45
40
35
30
25
20
Sound Pressure Level (dBA)
LAmax
LA1
LA10
LAeq
LA50
LA90
0:00
3:00
6:00
9:00
12:00
15:0
Monitoring or Survey Period (5 sec samples)

APPENDIX B

TERMS OF REFERENCE

Terms of Reference for the Expert Review of the Proposed Black Springs Wind Farm (MP06_0062)

To advise the Director-General regarding Wind Corporation Australia's proposed Black Springs Wind Farm including:

1. Consideration of operational noise including validity of predictions; the adequacy of background monitoring with regard to seasonal effects; and the acceptability of potential impacts. This should be undertaken having regard to current industry practice including the *Environmental Noise Guidelines: Wind Farms* (Environmental Protection Authority, South Australia);
2. Consideration of visual impacts including consideration of the validity of photomontages used, the area's ability to accept/absorb the turbines from both a regional and local perspective, and potential mitigation measures; and
3. Consultation with neighbouring residents, Oberon Council and the Proponent regarding 1 and 2 above.

APPENDIX C

LETTER FROM BLACK SPRINGS COMMUNITY LANDSCAPE GUARDIANS INC TO OBERON COUNCIL, 25 NOVEMBER 2007

OBERON COUNCIL
Doc No. 128210
24 NOV 2007

Black Springs Community Landscape Guardians Inc.

President: John Baxter
Vice-president: Graham Gilmore

c/o 484 Dog Rocks Road,
Black Springs, NSW, 2787

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SDCO	
PROMOTION	
RATES	
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25 November 2007

Mr. B. Fitzpatrick
General Manager
Oberon Council
137-139 Oberon St.
Oberon 2787

Dear Sir,

Proposed Black Springs Wind Farm

We refer to a letter Council received from Wind Corporation Australia (WCA), dated 11 October 2007, in reply to Council's letter of 30 August 2007 requesting clarification of background noise monitoring over a twelve month period at Black Springs.

It would be laughable if it were not so serious that WCA states that "any comparison or inferences drawn between the Toora Wind Farm and the Black Springs project are speculative at best" when WCA well knows that its wind speed projections and expected noise emissions for the Black Springs project are all pure speculation or to use WCA's description "predictive calculations".

As to the statistics quoted for Toora Wind Farm by Mark Fogarty in the WCA letter –

- Toora has in fact 12 turbines (not "17", "almost double the number of turbines proposed for Black Springs" quoted in the letter). Nine turbines are proposed for Black Springs.
- The turbines at Toora have a hub height of 67m, not the 98m quoted by WCA.
- The total height of the Toora tower and blades is 99m as opposed to 124m proposed for Black Springs.

The above figures are provided by Stanwell Corporation, the operators of Toora Wind Farm.

We make the following points –

*that at coastal Toora, residents living 1.2 km away from the turbines are troubled by night time noise –(McCausland).

* that night time noise annoyed European residents at least 1.9km from turbines – (McCausland).

* that as we noted to Council on 10.7.07, noise from wind turbines can be heard up to 6km away (Dr. van den Berg).

* that temperature inversion is known to be more common and pronounced inland – (McCausland).

* that there are major noise problems associated with Toora Wind Farm, to the extent that the wind farm operator is purchasing adjacent properties and demolishing the dwellings.

* that the background noise levels inland at night are extremely low.

* that although the WCA letter sites the closest Toora residents as only 500m from the closest turbine, the residence to which Dr. McCausland's paper gives most attention is 1km from the nearest turbine.

* that WCA identifies 14 residences at Black Springs (including those associated with the project) that may be impacted by noise, at distances between 316-1793m from the nearest turbine. One other dwelling at approximately 1800m and the historic Avoca Church at approximately 1100m are not included in that 14.

* that although there are differences between Toora and Black Springs, the Toora experiences are under Australian conditions and therefore must be taken into account.

* that in keeping with WCA's comments stating that the Black Springs area has only a marginal wind resource, the NSW Wind Atlas, produced by the Department of Energy, Utilities and Sustainability, clearly shows the Black Springs site as having significantly less wind resource than either Hampton or the poorly producing Crookwell and Blayney Wind Farms.

Page 22 of the Noise Study (Wind Corporation Australia's Response to Public Submissions 18.6.2007) states "It is recommended to perform a long term background noise monitoring before construction of the wind farm to monitor background noise". One can only ask, why hasn't this been done?

In relation to background noise testing, we note that the WCA letter omits the previous claim made by WCA in its Response to Public Submissions that "Seasonal variation of background noise is considered unnecessary as the measurements which were undertaken in February/March 2005 are considered to be sufficiently representative of the warmer and cooler periods of the year, resulting in a study which includes minimum and maximum background noise levels included in the analysis." (This is a statement we have noted to Council previously.)

The reference in the WCA letter to "long term sound emissions" is not relevant and is directing attention away from the real issues.

The facts remain that the Director General's Requirement for four season background noise testing in areas with temperature inversions has not been met. Over 30 years Oberon has averaged 90 days of minimums at or below 2 degrees c. The Bureau of Meteorology classes two degrees as freezing at ground level and 4 degrees c and below is an indicator of temperature inversion. Further, there are likely to be very low levels of background noise during frosty weather. By only testing background noise in February/March, the proponent has avoided testing on many nights on which temperature inversions have occurred.

