



Midwest Wind Farm

Noise & Vibration Impact Assessment

Mid West Wind Farm Pty Ltd

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Basis of Report

This report has been prepared by SLR Consulting Australia Pty Ltd (SLR) with all reasonable skill, care and diligence, and taking account of the timescale and resources allocated to it by agreement with Mid West Wind Farm Pty Ltd (the Client). Information reported herein is based on the interpretation of data collected, which has been accepted in good faith as being accurate and valid.

SLR disclaims any responsibility to the Client and others in respect of any matters outside the agreed scope of the work.



Executive Summary

SLR Consulting Australia Pty Ltd (SLR) has completed a noise and vibration impact assessment of the proposed Mid West Wind Farm (the "Project"). The methodology and criteria used in the assessment are supported by the Western Australian *Environmental Protection (Noise) Regulations* 1997, South Australia Environmental Protection Authority (SA EPA) *Environment Noise Guidelines for Wind Farms* (2009) and World Health Organisation (WHO) limits.

Vestas is proposing to develop the Project within a land development area of 16,498 hectares, approximately 50 km east of Geraldton, Western Australia within the Local Government Authorities of the City of Greater Geraldton.

The Project will involve the construction of up to 98 wind turbines with a total generation capacity of 700 MW, supplemented by a battery energy storage system (BESS) with a storage capacity of 4,200 MWh and nominal rating of 700 MW plus associated infrastructure. The Proposal will be developed across land with tenure comprising freehold properties and road reserve. Total ground disturbance for the Project will be approximately 730 ha, with minimal clearing of native vegetation required.

The Project will connect into the transmission line owned and operated by Western Power and connected to the South West Interconnected System (SWIS) from the Project's collector substation. The wind turbine generators (WTGs) nominally selected for the Project are the Vestas EnVentus model V172-7.2.

The results presented in this NIA indicate that wind farm noise emissions:

- Non-involved receptors: compliant with an LA₁₀ of 35 dB at Night period under the EPNR, which also ensures compliance at other times. Compliant with the minimum criteria of LA_{eq} 35 dB under SA Guidelines.
- Project-involved receptors: Compliant, predicted emissions no greater than L_{Aeq} 45 dB(A) are below the minimum 45 dB WHO criteria and DWER Memorandum recommended criteria of 40 dB when assessed according to this method.
- Predicted noise emissions exceeding LA₁₀ 35 dB extend beyond the Project boundary at some locations. There are no existing residences in these areas, so as proposed the noise emissions are compliant. However, should a new residence be constructed within these areas, the noise emissions may be non-compliant and mitigation through modified operation of relevant wind turbines may be required. Should these situations occur, Mid West Wind Farm Pty Ltd will work in good faith with the affected landowners.

The proposed layout is shown to comply at all receptors at all wind speeds.

The Project will be constructed over a 30-month period, with construction aiming to commence in 2028. Construction workforce is estimated to be up to 300 persons during the peak of construction, with the workforce predominately coming from the Mid West region. Operational workforce is expected to include 15 full time staff throughout the 25+ year operational life of the Project.

The intended design life is 25+ years, with option for repowering and structural inspection to extend the life by an additional 10+ years. Decommissioning and rehabilitation will occur following the cessation of the operational life. The decommissioning phase is anticipated to be around 18 months and will involve dismantling and removing the above ground wind turbine components, removing related above-ground infrastructure and rehabilitating internal access roads, not requested to be retained by individual landowners.

Where predicted noise emissions exceed LA_{eq} 35 dB for night works or LA_{eq} 40 dB during Sunday or Public Holiday work, a Construction Noise Management Plan for relevant work



near that receptor will be required. The predicted maximum footprint noise emissions shown in Appendix D demonstrate there are some construction work locations where a Construction Noise Management Plan may be required for out of hours work if there is a measurable 'noise characteristic' during the night period.

Vibration impacts from key construction activities have been assessed and the 'worst case' scenarios modelled were found to be acceptable.



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1.0 Introduction

SLR Consulting Australia Pty Ltd (SLR), has been engaged by Mid West Wind Farm Pty Ltd (the Client) as the acoustical consultants for the proposed Mid West Wind Farm (the "Project").

This report describes the methodology and findings of the Noise Impact Assessment (NIA) for the Project forming part of its environmental impact assessment.

Detailed in this report are the main aspects of the proposed wind farm project, the acoustic criteria, the background noise measurements and the predicted noise levels at all potentially impacted receptors from the operation of the proposed wind farm. It also addresses the noise and vibration impact of the wind farm during the construction phase.

1.1 Project Description

Vestas is proposing to develop the Project within a land development area of 16,498 hectares, approximately 50 km east of Geraldton, Western Australia within the Local Government Authorities of the City of Greater Geraldton. To provide regional context, a wider regional study area has been considered during the impact assessment which also extends to Shire of Mingenew and Shire of Irwin.

The Project will involve the construction of up to 98 wind turbine generators (WTGs) with a generation capacity up to 700 MW supplemented by a battery energy storage system (BESS) with a storage capacity of 4,200 MWh and nominal rating of 700 MW plus associated infrastructure (see **Figure 1**). The Project will be developed across land tenure comprising freehold properties and road reserve. Total ground disturbance for the Project will be approximately 730 ha (the TGD area), with minimal clearing of native vegetation required.

The Project will connect into the transmission line owned and operated by Western Power and connected to the South West Interconnected System (SWIS) from the Project's collector substation. The WTGs nominally selected for the Project are the EnVentus V172-7.2 model. This model range includes a new modular nacelle design that allows a range of models to be manufactured using the same base componentry, thereby reducing cost. The V172-7.2 model has the following technical features relevant to the environmental and social impact studies:

Standard rated power of 7,200 kW

- Cut-in wind speed at 3 m/s
- Wind class of IEC S (user defined)
- Rotor diameter of 172 m (approx. blade length = 84 m)
- Rotor swept area of 23,235 m²
- Hub height (above ground) = 150 m (IEC S)
- Maximum sound power level L_{WA} of 107.8 dB.

The wind turbine foundation design will be based on local geotechnical and terrain characteristics. Concrete supply will be obtained from an onsite concrete batching plant. To facilitate wind turbine erection and maintenance, the nominal hard stand area required at each turbine location (for construction and major maintenance) is 65 m x 70 m.

One substation comprising four 300 MVA, 3-phase 330/33 kV step-up transformers, oil-immersed forced-air-cooled (ONAF) will be included for connection to local networks. High voltage electrical collector cabling from each turbine to the substation will all be underground, 33 kV nominal. The BESS will also be connected to the substation via high



voltage cabling. Other electrical infrastructure will include Static Synchronous Compensators (STATCOMs).

The Project will be constructed over a 30-month period, with construction aiming to commence in 2028. Construction workforce is estimated to be up to 300 persons during the peak of construction, with the workforce predominately coming from the Mid West region. Operational workforce is expected to include 15 full time staff throughout the 25+ year operational life of the Project.

The Port of Geraldton is a major transport hub and will be the landing point for large site infrastructure e.g. turbine blades and transformers. Access to the Project site is provided by the local road network from Casurinas Road, Kiely Road and Nangetty-Walkaway Road. These local roads connect to the regional arterial network, the Brand Highway and Geraldton-Mount Magnet Road. Airports or airfields are located at Geraldton, Dongara, Mullewa, Morawa, and Mingenew.

Office and workshop facilities to support the Project's construction, commissioning and long-term operation and maintenance will be included in the Project.

During the operational phase of the Project, wind turbines, BESS and supporting infrastructure would require regular inspection and maintenance. During the initial operating years, operator attendance may be more regular while the wind farm operation is being optimised. Regular scheduled maintenance is required. It is possible that major unexpected or unscheduled maintenance could take place during the life of the wind farm.

The intended design life is 25+ years, with option for repowering and structural inspection to extend the life by an additional 10+ years. Decommissioning and rehabilitation will occur following the cessation of the operational life. The decommissioning phase is anticipated to be around 18 months and will involve dismantling and removing the above ground wind turbine components, removing related above-ground infrastructure and rehabilitating internal access roads, not requested to be retained by individual landowners.

1.2 Characteristics of the Site

The Project site incorporates five landowners. A noise assessment has been carried out for all dwellings within 5 km of a turbine under SA EPA Guidelines.

For Project involved receptor locations who have agreements with the proponent, a noise assessment has been carried out under WHO Guidelines to ensure there is no unreasonable impact on amenity.

Prevailing winds are easterlies and south westerlies.

All receptors surrounding the proposed Project have an ambient background noise environment that is determined by pre-dominantly natural sources which are largely wind influenced.

1.3 Receptor Locations

The assessment locations include all dwellings located within 5 km of a proposed WTG. **Table 34** in **Appendix B** lists the receptors, the distance from the nearest proposed WTG and their Project involved status. Some identified dwellings may be unoccupied.

Figure 1 shows the nearby receptor dwellings assessed for the Project referenced by project number, and the wind turbine area outline (blue). The location of the proposed BESS is shown in orange.

Receptor co-ordinates are provided in **Appendix B**.



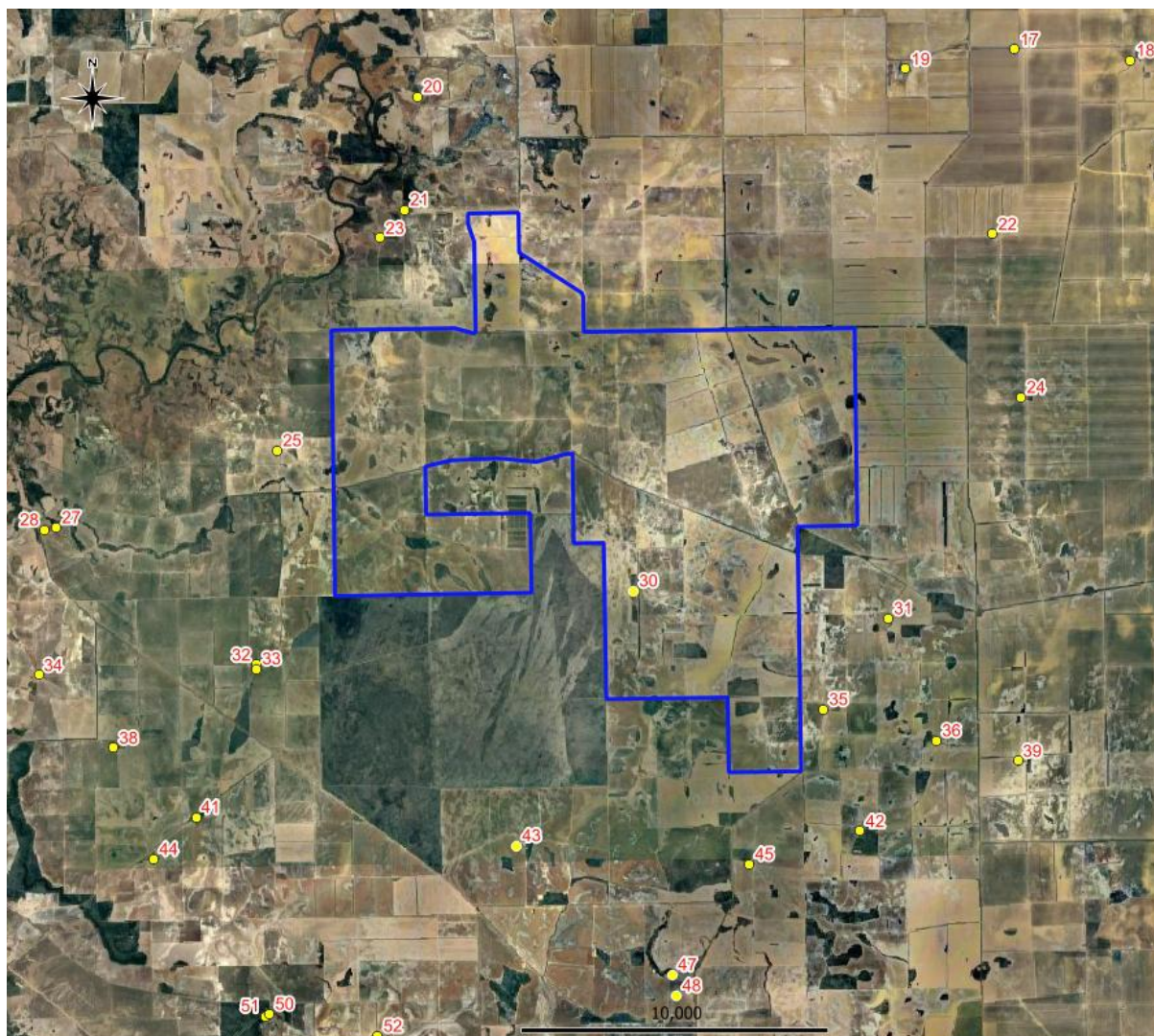


Figure 1: Receptor Locations and Project Area Wind Farm Layout

A tabulated listing of WTG coordinates for the layout is included in **Appendix B**. The locations are nominal, in that a deviation of up to 200m for individual wind turbines will not have a significant impact on the cumulative noise emission at residences. This allows for minor micro-siting of wind turbines following detailed geological testing at individual sites or due to other factors.

Figure 2 shows the nearby receptor dwellings assessed for the Project and the wind turbine Project area. Receptor dwellings (yellow dot) are identified by a project number, wind turbines (green dot) with associated reference number. The location of the proposed BESS is shaded in orange. Receptor dwellings involved in the wind turbine project are shown as a 'green dot'.



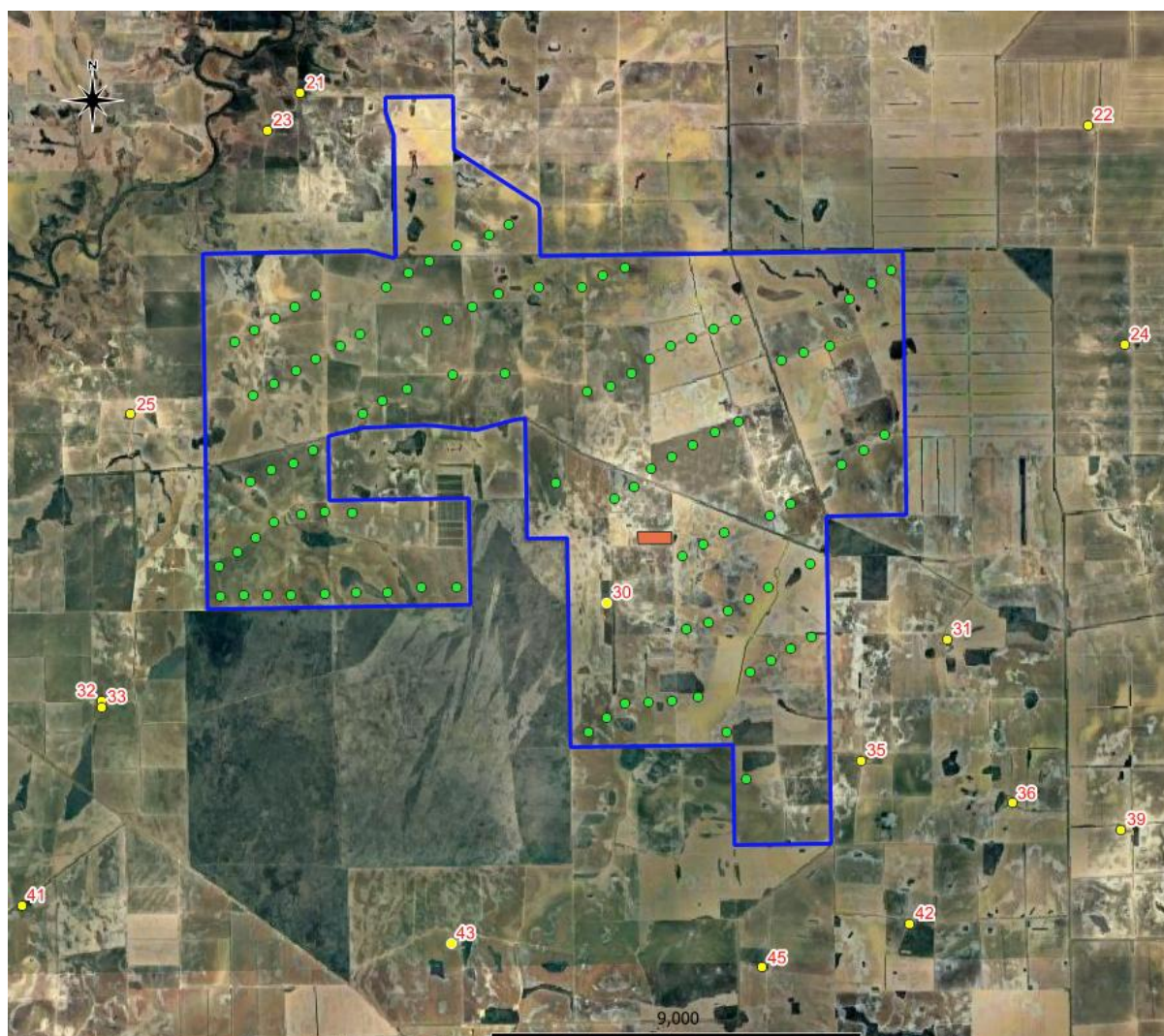


Figure 2: WTG and Receptor Layout

1.4 BESS

The proposed BESS is located within the Project area, approx. 1.6km NE of involved receptor '30' (refer Figure 2). The sound power data used to model the noise emitting infrastructure for the proposed BESS is provided in **Table 2**. The sound power data is based on BESS units common to larger BESS installations in Western Australia. The selection is nominal, allowing for alternative vendors. Should selected equipment sound power exceed the indicated values, noise mitigation or equipment management will be applied to ensure BESS noise emissions are not increased to the nearest (host) receptor, R30.

Table 1: Substation Sound Power Levels

Equipment	Overall Sound Power, L_{WA} dB
BESS unit – 1 of 1120	85
BESS inverter skid – 1 of 224	95
33 kV collector / transformer – 1 of 4	92



1.5 Substation

The proposed substation for the wind farm is located within the Project area, approx. 1km NE of involved receptor '30' (refer Figure 2). The sound power data used to model the noise emitting infrastructure for the proposed substation is provided in **Table 2**.

Table 2: Substation Sound Power Levels

Equipment	Overall Sound Power, L_{wA} dB
330 kV Transformer (1 of 4)	88
Cooling fan unit (1 per transformer)	81
Cap Bank (1 of 3, 4 sets)	69
STATCOM (1 of 4)	91

2.0 Legislation & Guidelines

2.1 Overview

The WA Planning Commission 'Position Statement: Renewable energy facilities (March 2020), section 5.3.4 documents the requirements for assessment of environmental noise from wind farms.

Two assessments are required:

- 1 An assessment of noise emissions in accordance with the requirements of the *Environmental Protection (Noise) Regulations 1997* (EPNR), a mandatory requirement.

Noise emissions from the combination of wind turbines and wind farm infrastructure such as substations should not exceed the EPNR 'Assigned Levels'. Modelling is based on the Pre-lodgement Memorandum "Wind farm noise assessment at development application stage – generic advice (28 August 2025)" provided during pre-referral by the Department of Water and Environmental Regulation (DWER).

- 2 An assessment under the South Australia EPA 'Wind Farms Environmental Noise Guidelines (2009)' ("SA Guidelines"), referenced for assessment purposes.

The principal acceptability limit criteria under the SA Guideline are that the wind farm $L_{eq,(10 \text{ min})}$ noise should not exceed the greater of an amenity limit of 35 dB or the pre-existing background noise, $L_{90,(10 \text{ min})}$ by more than 5 dB (for any given wind speed).

The methodology and acceptability limit criteria that have been applied to this study are based upon these documents.

The Project requirements and wind farm acceptability limit criteria are discussed in **Section 4.0**.

It is understood that DWER assessment of noise impact is based on assessment method 1), with DAP assessments focusing on the publicly documented Position Statement requirements which covers both methods 1) and 2). The DAP assessment is understood to include the SA Guidelines (which have historically provided the basis for wind farm assessments in Western Australia). This assessment covers both approaches. The relevant authority should be able to extract the assessment information specific to their approach.



2.2 Review of Relevant Requirements

2.2.1 WA Renewable Position Statement

The WA Planning Commission 'Position Statement: Renewable energy facilities (March 2020), section 5.3.4 documents the requirements for assessment of environmental noise from Wind Farms, as follows:

5.3.4 Noise impact (wind turbine proposals)

The minimum recommended distance between noise-sensitive land uses and a wind turbine is 1,500 metres*.

The minimum distance may be reduced with the approval of the local government, based upon advice from DWER.

Proposals for new wind turbines within 1,500 metres of an existing or new noise-sensitive premises (excluding caretaker dwellings) will require an acoustic study to enable the local government to determine the acceptability of a lesser separation distance. The acoustic study should be completed by a qualified acoustic consultant and include the provision of suitable noise attenuation measures, where required. Noise emissions from renewable energy facilities, including wind turbines, are required to meet the standards prescribed under the Environmental Protection (Noise) Regulations 1997. The South Australian Environmental Protection Authority – Wind Farms Environmental Noise Guidelines (2009) should also be referenced for assessment purposes. These guidelines acknowledge the potential for operation in the presence of higher wind-induced background noise levels.

Evidence suggests that there are unlikely to be any significant effects on physical or mental health for noise-sensitive land uses at distances greater than 1,500m from wind turbines¹.

2.2.2 WA Environmental Protection (Noise) Regulations

Environmental noise in Western Australia is regulated under the *Environmental Protection (Noise) Regulations 1997* ("EPNR", the "Regulations") as amended, under the *Environmental Protection Act 1986* (the "Act").

Unreasonable noise under the Act is described in clause s3(3):

For the purposes of this Act, noise is to be taken to be unreasonable if —

(a) it is emitted, or the equipment emitting it is used, in contravention of —

(i) this Act;

(ii) any subsidiary legislation made under this Act; or

(iii) any requirement or permission (by whatever name called) made or given by or under this Act;

(b) having regard to the nature and duration of the noise emissions, the frequency of similar noise emissions from the same source (or a source under the control of the same person or persons) and the time of day at which the noise is emitted, the noise unreasonably interferes with the health, welfare, convenience, comfort or amenity of any person; or

(c) it is prescribed to be unreasonable for the purposes of this Act.

The Regulations, as subsidiary legislation made under this Act, are applicable to noise generated by the wind turbines, given that no exclusion within Regulation 3 appears

¹ Source: National Health and Medical Research Council (February 2015 ref # EH57)



applicable, and no specific approval or permit has been granted (yet) to exceed statutory requirements.

Both operational and construction noise are addressed through the regulations.

2.2.2.1 Operational Noise

The noise emissions from premises are regulated in Western Australia under the Environmental Protection (Noise) Regulations 1997 ("Noise Regulations", "the Regulations"). Generally, to achieve compliance with the Regulations, the noise levels at nearby residential areas from the premise operations are not to exceed defined limits (assigned levels).

A summary of the applicable noise limits is provided in **Table 3**. These limits are determined from consideration of prevailing background noise levels and 'influencing factors' that considers the level of commercial and industrial zoning in the locality. The influencing factor (IF) considers zoning and road traffic within 450 metres of each noise sensitive premises.

Table 3: Assigned noise level summary

Part of premises receiving noise	Time of day	Assigned level, dB		
		L _{A10}	L _{A1}	L _{Amax}
Noise Sensitive premises at locations within 15 metres of a building directly associated with a noise sensitive use	0700 to 1900 hours Monday to Saturday ('Day')	45 + IF	55 + IF	65 + IF
	0900 to 1900 hours Sunday and public holidays ('Sundays')	40 + IF	50 + IF	65 + IF
	1900 to 2200 hours all days ('Evening')	40 + IF	50 + IF	55 + IF
	2200 hours on any day to 0700 Monday to Saturday and 0900 hours Sunday and public holidays ('Night')	35 + IF	45 + IF	55 + IF
Noise Sensitive premises at locations further than 15 metres from a building directly associated with a noise sensitive use.	All hours	60	75	80
Commercial premises	All hours	65	75	80
Industrial and utility premises	All hours	65	80	90

The specific assigned level for each receptor is detailed in **Table 6**.

