Resonate

# Meering West Wind Farm

## Pre-Construction Predictive Noise Assessment

M240298RP1 Revision E

Thursday, 23 April 2026

**Document Information**

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| | | | | |

# Glossary

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|---|---|
| A-weighting | A spectrum adaption that is applied to measured noise levels to represent human hearing. A-weighted levels are used as human hearing does not respond equally at all frequencies. |
| Adjustment $K_2$ | The adjustment, $K_2$, is applied under NZS 6808:2010 to any 10-minute sample of wind turbine noise where there is a special audible characteristic present. The value of the adjustment ranges from 1 to 6 dB depending on the type and magnitude of the characteristic. |
| Aggravated noise | Noise defined by the EP Regulations to exceed the noise limits established under the Noise Protocol by more than 15 dB or to exceed a noise level of 75 dB during the day period, 70 dB during the evening period or 65 dB during the night period. |
| Ambient noise | The overall environmental noise level at a given location caused by all noise sources in the area, both near and far, including all forms of traffic, industry, lawnmowers, insects, animals and the like. It is typically described by the $L_{Aeq}$ metric. |
| Amplitude modulation | The modulation, change, of the loudness of wind turbine noise. Wind turbine noise is generally accepted to have a normal level of modulation (blade 'swish') but has been known to occasionally exhibit excessive amplitude modulation which may be described as a 'thumping' noise and could warrant a special audible characteristic penalty. |
| Background noise | The underlying noise level at a given location, measured in the absence of a noise source under investigation and other industry noise. The background noise is typically described using the $L_{A90}$ metric to reduce the effect of short-term noise sources such as intermittent traffic, lawnmowers, insect, animals and the like. |
| BESS | Battery Energy Storage System |
| C-weighting | A spectrum adaption that is applied to measured noise levels to represent human hearing at high levels of noise. Because, unlike the A-weighting, the C-weighting does not apply large negative weightings to low frequency noise levels, it is commonly used for the assessment of low frequency noise. |
| Day period | Monday to Saturday (except public holidays), from 7 am to 6 pm as defined in the Environment Protection EP Regulations. |
| dB | Decibel—a unit of measurement used to express sound level. It is based on a logarithmic scale which means a sound that is 3 dB higher has twice as much energy. People typically perceive a 10 dB increase in sound as a doubling of loudness. |
| Effective noise level | The level of noise emitted from the commercial, industrial or trade premises and adjusted if appropriate for duration, character and position as defined in Part I, Section B2 of the Noise Protocol. |
| EP Act | Environment Protection Act 2017 |
| EP Regulations | The Victorian Environment Protection Regulations are subordinate legislation to the Environment Protection Act 2017. They give force to noise limits for commercial, industrial and trade premises. |
| EPA Victoria | Environment Protection Authority Victoria. |
| ERS | Environment Reference Standard |
| Evening period | Monday to Saturday, from 6 pm to 10 pm; and Sunday and public holidays, from 7 am to 10 pm, as defined in the EP Regulations. |

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| Frequency (Hz) | The number of times a sound pressure wave oscillates (moves back and forth) in one second. Fast movements produce high frequency sound (high pitch/tone), but slow movements mean the frequency (pitch/tone) is low. 1 Hz is equal to 1 cycle per second. |
| GED | General Environmental Duty – As defined by Section 25(1) of the EP Act, the GED requires that any person who is engaging in an activity that may give rise to risks of harm to human health or the environment from pollution or waste must minimise those risks, so far as reasonably practicable. |
| Impulsiveness | Transient sound having a peak level of very short duration, typically less than 100 ms. Impulsive sounds are subjectively more annoying than steady sounds. |
| Involved stakeholder | A dwelling where the landowner has an agreement in place that modifies the applicable noise limit in accordance with Regulation 131B of the EP Regulations. |
| $L_{A90}$ | A-weighted sound pressure level that is exceeded for 90% of the time interval considered. The $L_{A90}$ metric is used to assess wind turbine noise in Victoria and also to quantify the background noise level in an environment. |
| $L_{Aeq}$ | The equivalent continuous A-weighted sound pressure level. It is the value of the A-weighted sound pressure level of a continuous steady sound that has the same acoustic energy as a given time-varying A- weighted sound pressure level when determined over the same measurement time interval. The $L_{Aeq}$ metric is used to quantify the Effective Noise Level from a commercial, industrial or trade premises. |
| $L_{Ceq}$ | The equivalent continuous C-weighted sound pressure level. |
| $L_{WA}$ | Sound Power Level - a measure of the acoustic output of a source, independent of distance and referenced to $10^{-12}$ W. |
| Night period | Between 10 pm and 7 am of the following day as defined in the EP Regulations. |
| Noise Limit | The maximum allowable level of wind turbine noise as established in accordance with NZS 6808:2010. Also refers to the maximum effective noise level allowed in a noise sensitive area for a commercial or industrial premises, as determined in accordance with the Noise Protocol. |
| Noise Protocol | Environmental Protection Authority Publication 1826.4 Noise limit and assessment protocol for the control of noise from commercial, industrial and trade premises and entertainment venues. |
| Noise sensitive land use | Refers to a land use that may be sensitive to noise from a construction or operational source. The precise type of sensitive receivers can vary depending on the type of noise source and the legislation or guidelines that apply, but noise sensitive receivers generally include residential land uses (including aged care), educational land uses and hospitals. |
| NZS 6808:2010 | New Zealand Standard NZS 6808:2010 *Acoustics – Wind farm noise*. |
| Special audible characteristics | Special Audible Characteristics are unusual characteristics of wind farm sound that make it more likely to cause adverse community response at lower sound levels. Special audible characteristics are defined by NZS 6808:2010 to include tonality, impulsiveness and amplitude modulation. |
| Tonal adjustment $A_{tone}$ | When noise from a commercial or industrial premises assessed against the Noise Protocol is tonal in nature then an adjustment is applied of +2 dB for just detectable tonal character of the noise or +5 dB for prominent tonal character of the noise, as defined in Part I, Section B3 of the Noise Protocol. In cases where the adjustment is unclear, the objective method defined by the Noise Protocol should be used. |