Additionally, background noise monitors for residences at Black Springs were placed approximately 90m, 200-300m and as WCA states "450m" from houses and in fact closer to roads, (the Environmental Protection Authority noise guidelines for wind farms considers up to 20m as a valid distance for background noise monitors from residences).

Although Mr. Fogarty seeks to dismiss the "van den Berg" effect, Dr. van den Berg's findings that wind turbines produce more noise than predicted and that under night time temperature inversion conditions, this louder than expected noise is propagated undiminished over a much larger distance than expected, cannot be ignored.

In relation to the test mast of approximately 50-60m that Wind Corporation Australia erected some years ago on the side of Mt.Bathurst at Black Springs, the current owner of the land has repeatedly asked WCA to remove the now unnecessary and inoperative mast and WCA now claims that it cannot ascertain who owns the test mast, so has not removed the mast. This augurs badly for the future removal of obsolete wind turbines that WCA construct should the proposal be approved.

Wind Corporation Australia seeks to construct a wind energy development, which if approved, will have a devastating effect on the surrounding Black Springs area and its residents. It is deeply concerning that with all the resources that the proponent has at its disposal, so many details supplied by the proponent are mere "predictive calculations", or incorrect and misleading information or have been inadequately tested, that the entire proposal should be refused.

Yours faithfully

Precians

Lyndall Precians
Secretary

APPENDIX D

LETTER FROM BLACK SPRINGS COMMUNITY LANDSCAPE GUARDIANS INC TO JOHN WASSERMANN AND PETER HAACK, 27 NOVEMBER 2007

Black Springs Community Landscape Guardians Inc.

President: John Baxter
Vice-president: Graham Gilmore

c/o 484 Dog Rocks Road,
Black Springs, NSW, 2787

27 November 2007

Mr. John Wassermann
Mr. Peter Haack

Black Springs Wind Farm Proposal

Dear Sirs,

We are extremely concerned about a number if issues regarding this proposal and we wish to draw your attention to the following details showing why Black Springs is the wrong location for a wind farm.

- The extremely negative visual impact of 124m wind turbines on the planned village expansion, and would affect the agriculture, lifestyle and rural economy of too many non associated houses and almost 40 approved subdivisions.

- A wind farm in this landscape would totally alter the character of the area and adversely affect the presently close knit local community.

- The original photomontages are not accurately representative of the real visual impact of the proposed turbines.

- The developers claim that the main visual catchment of the proposed turbines is only 70 square km is extremely conservative given the local terrain.

- There is no need to locate a wind farm at Black Springs as there are other sites much less closely populated in the Oberon Local Government Area and elsewhere in the State.

- The main reason for choosing Black Springs is the inexpensive grid connection and the economics of the developer should not be the principal factor in siting a wind farm.

- The developer has acknowledged that Black Springs is a marginal wind resource and the NSW Wind Atlas produced by the Department of Energy, Utilities and Sustainability clearly shows the site to be a much lower resource than Hampton and the poorly producing Crookwell and Blayney Wind Farms.

- Fifteen houses and an historic church are within aproximately1800m of the nearest turbines and may be impacted by noise and associated serious health problems to greater or lesser extent.

- Only 3 background noise monitors were used for 15 houses, which is entirely inappropriate in this landscape.

- The locations of the background noise monitors at approximately 90m, 200-300m and 450m from houses was absurd and does not comply with SA EPA guidelines for a distance of up to 20m from houses.

- Why weren't background noise monitors placed at Kalgoorlie Hall (house 32) and at Aqualoria (house 24) and Daisybank (house 28)?

- Noise impacts on the 22 approved subdivisions adjoining and adjacent to the proposal have not even been considered let alone tested.

- SA EPA guidelines state that the EPA cannot ignore noise impacts (on host landholders) on the basis that an agreement has been made between the developer and the landowner. The developers cannot absolve themselves of their obligations under the Act by entering into the agreements with host landholders (to allow up to 50 dB(A) at houses).

- The Director General's Requirement for 4 season background noise testing has not been met and invalid reasons have been given for not meeting this requirement.

- In a sub-alpine climate with BoM temperature records showing an average of 90 days of 2 degrees C and below and the fact that 4 degrees C and below is an indicator of temperature inversion, it is totally negligent of the developer to only test February/ March and therefore avoid all the colder days in the year when temperature inversions occurred.

- The Land and Environment Court judge in the Taralga case, said he would not allow more than 35 dB(A) at the house facades. Non associated houses at Black Springs could experience up to 41 dB(A) when people are outside. How can this development be approved when the developers show 10 houses that will be subjected to sound levels above 35 dB(A)?

- We question the validity of all the predictions for this proposal because as far as we are aware there are no 124m turbines operating in Australia in similar conditions to Black Springs, to use for reference.

Lyndall Precians,

Secretary

APPENDIX E

NEW APPROVED SUB DIVISIONS

WM No .....
7 DEC 2007
ACTION .....

John,

Please find enclosed the approved Sketch Plans of the proposed patterns of subdivision for Development Applications 174/05, 232/05, 175/05 and 211/06.

These are the Development Consent files that are referenced in Figure 3 of Appendix J Property Values Assessment conducted by Roger Lee Property Consultants.

It should be noted that the purchaser of the property ("Winton Park" (DA 211/06) will probably not proceed with the Subdivision consent as she is a very large landowner in the district and buys property to continue agricultural interests.

