

Bodangora Wind Farm Noise Assessment

Executive Summary

Bodangora Wind Farm Pty Ltd (the Proponent) is requesting a modification to the blade length that was approved by the Department of Planning for Bodangora Wind Farm (application number 10_0157). The overall tip height that was approved at 150m will remain unchanged but the blade length will be modified from 57 m to 65m. To the extent that a larger blade is used, the hub height will be reduced from 100m to 85m to remain within the approved total tip height of 150m.

This assessment reviews whether the Proponent can comply with its operational noise conditions of consent (as outlined in F7 of the project approval and set out in Appendix 2) should it be granted an approval for the proposed modification. The results of this noise assessment which demonstrate compliance for F7 by comparing the “Criteria dB(A)” to the “Predicted Noise Level dB(A)” for the project is included as *Appendix 3*.

Background

The original noise assessment completed by Sonus for Bodangora Wind Farm was included as Attachment J of the Environmental Assessment (EA) and as Appendix C of the Submissions Response Report. The original noise assessment was based on the Vestas V112 3MW wind turbine, which has a maximum apparent sound power level of 106.6dB. The results of the original noise assessment included in the Submissions Response Report comparing the “Criteria dB(A)” to the “Predicted Noise Level dB(A)” for the project is included as *Appendix 1*.

The project was granted approval on the 30th August 2013 and the conditions of consent included the Operational Noise Criteria as condition F7. This condition is included as *Appendix 2*.

As the proponent now intends to use a revised turbine model a revised noise assessment has been undertaken based on GE technology. The assessment considers two models with a rotor diameter of 130m, and hub height of 85m and a rotor diameter of 120m, and hub height of 85m. These machines have a maximum apparent sound power level of 106.0dB as included as *Appendix 4*.

Wind Farm Layout

Figure 1 shows the proposed layout for Bodangora Wind Farm, including the surrounding dwellings. The locations of the associated and non-associated dwellings are included as *Attachment 1* of the submission report. The closest non associated dwelling is R11 at a distance of 2.09km.

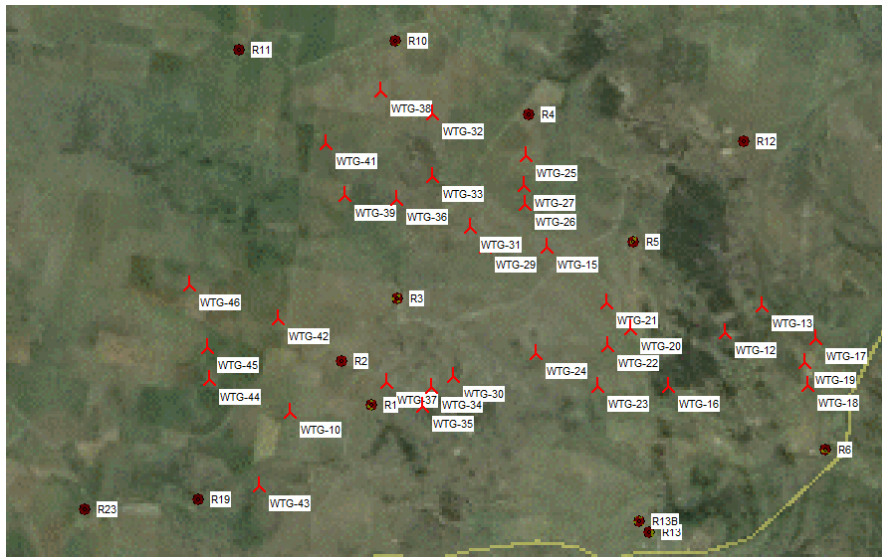


Figure 1 - Permitted Layout for Bodangora Wind Farm

Proposed Wind Turbines

The Proponent will select one of the following turbines for the project if granted an approval for the modification:

	Blade Diameter	Hub Height
1.	120m	85m
2.	130m	85m

The sound power levels for the Vestas V112 and the proposed machines are at a range of wind speeds that are provided as *Attachment 4*. It should be noted that the increase in rotor diameter does not change the maximum sound power level.

Noise criteria

The Noise conditions for Bodangora Wind Farm have been determined according to the South Australian Environment Protection Authority's Wind Farms – Environmental Noise Guidelines 2003 (the SA Guidelines). These guidelines state that the noise levels should not exceed 35dB(A), or the background noise level by 5dB(A), whichever is greater. Background noise monitoring was undertaken by Sonus in 2012 and is detailed as Appendix C in the Proponents Preferred Project Report, - S3627C9, October 2012.