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| Tonality | A characteristic of a noise where there is a distinctly higher level over a relatively narrow frequency range. Examples include the reversing signal on a truck or the wheel squeal that sometimes occurs when trains move around a curve. A noise exhibiting tonality is subjectively more annoying than a non-tonal noise at the same level. |
| Unreasonable noise | Noise defined by the EP Regulations to exceed the established noise limits is prescribed to be unreasonable noise. |
| WTG | Wind Turbine Generator |

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# Executive summary

Meering West Wind Farm Pty Ltd (MWWF) is proposing development of the Meering West Wind Farm (the Project), a wind energy project to be located within the Murray Renewable Energy Zone at a site approximately 25 km south west of Kerang, Victoria. The Project is proposed to consist of up to 164 wind turbines. The wind energy component will be supported by ancillary infrastructure comprising of collector stations, transmission infrastructure and a Battery Energy Storage System (BESS) of approximately 1000 MWh.

Resonate has been engaged by Aurecon, on behalf of MWWF, to undertake an environmental noise assessment of the Project to address the requirements of the Department of Transport and Planning (DTP) *Planning Guidelines for the Development of Wind Energy Facilities in Victoria* (DTP Guidelines) and *Environment Protection Regulations* (EP Regulations).

### Wind turbine noise assessment

Based on the candidate wind turbine selection and proposed 164 wind turbine layout, operational wind turbine noise levels were predicted against the minimum applicable noise limit of 40 dB $L_{A90}$ that applies under the DTP Guidelines, EP Regulations and New Zealand Standard (NZS) 6808:2010 *Acoustics – Wind farm noise*.

A total of nine noise-sensitive locations were identified within the predicted 35 dB $L_{A90}$ noise contour with predicted wind turbine noise levels being 37 dB or below at all of these locations. As such, it is expected that the Project can comply with the applicable noise limits under NZS 6808:2010 subject to appropriate turbine selection during detailed design. Predicted wind turbine noise levels at involved stakeholder locations were also below 45 dB in all cases.

As required by the *Environment Reference Standard*, wind turbine noise emissions were also considered at identified natural areas as defined in the Gannawarra and Loddon Planning Schemes in the context of human tranquillity. While wind turbine noise is expected to be audible during periods of higher wind speeds, it is reasonable to expect that there would be wind blowing through vegetation in these natural areas as well at these times to create background noise. One campground was identified within the Leaghur State Park PCRZ, with predicted noise levels at the campground being 31 dB $L_{A90}$ and 4 dB below the limit recommended for high amenity areas in NZS 6808:2010. No campgrounds were identified within other natural areas such that people would only be expected to be in the area for limited periods of time and carrying out recreational activities.

### Ancillary infrastructure noise assessment

The ancillary infrastructure noise assessment was based on a candidate BESS equipment model and layout, as well as typical transformer sound power levels for anticipated collector station equipment. Two ancillary infrastructure locations were assessed.

The assessment of ancillary infrastructure noise has concluded that the Project can comply with the applicable Noise Protocol noise limits for both locations, and that the risk of problematic low frequency noise can be managed through appropriate equipment selection and site design. The predicted noise levels comply with the noise limits at the nearest involved stakeholder locations and are 14 dB or more below the applicable noise limits at the nearest non-involved noise-sensitive locations regardless of which location is adopted.