Regards
Ralph
5/12/07

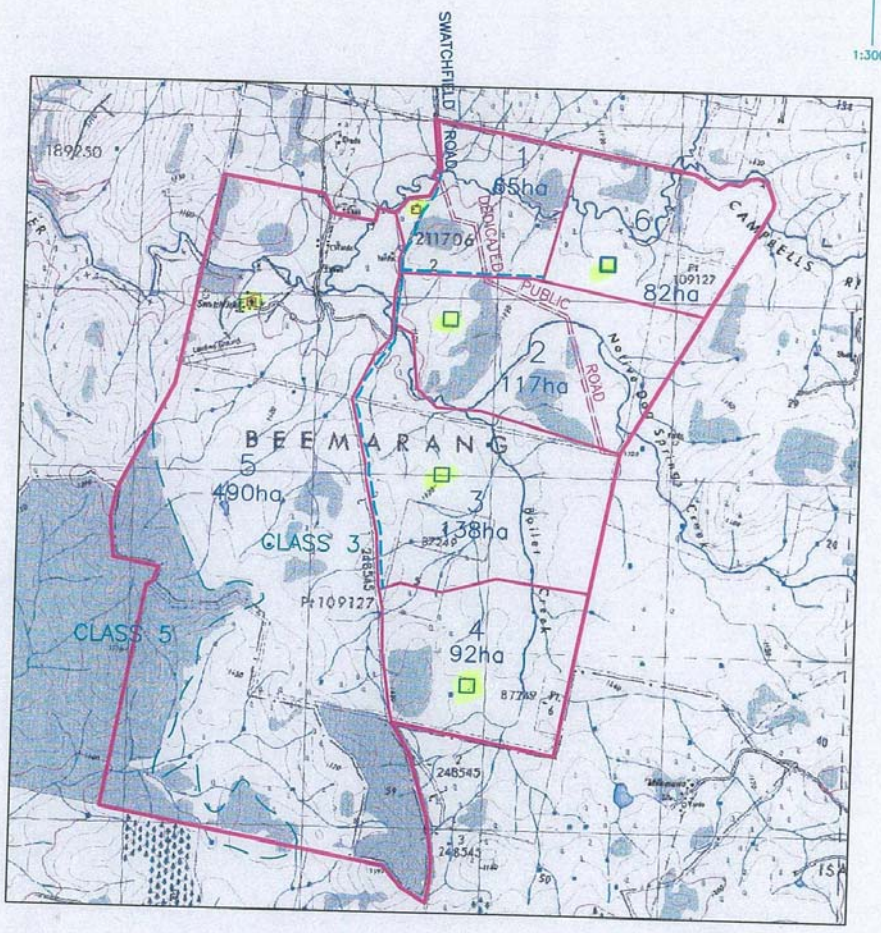
SKETCH PLAN

SHOWING DETAILS OF PROPOSED SUBDIVISION OF LOTS 1 & 3 IN DP 248545, LOT 2 IN DP 115062, LOT 59 IN DP 753009 AND LOT 2 IN DP 1060785

PARISH OF BEEMARANG
L.G.A OBERON

COUNTY OF GEORGIANA
LOCALITY OF SWATCHFIELD

1:30000



EXISTING BUILDING
BUILDING ENVELOPE 100m SQUARE
RIGHT OF CARRIAGEWAY

TABLELAND SURVEYORS PTY. LTD.
CONSULTING SURVEYOR
P.O. BOX 1495 BATHURST 2795
DATE: 15.02.2005
REFERENCE: 05/159

THE OBERON COUNCIL

DEVELOPMENT APPLICATION

This Plan, Detail, Specification, and/or Documentation
is part of APPROVAL NO: 232/05
DATE DETERMINED: 24/06/05
Signed: V-Stapleton

SKETCH PLAN

WING PROPOSED SUBDIVISION OF LOT B DP 365661, LOT 9 DP 733419, LOTS 27 & 112 DP 757072

PARISH OF SWATCHFIELD
L.G.A OBERON

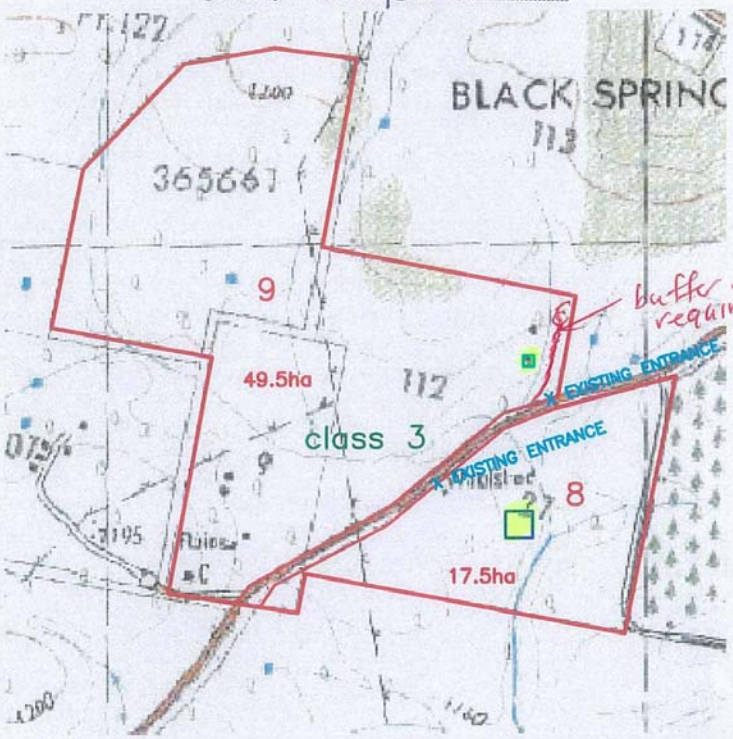
COUNTY OF WESTMORELAND
LOCALITY OF BLACK SPRINGS