Under the Regulations, if noise emitted from any premises when received at any other premises cannot reasonably be free of intrusive characteristics of tonality, modulation and impulsiveness, a series of adjustments are added to the emitted levels (measured or calculated), and the adjusted level must comply with the assigned level. The adjustments are detailed in **Table 4** and are further defined in Regulation 9(1) of the Regulations.

Table 4: Definition of noise characteristics

Noise characteristic	Definition	Adjustment if present (Note ¹)
Tones	Where the difference between the A weighted sound pressure level in any one third octave band and the arithmetic average of the A weighted sound pressure levels in the two adjacent one third octave bands is greater than 3 dB in terms of L _{Aeq,T} where the time period T is greater than 10% of the representative assessment period, or	+5 dB



Noise characteristic	Definition	Adjustment if present (Note ¹)
	greater than 8 dB at any time when the sound pressure levels are determined as LASlow levels.	
Modulation	A variation in the emission of noise that – Is more than 3 dB LAFast or is more than 3 dB LAFast in any one third octave band; Is present for at least 10% of the representative assessment period; and, Is regular, cyclic and audible.	+5 dB
Impulsiveness	Present where the difference between the LApeak and LAmax is more than 15 dB when determined for single representative event.	+10 dB

Note 1 where noise emission is not music, these adjustments are cumulative to a maximum of 15 dB

The critical case is for the night-time period of the regulations, when ‘worst case’ climatic conditions are occurring. For many of the key receptors, compliance at night is achieved if the noise emission is predicted to be no greater than an LA10 of 35 dB.

2.2.2.2 Construction Noise

Regulation 13 of the *Environmental Protection (Noise) Regulations 1997 EPNR* as amended applies to management of noise from construction activities. The relevant section of Regulation 13 states the following:

13(2) Regulation 7 [assigned noise levels] does not apply to ... construction work carried out between 0700 hours and 1900 hours on any day which is not a Sunday or public holiday if the occupier of the premises ... shows that:

- a) *The construction work was carried out in accordance with control of environmental noise practices set out in section 6 of AS 2436-1981 Guide to Noise Control on Construction, Maintenance and Demolition Sites;*
- b) *The equipment used on the premises was the quietest reasonably available; and*
- c) *If the occupier was required to prepare a noise management plan ... in respect of the construction site*
- d) *The noise management plan was prepared and given in accordance with the requirement, and approved by the Chief Executive Officer; and*
- e) *The construction work was carried out in accordance with the management plan.*

13(3) Regulation 7 does not apply to ... construction work carried out other than between the [above] hours if the occupier of the premises ... shows that –

- a) *The construction work was carried out in accordance with control of environmental noise practices set out in section 6 of AS 2436-1981 Guide to Noise Control on Construction, Maintenance and Demolition Sites;*
- b) *The equipment used on the premises was the quietest reasonably available;*
- c) *The construction work was carried out in accordance with a noise management plan in respect of the construction site –*

Prepared and given to the Chief Executive Officer not later than 7 days before the construction work commenced; and

Approved by the Chief Executive Officer;



- a) *At least 24 hours before the construction work commenced, the occupier of the construction site gave written notice of the proposed construction work to the occupiers of all premises at which noise emissions received were likely to fail to comply with the standard prescribed under regulation 7; and*
- b) *It was reasonably necessary for the construction work to be carried out at that time.*

From the above, the assigned noise levels do not apply to construction sites where the proponent:

- Demonstrates that the construction work is carried out in accordance with section 4 of AS 2436-2010
- Uses the quietest reasonably available equipment
- Prepares and supplies the CEO with an approved construction noise management plan (CNMP) no later than 7 days before the proposed works
- And where the works to take place outside standard hours
 - Provides notice to potentially affected residents at least 24 hours prior the start of the proposed works
 - Provides reasons for why it was necessary for the construction work to be carried out at that time.

2.2.3 SA EPA Guideline

The Position Statement references the 2009 revision of the SA Guidelines. This has been revised (November 2021), with reportedly minor changes.

The SA EPA Guideline recommends the following noise criteria for new wind farms,

“The predicted equivalent noise level ($L_{Aeq, 10min}$), adjusted for tonality in accordance with these guidelines, should not exceed:

- *35 dB, or*
- *the background noise level by more than 5 dB,*

whichever is the greater, at all relevant receivers for each integer wind speed from cut-in to rated power of the WTG.”

The Guideline also provides information on measuring the background noise levels, locations and requirements on the number of valid data points to be obtained and the methodology for excluding invalid data points. It also outlines the process for determining lines of best fit for the background data, and determination of the noise limit.

The Guideline accepts that wind farm developers commonly enter into agreements with private landowners in which they are provided compensation. The guideline is intended to be applied to premises that do not have an agreement with the wind farm developer. This does not absolve the obligations of the wind farm developer entirely as appropriate action can be taken under the *Environmental Protection Act* if a development ‘unreasonably interferes’ with the amenity of an area. The guideline lists that there is unlikely to be unreasonable interference if:

- a formal agreement is documented between the parties
- the agreement clearly outlines to the landowner the expected impact of the noise from the wind farm and its effect on the landowner’s amenity
- the likely impact of exposure will not result in adverse health impacts (e.g. the level does not result in sleep disturbance).



The proponent has discussed the possible noise implications of the proposed turbine layout with the involved residents whose property the turbines would be located on and will enter into agreements with these parties.

2.2.4 World Health Organisation (WHO) Guidelines

Where noise levels at Project-involved residences do not comply with the SA EPA Guidelines, the proponent intends to enter into agreements with the owners of those residences to achieve noise criteria in accordance with World Health Organisation (WHO) Guidelines. The proponent will apply those guidelines as necessary to ensure that the project does not result in an 'unreasonable interference' with the amenity or cause any adverse health effects at those residences.

The WHO publication '*Compendium of WHO and UN guidance on health and environment (2022)*² provides a summary of its guidance as of 2022, and it is considered current.

In the referenced guidelines³, the WHO 'conditionally' recommends an outdoor target of L_{den} 45 dB, but notes that there is "*wide variability in the values and preferences of the population, with particularly strong negative attitudes in populations living in the vicinity of wind turbines ... Based on the low quantity and heterogeneous nature of the evidence, the [WHO Guideline Development Group] was not able to formulate a recommendation addressing sleep disturbance due to wind turbine noise at night time.*"

For the assessment of Project-involved residences the adopted external criteria of 45 dB or the level given by the SA EPA Guideline criteria, where higher, will be adopted.

Effectively this becomes L_{Aeq} 45 dB or background + 5 dB, whichever is the higher.

2.2.5 Vibration Guidelines

Impacts from vibration can be considered both in terms of effects on building occupants (human comfort) and the effects on the building structure (building damage). Of these considerations, the human comfort limits are the most stringent. Therefore, for occupied buildings, if compliance with human comfort limits is achieved, it will follow that compliance will be achieved with the building damage objectives.

2.2.5.1 Human Comfort

The DECCW's Assessing Vibration: A Technical Guideline provides acceptable values for continuous and impulsive vibration based upon guidelines contained in BS 6472–1992, Evaluation of human exposure to vibration in buildings (1–80 Hz).

Both preferred and maximum vibration limits are defined for various locations and are shown in **Table 5** with the preferred night-time PPV criteria of 0.2 mm/s being the most relevant to the project.

² https://cdn.who.int/media/docs/default-source/who-compendium-on-health-and-environment/who_compensum_noise_01042022.pdf

³ World Health Organisation (2018), *Environmental noise guidelines for the European Region*, Regional Office for Europe. <https://iris.who.int/handle/10665/279952>



Table 5: Preferred and maximum values for continuous and impulsive vibration

Location	Assessment period ¹	Preferred values RMS acceleration m/s ²		Maximum values RMS acceleration m/s ²		Peak Velocity PPV mm/s	
		z-axis	x- and y-axes	z-axis	x- and y-axes	Preferred	Maximum
Continuous vibration							
Critical areas ²	Day- or night-time	0.0050	0.0036	0.010	0.0072	0.14	0.28
Residences	Daytime	0.010	0.0071	0.020	0.014	0.28	0.56
	night-time	0.007	0.005	0.014	0.010	0.20	0.40
Offices, schools, educational institutions and places of worship	Day- or night-time	0.020	0.014	0.040	0.028	0.56	1.1
Workshops	Day- or night-time	0.04	0.029	0.080	0.058	1.1	2.2
Impulsive vibration							
Critical areas ²	Day- or night-time	0.0050	0.0036	0.010	0.0072	0.14	0.28
Residences	Daytime	0.30	0.21	0.60	0.42	8.6	17.0
	night-time	0.010	0.0071	0.020	0.014	2.8	5.6
Offices, schools, educational institutions and places of worship	Day- or night-time	0.64	0.46	1.28	0.92	18.0	36.0
Workshops	Day- or night-time	0.64	0.46	1.28	0.92	18.0	36.0

Note1: Daytime is 7.00 am to 10.00 pm and night-time is 10.00 pm to 7.00 am

Note 2: Examples include hospital operating theatres and precision laboratories where sensitive operations are occurring. There may be cases where sensitive equipment or delicate tasks require more stringent criteria than the human comfort criteria specified above. Stipulation of such criteria is outside the scope of this policy, and other guidance documents (e.g. relevant standards) should be referred to. Source: BS 6472–1992

These limits relate to a long-term (16 hours for daytime), continuous exposure to vibration sources. Where vibration is intermittent, a higher level of vibration is typically acceptable.

2.2.5.2 Building Damage

In regard to potential building damage, the German Standard DIN4150 recommends a limit of 10 mm/s PPV within any building and the British Standard BS7385: Part 2 – 1993 sets a limit within buildings which depends upon the vibration frequency but is as low as 7.5 mm/s PPV (at 4.5 Hz). For the purposes of ensuring a reasonable factor of safety, a conservative limit of approximately 5 mm/s PPV has been applied for this Project.



3.0 Existing Environment

The Project is located in a remote region which is sparsely populated and predominantly made up of broad acreage farming.

All receptors surrounding the proposed Project have an ambient background noise environment that is determined by pre-dominantly natural sources, including those which are wind influenced such as wind noise in foliage.

3.1 Ambient Noise Monitoring

In order to establish the intrusive noise limit, background noise monitoring is required to establish the pre-existing ambient noise environment as a function of wind speed. As wind speed increases the ambient noise level at most receptors generally also increases as natural sources such as wind in trees begin to dominate. The variation of background noise with wind speed is usually quite site specific and related to various physical characteristics such as topographic shielding and the extent and height of exposed vegetation.

Noise monitoring is completed for a period of approximately 6 weeks and correlated to synchronous wind speed and direction data measured at the wind farm monitoring mast. The LA90 (Fast response) statistical noise level for each 10-minute measurement period is used for assessment.

The captured data is screened for validity, with data monitored during periods of rain or where the average wind speed at the microphone position likely exceeded 7 m/s (where large wind socks are fitted to microphones) being discarded from the data set. The hub height wind speed bin average of all valid data is used to determine the baseline noise in accordance with the procedure outlined in the South Australian Wind Farms Environmental Noise Guidelines (2009), section 3.3 (page 13).

3.2 Baseline Surveys

To quantify the existing ambient noise environment baseline noise monitoring was conducted at 4 reference receptor locations in the Project area between 21st August and 13th November, 2024.

The monitoring campaign included periods of rain, which were removed from the analysed data set.

At each location, noise monitoring equipment was placed in the vicinity of the buildings and trees, at a location representative of occupied residences in the local area. Consideration was given to avoiding other potential sources of extraneous noise and the position of the monitoring equipment was documented with photographs.

The baseline surveys utilised noise monitoring equipment that meets the sound level meter requirements of IEC 61672-1:2002 – Class 1, with current NATA calibration and they utilised high-performance microphone wind socks (150 mm diameter). The M2 site also included a local weather station, which was used to evaluate local rainfall and local wind speed to assist in the screening of valid data. Pre and post survey acoustic calibrations were completed on-site.

Reference wind speed was provided by Vestas from wind and temperature measurements on the site met mast, with the upper wind speed and direction sensors at 115m AGL.

A consolidated wind data set from the above was used and from this the local noise data was then correlated to the 150 m AGL wind speed.

Baseline survey noise data was additionally processed and provided for the night period to address the DWER Memorandum recommendations.



3.3 Measurement Locations

The locations for the background noise measurements were selected by SLR Consulting on the basis of preliminary predicted WTG noise levels as well as proximity and similarity to other receptors.

The monitoring locations are shown in **Figure 3**.

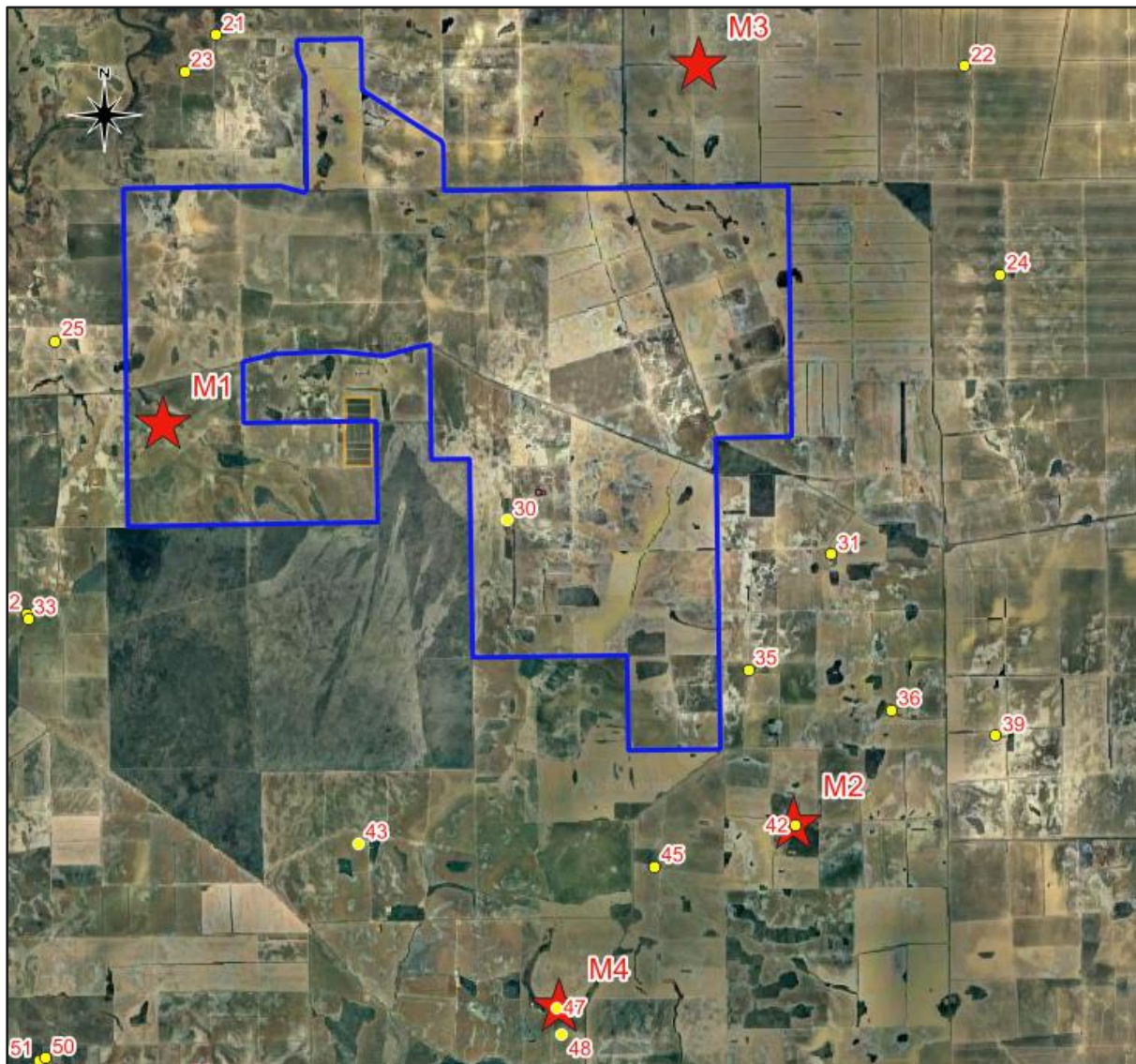


Figure 3: Baseline monitoring locations

3.4 Measurement Details

The measurement location, monitoring period, and serial number of the noise loggers for all testing are summarised in **Appendix A** along with the number of valid data points for each location.

The SA EPA Guideline recommends a set of approximately 2,000 valid data points. Any data points adversely affected by periods of rain or extraneous noise were excluded. The equipment used, the period of monitoring at each location, number of valid data points (with all thresholds set by the Guidelines being reached) and other related information is provided in **Appendix A**.



The measured background noise levels (L_{A90}) are then plotted against the hub height wind speed to obtain a background versus wind speed characteristic. The average wind speed bin noise level for the data set is then determined, as required by the SA EPA Guideline.

The baseline noise monitoring survey locations are pictured along with data and results which are detailed fully in **Appendix A**.

4.0 Operational Noise Criteria

Wind turbine operational noise criteria are determined separately for EPNR and SA Guidelines. In addition, the EPNR criteria apply to the cumulative wind turbine and infrastructure noise emissions. Infrastructure includes BESS, substations and any other operational equipment associated with the wind farm proposal.

4.1 Sensitive Receptor EPNR Criteria

One residential receptor within the Project area has commercial agreements with the wind farm and are considered as 'caretakers' under the regulations.

There remain obligations to ensure those receptors have reasonable amenity. This has historically been assessed as an external noise level no greater than L_{A10} 45 dB from the wind farm noise sources.

It is noted that a Technical (Review) Report on the noise assessment for the Parron wind farm development (Badgingarra) by DWER⁴ contained a comment that the recommended Target for residences in partnership with the project is L_{A10} 40 dB.

The locality is predominantly rural, the receptors surrounding the wind farm project are all assessed as having a zero 'influencing factor' under the ENPR, with night time 'Assigned Level' of L_{A10} of 35 dB.

The EPNR noise criteria are as per **Table 6**.

Table 6: WTG EPNR noise criteria summary

Project involved status	Minimum criteria (L_{A10})
No (residential)	35 dB
Yes (residential)	45 dB (40 dB L_{A10} recommended by DWER)

4.2 SA Guidelines Wind Turbine Noise Criteria

The assessment of the acceptability of wind farm noise was undertaken at all assessment residential receptors (located within 5 km of a WTG) using the noise limit set in SA EPA Guidelines. Dwellings further than this distance are deemed to comply if dwellings closer to turbines comply with the SA EPA noise limit.

The proponent intends to enter into noise agreements with the project involved residences prior to construction. Under the SA EPA Guidelines these residences are not required to comply to the 35 dB or 'background + 5 dB' limits.

However, it is necessary to ensure that the Project does not result in an 'unreasonable interference' with the amenity of these areas or cause any adverse health effects. Therefore,

⁴ Department of Water and Environmental Regulation 2024, 'Technical (Review) Report – Advice on the acoustic assessment for the proposed Parron wind farm development in Badgingarra, prepared for the Shire of Dandaragan, Reference DWERT1025582 accessed from https://www.epa.wa.gov.au/sites/default/files/Referral_Documentation/RSD%20Appendix%20H%20-%20Technical%20%28Review%29%20Report%20Advice%20on%20the%20Acoustic%20Assessment.pdf on 12 May 2026.



for the assessment of Project involved residences the adopted external criteria of 45 dB (as per the WHO Guideline) or the level given by the SA EPA Guideline criteria, where higher, will be adopted. Effectively this becomes 45 dB or background + 5 dB, whichever is the higher.

Background noise as determined using the methods of the SA Guidelines for the four monitoring locations are shown in **Table 7**.

Table 7: Measured background noise vs HH wind speed, LA90 dB (ten minute)

Wind speed m/s	3	4	5	6	7	8	9	10	11	12	13	14	15
M1	23	24	26	26	29	30	30	32	36	39	37	38	35
M2	27	28	30	33	36	35	34	32	30	30	33	33	34
M3	22	24	25	27	28	29	27	30	32	35	35	36	34
M4	28	28	30	31	32	32	33	34	32	30	29	29	29

Background noise levels exceeding LA90 of 30 dB shown shaded in green.

The maximum sound power generated by the wind turbine is for hub height wind speed of 10 m/s or higher. Because at least one measured background noise bin is at 30 dB or lower at each of the monitoring locations for a wind speed of 10 m/s or higher, the critical assessment criteria for compliance at maximum wind turbine sound power output will be 30 plus 5 dB.

The exception are receptors around location M1, where the criteria at a hub height wind speed of 9 m/s is the most critical in terms of compliance. There is a wind turbine sound power emission of 107.1 and 107.8 dB(A) for 9 and 10 m/s hub height wind speed (a difference of 0.7 dB). The 'baseline plus 5' criteria increase by 2 dB(A) at 10 m/s compared to 9 m/s, hence 9 m/s operating condition is the most significant. Receptors 21, 23, 25, 32 and 33 are the key receptors where slightly higher 'baseline plus five' criteria apply under the South Australian guidelines.

The criteria determined applicable as per the South Australian Guidelines is in **Table 8**.

Table 8: SA Guidelines Criteria vs HH wind speed, LAeq dB

Wind speed m/s	3	4	5	6	7	8	9	10	11	12	13	14	15
M1	35	35	35	35	35	35	35	37	41	44	42	43	40
M2	35	35	35	35	41	35	39	37	35	35	38	38	39
M3	35	35	35	35	35	35	35	35	37	40	40	41	39
M4	35	35	35	36	37	37	38	39	37	35	35	35	35

Owing to the relatively low levels of background noise determined by the baseline noise monitoring, detailed in **Appendix B**, the Minimum Criteria outlined in **Table 9** will generally apply except for receptors nearest baseline monitor M1.

Table 9: WTG noise criteria summary

Project involved status	Minimum Criteria, LAeq	Background criteria
no (residential)	35 dB	Background + 5 dB
yes	45 dB	Background + 5 dB



5.0 Wind Farm Assessment Methodology

5.1 Source levels

The wind turbine generators (WTGs) nominally selected for the Project are the EnVentus V172-7.2 model. This model range includes a new modular nacelle design that allows a range of models to be manufactured using the same base componentry, thereby reducing cost. The V172-7.2 model has the following technical features relevant to the environmental and social impact studies:

- Standard rated power = 7,200 kW
- Cut-in wind speed = 3 m/s
- Wind class = IEC S (user defined)
Rotor diameter = 172 m (approx. blade length = 84 m)
- Rotor swept area = 23,235 m²
- Hub height (above ground) = 150 m (IEC S)
- Maximum sound power level L_{WA} of 107.8 dB.

Noise emissions for the proposed WTG have been provided by the manufacturer, with the Three variations of the model are presented which are:

1. Standard
2. Serrated trailing edge (S00)
3. Serrated trailing edge under 8 separate noise management modes (from S01 to S08).

The overall L_{Aeq} sound power levels for these variations used in the modelling are provided in **Table 10**. **Table 11** presents the one-third octave band noise level used for the final modelling scenario.