Due to the significant separation distances of over 3.5 km between the ancillary infrastructure sites under consideration and the identified natural areas, it is expected that the level of ancillary infrastructure noise at the identified natural areas would be significantly lower than the wind turbine noise emissions.

## Summary and recommendations

This assessment has concluded that the Project has been designed, and can be constructed and operated, in such a way as to manage wind turbine and ancillary infrastructure noise emissions in accordance with applicable legislation, policies and guidelines subject to final equipment selection and detailed design.

The assessment is based on a candidate wind turbine model, ancillary infrastructure selection and layout that may be subject to further refinement post-approval. It is recommended that, prior to the commencement of construction of the Project and in addition to the obligations that exist for wind energy facilities under the EP Regulations:

- A Construction Noise Management Plan be developed to identify measures to be implemented to reduce the impact of construction noise so far as reasonably practicable. The Construction Noise Management Plan should sit as a sub-plan to the Construction Environmental Management Plan and should be implemented during construction.
- A Pre-Construction Noise Assessment be prepared that reflects the final wind turbine selection, wind turbine numbers and design.
- The Pre-Construction Noise Assessment should include background noise monitoring conducted at representative noise-sensitive locations within the predicted 35 dB $L_{A90}$ noise contour consistent with NZS 6808:2010.
- A Pre-Construction Noise Assessment also be prepared for the final ancillary infrastructure selection and design.

# 1 Introduction

Meering West Wind Farm Pty Ltd (MWWF) is proposing development of the Meering West Wind Farm (the Project), a wind energy project to be located within the proposed Murray Renewable Energy Zone at a site approximately 25 km south west of Kerang, Victoria. The Project is proposed to consist of up to 164 wind turbines. The wind energy component will be supported by ancillary infrastructure comprising of collector stations, transmission infrastructure and a Battery Energy Storage System (BESS) of approximately 1000 MWh.

Resonate has been engaged by Aurecon, on behalf of MWWF, to undertake an environmental noise assessment of the Project to address the requirements of the Department of Transport and Planning (DTP) *Planning Guidelines for the Development of Wind Energy Facilities in Victoria* (DTP Guidelines) and *Environment Protection Regulations* (EP Regulations).

This report sets out the environmental noise assessment. It:

- identifies applicable legislation, policies and guidelines relating to noise emissions from wind turbine noise and ancillary infrastructure
- establishes applicable noise limits
- presents predicted wind turbine noise and ancillary infrastructure noise at noise sensitive land uses
- assesses predicted noise against the applicable noise limits.

# 2 Project description

## 2.1 Site description

The Project is located within the Loddon and Gannawarra local government areas (LGAs). The Meering West Wind Farm is situated in Northern Victoria, approximately 250 km north of Melbourne and around 110 km north of Bendigo and 25 kilometres south-west of Kerang.

The Project encompasses approximately 20,000 ha, with most of the area located within the Shire of Gannawarra with a smaller Project component located within the Shire of Loddon. The landscape is predominantly characterized by agricultural land, featuring cropped fields that are well-maintained and utilised mostly for dryland cropping. The environment is largely flat to gently undulating.

The Project Area is surrounded by small rural localities including Quambatook to the west, Boort to the south-east, and Kerang to the north-east as the nearest regional and community centre for shopping, employment and business services.

The Project Area is predominantly characterised by agricultural land, featuring cropped fields that are well-maintained and utilised mostly for dryland cropping

The proposed layout of the site is shown in Figure 1, with wind turbine coordinates included in Appendix A.