THE OBERON COUNCIL

DEVELOPMENT APPLICATION

This Plan, Detail, Specification, and/or Documentation
is part of APPROVAL NO: 174/05
DATE DETERMINED: 11/04/05
Signed: V. Stapleton

1:10000



X EXISTING ENTRANCE

EXISTING DWELLINGS OR BUILDINGS

BUILDING ENVELOPE 50m SQUARE
ALL NOMINAL BUILDING ENVELOPES ARE AT LEAST 50m FROM BOUNDARIES

TABLELAND SURVEYORS PTY. LTD.
CONSULTING SURVEYOR
P.O. BOX 1495 BATHURST 2795

DATE: 19.12.2004

REFERENCE: 04/549

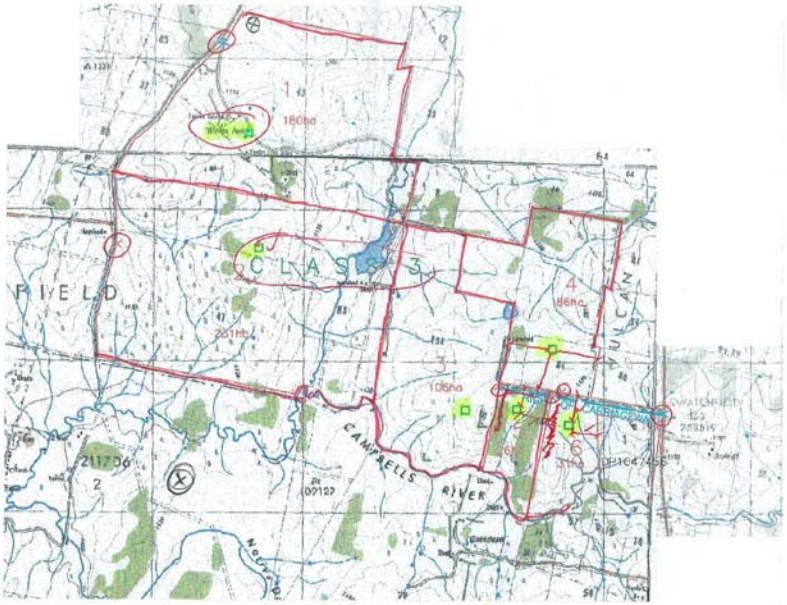

WM No
7 DEC 2007
ACTION
SKETCH PLAN
SHOWING PROPOSED SUBDIVISION OF LOTS 17, 18, 37, 80 & 85 DP 757072
PARISH OF SWATCHFIELD
L.G.A OBERON
COUNTY OF WESTMORELAND
LOCALITY OF BLACK SPRINGS
10
19.9hd
EXISTING ENTRANCES
11
48.5ha
CLASS 3
HIGH VOLTAGE POWERLINE
12
47.6ha
NEW ENTRANCE
Tennis Courts
Winton Park
DEVELOPMENT APPLICATION
This Plan, Detail, Specification, and/or Documentation
is part of APPROVAL NO: 179.05
DATE DETERMINED: 01.05.05
Signed: V Stapleton
X EXISTING ENTRANCE
X NEW ENTRANCE
EXISTING DWELLINGS OR BUILDINGS
BUILDING ENVELOPE 50m SQUARE
ALL NOMINAL BUILDING ENVELOPES ARE AT LEAST 50m FROM BOUNDARIES
TABLELAND SURVEYORS PTY. LTD.
CONSULTING SURVEYOR
P.O. BOX 1495 BATHURST 2795
DATE: 21.12.2004
REFERENCE: 04/550

SKETCH PLAN

SHOWING DETAILS OF PROPOSED SUBDIVISION OF LOTS 41, 43, 83 & 134 DP 757072
& LOT 2 DP 1047456

PARISH OF SWATCHFIELD
L.G.A. OBERON

COUNTY OF WESTMORELAND
LOCALITY OF BLACK SPRINGS



1:25000

DEVELOPMENT APPLICATION
211/06
This Plan, Detail, Specification, and/or Documentation
is part of APPROVAL NO: 211/06
DATE DETERMINED : 3/8/2007
Signed

@ quarry location.