Table 10: Sound Power Levels for WTGs

Turbine	Overall Sound Power Level, L_{WA} dB
V172 PO7200-0S without serrated edge	111.1
V172-PO7200 with serrated edge (Table 11)	107.8
V172 S01	105.0
V172 S02	104.0
V172 S03	103.0
V172 S04	102.0
V172 S05	101.0
V172 S06	100.0



Overall Level, L _{WA}	One-third Octave Band Centre Frequency, Hz																				
	50	63	80	100	125	160	200	250	315	400	500	630	800	1k	1.25k	1.6k	2k	2.5k	3.15k	4k	5k
107.8	81	84.9	87.2	89.7	92	93.6	95.7	97.2	96.9	95.8	95.4	95.6	96.2	96.4	96	95.5	95.2	94.6	94.8	94.3	90

Figure 4: WTG Sound Power Level vs Wind Speed

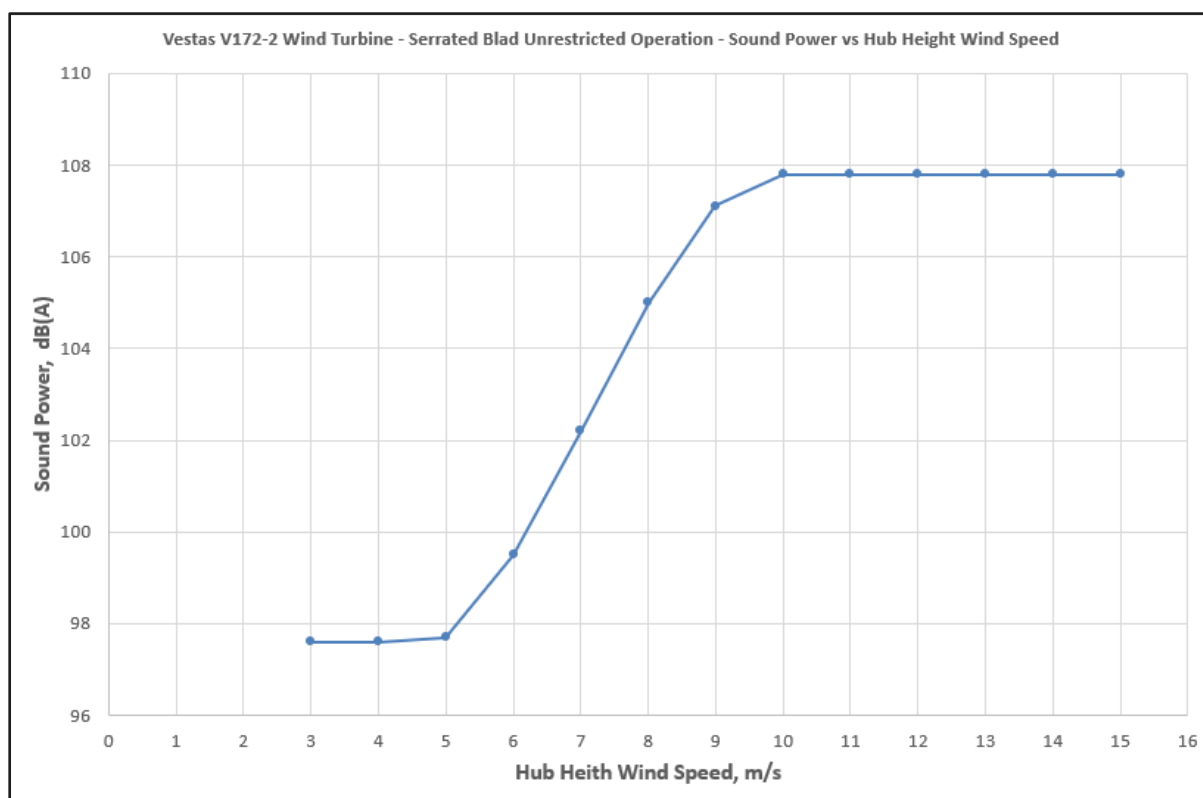


Table 12: Substation Sound Power Levels

Equipment	Overall Sound Power, L _{WA} dB
330 kV Transformer (1 of 4)	88
Cooling fan unit (1 per transformer)	81
Cap Bank (1 of 3, 4 sets)	69
STATCOM (1 of 4)	91



Table 13: BESS Sound Power Levels

Equipment	Overall Sound Power, L_{wA} dB
33 kV Transformer (1 of 4)	92
BESS Unit (1 of 1120)	85
BESS inverter (1 of 224)	95

5.2 Overview

Assessment of operational noise from the Project has been undertaken in accordance with the following guidelines and information resources:

- Western Australian EPNR
- DWER correspondence
- SA Guidelines.

The following subsections detail how these guidelines and correspondence have been implemented within the assessment. Where the respective guidelines specify a modelling condition, these have been implemented. It is noted that the guidelines used are the latest version issued and available.

5.3 EPNR Infrastructure Noise Emission Modelling

5.3.1 Environmental propagation

The CONCAWE prediction methodology was utilised within SoundPLAN for noise sources other than wind turbines. The CONCAWE prediction method is specially designed for large facilities and incorporates corrections to account for the potential influence of wind effects and atmospheric stability conditions.

5.3.2 Modelling parameters

The 'default meteorological conditions' for noise modelling in published DWER guidelines have been adopted where the CONCAWE algorithm is used for noise emission prediction. The weather conditions summarised in **Table 14** used to approximate the typical 'worst-case' scenario for enhancement of sound propagation in each time period.

Table 14: Default 'worst-case' meteorological conditions for CONCAWE modelling

Parameter	'Day' 0700-1900	'Evening' and 'Night' 1900-0700
Wind Speed and Direction	4 m/s source to receptor	3 m/s source to receptor
Temperature inversion lapse rate	0°C per 100m	2°C per 100m
Pasqual stability class	E	F
Hub height windspeed (150m AGL)	7 m/s	5 m/s
Wind turbine sound power	107.8 dB(A)	107.8 dB(A)
Temperature	20°C	15°C
Relative Humidity	50%	50%
Ground Absorption Coefficient	0.6	0.6
Receptor Height	1.5m AGL	1.5m AGL



As wind turbines operate during both day and night periods, only the more critical night period has been modelled. The 'Assigned Level' for the day period being at least 5 dB higher for the same noise source, compliance for the Night period ensures compliance during the Day period.

A ground absorption coefficient of 0.6 is applicable to most modelling situations in Western Australia using the CONCAWE algorithm. This is slightly more conservative than the ISO 9613-2:2024 recommended ground absorption for wind turbine modelling which indicates that a Ground Absorption Coefficient of 0.5 can be used with that algorithm.

5.4 State Government Advice

As part of the pre-referral process, the DWER Environmental Noise Branch (ENB) provided a memorandum⁵ outlining the department's expectations in relation to modelling, data collection, analysis and information to be included in noise impact assessment(s) for wind farm noise emissions at the development approval stage.

Noting that wind farm noise regulations are currently under review⁶, the advice states that the Noise Regulations are the prescribed standards for noise emissions in Western Australia and, therefore, apply to noise emissions from wind farms.

In broad terms, the noise criteria, or assigned levels, are fixed noise levels not to be exceeded and which are independent of measured background noise levels. The noise emissions from the Project are to comply with the Noise Regulations at any dwelling not associated with the Project. The Project should be sited and designed such that predicted noise levels at sensitive receivers outside of the project envelope meet the noise criteria, after considering intrusive characteristics in accordance with Regulation 9).

Cumulative noise issues may arise where a proposed wind farm will impact on a receiver already impacted by an existing wind farm or commercial/industrial activities nearby.

DWER has historically considered 'involved' or 'stakeholder' receivers as being within the noise emitting premises, such that the assigned levels of the Noise Regulations would not apply. Nonetheless, DWER has recommended a target level of L_{A10} 40 dB for these receivers on past projects to provide some protection to health and amenity.

To provide consistency between projects, the following modelling methodology is to be used:

5.4.1 Wind turbine noise emissions

Noise emissions from wind turbines are modelled as follows:

- Use a point source at hub height without any directional characteristics to represent each turbine
- The quoted turbine sound power levels from the manufacturer can be used without adjustment
- Locate receivers at 4 metres above natural ground level
- Use a ground absorption $G = 0.5$ for the whole study area
- Use a temperature of 10 degrees Celsius and 70% relative humidity.

⁵ Department of Water and Environmental Regulation, "Wind farm noise assessment at development application stage – generic advice", dated 28 August 2025

⁶ State Government of Western Australia, "Wind Farm Noise Reform", accessed from <https://www.wa.gov.au/organisation/departments/departments-of-water-and-environmental-regulation/wind-farm-noise-reform> on 12 May 2026.



These settings align with Appendix D of ISO 9613-2:20204.

5.4.2 Non-wind turbine noise emissions

Noise emissions from other non-wind farm noise sources such as battery energy storage systems or transformers should be modelled using the CONCAWE method with 'default worst-case' conditions per **Table 15**.

Table 15: DWER CONCAWE meteorological conditions for noise modelling

Parameter	Daytime, 0700 – 1900	Nighttime, 1900 - 0700
Wind Speed	4 m/s	3 m/s
Temperature inversion lapse rate	0 °C / 100m	2 °C / 100m
Pasquil Stability	E	F
Temperature	20 °C	15 °C
Relative Humidity	50 %	50 %

It is the cumulative noise emission of the wind turbines modelled in accordance with **Section 5.4.1** and infrastructure (including BESS) modelled in accordance with **Section 5.4.2** that is assessed for compliance against the Assigned Levels under the EPNR.



5.5 SA Wind Farms Guidelines Noise Emission Modelling

5.5.1 Wind turbine noise source

Predicted L_{Aeq} noise levels were calculated based upon sound power levels determined in accordance with the recognised standard IEC-61400-11:2002 (*Wind Turbine Generator Systems - Part 11: Acoustic Noise Measurement Techniques*), where available, for the wind range 3 to 15 m/s.

The noise character of Wind Turbine Generator (WTG) noise emissions is also assessed for any special audible characteristics, such as tonality or low frequency content, which would be deemed more annoying or offensive. If sufficient characteristics such as tonality are identified, then the predicted noise level would be penalised by the addition of 5 dB. It should be noted that the characteristic noise level modulation of WTGs, commonly referred to as 'swish', is a fundamental part of wind farm noise and is considered via the SA EPA Guideline assessment procedure.

5.5.2 Other noise sources

Other noise sources such as substations and BESS are modelled concurrently with the wind turbine noise sources, with the cumulative noise emission reported.

5.5.3 Environmental Propagation

A three-dimensional SoundPLAN computer noise model was used to predict L_{Aeq} noise levels from all WTGs at all surrounding residential dwellings within 10km of a turbine.

The ISO 9613 noise model incorporates a 'hard ground' assumption and includes one-third octave band calculated effects for air absorption, ground attenuation and topographic shielding with amendments in accordance with the Institute of Acoustics (IoA) *Good Practice Guide on Wind Turbine Noise*.

It is noted that ISO 9613 equations predict for average downwind propagation conditions and also hold for average propagation under a well-developed moderate ground-based temperature inversion.

The stated uncertainty in the ISO 9613 prediction model is ± 3 dB.

5.5.4 Modelling Parameters

The modelling conditions specified within the SA Guidelines have been adopted. These are shown in **Table 16**.

Table 16: Default 'worst-case' meteorological conditions for noise modelling

Parameter	Value	SA Guideline Reference
Temperature	10°C	Section 3.3, page 11
Relative Humidity	80	Section 3.3, page 11
Ground Absorption Coefficient	0 (hard ground)	Section 3.3, page 11
Receptor Height	4m AGL	Institute of Acoustics, section 4.3.8.
Acoustic parameter	$L_{Aeq,10}$	Predicted noise level, Glossary 7

There are some significant differences between the 2024 and 1996 revisions of ISO 9613-2. As the modelling parameters are specifically described in the SA Guidelines and the stated intention is to be conservative in prediction, the conservative values described in **Table 16** have been adopted for the assessment for comparison with the SA Guidelines criteria.



5.5.5 Assessment Procedure

In general, the assessment procedure contains the following steps:

- 1 Predict and plot the L_{Aeq} 35 dB noise level contour from the wind farm under reference conditions. Receptors outside the contour are considered to be within acceptable wind farm noise levels.
- 2 Establish the pre-existing background noise level at each of the relevant assessment receptors within the L_{Aeq} 35 dB noise level contour through background noise monitoring.
- 3 Predict Project operational noise levels at all relevant assessment receptors for the wind range from cut-in of the WTG to approximately 15 m/s (at hub height).
- 4 Assess the acceptability of wind farm noise at each relevant assessment receiver to the established limits.

In addition, where the assessment of a receptor has predicted unacceptable wind farm noise levels, a process of noise mitigation and alternative wind farm layouts is considered and Steps 3 and 4 are repeated until an acceptable arrangement is developed.

5.6 Uncertainty of prediction

The stated level of prediction uncertainty for propagation according to ISO 9613 is 3 dB.

The statistical accuracy of environmental noise predictions using CONCAWE was investigated by Marsh (Applied Acoustics 15 - 1982). Marsh concluded that CONCAWE under specific controlled conditions was accurate to within ± 2 dB in any one octave band between 63 Hz and 4 kHz and ± 1 dB overall.

It is important to understand that this variance is specific to where the modelled meteorological conditions match actual. The frequency at which 'worst case' wind conditions occur depends on local meteorological statistics, noting that received levels at other times would generally be less.

In the context of a receptor at the 35 dB(A) noise contour from the wind farm, micro-siting where all wind turbines were moved 200m closer is calculated to increase the noise emission by 0.5 dB. Micro-siting can be expected to involve random relocations in multiple directions with a statistical averaging about the reference location.

If only the wind turbine nearest the receptor was moved 200m closer, the calculated increase in overall wind farm emission at that receptor is less than 0.1 dB, which is negligible in terms of the stated prediction uncertainty.



6.0 Assessment of Operational Noise

6.1 Introduction

The prediction and assessment of wind farm noise for the respective EPNR and SA Guidelines may be different, not only due to the different modelling methods and inputs, but because sometimes the criteria under the SA Guidelines for different hub height wind speeds the criteria is different.

However, because the measured baseline noise levels included measurements below 30 dB at some wind speed bins at or above a hub height wind speed of 9 m/s, the critical criteria for compliance under the SA Guidelines is 35 LAeq for most receptors.

The applicable criteria at night under the EPNR is an LA10 of 35 dB. As the noise emission of wind turbines is constant above 10 m/s hub height winds, the WTG LA10 sound power is the same as used for the LAeq calculation.

The cumulative effects of noise from fixed infrastructure (in this case a substation and BESS) in addition to the WTGs are included in the assessment. The sub-station noise emission is included in the EPNR modelling through addition of the infrastructure noise emissions using CONCAWE algorithm and modelling conditions, to the ISO 9613-2:2024 predicted wind turbine noise emissions, in accordance with the DWER Memorandum. For assessment under South Australian Guidelines the sub-station is included in the noise sources modelled, in accordance with the method of those guidelines.

The major difference between the EPNR and SA Guidelines predictions is the modelling algorithm, and usually the wind turbine sound power (for the EPNR assessment). However, as the baseline monitoring demonstrated that background noise can be low at ground level while hub height wind speed exceeds 10 m/s, both modelling methods utilise the maximum wind turbine sound power as the most critical scenario. This may not be the case for all wind farm locations.

Both sets of results are presented for completeness.

6.2 Noise Assessment

6.2.1 EPNR

The wind farm noise levels from the proposed WTG layout are calculated for a hub height wind condition of 10 m/s under Nighttime 'worst case' conditions. The cumulative noise emission of infrastructure (BESS, substation) and wind farm are listed in **Table 17**. The predicted noise contour plot is presented in **Figure 5. Appendix C, Figures 20, 21 and 22** show the predicted noise emission contours for the wind turbines (only), the BESS (at 100%) only, and the combined maximum noise emission.

The levels represent the highest predicted noise emissions of the modelling for 'standard worst case' conditions.

Table 17: EPNR - Predicted noise emissions to key receptors, LA10 dB

Receptor	Night time Assigned Level, LA10 dB	Noise Level, dB	Compliant Night & other periods
Receptors within wind farm boundary			
30	40 (host)	38	Yes
Receptors outside wind farm boundary			
15	35	17	Yes

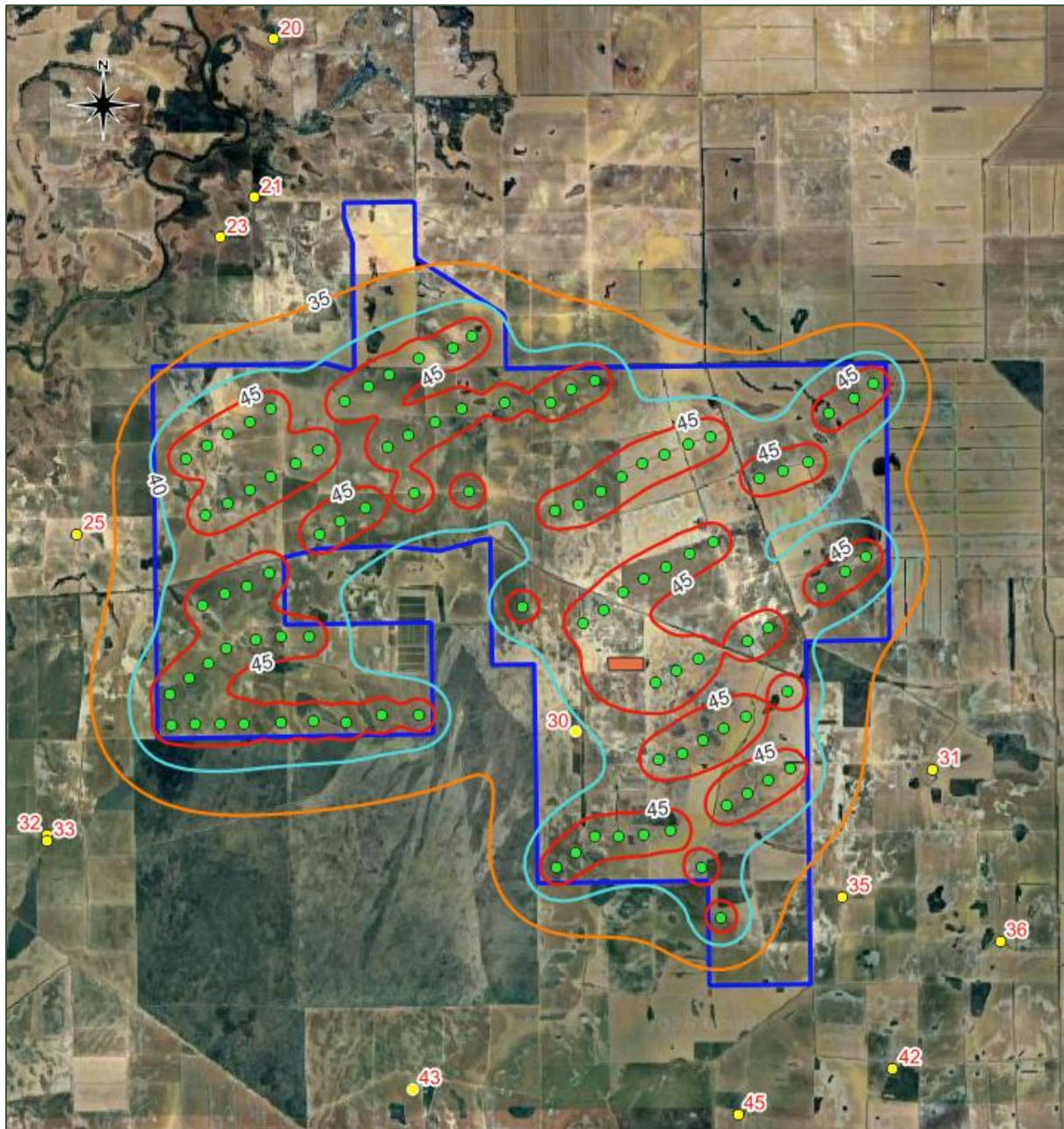


Receptor	Night time Assigned Level, LA10 dB	Noise Level, dB	Compliant Night & other periods
17	35	18	Yes
18	35	16	Yes
19	35	20	Yes
20	35	23	Yes
21	35	27	Yes
22	35	22	Yes
23	35	28	Yes
24	35	24	Yes
25	35	31	Yes
27	35	19	Yes
28	35	18	Yes
31	35	29	Yes
32	35	27	Yes
33	35	27	Yes
34	35	19	Yes
35	35	30	Yes
36	35	24	Yes
38	35	20	Yes
39	35	21	Yes
41	35	20	Yes
42	35	24	Yes
43	35	24	Yes
44	35	17	Yes
45	35	24	Yes
47	35	19	Yes
48	35	18	Yes
50	35	15	Yes
51	35	15	Yes
52	35	16	Yes
54	35	16	Yes
55	35	18	Yes
56	35	16	Yes
57	35	18	Yes
63	35	15	Yes
64	35	13	Yes
65	35	13	Yes



Receptor	Night time Assigned Level, LA10 dB	Noise Level, dB	Compliant Night & other periods
67	35	10	Yes
70	35	8	Yes
71	35	8	Yes

Figure 5 : EPNR Predicted Noise Contour Map – vHH=10m/s, LA10



Noise emissions are predicted to be compliant at agreement and non-agreement residences.

It is noted that should landowners outside of the Project area construct an occupancy dwelling within the zone of the 35 dB contour, there is a risk of non-compliance with the regulations under some wind conditions. In the event of future non-compliance, the wind farm will be required to modify operations to ensure noise emissions are compliant at any



new residence. Commercial agreements with those potentially affected landowners are one avenue to avoid the scenario, while not physically impacting that land holding.

Occurrence of 'modulation' noise characteristic is uncommon in Western Australia, however it is known that it can occur. It is our understanding that modulation (1 wind turbine) can sometimes occur in conditions where the wind turbine blade encounters laminar wind condition at the low part of the swept path, but turbulent conditions at the upper part. Historic wind turbines have designs with low hub heights, it is considered less likely that this scenario will occur for the much higher elevation wind turbines being installed on this project, with the lower edge of the swept path above the typical transition zone for bi-mode wind turbulence. The other known factor for generation of modulation is where a wind turbine is operated in a noise mitigated mode, potentially because the airflow across the turbine blade is not consistent with efficient operation of the wind turbine. It is not intended that any wind turbines for this Project be operated in noise mitigated mode.

If there was modulation occurring, there is only one receptor assessed in accordance with the method used (see **Table 18**) that is not shown with a 5 dB margin of compliance, that being receptor R25, which has a margin of 4 dB compliance. There is a low likelihood of a non-compliant scenario where modulation characteristic could be measurable. If such an occurrence is problematic, minor curtailment of two wind turbines nearest the receptor could ensure compliance.

6.2.2 SA Guidelines

The wind farm noise levels from the proposed WTG layout is calculated for a 150-metre hub height wind condition of 10 m/s and listed in **Table 18**. The predicted noise contour plot is presented in **Figure 6**.

Furthermore, noise levels from the proposed wind farm layout were calculated for all integer wind speeds in the range of 4 m/s to 9 m/s (hub height) and presented as noise contours, Appendix C. Wind turbine sound power emissions are the same for wind speeds from 10 m/s – 15 m/s, and the sound power at 3 m/s and 4 m/s is the same.

The predicted emissions are inclusive of infrastructure including BESS and substation, in accordance with the guidelines.

Predicted noise emissions in accordance with the SA Guidelines are shown in **Table 20**.



Table 18: SA Guidelines – Maximum predicted noise emissions to receptors, LAeq dB

Receptor	Criteria V _{HH} : 10 – 15 m/s LAeq dB	Predicted Noise Level LAeq dB	Compliant Night & other periods
Receptors within wind farm boundary			
30	45 (participant)	42	Yes
Receptors outside wind farm boundary near Baseline Monitor M1 (**)			
21	37	31	Yes
23	37	32	Yes
25	37	35	Yes
32	37	33	Yes
33	37	31	Yes
Receptors outside wind farm boundary			
15	35	19	Yes
17	35	21	Yes
18	35	18	Yes
19	35	23	Yes
20	35	26	Yes
22	35	26	Yes
24	35	27	Yes
27	35	22	Yes
28	35	22	Yes
33	35	31	Yes
34	35	22	Yes
35	35	34	Yes
36	35	28	Yes
38	35	23	Yes
39	35	24	Yes
41	35	23	Yes
42	35	27	Yes
43	35	28	Yes
44	35	20	Yes
45	35	28	Yes
47	35	22	Yes
48	35	21	Yes
50	35	18	Yes
51	35	18	Yes
52	35	19	Yes
54	35	19	Yes



Receptor	Criteria V _{HH} : 10 – 15 m/s L _{Aeq} dB	Predicted Noise Level L _{Aeq} dB	Compliant Night & other periods
55	35	21	Yes
56	35	19	Yes
57	35	21	Yes
63	35	17	Yes
64	35	16	Yes
65	35	16	Yes
67	35	13	Yes
70	35	10	Yes
71	35	9	Yes

Noise emissions are predicted to be compliant at agreement and non-agreement residences. It is noted that under SA Guidelines, compliance is achieved at involved receivers where predicted emissions do not exceed 45 dB(A). The modelling methodology with 'hard' ground is a conservative method. The combination of SA Guideline hard ground model and 45 dB(A) criteria is compatible with modelling using medium hardness ground and a reduced target.