Results

The revised noise assessments were performed using the ISO 9613 noise with a ground factor setting of 0.5 (50% hard, 50% soft). The results are included as *Appendix 3*. Based on these results the proponent has demonstrated that it can comply with its conditions of consent for noise if granted approval for the proposed modification.

Appendix 1 – Approved Predicted Wind Farm Noise – V112

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Appendix H: Predicted Wind Farm Noise and Relevant Criteria

Wind Speed (m/s)	Criteria (dB(A))							Predicted Noise Level (dB(A))						
	4	5	6	7	8	9	10	4	5	6	7	8	9	10
R1	45	45	45	45	45	45	45	36	40	43	44	43	42	42
R2	45	45	45	45	45	45	45	32	36	39	40	39	38	39
R3	45	45	45	45	45	45	45	30	35	38	39	38	37	37
R4	45	45	45	45	45	45	45	32	36	40	41	40	38	39
R5	45	45	45	45	45	45	45	30	34	38	39	38	36	37
R6	45	45	45	45	45	45	45	28	32	35	36	35	34	34
R7	45	45	45	45	45	45	45	26	26	26	27	27	26	27
R8	45	45	45	45	45	45	45	24	24	25	26	25	25	25
R9	45	45	45	45	45	45	45	27	27	27	27	27	27	27
R10	45	45	45	45	45	45	45	30	34	37	38	37	36	36
R11	35	35	35	35	35	35	37	22	26	30	31	30	29	29
R12	35	35	35	35	38	40	43	21	25	28	30	29	28	29
R13	40	41	41	42	43	45	46	23	27	30	31	30	29	30
R13B	35	35	35	35	35	35	37	22	26	29	30	30	28	29
R14	35	35	35	36	39	42	45	15	19	22	23	23	21	22
R15	35	35	35	35	35	35	37	18	20	23	24	24	23	23
R16	35	35	37	41	44	47	49	20	24	27	29	28	27	27
R17	35	35	35	35	35	35	37	26	26	26	26	26	26	26
R18	35	35	35	35	35	35	37	15	16	18	20	19	18	19
R19	45	45	45	45	45	45	45	27	31	34	35	34	33	34
R20	35	35	35	35	35	35	37	10	14	17	19	18	17	18
R21	35	35	35	35	35	35	37	13	17	21	22	22	21	22
R22	35	35	35	35	35	35	37	16	18	20	21	21	20	20
R23	35	35	35	35	35	35	37	19	23	26	27	26	25	26
R24	35	35	35	35	35	35	37	13	17	21	22	22	21	21
R25	35	35	35	35	35	35	37	14	18	21	23	22	21	22

Appendix 2 – Operational Noise Criteria

Project Approval condition F7

30th August 2013

- F6. The Proponent shall implement a revegetation and rehabilitation programme for all areas of the Project footprint which are disturbed during the construction of the Project, which are not required for the ongoing operation of the Project, including temporary construction facility sites and sections of construction access roads. The Proponent shall ensure that all revegetation measures are implemented progressively where possible and in all cases within six months of the cessation of construction activities at the relevant area. Unless otherwise agreed to by the Director-General, the Proponent shall monitor and maintain the health of all revegetated areas until such time that the plantings have been verified by an independent and suitably qualified expert (whose appointment has been agreed to by the Director-General) as being well established, in good health and self sustaining.

NOISE

Operational Noise Criteria – Wind Turbines

- F7. The Project shall be designed, operated and maintained to ensure that the equivalent noise level (L_{Aeq} (10-minute)) from the Project does not exceed at any residential receiver (excluding those associated with the wind farm) in existence or the subject of a valid development consent at the date of this Approval:

(a) 35 dB(A); or

(b) the existing background noise level (L_{A90} (10-minute)) (as identified in the Proponent's Submissions Response Report – Appendix C 'Environmental Noise Assessment' Sonus 2012) correlated to the integer wind speed at hub height at the wind farm site by more than 5 dB(A),

whichever is the greater, for each integer wind speed (measured at hub height) from cut-in to rated power of the wind turbine generator, as determined with reference to the *South Australian Environment Protection Authority Wind Farm Guidelines 2003* and subject to any applicable penalties for excessive tonality and low frequency noise, as set out in conditions F10 and F11.