X NEW ENTRANCE
X EXISTING ENTRANCE
□ EXISTING DWELLING
□ BUILDING ENVELOPE 50m SQUARE
MINIMUM 50m SETBACKS

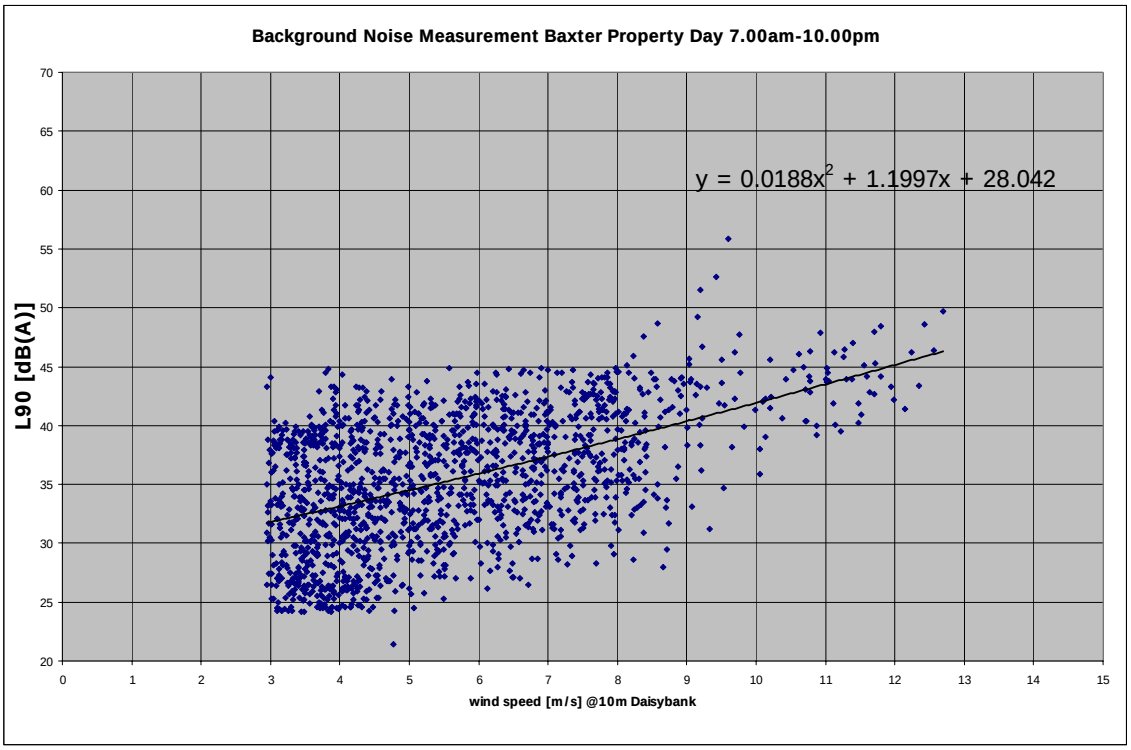
TABLELAND SURVEYORS PTY LTD
CONSULTING SURVEYORS
P.O. BOX 1495 BATHURST 2795

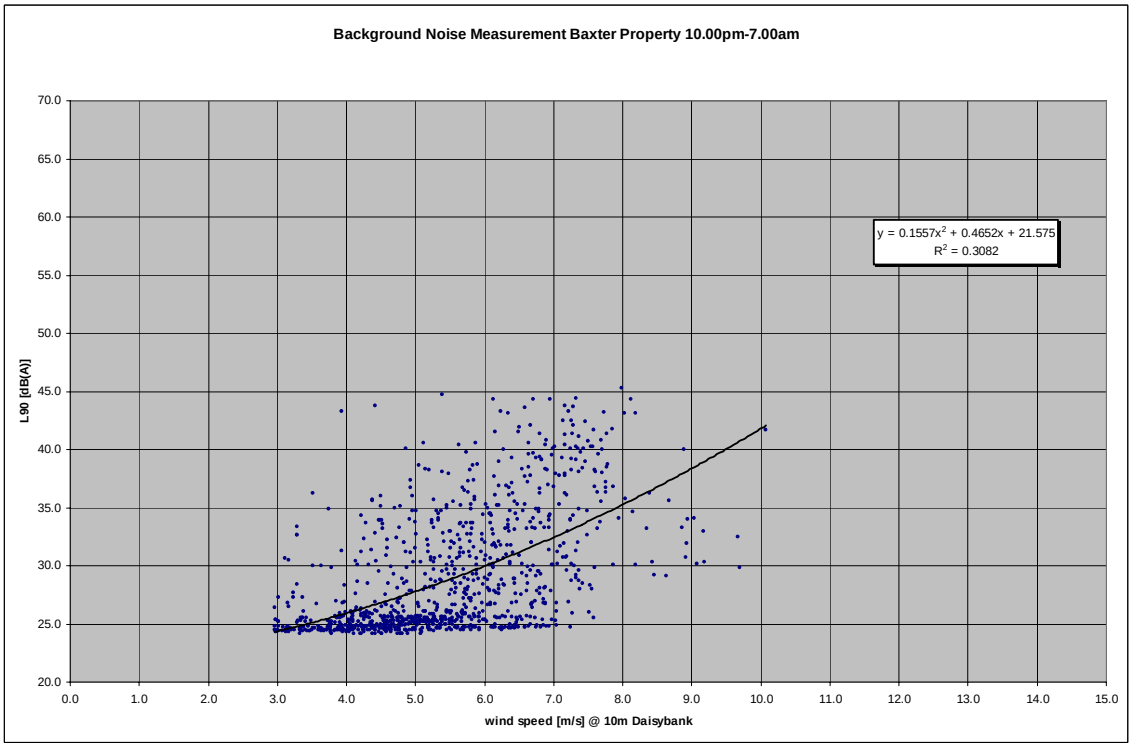
DATE: 11.5.2006

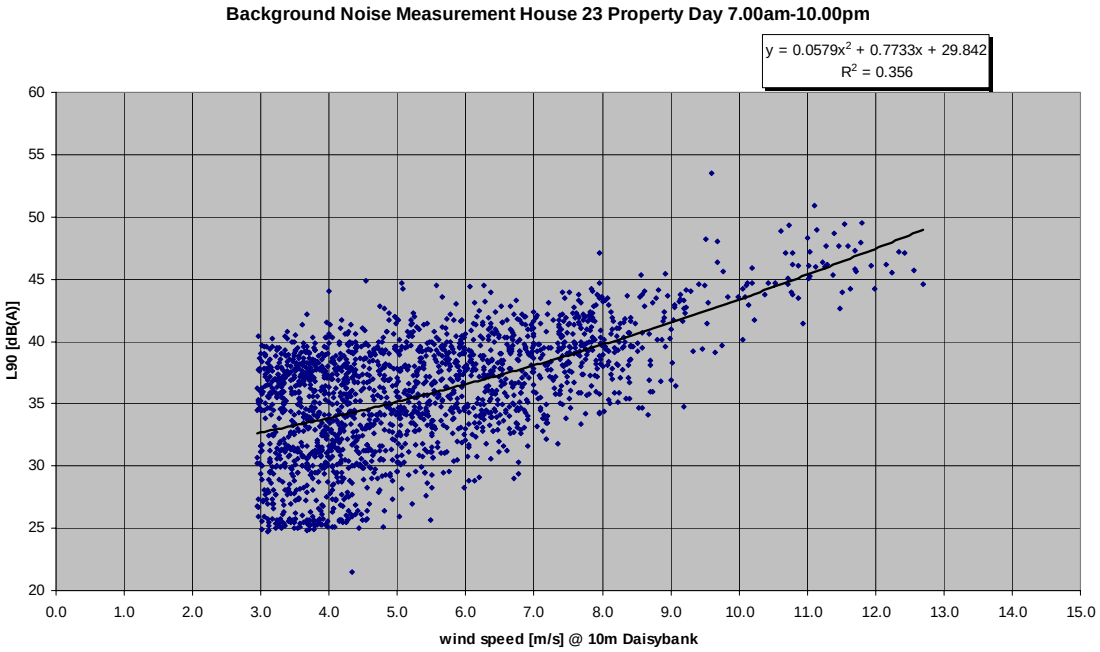