Receptors near baseline monitoring location M1 have also been reviewed relative to operating condition with hub height wind speed of 9 m/s. The 'baseline plus five' criteria is 35 dB(A). As the predicted emissions for 10 m/s (107.8 dB(A) sound power) are less than 35 dB(A), the 9 m/s (107.1 dB(A) sound power) emission will also be less than 35 dB(A) and comply. This is shown in **Table 21**, with the nearest receivers to each baseline monitoring location (and associated criteria – background plus five), vs predicted noise emission at the respective hub height wind speeds.

All predicted emissions are shown compliant with the criteria determined in accordance with the South Australian Guidelines.



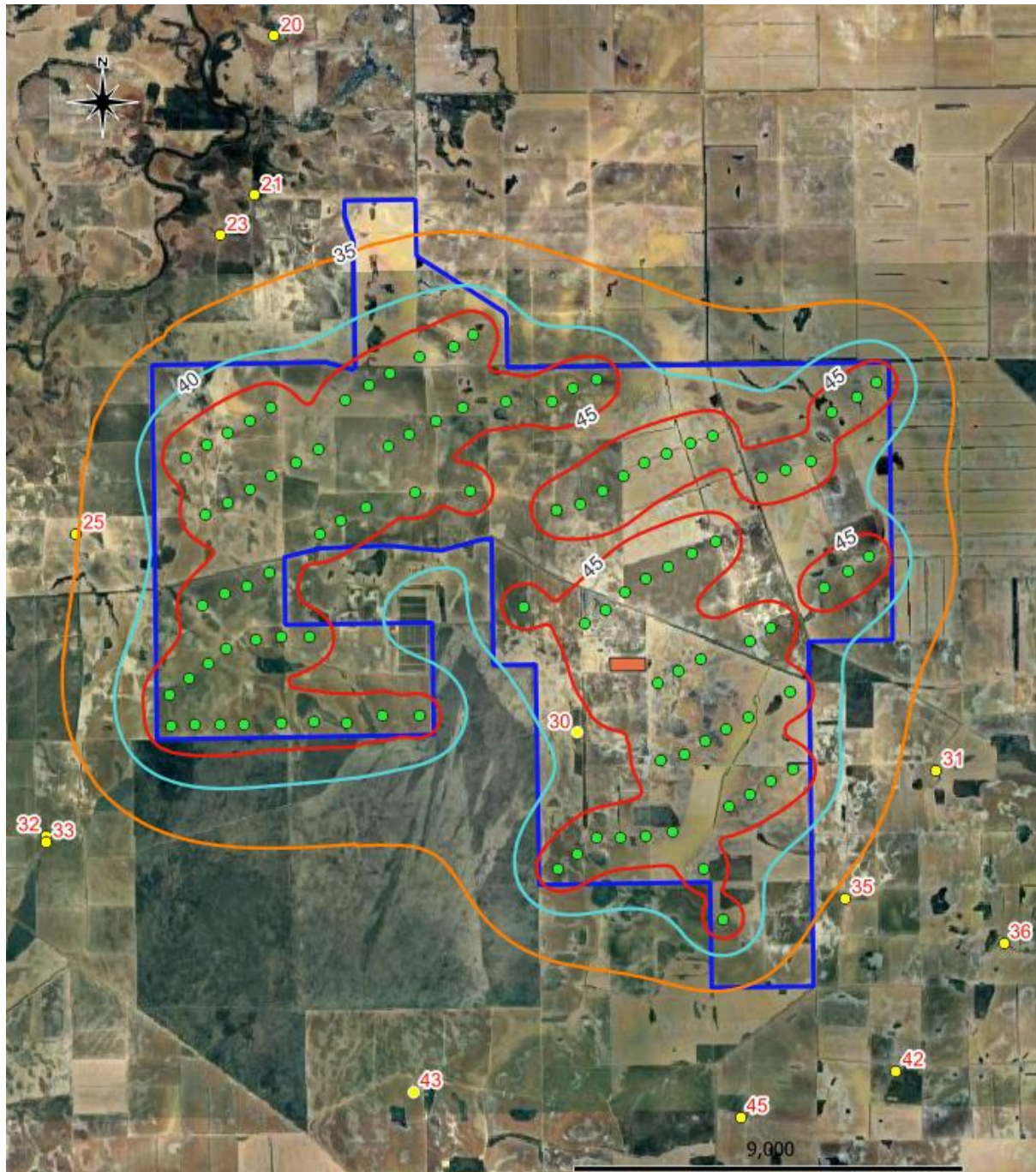
Table 19: SA Guidelines –Predicted noise emissions to receivers for the range of hub height wind speeds, LAeq dB

	Wind speed m/s												
	3	4	5	6	7	8	9	10	11	12	13	14	15
M1	35	35	35	35	35	35	35	37	41	44	42	43	40
21	25	25	26	27	28	30	29	31	31	31	31	31	31
23	26	26	26	27	29	30	30	32	32	32	32	32	32
25	28	28	28	30	31	33	33	35	35	35	35	35	35
31	27	27	27	28	30	31	31	33	33	33	33	33	33
32	25	25	25	26	28	29	29	31	31	31	31	31	31
M2	35	35	35	35	41	35	39	37	35	35	38	38	39
17	17	17	17	18	19	21	19	21	21	21	21	21	21
19	19	19	19	20	22	23	21	23	23	23	23	23	23
22	21	21	21	22	24	25	24	26	26	26	26	26	26
24	22	22	22	24	25	26	25	27	27	27	27	27	27
M3	35	35	35	35	35	35	35	35	37	40	40	41	39
31	28	28	28	29	30	31	31	33	33	33	33	33	33
35	28	28	29	29	31	32	32	34	34	34	34	34	34
36	22	22	23	24	25	27	26	28	28	28	28	28	28
39	20	20	20	21	23	24	23	24	24	24	24	24	24
42	22	22	22	24	25	26	25	27	27	27	27	27	27
43	23	23	23	24	26	27	26	28	28	28	28	28	28
45	23	23	23	24	26	27	26	28	28	28	28	28	28
47	18	18	18	19	20	21	20	22	22	22	22	22	22



It is noted that should landowners outside of the Project area construct an occupancy dwelling within the zone of the 35 dB contour, there is a risk of non-compliance with the regulations under some wind conditions. If this occurs, then the wind farm will work in good faith with the affected land owners to reach a mutually acceptable commercial arrangement and/or be required to modify operations to ensure noise emissions are compliant at any new residence.

Figure 6: SA Guideline Predicted Noise Contour Map – vHH=10m/s, LAeq



6.2.3 Summary

A predictive assessment for the nominal 98 WTG base layout at a wind speed of 10 m/s (hub height), which represents the highest noise emission, was undertaken against the minimum noise criteria of L_{Aeq} 35 dB for Project non-involved receivers and L_{Aeq} 40 dB for



involved receivers at all assessment receivers located within 5 km of the Project area. Dwellings further than this distance are deemed to comply if dwellings closer to turbines comply with the relevant noise limit.

Assessments against the mandatory EPNR and the required SA Guidelines were carried out.

The results presented in this NIA indicate that wind farm noise emissions:

- Non-involved receptors: compliant with an LA10 of 35 dB for the Night period under the EPNR, which also ensures compliance at other times. Compliant with the minimum criteria of LAeq of 35 dB under the SA Guidelines.
- Project-involved (host) receptors: Compliant, predicted emissions below the minimum LAeq 45 dB criteria, and noted to be below 40 dB(A) when assessed in accordance with DWER recommended methods.
- Predicted noise emissions exceeding LA10 35 dB extend beyond the project boundary at some locations. There are no existing residences in these areas, so as proposed the noise emissions are compliant. However, should a new residence be constructed within these areas, the noise emissions may be non-compliant and mitigation through modified operation of relevant wind turbines may be required. Should these situations occur, Mid West Wind Farm Pty Ltd will work in good faith with the affected land owners.

The proposed layout is shown to comply at all receptors at all wind speeds.

6.3 Vibration Assessment

There are no expected impacts from vibration during normal operation. The highest levels of ground vibration are expected from the substation transformers. This will not be perceptible at distances greater than 50m from the substation. There are no identified 'vibration sensitive' infrastructure close to proposed operating equipment.

7.0 Assessment of Construction Noise & Vibration

7.1 Background

A number of key construction activities associated with the building of wind farm infrastructure and BESS have been evaluated, including:

- construction of access roads
- establishment of turbine tower foundations and electrical substation
- digging of trenches to accommodate underground power cables
- erection of turbine towers and assembly of WTG's
- The equipment required to complete the above tasks will typically include:
 - Excavator/grader, bulldozer, dump trucks, vibratory roller
 - bucket loader, rock breaker, drill rig, excavator/grader, bulldozer, dump truck, flat bed truck, concrete truck
 - cranes, forklift, and various 4WD and service vehicles.

The Operational noise of a temporary concrete batching plant to facilitate foundation construction have also been assessed.



It is assumed that up to two trucks will be batching at any one time. Other plant and equipment that have been assumed to be on site as a worst-case scenario are:

- front end loader
- material conveying system
- cement silo dust extraction fans
- concrete mix trucks loading under silos
- concrete mix trucks slumping
- batch hopper
- concrete mix truck idling
- concrete mix truck moving slowly on site
- concrete mix truck at washout
- bulk material truck delivery and unloading.

The Project will be constructed over a 30-month period, with construction aiming to commence in 2028.

Decommissioning and rehabilitation will occur following the cessation of the operational life. The decommissioning phase is anticipated to be around 18 months and will involve dismantling and removing the above ground wind turbine components, removing related above-ground infrastructure and rehabilitating internal access roads not requested to be retained by individual landowners.

7.2 Noise Assessment

7.2.1 Criteria

Regulation 13 of the *Environmental Protection (Noise) Regulations 1997* sets out the requirements in terms of acceptable construction noise. Construction contractors may determine the most efficient method to undertake the required work at the time of contract, or event modify during construction. It is therefore common practice to provide contractual obligations with the contractor(s) to ensure compliance with Regulation 13, including preparation of Construction Environmental Noise Management Plans where applicable.

The extent of likely noise emission from construction operations can be estimated through modelling of the highest expected noise sources and generate on the maximum noise emission contour around infrastructure areas to be developed during wind farm construction.

7.2.2 Method

In order to predict the potential noise levels from construction equipment associated with the project, a SoundPLAN computer noise model was developed.

The model used the standard nighttime modelling parameters for WA EPNR modelling with the CONCAWE algorithm.

The model used the following noise sources to represent a normal maximum noise emission from the respective locations as follows:



Table 20: Construction Noise Modelling Sources

Location	Maximum noise emission item	Sound Power (dB)
Roads and trench areas	Vibratory 12-ton roller	111
BESS site – paving & install	Vibratory 12-ton roller	111
Wind turbine pads	Rock breaker	121
Concrete batching plant	Mixer and agitator slumping, concurrent	116

Results **Appendix D** contains an aerial map of the Project area with the predicted construction noise maximum contours overlaid. Receptors and outbuildings are also shown.

The predicted noise footprint is an estimate of the impact extent of proposed construction, excluding traffic increases on gazetted roads.

Normal construction progresses across the Project area over the anticipated construction timeframe of 30 months, therefore only a portion of the Project area is experiencing noisy construction activity at any one time.

It should be assumed that construction may occur during the night period, however this has not been determined, and until the construction contractor is engaged the extent of any night works will not be known.

As a guide, where predicted noise emissions exceed 35 dB for night works or 40 dB during Sunday or Public Holiday work, a Construction Noise Management Plan for relevant work near that receptor will be required. The predicted maximum footprint noise emissions shown in Appendix D demonstrate there are some construction work locations where a Construction Noise Management Plan may be required for out of hours work.

7.3 Vibration Assessment

Vibration generated by construction has the potential to impact on occupants (human comfort) and structures (building damage).

The activities and equipment with the potential to generate the highest levels of ground vibration are the operation of vibratory rollers during construction of access roads and the operation of any rock breakers during establishment of turbine tower foundations. Typical vibration levels from these sources are presented in **Table 21**.

Table 21: Typical Vibration Emission Levels from Construction Plant

Activity	Minimum limit PPV mm/s					
	human comfort	building damage	10m	20m	30m	100m
4-Tonne Vibratory Roller	0.2	7.5	2.0 - 2.4	0.4 - 1.2	0.2 - 0.8	<0.2
Hydraulic Hammer (30t)	0.2	7.5	3	1.5	1.0	<0.5

It is evident that given the large distances between receptors and structures where construction works are likely to be undertaken, that the building damage and human comfort vibration criteria will easily be met during construction.



8.0 Conclusion

8.1 Operational Noise

Noise levels were predicted for the combined output of BESS and nominal 98 WTG base layout at a wind speed of 10 m/s (hub height), which represents the highest noise emission scenario. These levels were assessed against the mandatory EPNR and the required SA Guidelines, with minimum noise criteria of L_{A10} 35 dB for project uninvolved receivers and L_{A10} 40 dB for Project involved receivers at all assessment receivers located within 5 km of the Project area. Dwellings further than this distance are deemed to comply if dwellings closer to turbines comply with the relevant noise limit. The results presented in this NIA indicate that wind farm noise emissions:

- Non-involved receptors: compliant with an L_{A10} of 35 dB for the nighttime period under the EPNR, which also ensures compliance at other times. Compliant with the minimum criteria of L_{Aeq} of 35 dB under the SA Guidelines.
- Project-involved receptors: Compliant, predicted emissions no greater than L_{Aeq} 45 dB(A) are below the minimum 45 dB WHO criteria and DWER Memorandum recommended criteria of 40 dB when assessed according to this method.
- Predicted noise emissions exceeding L_{A10} 35 dB extend beyond the project boundary at some locations. There are no existing residences in these areas, so as proposed the noise emissions are compliant. However, should a new residence be constructed within these areas, the noise emissions may be non-compliant and mitigation through modified operation of relevant wind turbines may be required. Should these situations occur, Mid West Wind Farm Pty Ltd will work in good faith with the affected landowners.

The proposed layout is shown to comply at all receptors at all wind speeds.

8.2 Construction Noise and Vibration

Regulation 13 of the *Environmental Protection (Noise) Regulations 1997* sets out the requirements in terms of acceptable construction noise.

Construction contractors may determine the most efficient method to undertake the required work at the time of contract, or event modify during construction. It is therefore common practise to provide contractual obligations with the contractor(s) to ensure compliance with Regulation 13, including preparation of Construction Environmental Noise Management Plans where applicable.

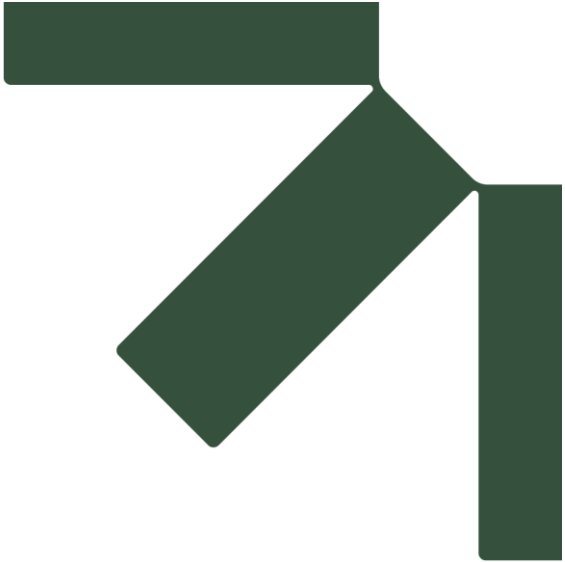
A noise impact prediction for the maximum noise generating activity for each work area has been carried out and is presented in **Appendix D**, showing the expected maximum extent of noise impact during construction.

As a guide, where predicted noise emissions exceed L_{Aeq} 35 dB for night works or 40 dB during Sunday or Public Holiday work, a Construction Noise Management Plan for relevant work near that receptor will be required. The predicted maximum footprint noise emissions shown in Appendix D demonstrate there are some construction work locations where a Construction Noise Management Plan may be required for out of hours work.

To ensure all appropriate measures are being taken to manage construction noise, a more detailed construction management plan should be developed by the proponent or construction contractor. This document will provide detailed guidance on various noise mitigation strategies for the construction stage.

Vibration impacts from key construction activities have been assessed and predicted levels associated with the 'worst case' scenarios modelled were found to be acceptable.





Appendix A Baseline Noise Monitoring

Midwest Wind Farm

Noise & Vibration Impact Assessment

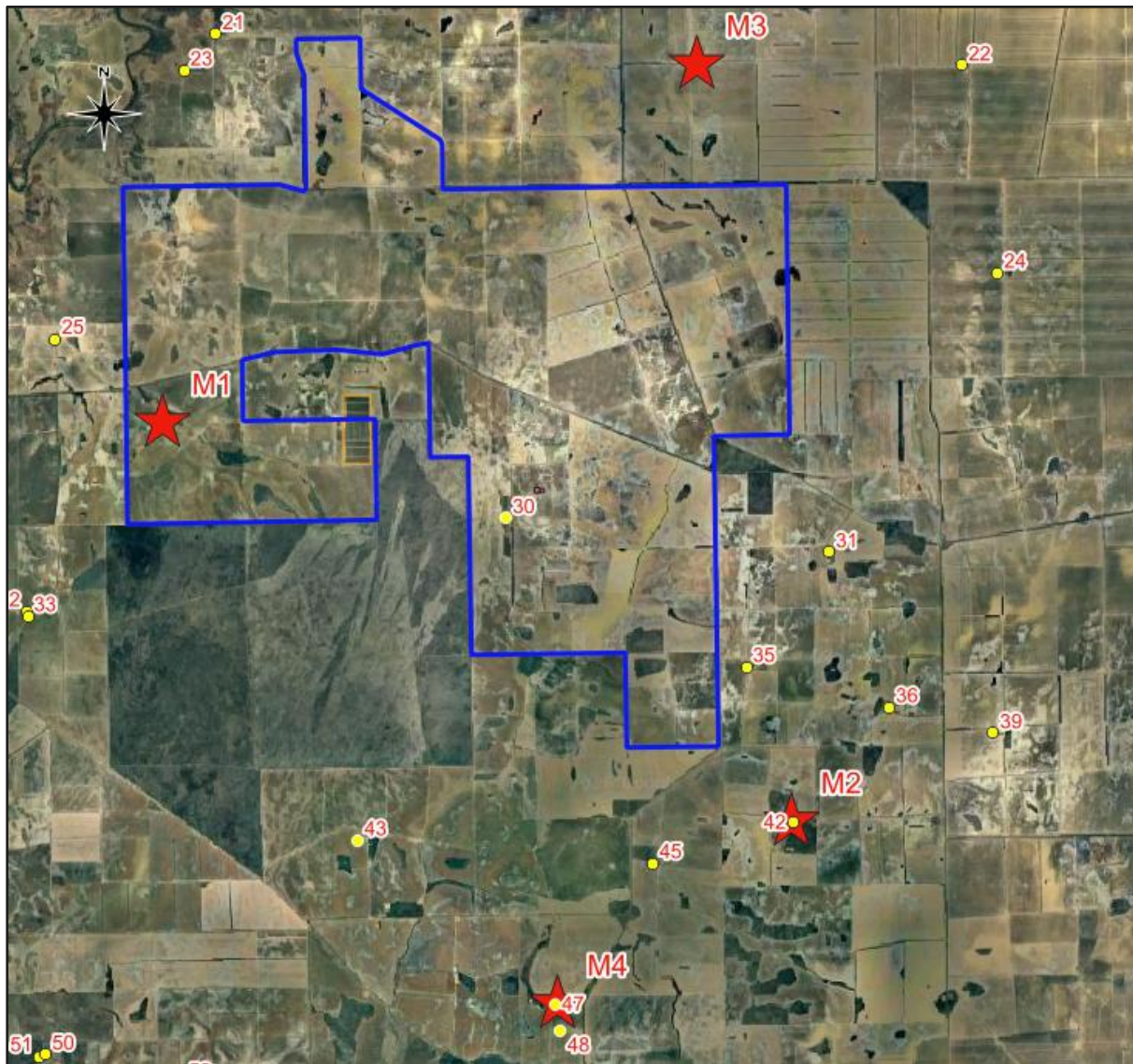
Mid West Wind Farm Pty Ltd

Report 675.072296.00004-R02

30 July 2026



Figure 7: Baseline Noise Monitor locations



Baseline noise monitors were located near buildings on landholdings with authorised access to these locations. Care was taken to locate noise monitors so that they were at an equivalent distance from trees surrounding the building as the distance from trees to the façade of the building.

As background noise associated with wind is mostly generated by tree foliage movement, the baseline noise measured is representative of noise received at a residence. The selected locations are in a similar area to residences surrounding the proposed wind farm. A review of aerial imagery indicated that these residences generally have a similar tree surround to those where the monitors were located.



Monitor M1

This appears to be an occasional use building. The location is considered representative of surrounding residences, including non-involved houses to the west of this location.

Figure 8: Location M1 photographs



The installed noise monitor was a SVAN 957 sound meter with current NATA calibration, serial number 20674. An 150 mm wind sock was fitted to the microphone to limit regenerated noise at the microphone.



The monitoring period was from 21st August to 16th October 2024, with 3,700 valid 10-minute measurement periods.

The results of the background noise monitoring showing the LA₉₀ data points, excluded data points due to rain and average background noise level for each hub-height integer windspeed bin are shown in **Figure 9**. A 150-metre hub height windspeed calculated by Vestas from the 120m high met mast was used in the assessment.