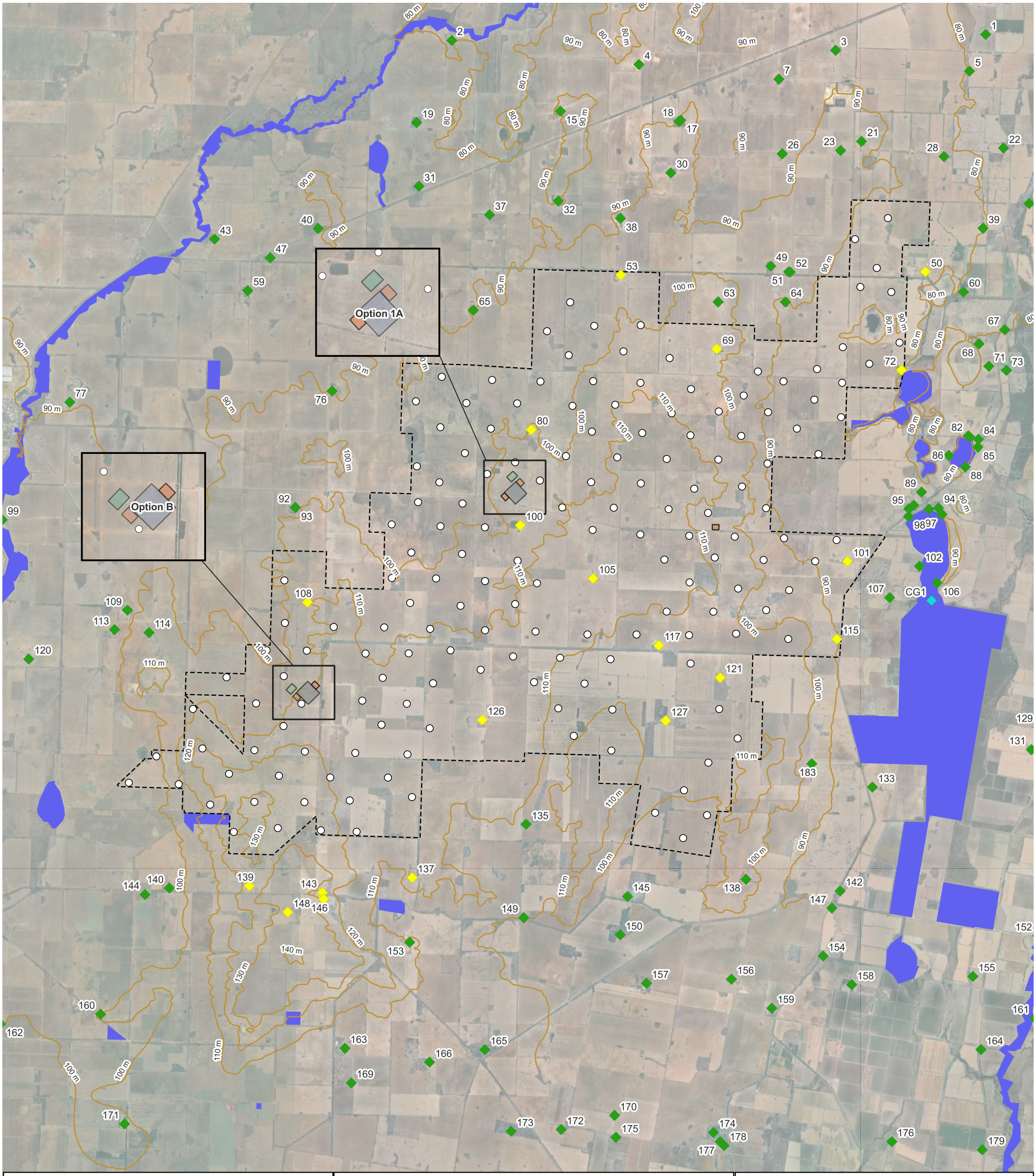
The ancillary infrastructure, consisting of collector stations and the BESS are also shown on Figure 1. Two options are under consideration for the ancillary infrastructure, both of which are assessed in this report.

## 2.2 Noise-sensitive locations

MWWF has provided information on 157 identified noise-sensitive locations around the site that are within 10 km of a proposed WTG location as shown on Figure 1, with coordinates tabulated in Appendix B.

The noise-sensitive locations are located within a Farming Zone as defined by the Gannawarra and Loddon Planning Schemes. The township of Quambatook includes noise-sensitive locations within a Township Zone, but these noise-sensitive locations are over 8 km from the nearest Project turbine and are therefore well outside of the predicted 35 dB $L_{A90}$ noise contour from the Project as documented in this report.

A total of 18 involved landowner houses, including two unoccupied houses, have also been identified within and around the site boundary as shown on Figure 1. It is understood there would be an agreement in place with the owners of each of these dwellings to allow higher wind turbine noise limits. The coordinates of these involved landowner houses are tabulated in Appendix B.




# MEERING WEST WIND FARM

## Meering West, VIC
## Figure 1: Project area and surrounding areas

| | |
|---|---|
| PROJECT NUMBER | M240298 |
| DRAWN BY | TE |
| DATE | June 2025 |
| CLIENT | Aurecon |
| AERIAL IMAGERY | (c) Google |

Legend

- Project area
- WTG

Ancillary Infrastructure

- BESS (Indicative location)
- Substation BESS (Indicative location)
- Terminal station (Indicative location)
- Topographical contour

Dwelling

- Landowner
- Noise-Sensitive Location
- Campground

ERS Natural Area

- Natural Area (PCRZ)

ADVERTISED PLAN

0 2 4 6 km

Datum GDA20 MGA Zone 54



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## 2.3 Natural areas

The *Environment Reference Standard* (ERS) (refer Section 3.1.2) requires consideration of the potential for noise and vibration to impact on human tranquility and enjoyment outdoors in natural areas. The ERS defines natural areas as:

> National parks, state parks, state forests, nature conservation reserves, wildlife reserves and environmentally significant areas and landscapes outside metropolitan Melbourne that are identified in a planning scheme.