- F8. The Proponent shall prepare a revised **Noise Assessment** for the final turbine model and turbine layout selected, in consultation with the EPA, which shall be submitted to the Director-General prior to commissioning of the wind turbines. The revised Noise Assessment shall include the noise predictions of the final turbine model and layout selected at each of the receiver locations. The assessment shall demonstrate consistency with the EA and the ability of the final turbine model and layout to meet the requirements of condition F7. The assessment shall include a discussion of the difference of the spectral noise signature between the final turbine model and the original turbine model used within the EA noise assessment.
- F9. Noise from the Project is to be measured at the most affected point within the residential boundary, or at the most affected point within 30 metres of the dwelling, where the dwelling is more than 30 metres from the boundary, to determine compliance with the noise level limits in condition F7.
- F10. For the purposes of condition F7 of this Approval, the presence of excessive tonality (a special noise characteristic) is consistent with that described in *ISO 1996.2: 2007 Acoustics — Description, measurement and assessment of environmental noise - Determination of environmental noise levels*.

If tonality is found to be a repeated characteristic of the wind turbine noise, 5dB(A) should be added to measured noise level from the wind farm. If tonality is only identified for certain wind directions and speeds, the penalty is only applicable under these conditions.

Appendix 3 – Predicted Wind Farm Noise and Relevant Criteria

10m Wind Speed (m/s)	Criteria (dB(A))							Predicted Noise Level (dB(A)) (GE 2.75-120)							Predicted Noise Level (dB(A)) (GE 3.2-130)						
	4	5	6	7	8	9	10	4	5	6	7	8	9	10	4	5	6	7	8	9	10
R1	45	45	45	45	45	45	45	37	42	43	43	43	43	43	35	40	43	44	44	44	44
R2	45	45	45	45	45	45	45	34	39	40	40	40	40	40	32	36	39	40	40	40	40
R3	45	45	45	45	45	45	45	32	37	38	39	39	39	39	31	35	38	39	39	39	39
R4	45	45	45	45	45	45	45	34	39	40	40	40	40	40	32	37	40	40	40	40	40
R5	45	45	45	45	45	45	45	32	37	38	38	38	38	38	31	35	38	39	39	39	39
R6	45	45	45	45	45	45	45	29	34	36	36	36	36	36	28	32	35	36	36	36	36
R7	45	45	45	45	45	45	45	17	21	22	23	23	23	23	16	20	23	24	24	24	24
R8	45	45	45	45	45	45	45	18	22	23	24	24	24	24	17	21	24	25	25	24	24
R9	45	45	45	45	45	45	45	17	21	22	23	23	23	23	16	20	23	24	24	24	23
R10	45	45	45	45	45	45	45	31	36	37	38	38	38	38	30	34	37	38	38	38	38
R11	35	35	35	35	35	35	37	25	29	30	31	31	31	31	23	28	31	31	31	31	31
R12	35	35	35	35	38	40	43	25	29	30	31	31	31	31	23	28	30	31	31	31	31
R13	40	41	41	42	43	45	46	25	30	31	31	31	31	31	24	28	31	32	32	32	31
R13B	35	35	35	35	35	35	37	26	30	31	32	32	32	32	24	29	32	32	32	32	32
R14	35	35	35	36	39	42	45	19	23	24	25	25	25	25	18	22	25	25	25	25	25
R15	35	35	35	35	35	35	37	19	23	24	25	25	25	25	18	22	25	26	26	26	26
R16	35	35	37	41	44	47	49	22	26	28	28	28	28	28	21	25	28	29	29	29	29
R17	35	35	35	35	35	35	37	14	17	18	19	19	19	19	13	17	20	21	21	21	20
R18	35	35	35	35	35	35	37	15	18	19	20	20	20	20	14	18	21	21	21	21	21
R19	45	45	45	45	45	45	45	29	34	35	35	35	35	35	27	32	35	35	35	35	35
R20	35	35	35	35	35	35	37	15	19	20	21	21	21	21	14	18	21	22	22	22	22
R21	35	35	35	35	35	35	37	16	20	21	22	22	22	22	16	20	23	23	23	23	23
R22	35	35	35	35	35	35	37	16	20	21	22	22	22	22	15	19	22	23	23	23	23
R23	35	35	35	35	35	35	37	22	26	27	28	28	28	28	21	25	28	28	28	28	28
R24	35	35	35	35	35	35	37	17	21	22	22	22	22	22	16	20	23	23	23	23	23
R25	35	35	35	35	35	35	37	18	22	23	24	23	23	23	17	21	24	24	24	24	24

Appendix 4 – Normal Operation Sound Power Levels

Wind Speed (10m)	Vestas V112	GE 2.75-120	GE 3.2-130
4	98.8	99.5	97.7
5	103.1	104.4	102.0
6	105.8	106.0	105.2
7	106.6	106.0	106.0
8	106.0	106.0	106.0
9	105.1	106.0	106.0
10	105.8	106.0	106.0