Table 22: Location M1 – Average LA₉₀ Noise vs 150m Hub Height Wind Speed, dB

Wind speed m/s	3	4	5	6	7	8	9	10	11	12	13	14	15
Average noise level, dB	23	24	26	26	29	30	30	32	36	39	37	38	35

For the Night Period (1900hrs – 0700hrs) the measured background noise levels were:

Table 23: Location M1 – Night L₉₀ of LA₉₀ Noise vs 150m HH Wind Speed, dB

Wind speed m/s	3	4	5	6	7	8	9	10	11	12	13	14	15
L ₉₀ of L ₉₀ noise level, dB	18	18	18	18	18	18	18	19	19	22	22	22	23

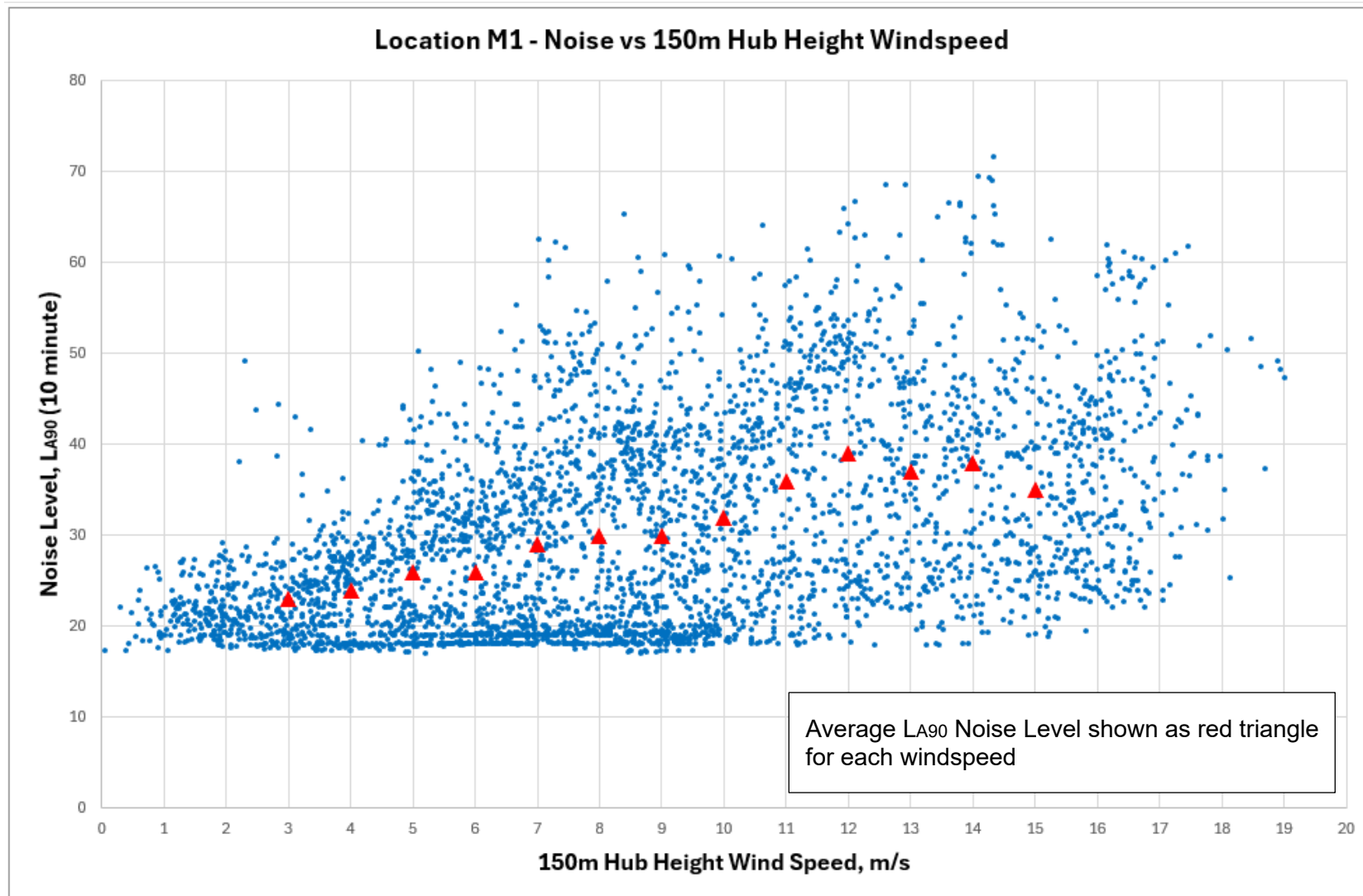
The number of data samples for wind coming from specific wind directions are shown in **Table 24**.

Table 24: Location M1 – Night Data Sample Count by Direction

N	NE	E	SE	S	SW	W	NW
6	54	401	455	357	186	352	120



Figure 9: Location M1 Graph - LA90 vs HH Wind Speed



Monitor M2

This is a lived in residence, the regular access to the house is from the eastern side, away from the monitor location.

Figure 10: Location M2 photographs



The installed noise monitor was a SVAN 307A sound meter with current NATA calibration, serial number 137601. An 150 mm wind sock was fitted to the microphone to limit regenerated noise at the microphone. The sound meter was complimented with a “GMX600 weather station positioned at microphone height, to identify local rain events and windspeed at the microphone.

The monitoring period was from 18 September to 16th October, with 3,288 valid 10 minute measurement periods.



The results of the background noise monitoring showing the LA₉₀ data points, excluded data points due to rain and average background noise level for each hub-height integer windspeed bin are shown in **Figure 11**. A 150m hub height windspeed calculated by Vestas from the 120m high met mast was used in the assessment.

Table 25: Location M2 – Average LA₉₀ Noise vs 150m Hub Height Wind Speed, dB

Wind speed m/s	3	4	5	6	7	8	9	10	11	12	13	14	15
Average noise level, dB	27	28	30	33	36	35	34	32	30	30	33	33	34

For the Night Period (1900hrs – 0700hrs) the measured background noise levels were:

Table 26: Location M2 – Night L₉₀ of LA₉₀ Noise vs 150m HH Wind Speed, dB

Wind speed m/s	3	4	5	6	7	8	9	10	11	12	13	14	15
L ₉₀ of LA ₉₀ noise level, dB	19	19	19	19	19	19	20	20	21	23	25	25	29

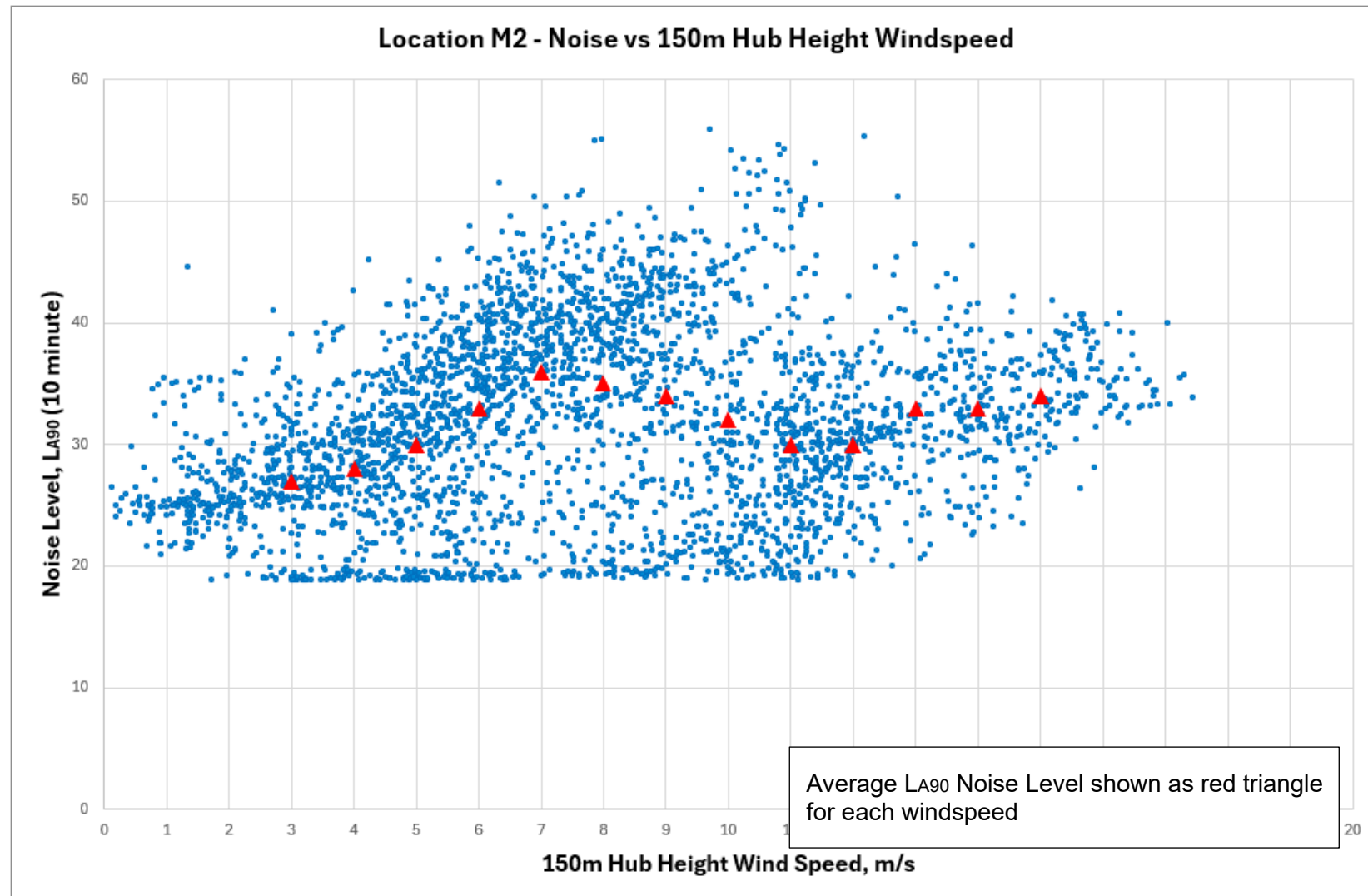
The number of data samples for wind coming from specific wind directions are shown in **Table 27**.

Table 27: Location M2 – Night Data Sample Count by Direction

N	NE	E	SE	S	SW	W	NW
35	86	53	388	590	288	145	41



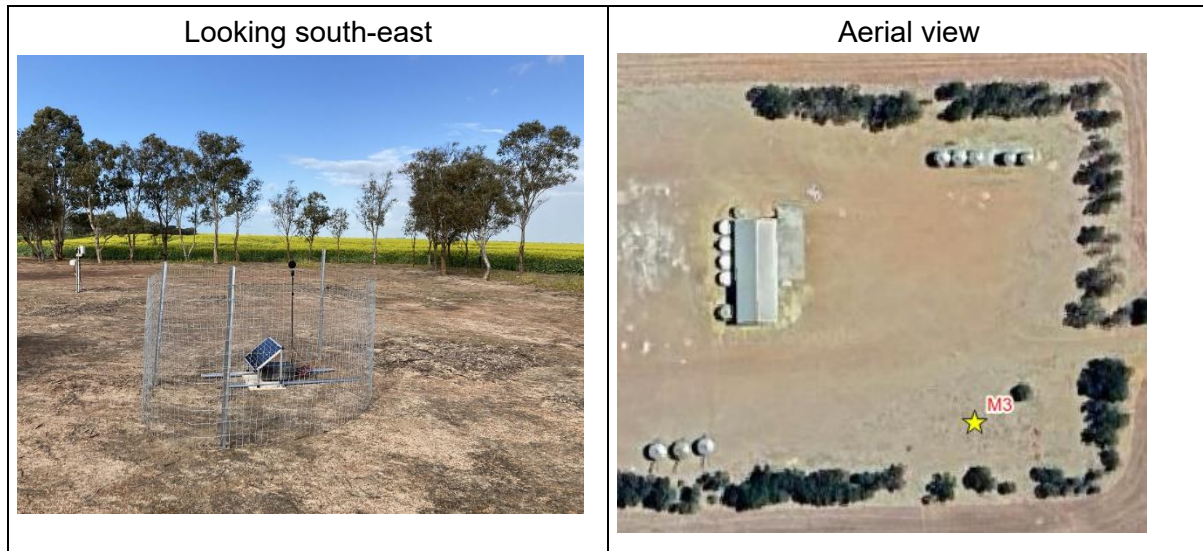
Figure 11: Location M2 Graph - LA90 vs HH Wind Speed



Monitor M3

This is a location with a farm shed and silos, with perimeter trees similar to those of nearby residences outside the wind farm perimeter.

Figure 12: Location M3 photographs



The installed noise monitor was a SVAN 957 sound meter with current NATA calibration, serial number 27580.

The monitoring period was from 22nd August to 26th August 2024, and 17th October to 13th November 2024, with 4451 valid 10 minute measurement periods.

The results of the background noise monitoring showing the LA₉₀ data points, excluded data points due to rain and average background noise level for each hub-height integer windspeed bin are shown in **Figure 13**. A 150m hub height windspeed calculated by Vestas from the 120m high met mast was used in the assessment.

The tabulated background noise levels are found in **Table 28**.

Table 28: Location M3 – Average LA₉₀ Noise vs 150m Hub Height Wind Speed, dB

Wind speed m/s	3	4	5	6	7	8	9	10	11	12	13	14	15
Average noise level, dB	22	24	25	27	28	29	27	30	32	35	35	36	34



For the Night Period (1900hrs – 0700hrs) the measured background noise levels were:

Table 29: Location M3 – Night L₉₀ of LA₉₀ Noise vs 150m HH Wind Speed, dB

Wind speed m/s	3	4	5	6	7	8	9	10	11	12	13	14	15
L ₉₀ of LA ₉₀ noise level, dB	17	17	17	17	17	18	18	18	18	19	21	24	27

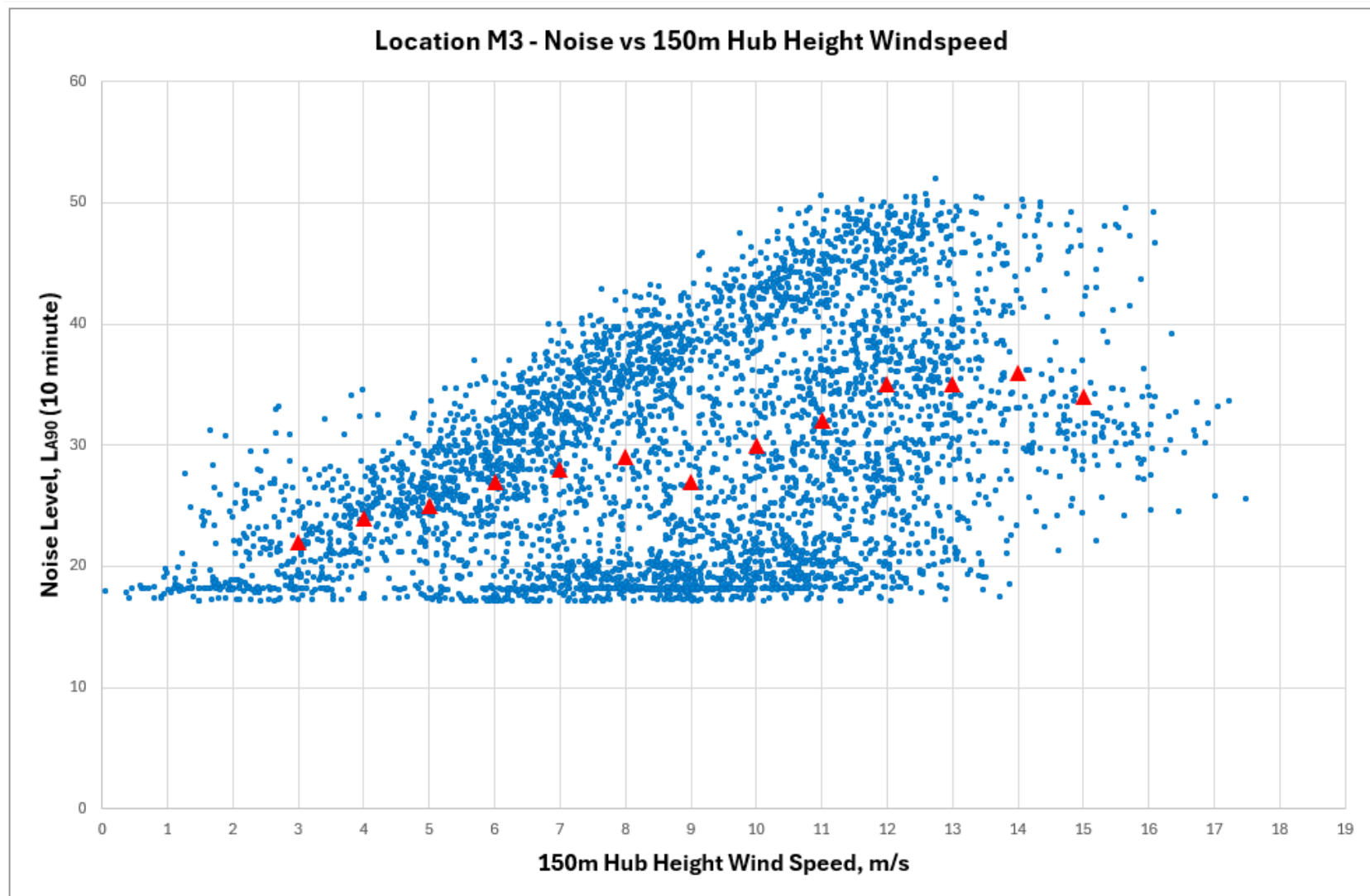
The number of data samples for wind coming from specific wind directions are shown in **Table 30**.

Table 30: Location M3 – Night Data Sample Count by Direction

N	NE	E	SE	S	SW	W	NW
0	7	81	475	1125	358	122	75



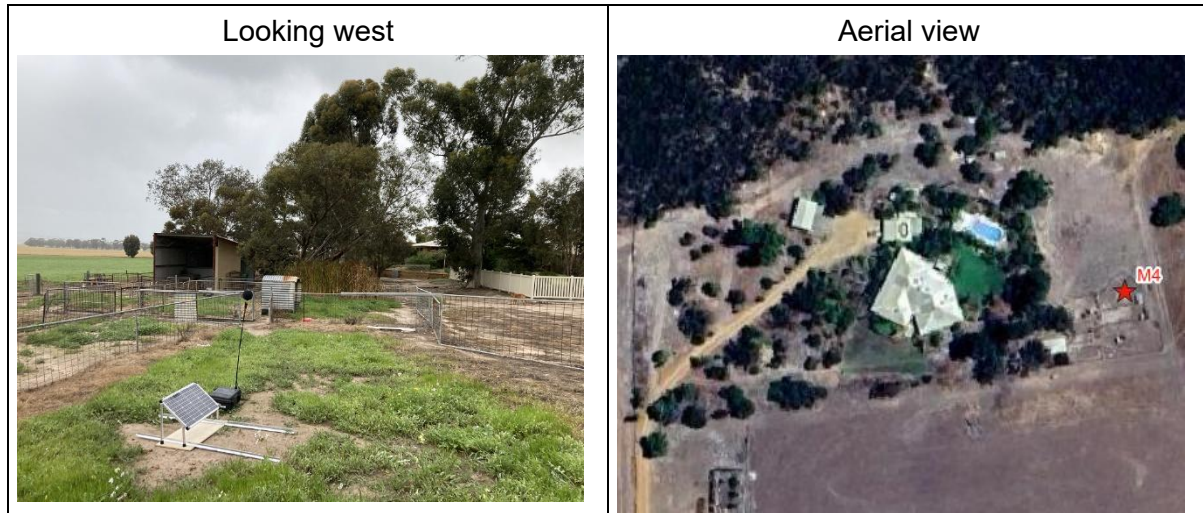
Figure 13: Location M3 Graph - LA90 vs HH Wind Speed



Monitor M4

This is a lived in residence, the regular access to the house is from the western side, away from the monitor location. The monitor is located in existing yards to the east of the house, by agreement with the landowner.

Figure 14: Location M1 photographs



The installed noise monitor was a SVAN 957 sound meter with current NATA calibration, serial number 27580. A 150mm wind sock was fitted to the microphone to limit regenerated noise at the microphone.

The monitoring period was from 22nd August to 16th October, with 6,666 valid 10 minute measurement periods.

The results of the background noise monitoring showing the LA₉₀ data points, excluded data points due to rain and average background noise level for each hub-height integer windspeed bin are shown in **Figure 19**. A 150 metre hub height windspeed calculated by Vestas from the 120m high met mast was used in the assessment.

The tabulated background noise levels are found in **Table 31**.

Table 31: Location M4 – Average LA₉₀ Noise vs 150m Hub Height Wind Speed, dB

Wind speed m/s	3	4	5	6	7	8	9	10	11	12	13	14	15
Average noise level, dB	28	28	30	31	32	32	33	34	32	30	29	29	29



For the Night Period (1900hrs – 0700hrs) the measured background noise levels were:

Table 32: Location M4 – Night L₉₀ of LA₉₀ Noise vs 150m HH Wind Speed, dB

Wind speed m/s	3	4	5	6	7	8	9	10	11	12	13	14	15
L ₉₀ of LA ₉₀ noise level, dB	20	20	20	20	20	20	20	21	21	21	20	22	22

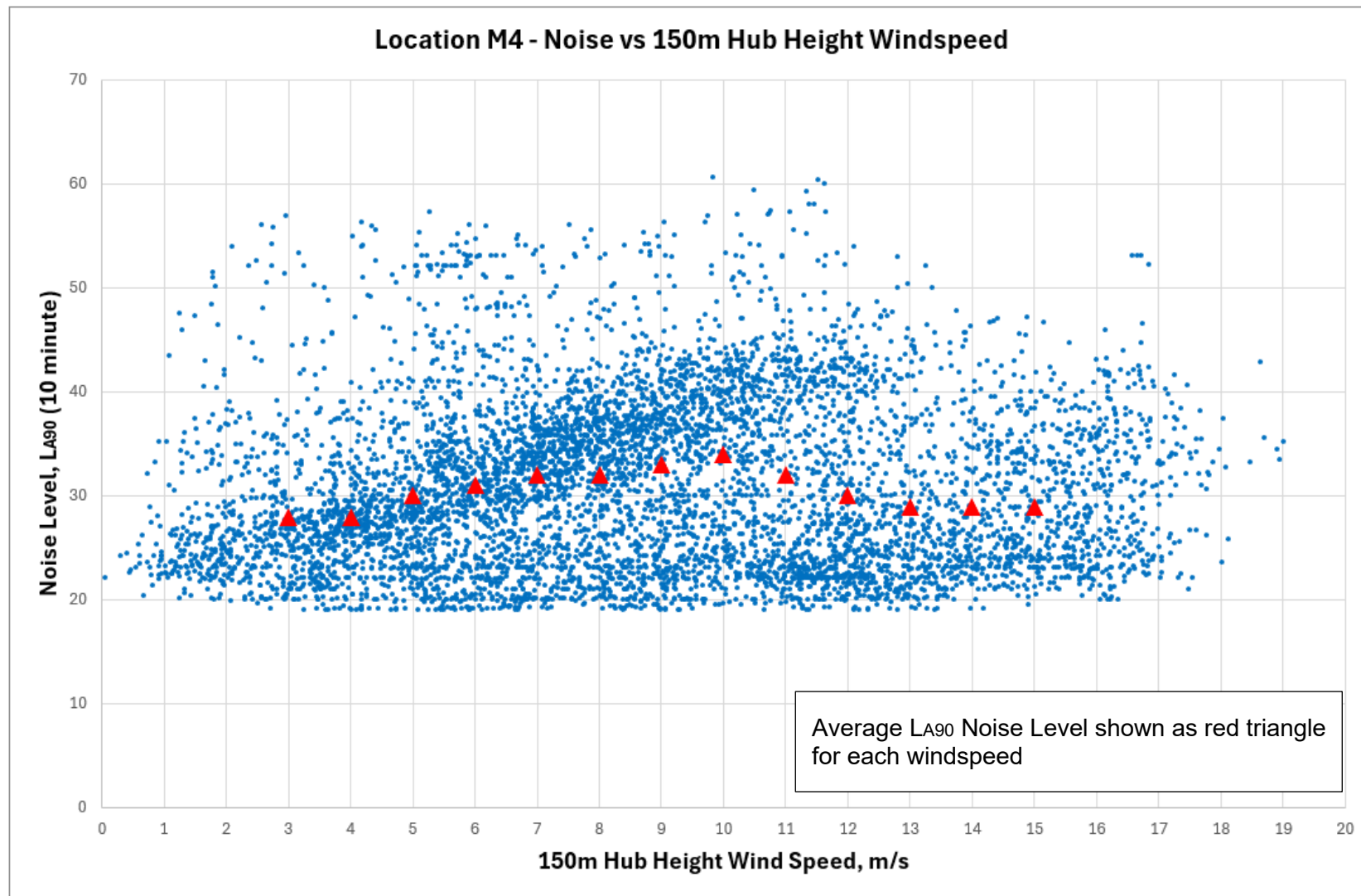
The number of data samples for wind coming from specific wind directions are shown in **Table 33**.