The largest natural area identified within the Gannawarra and Loddon Planning Schemes is the Leaghur State Park Public Conservation and Resource Zone (PCRZ), approximately 2 km east of the nearest wind turbine (being WTG76). From a review of information regarding Leaghur State Park, a public campground is located on the southern end of Lake Meran and is considered relevant for the assessment of human tranquility. The site is shown on Figure 1 with coordinates included in Appendix B.

A number of other natural areas exist around the Project boundary as shown on Figure 1 including:

- Great Spectacle Lake and Little Spectacle Lake PCRZ adjacent to the eastern boundary
- Round Lake and Tobacco Lake PCRZ approximately 2 km from the eastern boundary
- Little Lake PCRZ approximately 3 km from the eastern boundary
- Quambatook I208 Bushland Reserve PCRZ adjacent to the southwest boundary
- Gredgwin Bushland Reserve PCRZ approximately 1.km south of the southern boundary.

No defined camping areas were identified within these areas, such that human occupancy is expected to be limited to transient daytime activities such as recreational hunting.

## 2.4 Wind turbine model

At this stage of the Project, the wind turbine model that will be used has not been confirmed and would be confirmed through a competitive tender process after the Project has received planning approval. Based on the information supplied by MWWF, it is understood that the planning permit application will seek approval for turbines with a height of up to 280 m above ground. Wind turbines will have a rotor diameter of up to 172 m and a rated power capacity of 6 to 8 MW.

A candidate turbine has been selected for this assessment that is considered representative of the typical range of modern wind turbine sound power levels with a rated power capacity of between 6 and 8 MW. The candidate wind turbine is a Vestas V172-7.2MW. Sound power levels have been based on Vestas specification documents.[1]

The overall sound power levels with hub height wind speed for the Vestas V172-7.2MW are summarised in Table 1, with this preliminary assessment based on the model with serrated trailing edges (STE)[2]. STE are one example of noise reduction mechanisms available to wind farm operators and have been included in this assessment to demonstrate the typical effect of such mechanism.



[1] Sound power levels have been based on a V172-7.2MW WTG with serrated trailing edges as detailed in Vestas specification document 0180-4980 V01 *Sound Performance Specification EnVentus V172-7.2MW*. No uncertainty has been applied as, based on discussions with Vestas, it is understood that the sound power levels incorporate an uncertainty factor and align with warranted sound power levels.

[2] STEs can be attached to wind turbine blades to reduce trailing edge turbulence and, as a result, reduce sound power levels in the order of 2-3 dB.

Table 1 Wind turbine sound power levels with wind speed

| Turbine | Sound power level in dB $L_{WA}$ for hub height wind speed in m/s | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 3 | 4 | 5 | 6 | 7 | 8 | 9 | ≥ 10 |
| V172-7.2MW with STE | 97.6 | 97.6 | 97.7 | 99.5 | 102.2 | 105.0 | 107.1 | 107.8 |

As is normal for modern pitch-controlled wind turbines, the sound power levels for the Vestas V172-7.2MW wind turbine increase from the cut-in wind speed before levelling off at a wind speed close to the wind speed at which the turbines reach rated power. This noise assessment has been based on the maximum sound power level, with the assumed sound power level spectrum, and incorporating the 1 dB uncertainty factor based on the supplied specification, presented in Table 2.

Table 2 Wind turbine sound power level spectrum

| Turbine | Sound power level in dB $L_{WA}$ at octave band centre frequency in Hz | | | | | | | | Overall |
|---|---|---|---|---|---|---|---|---|---|
| | 31.5 | 63 | 125 | 250 | 500 | 1000 | 2000 | 4000 | dB $L_{WA}$ |
| V172-7.2MW with STE | 78.3 | 89.8 | 96.8 | 101.4 | 100.4 | 101 | 99.9 | 98.3 | 107.8 |

## 2.5 Ancillary infrastructure

The Project will include ancillary infrastructure including a BESS and electrical infrastructure at collector and terminal stations, with two options (Option 1A and Option B) under consideration as shown in Figure 1.

As with the wind turbines, selections for the ancillary infrastructure, including BESS, has not been made at this stage of the Project.