REFERENCE: 06/113

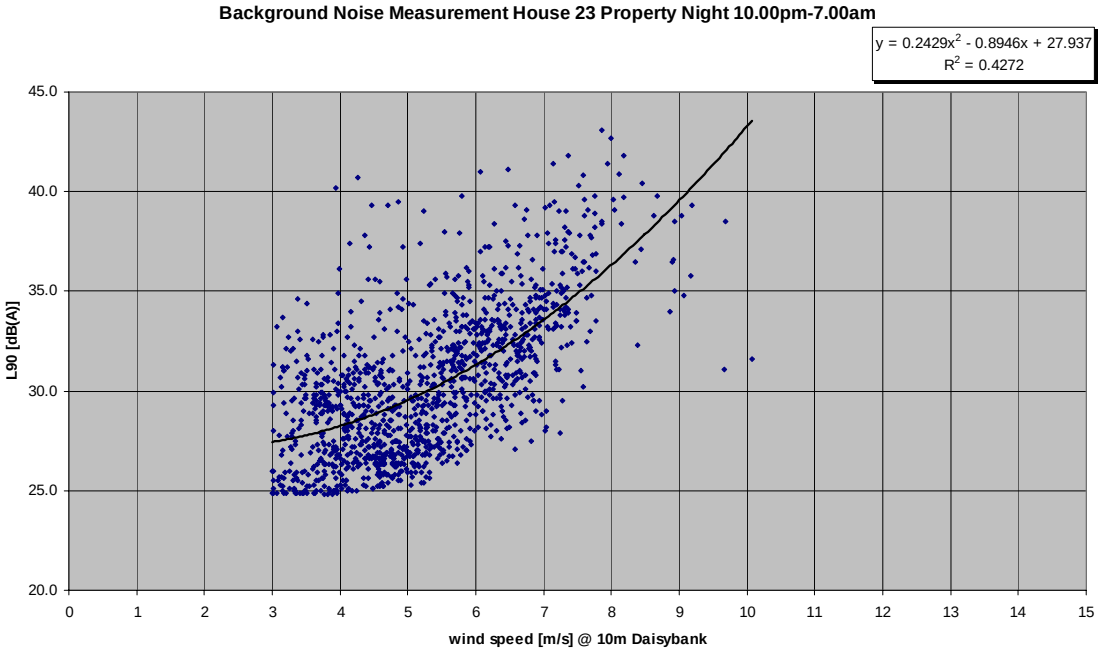
APPENDIX F

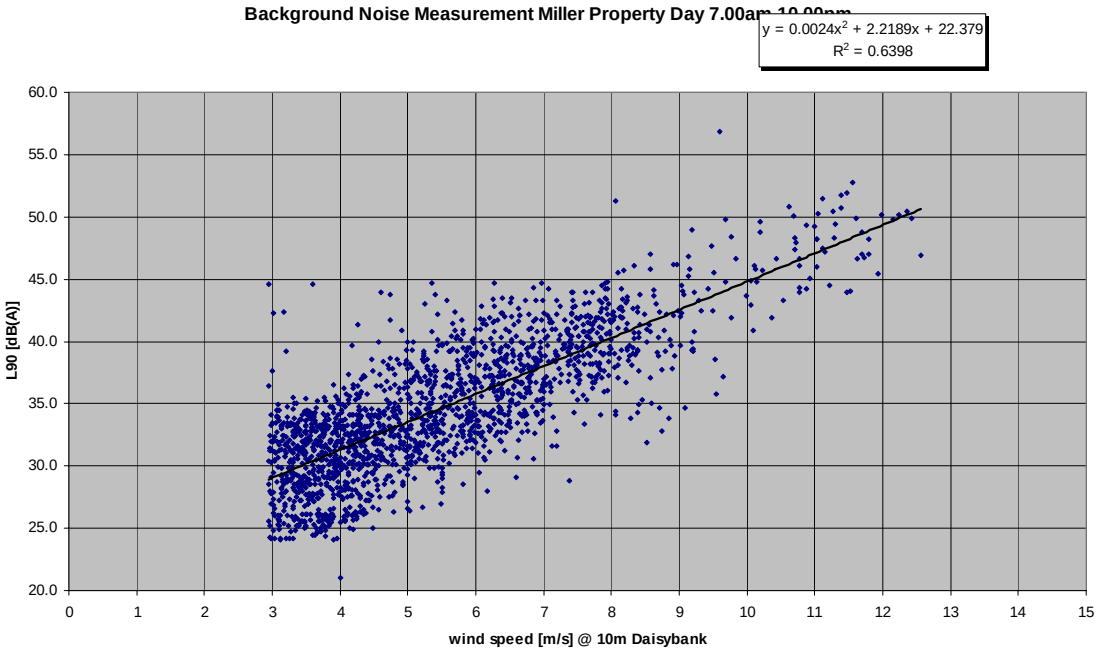
RE-ANALYSED BACKGROUND NOISE LEVEL DATA

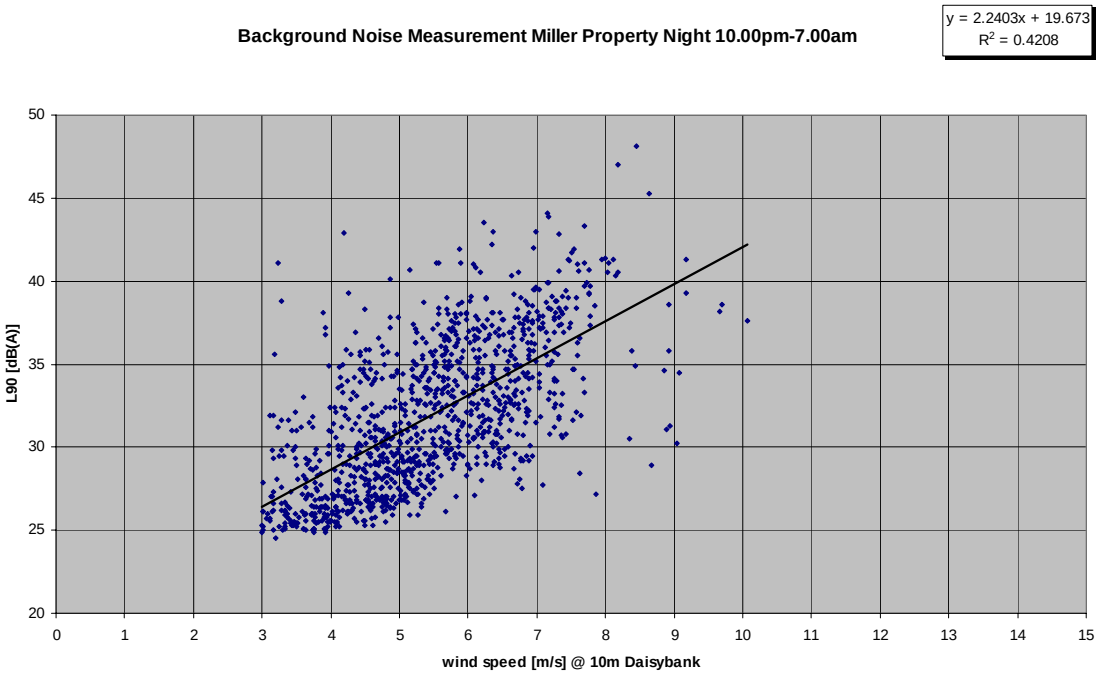

Background Noise Measurement Baxter Property Day 7.00am-10.00pm
y = 0.0188x2 + 1.1997x + 28.042
L90 [dB(A)]
wind speed [m/s] @10m Daisybank


Background Noise Measurement Baxter Property 10.00pm-7.00am
y = 0.1557x2 + 0.4652x + 21.575
R2 = 0.3082
L90 [dB(A)]
wind speed [m/s] @ 10m Daisybank


Background Noise Measurement House 23 Property Day 7.00am-10.00pm
y = 0.0579x² + 0.7733x + 29.842
R² = 0.356
L90 [dB(A)]
wind speed [m/s] @ 10m Daisybank