Table 33: Location M4 – Night Data Sample Count by Direction

N	NE	E	SE	S	SW	W	NW
41	108	438	840	944	459	431	121



Figure 15: Location M3 Graph - LA90 vs HH Wind Speed



Monitoring Data Verification

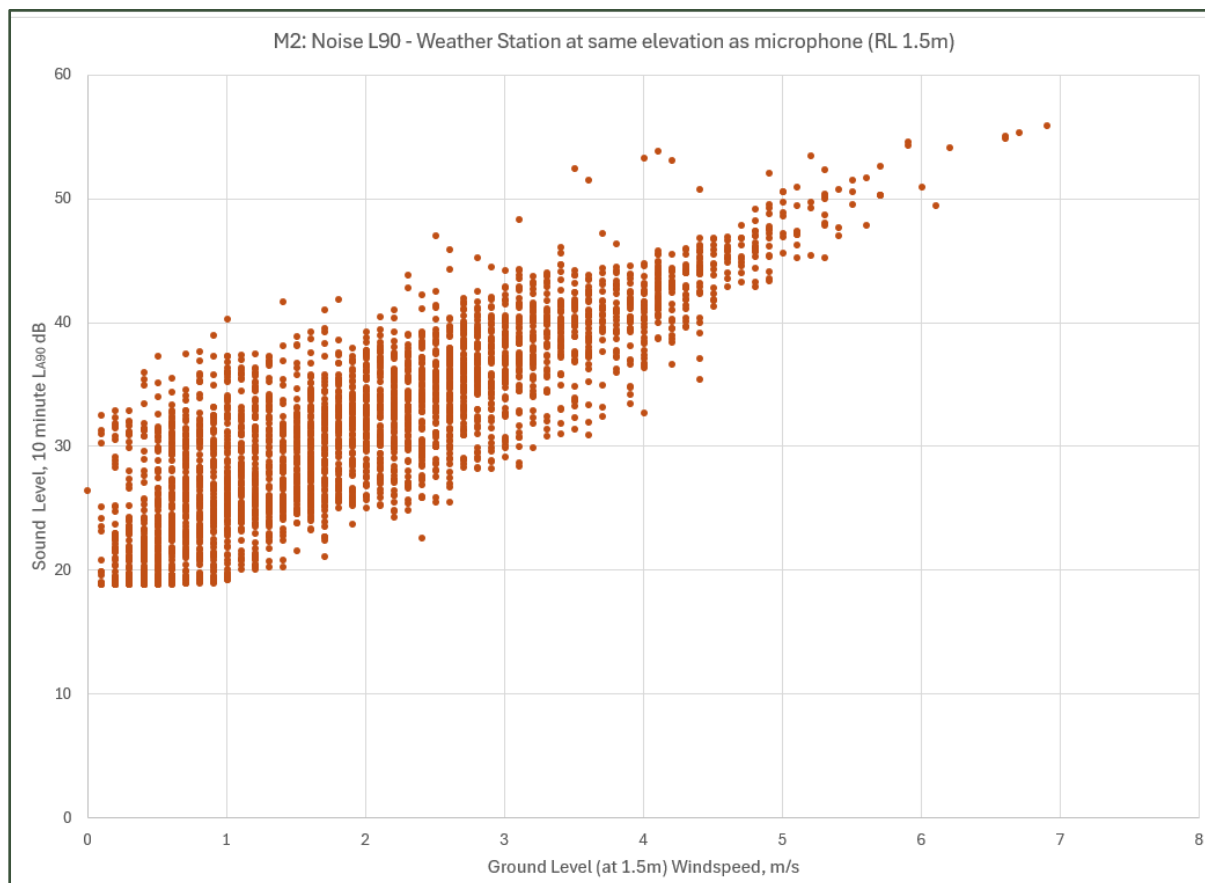
Monitoring data was reviewed and data associated with rainfall events was excluded from the assessment, as per the guidelines.

The scatter graphs of measured 10 minute LA90 noise level vs hub height windspeed exhibit a low coherence between the noise level and windspeed. In particular, there are many data points showing a lower measured noise level for the higher hub height windspeeds.

Some data review was undertaken to provide confidence that the presented data is representative of the background noise environment near the Project area.

Location M2 measurements were for both background noise level and weather data (1.5m AGL). A plot of 10 minute LA90 vs windspeed (1.5m AGL) shows a good correlation, indicative that there is a strong relationship between background noise and windspeed near ground. This is expected as the primary noise source for wind influenced background noise is movement of foliage on trees, associated with excitation by the wind.

Figure 16: M2 background noise vs 1.5m AGL wind speed

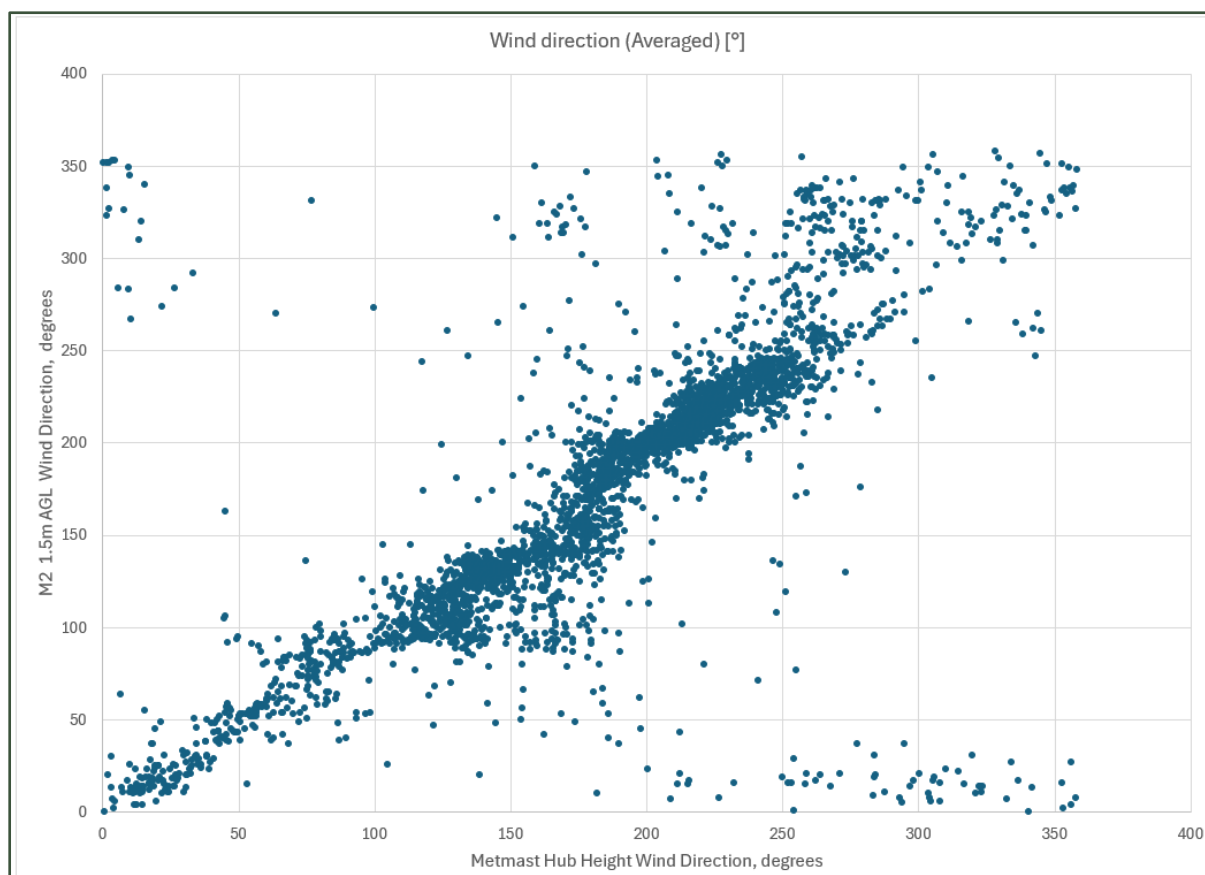


Monitoring location M2 is approximately 10km south of the met mast. There is potential for time shift of wind changes which could reduce data correlation between the two locations. A second measure of correlation can be undertaken by review of wind direction relationship between the met mast 115m AGL wind direction and the M2 1.5m AGL weather monitors.

This relationship is shown in **Figure 17**. There is good correlation of wind direction between the two locations. Outliers near the vertical and horizontal axis are likely to be associated with minor differences which cross the north direction, one side with a near zero value and the other side with a near 360 degrees value.



Figure 17: M2 background noise vs 1.5m AGL wind speed



The less than expected correlation between monitored noise levels and met mast hub height wind speed is similar for all four locations, indicating that it is the met mast windspeed that is the common factor resulting in the observed windspeed vs noise scatter diagrams.

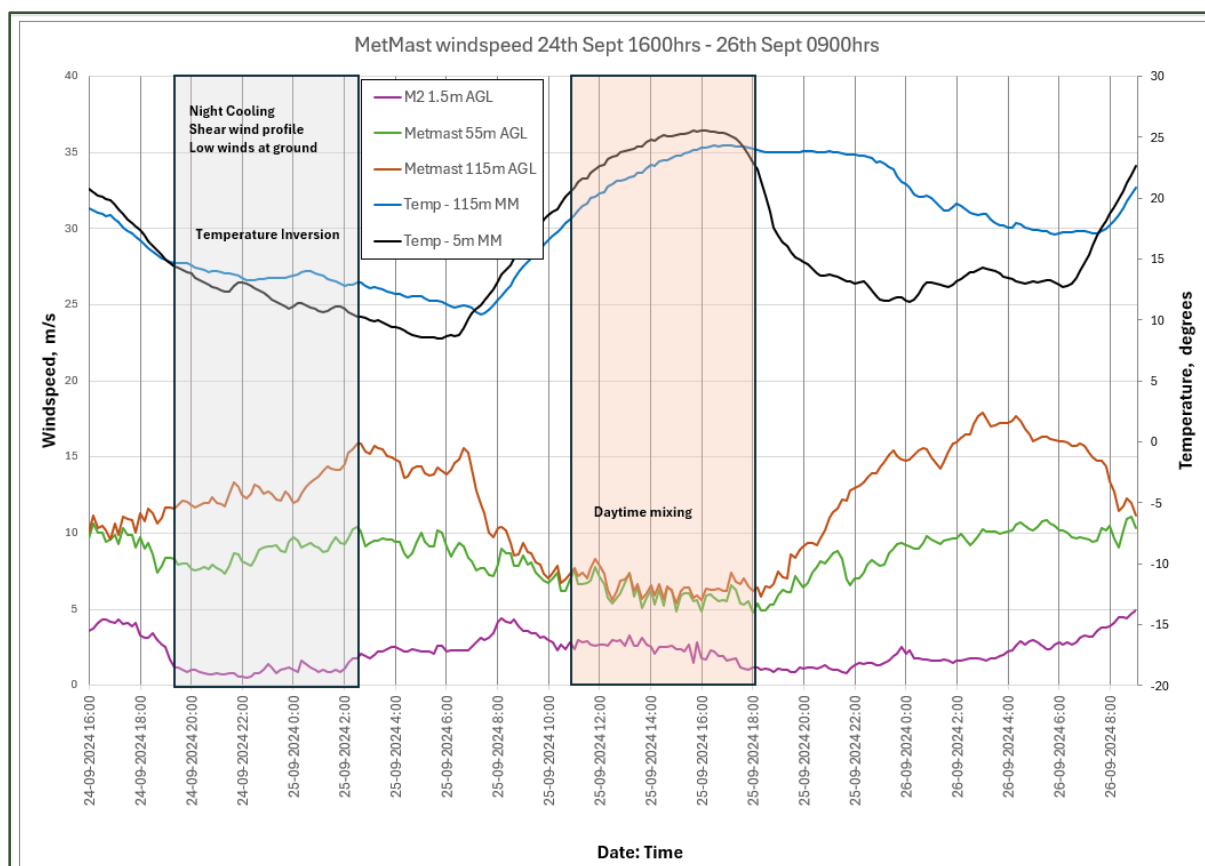
Discussion with the Vestas wind engineer provided insight into the wind behaviour at the Project area.

In summary, during the day and at other periods, there is a typical shear wind profile present, with normal 'turbulent' wind behaviour. During some night periods, radiation of heat to the night sky results in cooling at ground level, causing a laminar air layer near ground. Review of available temperature and windspeed data clearly shows the formation of thermal inversion, where the ground level temperature falls below the upper level temperature.

With formation of a laminar air layer near ground, this stable layer has a low wind speed relative to wind behaviour at higher levels. The low windspeed results in low background noise being generated by tree foliage, and at the same time the hub height windspeed can be measured as significant. **Figure 18** shows the measured temperatures and winds speeds for one such night period, and the corresponding conditions for a day time period.



Figure 18: Multi height wind speed and temperature profile

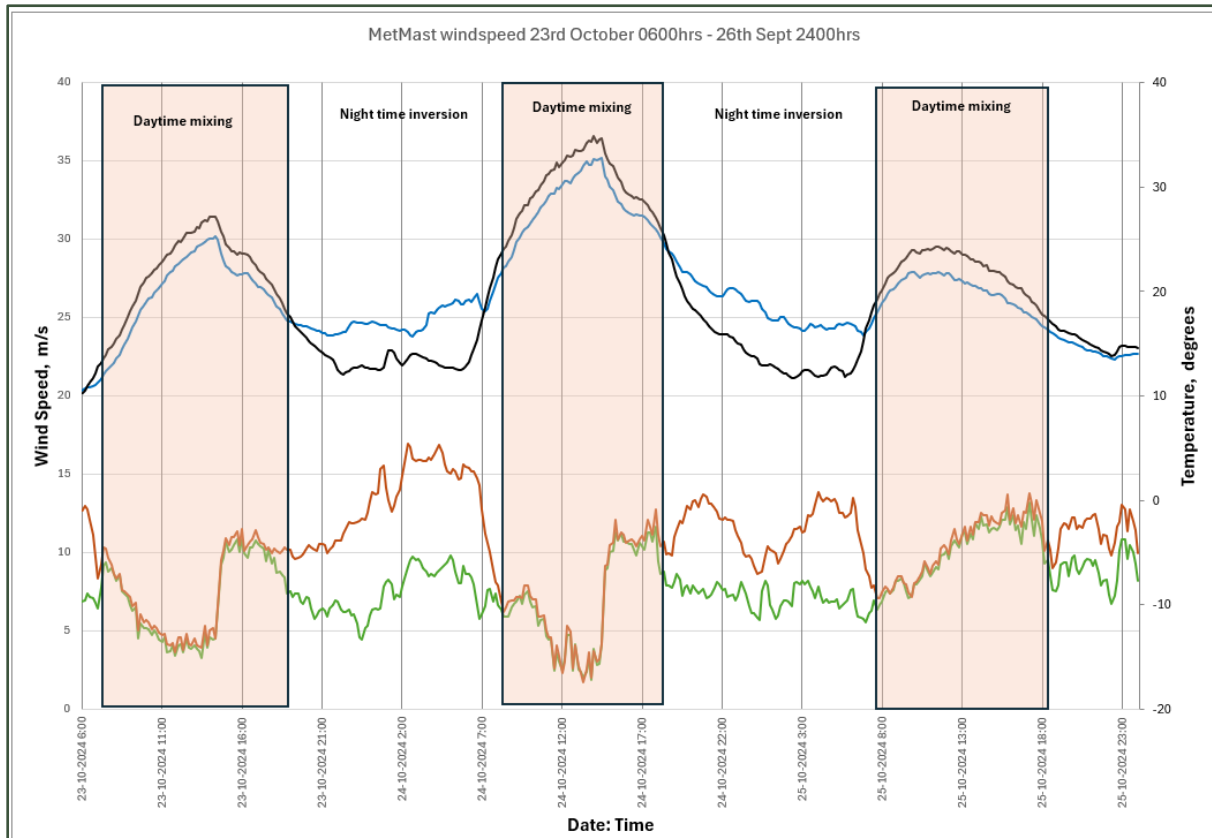


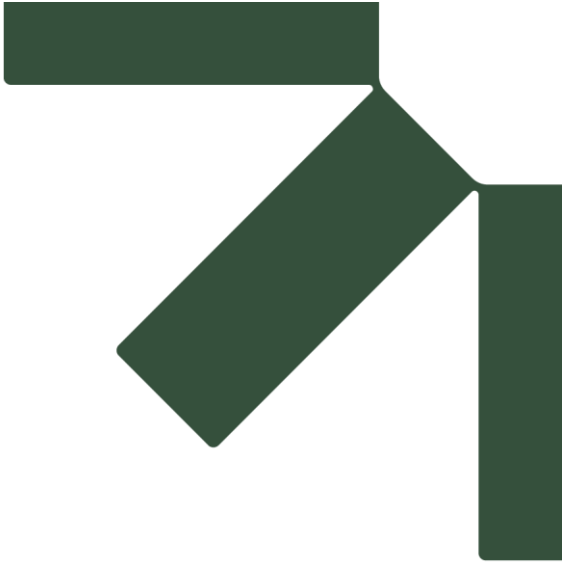
From the above figure the occurrence of temperature inversions is shown where the ground temperature (black) is below the met mast 115m temperature (blue). The windspeed profile is shown, with the wind speed at the M2 noise monitor showing for the different wind profiles.

An additional example is shown in Figure 19.



Figure 19: Multi height wind speed and temperature profile – October 2024





Appendix B WTG & Receptor Coordinates

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Table 34: Wind Turbine Layout – Coordinates

Turbine No	Easting	Northing	Turbine No	Easting	Northing
1	317312	6808143	50	312573	6802641
2	316839	6807870	51	321301	6802487
3	316047	6807617	52	312085	6802321
4	315388	6807230	53	325408	6802291
5	320137	6807096	54	320799	6802188
6	326614	6807032	55	311541	6802157
7	314893	6806945	56	311048	6801872
8	319602	6806883	57	318452	6801848
9	326162	6806689	58	320374	6801761
10	314344	6806624	59	319884	6801461
11	319108	6806598	60	324174	6801345
12	318068	6806593	61	312855	6801139
13	317055	6806435	62	313517	6801130
14	312624	6806429	63	312290	6801076
15	325602	6806332	64	323680	6801060
16	312130	6806144	65	311604	6800882
17	316450	6806133	66	322548	6800640
18	311637	6805859	67	311166	6800517
19	315832	6805820	68	322055	6800355
20	322846	6805803	69	310720	6800166
21	322323	6805603	70	321561	6800070
22	311143	6805574	71	324642	6799863
23	315331	6805543	72	310273	6799814
24	313715	6805470	73	315191	6799315
25	321783	6805377	74	316068	6799315
26	310649	6805289	75	323655	6799293
27	325119	6805196	76	313622	6799175
28	313221	6805185	77	314383	6799167
29	321252	6805182	78	312846	6799141
30	324512	6805008	79	312016	6799127
31	320760	6804859	80	311448	6799117
32	312637	6804848	81	310878	6799108
33	323961	6804836	82	310309	6799098
34	312143	6804563	83	323161	6799008
35	317215	6804515	84	322668	6798723



Turbine No	Easting	Northing	Turbine No	Easting	Northing
36	320295	6804506	85	322174	6798438
37	315954	6804475	86	321631	6798305
38	311607	6804254	87	324682	6798085
39	319790	6804203	88	324188	6797800
40	314836	6804138	89	323694	6797515
41	319216	6804078	90	323201	6797230
42	311114	6803969	91	321918	6796650
43	314245	6803843	92	321293	6796544
44	313752	6803516	93	320714	6796513
45	322904	6803351	94	320146	6796490
46	322341	6803082	95	319694	6796137
47	326454	6803008	96	322639	6795771
48	321803	6802765	97	319273	6795770
49	325966	6802653	98	323089	6794624

Note: Co-ordinates referenced to GDA2020 (EPSG 7850)

Receptors identified and shown in this assessment are described by the Lot number within which they are located, with GDA 2020 (EPSG 7850) co-ordinates provided in **Table 35**.

Table 35: Receptor Coordinates

Receptor	Easting	Northing	Type	Project Relationship
15	318978	6823579	House	-
17	332110	6816565	House	-
18	335882	6816188	House	-
19	328558	6815924	House	-
20	312693	6815029	House	-
21	312246	6811348	House	-
22	331411	6810549	House	-
23	311444	6810421	House	-
24	332321	6805225	House	-
25	308122	6803514	House	-
27	300907	6800989	House	-
28	300514	6800912	House	-
30	319702	6798928	House	Project host
31	328000	6798050	House	-
32	307413	6796535	House	-
33	307428	6796392	House	-



Receptor	Easting	Northing	Type	Project Relationship
34	300341	6796197	House	-
35	325889	6795090	House	-
36	329565	6794053	House	-
38	302772	6793832	House	-
39	332218	6793406	House	-
41	305466	6791559	House	-
42	327082	6791118	House	-
43	315916	6790637	House	-
44	304080	6790196	House	-
45	323474	6790050	House	-
47	320969	6786456	House	-
48	321110	6785754	House	-
50	307875	6785156	House	-
51	307707	6785090	House	-
52	311378	6784437	House	-
54	328773	6783583	House	-
55	322350	6783549	House	-
56	328722	6783363	House	-
57	318254	6783271	House	-
63	316044	6780187	House	-
64	324720	6778964	House	-
65	321799	6778436	House	-
67	312373	6776763	House	-
70	315463	6775286	House	-
71	315348	6775104	House	-



Appendix C Noise Contours

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Figure 20: EPNR 10m/s HH Wind Turbine Only Noise Compliance Contours, LA10, dB