For the electrical infrastructure and the collector substation and terminal station, the preliminary design[3] has two main transformers, assumed to have a rating of 500 MVA each, supported by associated smaller earthing transformers and switchgear. The transformer models have not been selected at this stage, so a sound power level aligned with the standard level specified in AS/NZS 60076.10:2009 *Power transformers – Determination of sound levels* has been adopted for the main 500 MVA transformers, with other associated equipment expected to be significantly quieter based on previous experience. The sound power level for the transformer is shown in Table 3 with a typical transformer noise spectrum based on previous Resonate measurements. It is noted that transformers with a lower MVA rating would have a lower permissible sound power level under AS/NZS 60076.10:2009.

Table 3 Octave band sound power levels for 500 MVA transformer

| Transformer | Sound power level in dB $L_{WA}$ at octave band centre frequency in Hz | | | | | | | | Overall |
|---|---|---|---|---|---|---|---|---|---|
| | 31.5 | 63 | 125 | 250 | 500 | 1000 | 2000 | 4000 | dB $L_{WA}$ |
| Per 500 MVA transformer | 78.1 | 82.9 | 90.9 | 98.4 | 100.8 | 93 | 90.2 | 83 | 103.7 |



[3] GridLink *BESS 220/33kV Collector Substation – General Arrangement* Drawing MWWF-EP-DWG-GNA-05-011 dated 5 August 2024

For the BESS model, this assessment has been based on a candidate battery module being the Tesla Megapack 2 XL and the preliminary design for the BESS.[4] Based on the Project's proposed BESS capacity, this assessment has been based on a total of 288 megapacks for the BESS site.

Tesla specified sound power levels for a 9-fan Megapack running at 60% and 40% fan capacity are shown in Table 4. It is noted that the sound power levels from the Tesla Megapacks incorporate noise from various sources including batteries, inverters and fans. The overall sound power levels are controlled by the fans and based on previous experience with Tesla systems it has been assumed that the BESS would operate at a worst case 60% during Day / Evening and 40% during Night.

**Table 4 BESS sound power levels**

| BESS unit | Sound power level in dB $L_{WA}$ at octave band centre frequency in Hz | | | | | | | | Overall |
|---|---|---|---|---|---|---|---|---|---|
| | 31.5 | 63 | 125 | 250 | 500 | 1000 | 2000 | 4000 | dB $L_{WA}$ |
| Per Megapack at 60% | 53.6 | 66.8 | 72.1 | 90.7 | 87.2 | 89.6 | 89.2 | 86.4 | 96.0 |
| Per Megapack at 40% | 53.8 | 67.0 | 72.3 | 82.7 | 81.8 | 83.9 | 83.6 | 80.6 | 89.8 |

It is noted that additional equipment would generally be installed at a BESS site including smaller capacity transformers that support the batteries. Based on prior experience, the sound power levels of these transformers are significantly lower than (more than 10 dB below) those of the battery units and the noise emissions from the BESS will be controlled by the Megapacks. As such, this noise assessment has been based on noise emissions from the Megapacks controlling the overall noise emissions from the BESS.

It is noted that the assumed sound power levels above are considered typical of the highest sound power levels that would be anticipated for ancillary infrastructure.



[4] GridLInk *Meering West 500MW BESS – BESS Overall General Arrangement* Drawing MWWF-BS-DWG-GNA-01-001-(B) dated 26 September 2024

# 3 Legislation, policy and guidelines

## 3.1 Legislation and policy

### 3.1.1 EP Act

The *Environment Protection Act 2017* (EP Act) includes environmental obligations and protections for all Victorians and establishes Victoria's focus for environment protection and human health as a prevention-based approach. The cornerstone of the EP Act is the general environmental duty (GED), which states:

> A person who is engaging in an activity that may give rise to risks of harm to human health or the environment from pollution or waste must minimise those risks, so far as reasonably practicable.

In the context of the EP Act, 'reasonably practicable' measures mean putting in controls to eliminate the risk of harm to human health and the environment so far as reasonably practicable. If eliminating the risk of harm is not reasonably practicable, then the risk of harm must be reduced so far as reasonably practicable. A number of matters must be considered in deciding what is reasonably practicable in the circumstances:

- the likelihood of those risks eventuating
- the degree of harm that would result if those risks eventuated
- what the person concerned knows, or ought reasonably to know, about the harm or risks of harm and any ways of eliminating or reducing those risks
- the availability and suitability of ways to eliminate or reduce those risks
- the cost of eliminating or reducing those risks.