Background Noise Measurement House 23 Property Night 10.00pm-7.00am
y = 0.2429x² - 0.8946x + 27.937
R² = 0.4272
L90 [dB(A)]
wind speed [m/s] @ 10m Daisybank


Background Noise Measurement Miller Property Day 7.00am-10.00pm
y = 0.0024x² + 2.2189x + 22.379
R² = 0.6398
L90 [dB(A)]
wind speed [m/s] @ 10m Daisybank


Background Noise Measurement Miller Property Night 10.00pm-7.00am
y = 2.2403x + 19.673
R² = 0.4208
L90 [dB(A)]
wind speed [m/s] @ 10m Daisybank

APPENDIX G

SUZLON S88 2.1 MW SOUND POWER LEVELS

S88 2.1MW Sound Power Levels - Standard Conditions

WTG:	S88/2100	**Rated Power:**	2100kW
Hub Height (m):	80	**Power Control:**	Pitch
Rotor Diameter (m):	88	**Number of Rotor Blades:**	3 (upwind)
Air Density (kg/m3):	1.225	**Tower Type:**	Tubular steel
Est. Wind Shear:	0.16	**Rated RPM:**	15.5
Blade:	AE43-V3	**Generator:**	Single Generator

Estimated Hub Height Wind Speed (m/s)	4.2	5.6	7.0	8.4	9.7	11.1	12.5
10m AGL Wind Speed (m/s)	3	4	5	6	7	8	9
A-Weighted Sound Power Level (dBA)	100.4	101.5	102.4	103.0	103.7	104.3	103.6

1/3 Octave Band Data - A-Weighted Sound Power Level (dBA)							
	10m AGL Wind Speed (m/s)						
	3	4	5	6	7	8	9
Freq (Hz) Bin	m/s	m/s	m/s	m/s	m/s	m/s	m/s
20	44.8	45.8	46.8	47.4	45.3	48.1	50.1
25	48.8	49.8	50.8	51.4	50.9	52.3	53.2
31.5	49.4	50.4	51.4	52.0	51.2	54.0	56.4
40	58.6	59.6	60.6	61.2	60.5	64.1	66.0
50	64.3	65.3	66.3	66.9	67.6	70.5	70.5
63	70.8	71.8	72.8	73.4	73.8	76.3	75.5
80	74.7	75.7	76.7	77.3	78.2	80.9	80.0
100	79.9	80.9	81.9	82.5	83.7	85.5	83.7
125	83.4	84.4	85.4	86.0	87.2	88.9	88.2
160	86.0	87.0	88.0	88.6	89.7	91.9	89.3
200	88.4	89.4	90.4	91.0	92.2	93.6	92.2
250	89.7	90.7	91.7	92.3	93.4	94.9	93.1
315	91.8	92.8	93.8	94.4	95.5	96.2	94.1
400	91.1	92.1	93.1	93.7	94.6	95.1	94.8
500	90.5	91.5	92.5	93.1	93.9	94.2	94.2
630	90.1	91.1	92.1	92.7	93.2	93.1	93.4
800	89.0	90.0	91.0	91.6	92.3	91.6	92.1
1000	89.3	90.3	91.3	91.9	92.3	90.9	91.7
1250	88.4	89.4	90.4	91.0	91.7	90.3	91.7
1600	88.3	89.3	90.3	90.9	89.1	89.7	89.6
2000	85.7	86.7	87.7	88.3	88.1	89.1	87.8
2500	83.0	84.0	85.0	85.6	85.6	86.9	85.2
3150	80.1	81.1	82.1	82.7	83.2	84.9	83.1
4000	76.6	77.6	78.6	79.2	80.2	82.5	79.8
5000	72.5	73.5	74.5	75.1	76.1	79.0	75.9
6300	67.7	68.7	69.7	70.3	70.5	74.2	70.4
8000	60.7	61.7	62.7	63.3	62.5	66.8	62.6
10000	49.9	50.9	51.9	52.5	52.5	56.5	52.6
12500	48.3	49.3	50.3	50.9	51.1	51.5	50.8
16000	46.6	47.6	48.6	49.2	49.4	49.8	49.2
20000	44.5	45.5	46.5	47.1	47.4	47.7	47.1

1 Octave Band Data - A-Weighted Sound Power Level (dBA)							
	10m AGL Wind Speed (m/s)						
	3	4	5	6	7	8	9
Freq (Hz) Bin	m/s	m/s	m/s	m/s	m/s	m/s	m/s
62.5	76.5	77.6	78.5	79.1	79.8	82.6	81.8
125	88.5	89.6	90.5	91.1	92.2	94.3	92.4
250	94.9	96.0	97.0	97.5	98.6	99.8	98.0
500	95.3	96.4	97.4	97.9	98.7	99.0	99.0
1000	93.6	94.7	95.7	96.2	96.8	95.7	96.6
2000	90.9	92.0	93.0	93.5	92.6	93.5	92.7
4000	82.2	83.2	84.2	84.7	85.5	87.5	85.3
8000	68.6	69.7	70.6	71.2	71.2	75.0	71.2

Note:
Warranty relates to Standard conditions - Wind shear coeff. average of 0.16, standard air density, 10% site turbulence, Clean Blades, No Ice/Snow on blades, No Damage to Leading Edge, Terrain to IEC 61400-12, Inflow Angle: 0+/-2 Deg. Should site conditions vary substantially from these values the actual sound power level output may also vary.