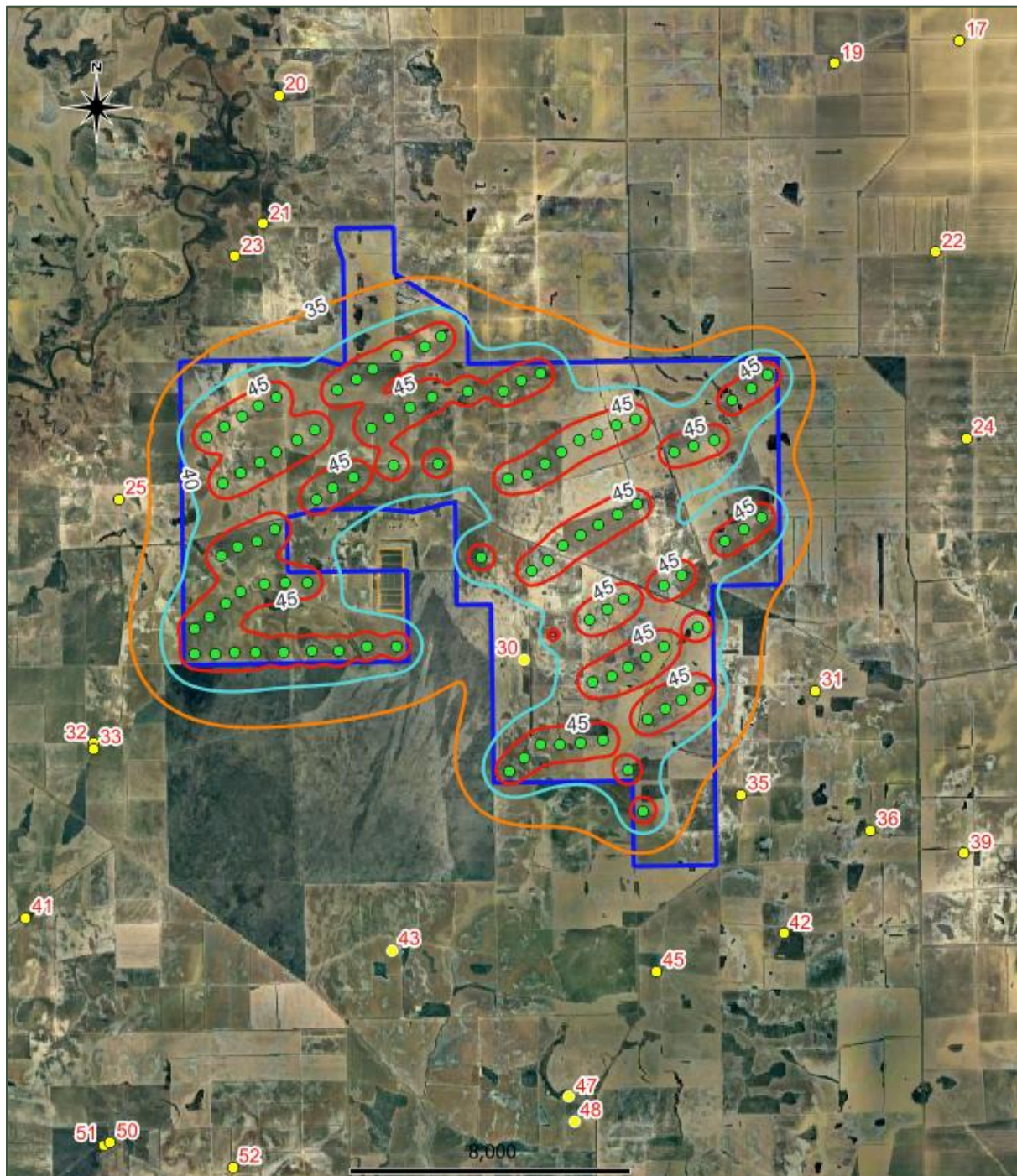


Figure 21: EPNR BESS Only Night-time Noise Contours, LA10, dB

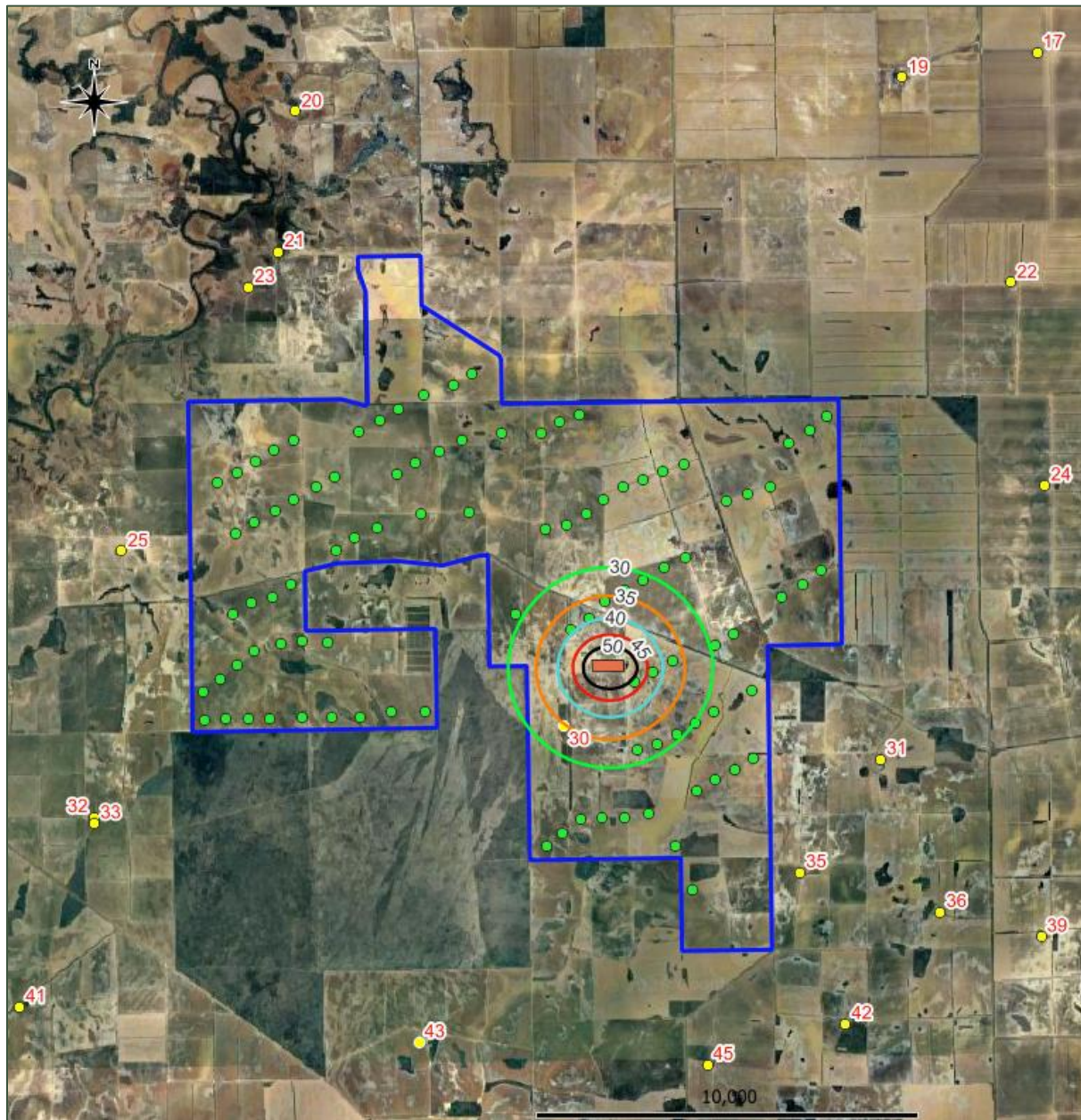


Figure 22: EPNR 10m/s HH Wind Noise Compliance Contours, LA10, dB

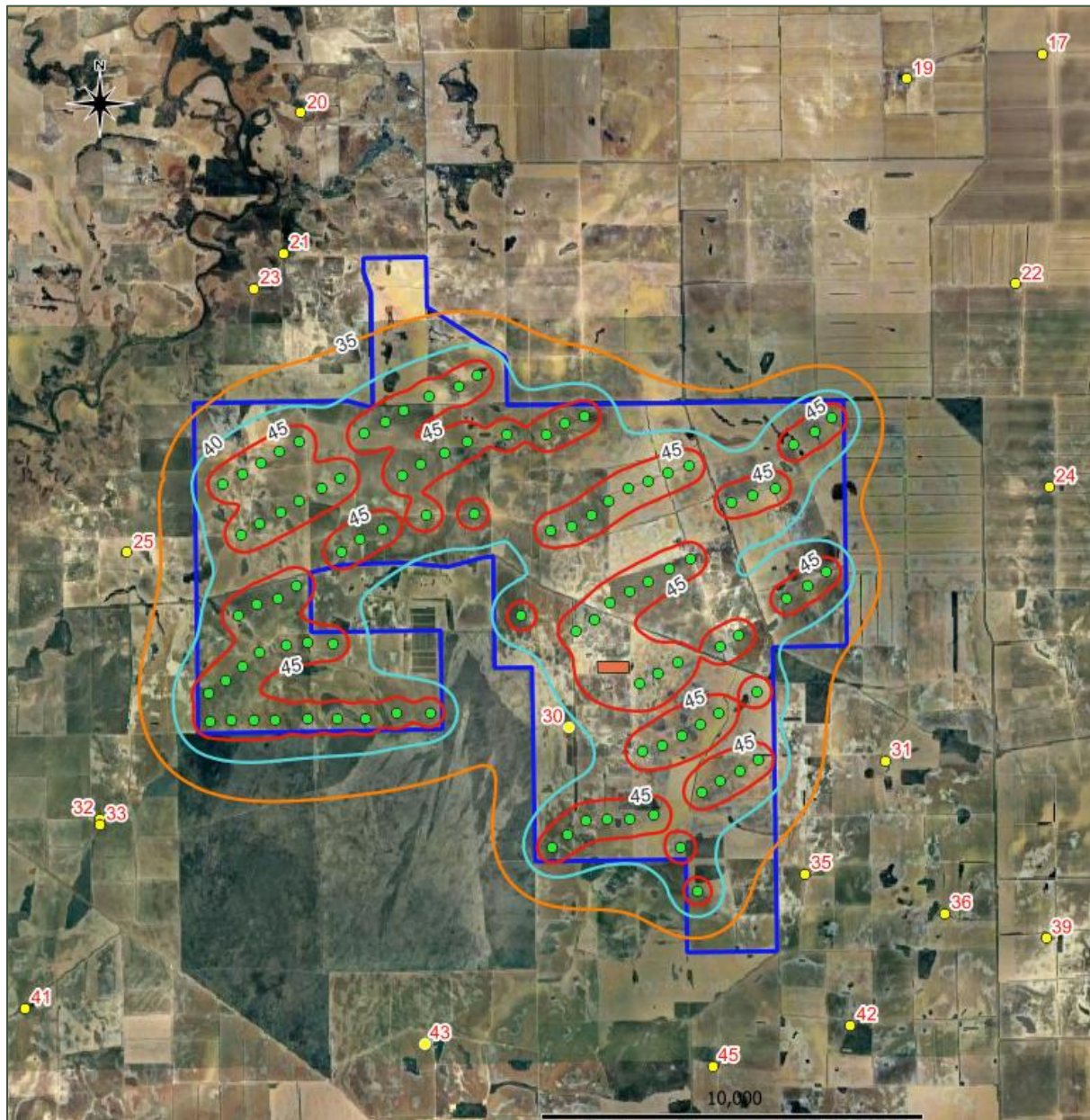


Figure 23: SA ISO 10m/s HH Wind Noise Compliance Contours, LA10, dB

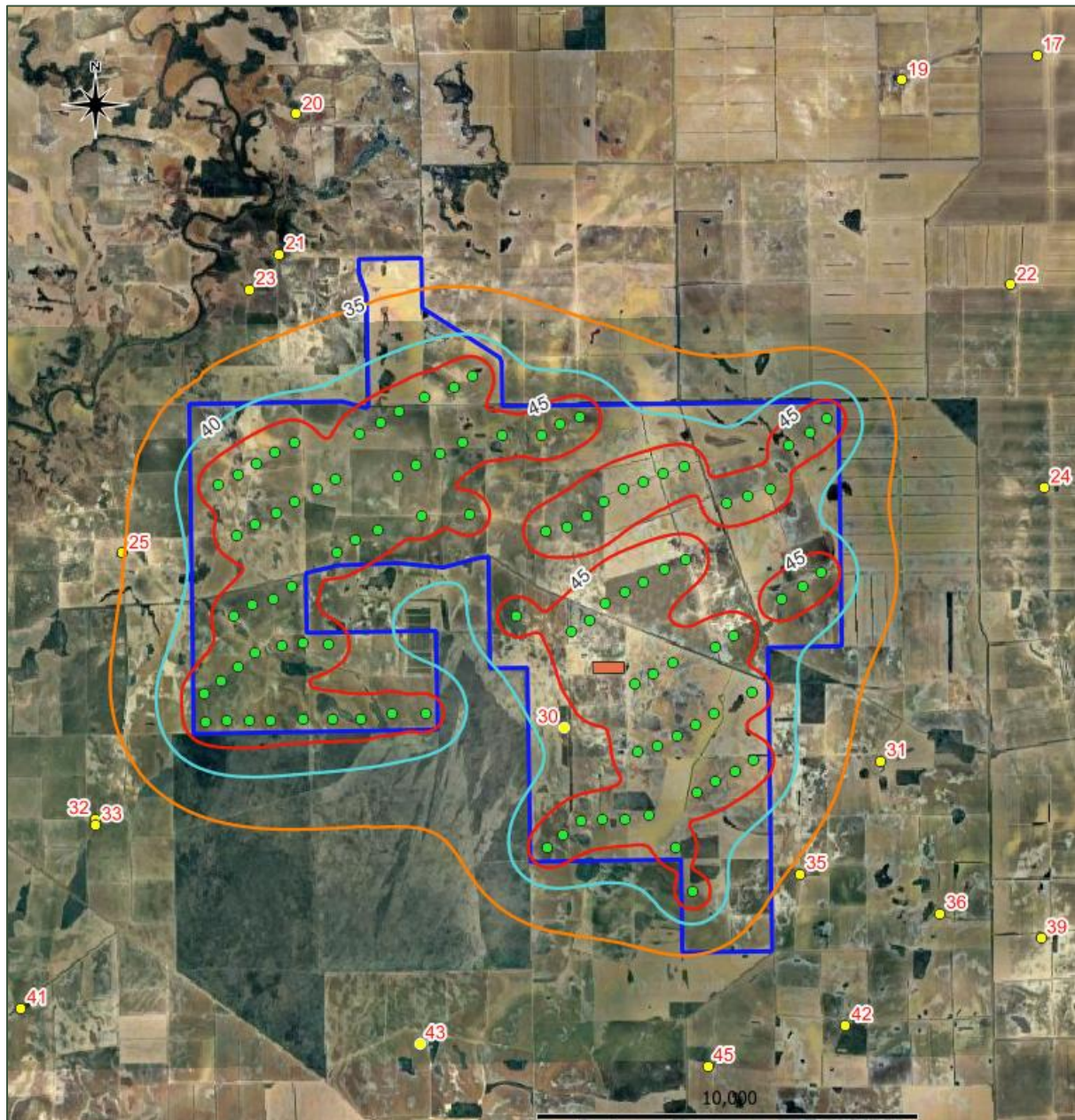


Figure 24: SA ISO 4m/s HH Wind Noise Contours, LA10, dB

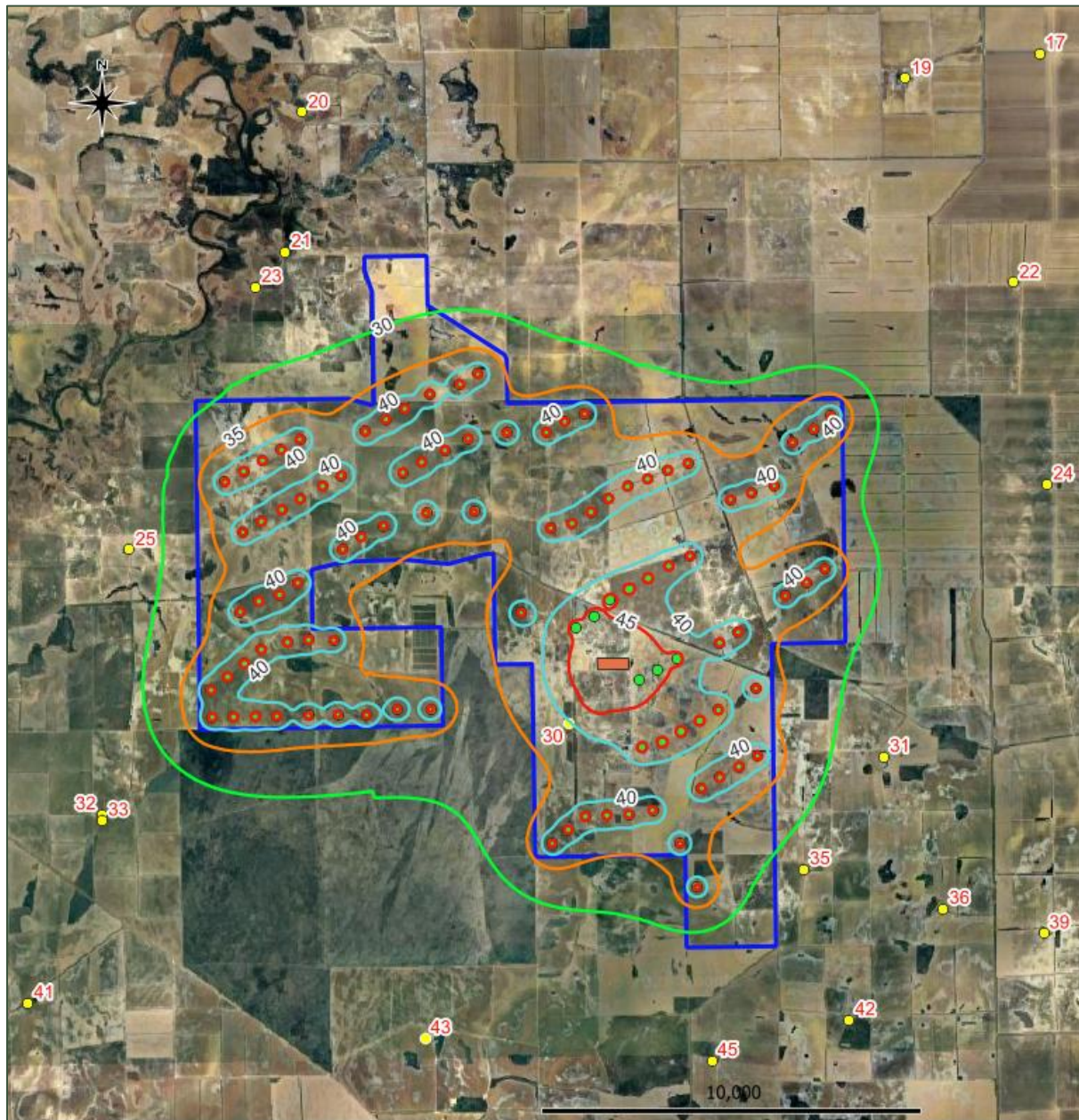


Figure 25: SA ISO 5m/s HH Wind Noise Contours, LA10, dB

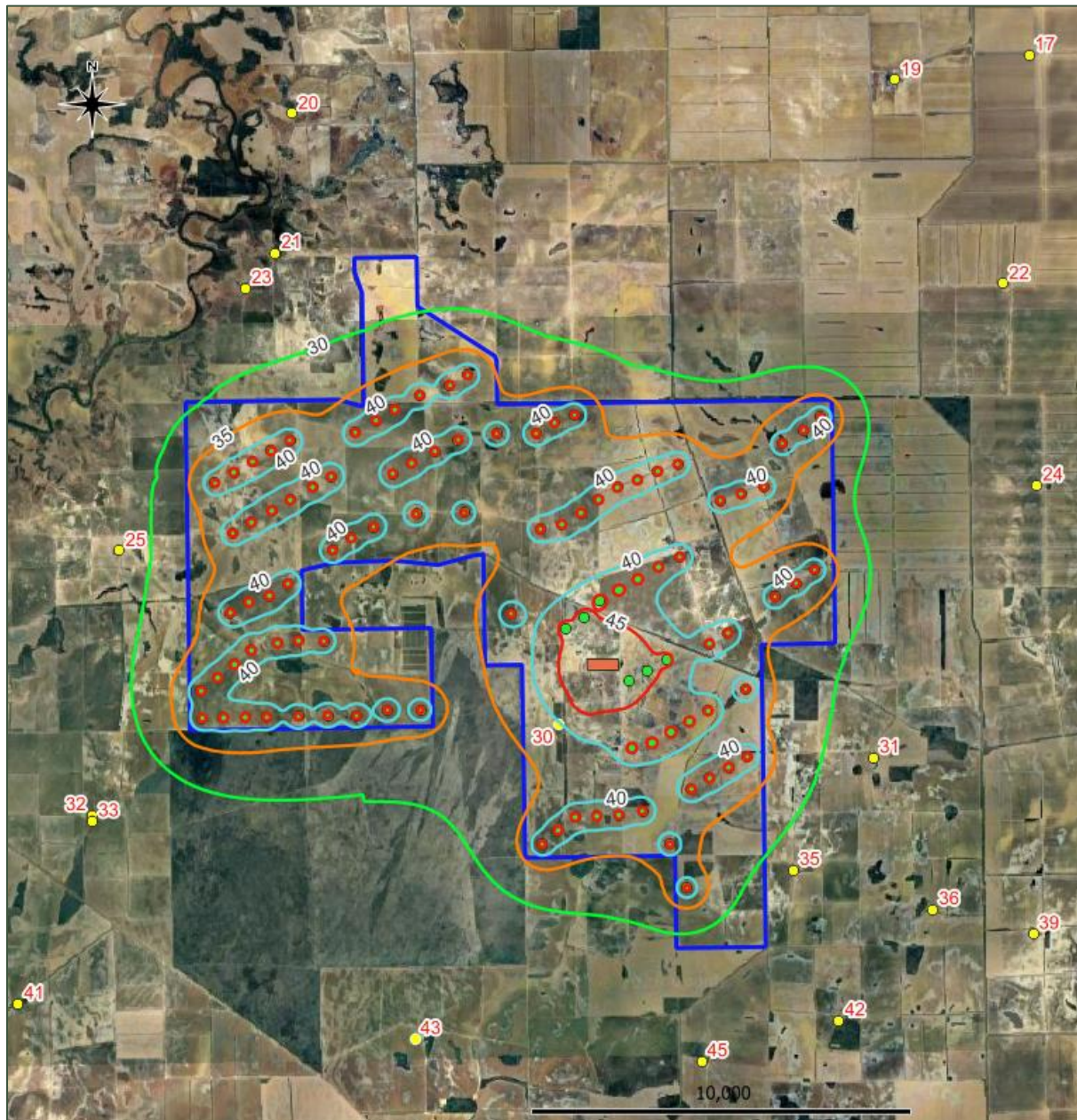


Figure 26: SA ISO 6m/s HH Wind Noise Contours, LA10, dB

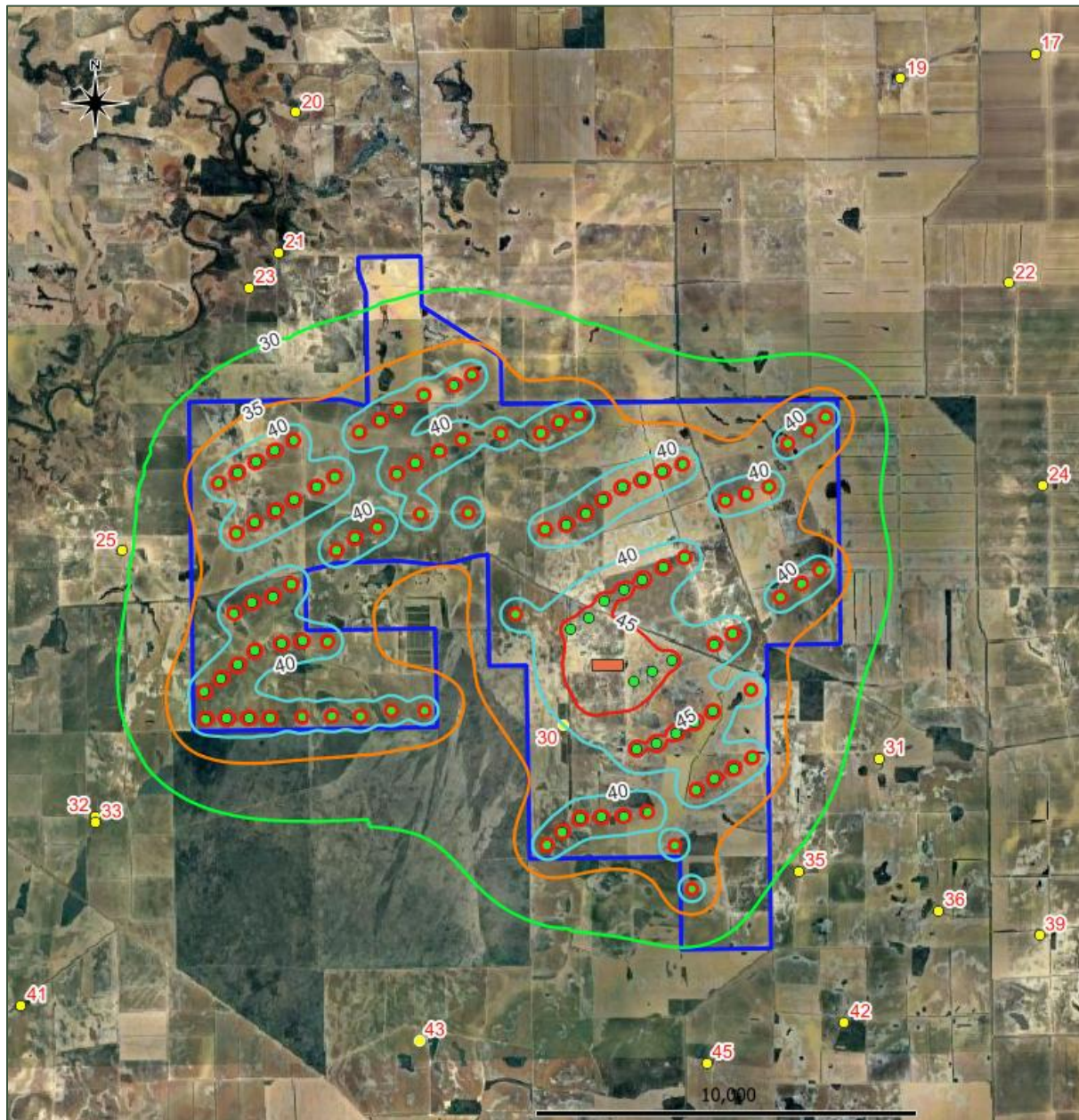


Figure 27: SA ISO 7m/s HH Wind Noise Contours, LA10, dB

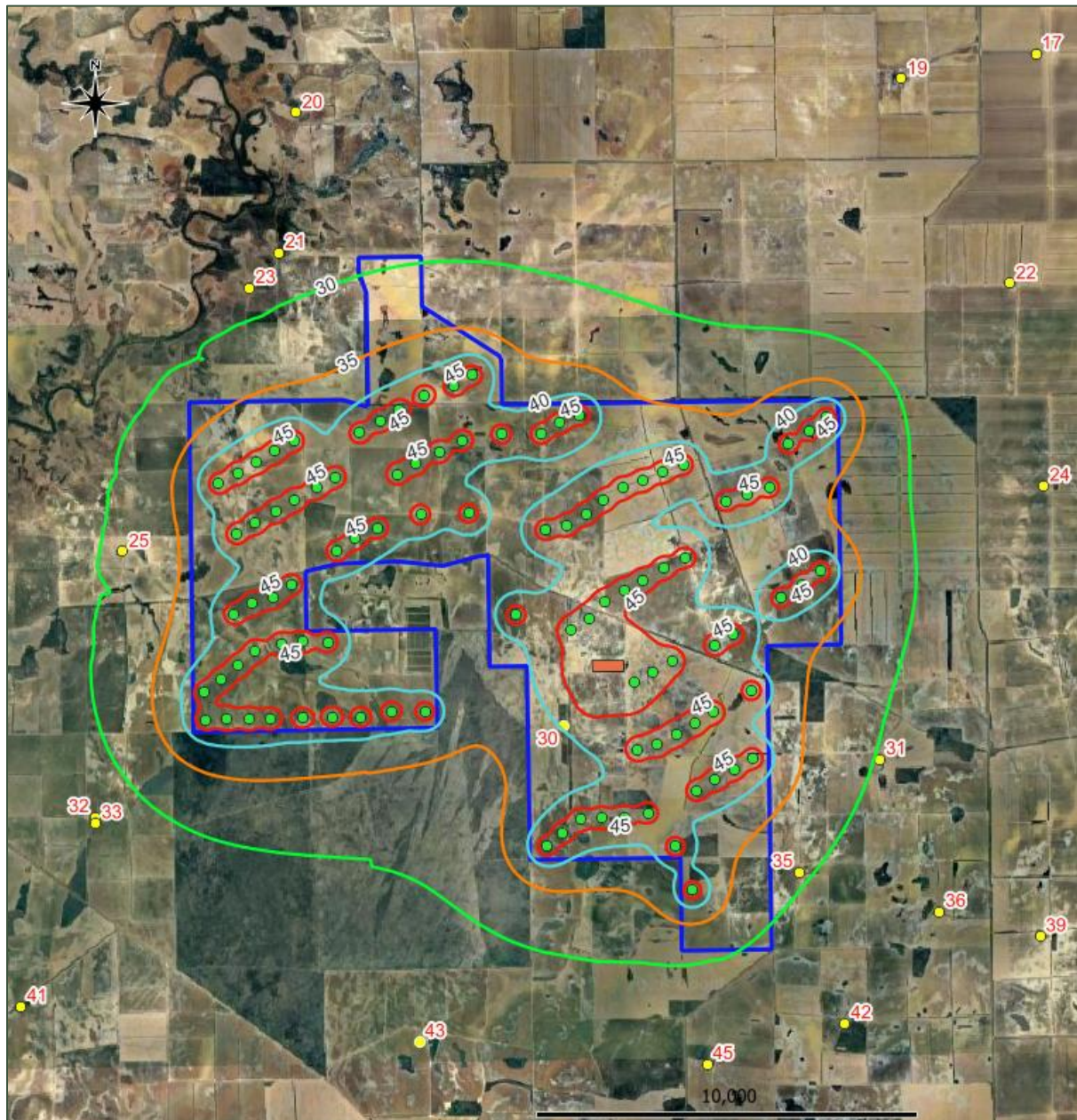