EPA Victoria Publication 1856: *Reasonably practicable* explains that, when dealing with a common risk or harm, it is possible to demonstrate that the risk has been reduced so far as reasonably practicable if well-established effective practices or controls have been adopted to eliminate or manage risk. Where well-established practices or controls do not exist, then it is necessary to show that effective controls have been assessed and adopted.

The EP Act also prohibits the emission of unreasonable noise and aggravated noise. The Act provides a definition for 'Unreasonable noise' in two parts. Section 3(1)(a) states that noise that is unreasonable having regard to the following:

- its volume, intensity or duration
- its character
- the time, place and other circumstances in which it is emitted
- how often it is emitted
- any prescribed factor.



Section 3(1)(b) states that noise is unreasonable noise if it is prescribed to be so. Under the EP Regulations, noise that exceeds noise limits established for wind turbine noise or ancillary infrastructure noise is prescribed to be unreasonable noise.

### 3.1.2 Environment Reference Standard

The *Environment Reference Standard* (ERS) exists under the Act and specifies reference standards that reflect the environmental values that the Victorian community wants to achieve and maintain. A reference standard is not a compliance standard which a duty holder, such as Proponent, must achieve, but is intended to inform planning decisions. A reference standard set in the ERS may be taken into account by any decision maker, where it is helpful, to assist with making an environment protection decision.

Part 3 of the ERS documents environmental values of the ambient sound environment and indicators and objectives for the ambient sound environment that are intended to support these values. Table 5 presents the environmental values of the ambient sound environment and Table 6 presents the supporting indicators and objectives.

**Table 5 Environmental values of the ambient sound environment**

| Environmental value | Description of environmental value |
|---|---|
| Sleep during the night | An ambient sound environment that supports minimal sleep disruption at night |
| Domestic or recreational activities | An ambient sound environment that supports recreational and domestic activities in a residential setting |
| Normal conversation | An ambient sound environment that allows for a normal conversation indoors without the need to raise voices |
| Child learning and development | An ambient sound environment that supports cognitive development and learning in children |
| Human tranquillity and enjoyment outdoors in natural areas | An ambient sound environment that allows for the appreciation and enjoyment of the environment for its natural condition and the restorative benefits of tranquil soundscapes in natural areas |
| Musical entertainment | An ambient sound environment that recognises the community's demand for a wide range of musical entertainment |

**Table 6 Indicators and objectives of the ambient sound environment**

| Land use category | Indicator | Objective |
|---|---|---|
| Category 1: An urban form with distinctive features or characteristics of taller buildings, high commercial and residential intensity and high site coverage. For example, Industrial Zone 1, Industrial Zone 2, Port Zone, Road 1 Zone, Capital City Zone and Docklands Zone. | Outdoor $L_{Aeq,8h}$ | 55 dB |
| | Outdoor $L_{Aeq,16h}$ | 60 dB |
| Category 2: Medium rise building form with a strong urban or commercial character. For example, Industrial Zone 3, Commercial Zones, Activity Centre Zone, Mixed Use Zone and Road Zone 2. | Outdoor $L_{Aeq,8h}$ | 50 dB |
| | Outdoor $L_{Aeq,16h}$ | 55 dB |
| Category 3: Lower rise building form including lower density residential development and detached housing, typical or suburban residential settings or in towns of district or regional significance. For example, Residential Growth Zone, General Residential Zone, Neighbourhood Residential Zone, Urban Floodway Zone, Public Park and Recreation Zone and Urban Growth Zone. | Outdoor $L_{Aeq,8h}$ | 40 dB |
| | Outdoor $L_{Aeq,16h}$ | 50 dB |
| Category 4: Lower density or sparse populations with settlements that include smaller hamlets, villages and small towns that are generally unsuited for further expansion. Land uses include primary industry and farming. For example, Low Density Residential Zone, Township Zone, Rural Living Zone, Green Wedge A Zone, Rural Conservation Zone, | Outdoor $L_{Aeq,8h}$ | 35 dB |
| | Outdoor $L_{Aeq,16h}$ | 40 dB |

| Land use category | Indicator | Objective |
|---|---|---|
| Public Conservation and Resource Zone, Green Wedge Zone, Farming Zone and Rural Activity Zone. | | |
| Category 5: Unique combinations of landscape, biodiversity and geodiversity. These natural areas typically provide undisturbed species habitat. | Qualitative | A sound quality that is conducive to human tranquillity and enjoyment having regard to the ambient natural soundscape. |

The Project is considered to be located in a Category 4 area for the purposes of the ERS.

### 3.1.3 EP Regulations

The *Environment Protection Regulations* (EP Regulations) are subordinate legislation that support the Act. The EP Regulations establish requirements for the Project that are relevant to operational wind turbine noise and ancillary infrastructure noise, described under the EP Regulations as noise from commercial, industrial and trade premises.