Figure 28: SA ISO 8m/s HH Wind Noise Contours, LA10, dB

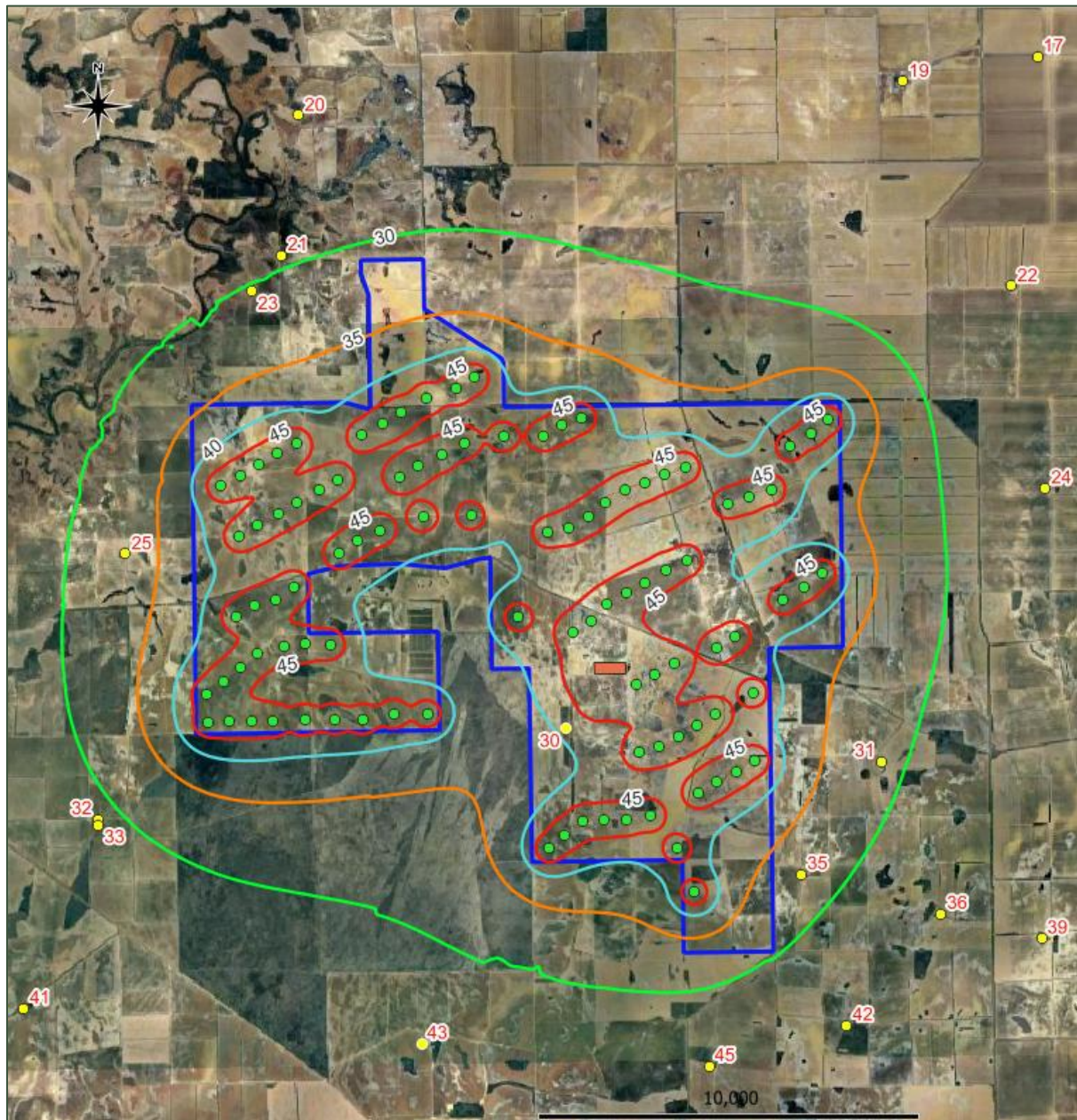


Figure 29: SA ISO 9m/s HH Wind Noise Contours, LA10, dB

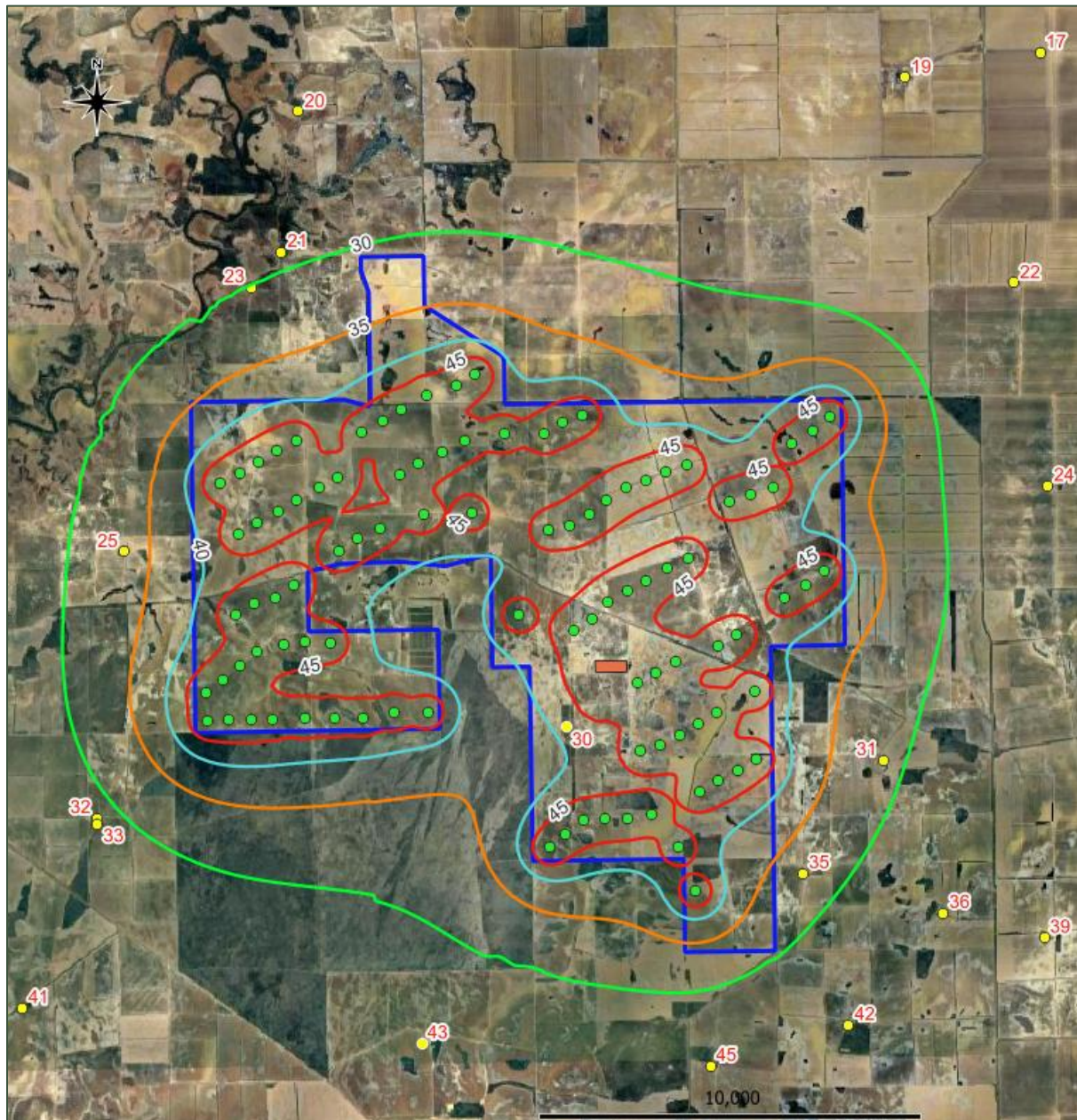
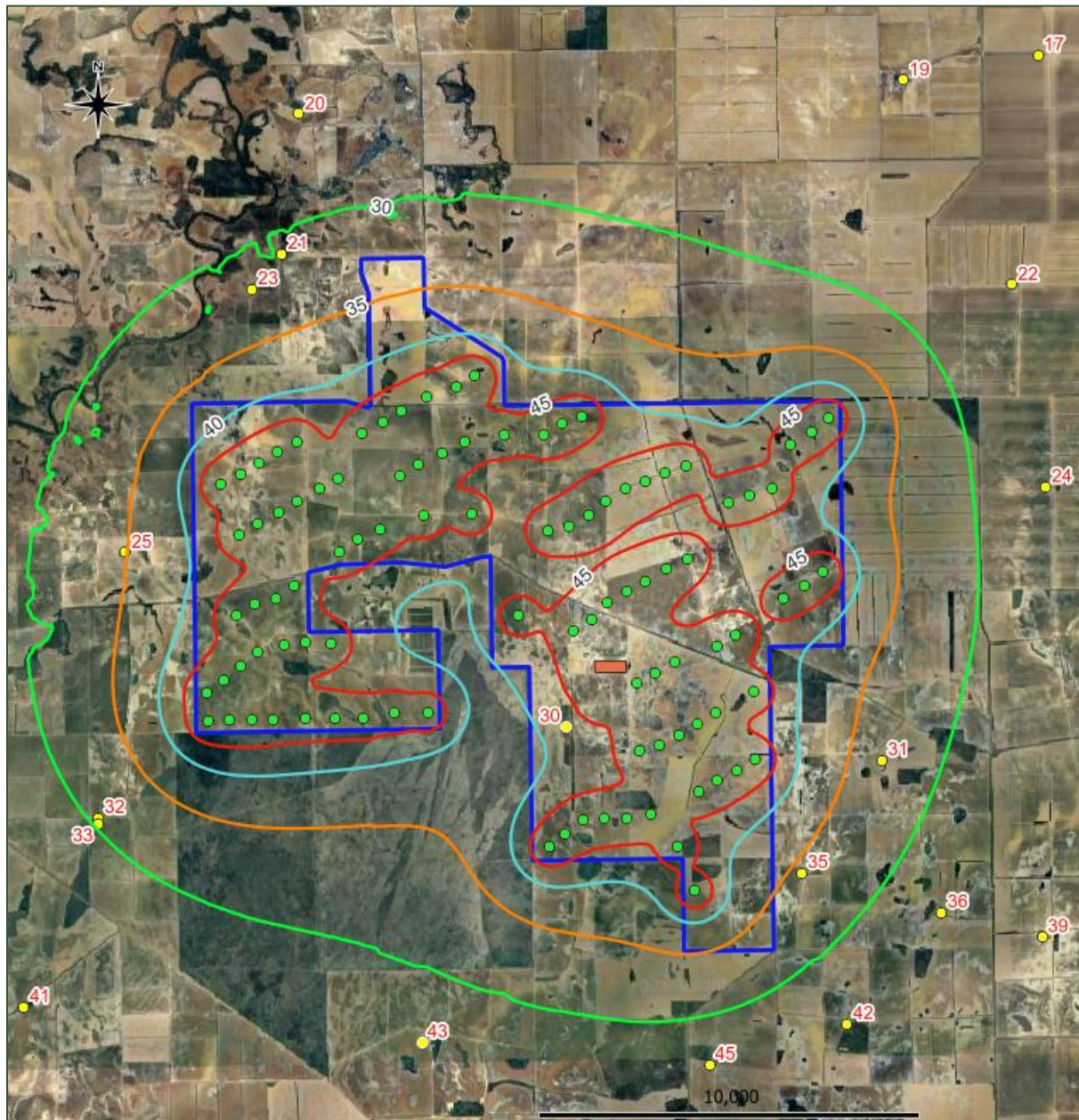
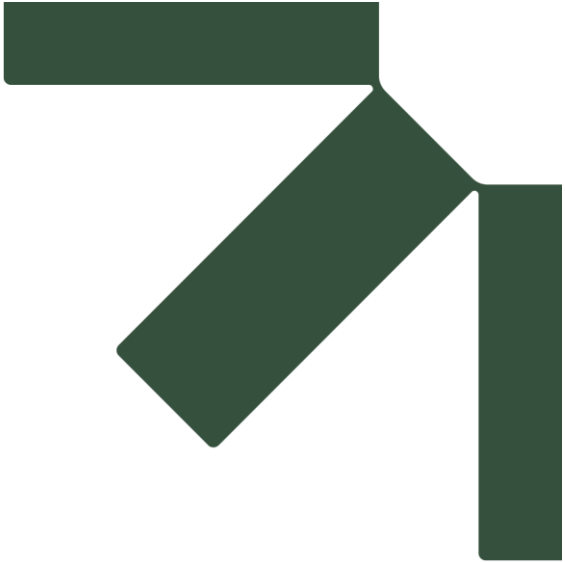


Figure 30: SA ISO 10m/s HH Wind Noise Contours, LA10, dB





Appendix D Construction Plan Layout

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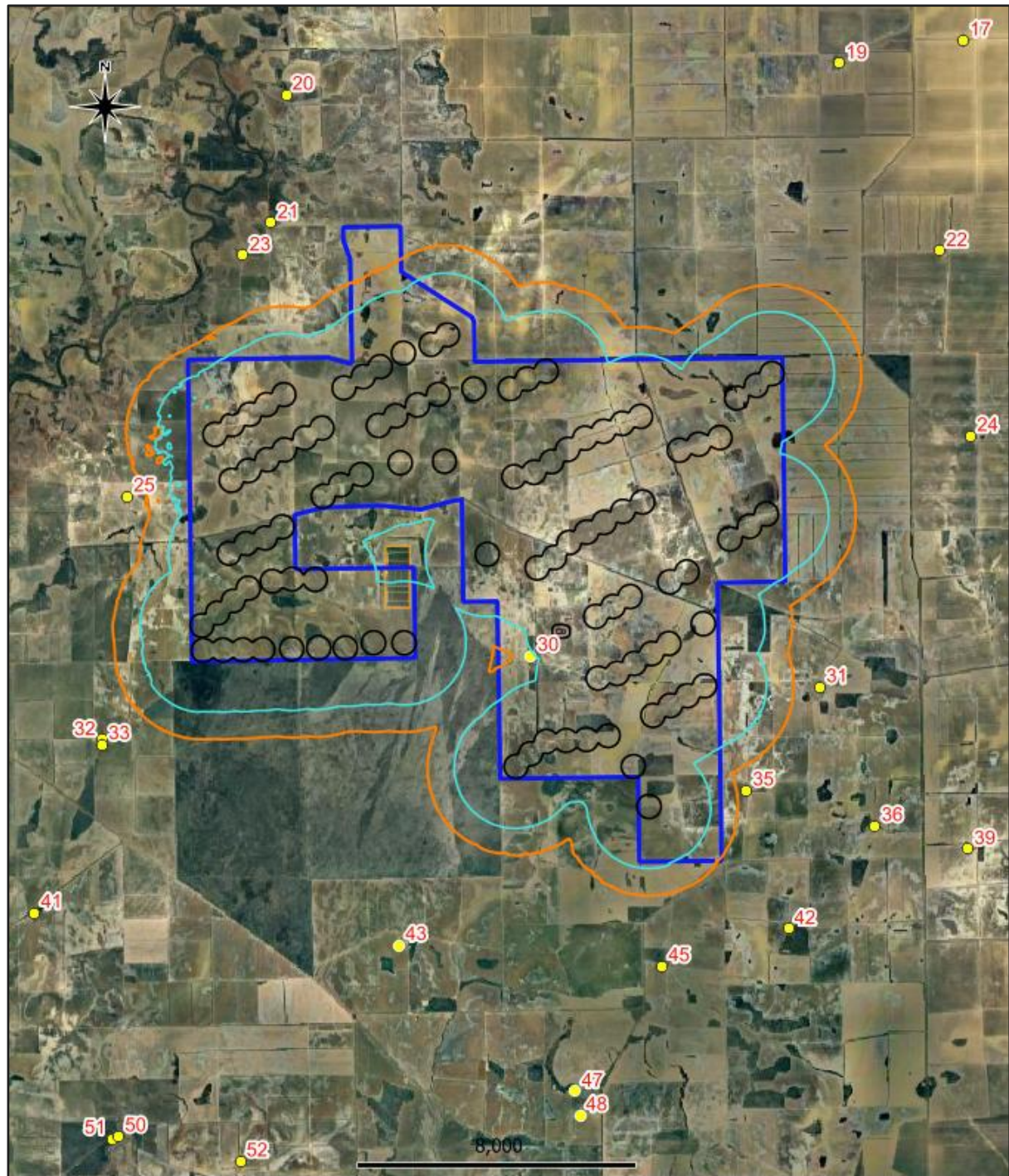
Figure 31: Construction Footprint Maximum Extent Noise Contours, LAeq, dB

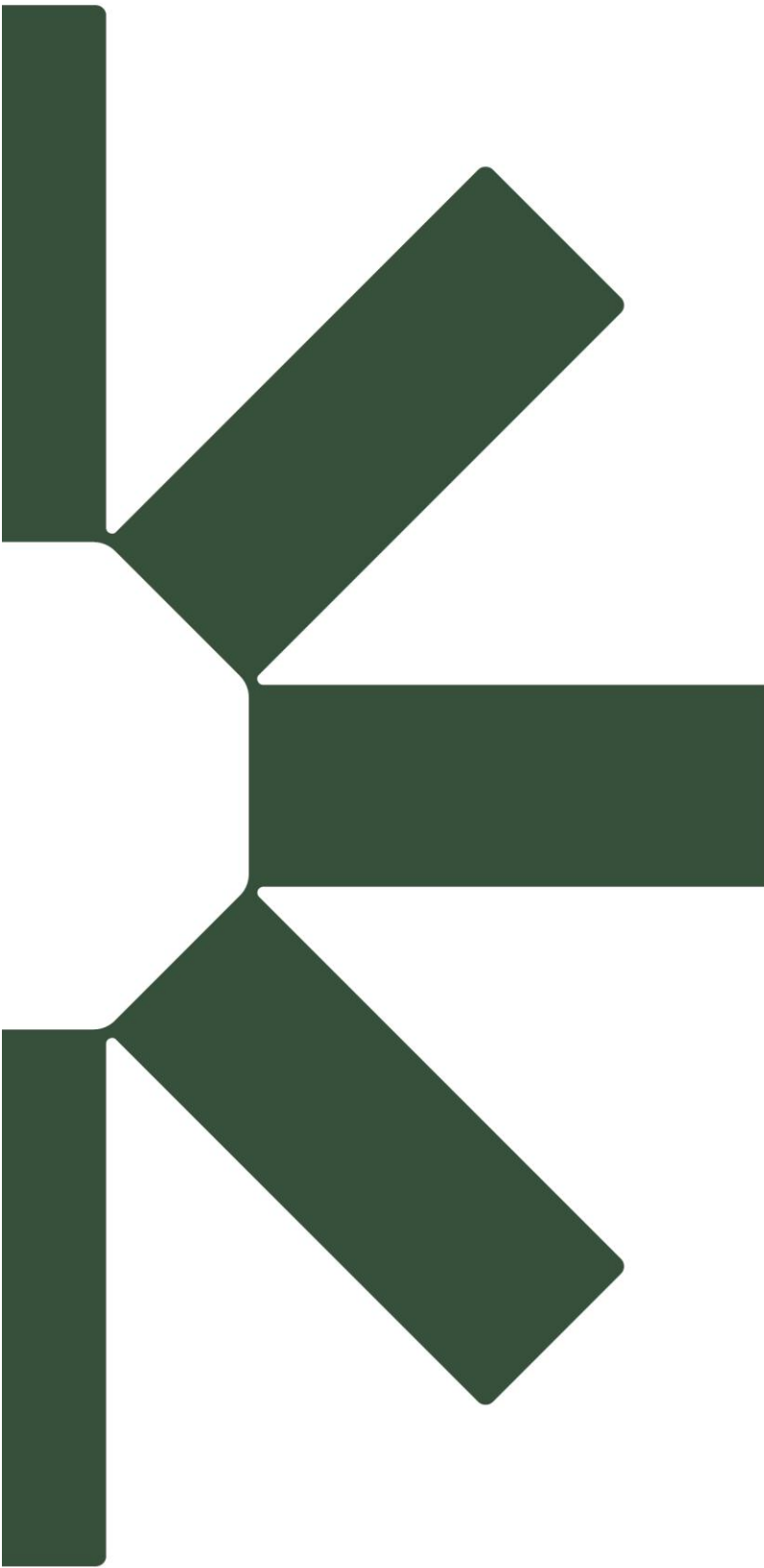
LAeq 35 dB – Orange Contour

LAeq 40 dB – Light Blue Contour

LAeq 60 dB – Black Contour

Receptor – Yellow Dot





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