#### Wind turbine noise

Division 5 of Part 5.3 of the EP Regulations sets out that the assessment of wind turbine noise in Victoria for any wind energy facility with an authorising document issued on or after 1 January 2011, or amended to do so, must be carried out in accordance with NZS 6808:2010. By achieving compliance with the NZS 6808:2010 noise limits, as well as the other relevant requirements of the EP Regulations, Regulation 131C advises that a wind farm operator is able to demonstrate compliance with the GED with respect to wind turbine noise emissions.

The requirement to comply with the NZS 6808:2010 noise limits does not apply at dwellings on the wind farm site (as these are excluded from the definition of noise sensitive location by NZS 6808:2010) nor at dwellings with which an appropriate agreement is in place between the landowner and wind farm operator under Regulation 131A, collectively referred to as involved landowner houses in this case. In the case of an involved landowner who has an agreement in place, the noise limit is increased to 45 dB $L_{A90}$ or the background sound level plus 5 dB, whichever is the greater when assessed in accordance with NZS 6808:2010.

The EP Regulations also establish a number of requirements that are relevant to an operational, rather than proposed, wind energy facility, including:

- A requirement for a post-construction noise assessment to be conducted by a suitably qualified and experienced acoustician within 12 months of operations commencing.
- A requirement for a wind energy facility operator to prepare an implement a Noise Management Plan.
- A requirement for a wind energy facility operator to provide an annual statement to EPA Victoria detailing noise complaints, evidence that operating modes have been complied with, and details of maintenance activities and any noise remediation actions.
- A requirement for a wind energy facility operator to engage a suitably qualified and experienced acoustic consultant to undertake monitoring procedures every five years from the start of operation to ensure that the wind turbine noise complies with the noise limits or, if the assessment is conducted at an alternative monitoring location, the applicable alternative monitoring point criteria.

### Commercial, industrial and trade premises

Division 3 of Part 5.3 of the EP Regulations set out that the assessment of noise from commercial, industrial and trade premises at noise sensitive areas must be carried out in accordance with the Noise Protocol, both in terms of establishing noise limits as noise sensitive areas and in terms of the measurement of noise from the subject premises. With respect to the Project, these requirements apply to noise associated with ancillary infrastructure including the on-site collector stations and BESS, as well as noise generated by the concrete batching plants during the construction phase.

Noise sensitive areas for ancillary infrastructure are defined in the EP Regulations as:

- The area within 10m of the external walls of dwellings (including residential care facilities but excluding caretaker's houses), residential buildings and noise sensitive residential uses.
- The area within 10m outside the external walls of any dormitories, wards, bedrooms and living rooms of caretaker's houses, hospitals, hotels, motels, residential hotels specialist disability accommodation, corrective institutions, tourist establishments, retirement villages and residential villages.
- The area within 10m outside the external walls of classrooms or other rooms in which learning occurs at childcare centres, kindergartens, primary schools and secondary schools.
- Within the boundary of tourist establishments, campgrounds and caravan parks that are located in rural areas.

Note that, in this report, the term noise sensitive receiver has been used to describe the above uses and, where considering noise that is subject to the EP Regulations is consistent with the term noise sensitive area.

The EP Regulations also define Day, Evening and Night time periods for the assessment of noise, reproduced in Table 7.

**Table 7 Time periods for operational noise assessment**

| Time period | Details |
|---|---|
| Day | Weekdays and Saturdays, 7 am to 6 pm |
| Evening | Weekdays and Saturdays, 6 pm to 10 pm<br>Sundays and public holidays, 7 am to 10 pm |
| Night | 10 pm to 7 am any day |

Under the EP Regulations, noise that exceeds the noise limits is prescribed to be unreasonable noise. While the EP Regulations state that noise limits must be established in accordance with the Noise Protocol, Regulation 118(2) sets base noise limits that are the lowest decibel value that may be set as a noise limit for urban and rural areas across different times of day. Regulation 118(3) also states that the night period noise limit must not exceed 55 dB $L_{Aeq,30min}$.

The EP Regulations also define frequency spectrum as a prescribed factor for the purposes of establishing unreasonable noise under Section 3(1)(a) of the Act. EPA Victoria Publication 1996 provides detailed guidance on the assessment of low frequency noise for the purposes of establishing whether unreasonable noise is being produced. EPA Victoria Publication 1996 is discussed further in Section 3.2.6.

## 3.1.4 Gannawarra and Loddon Planning Schemes

The Victoria Planning Provisions set out standard provisions that form the framework of the Gannawarra and Loddon Planning Schemes that the Project must address, including provisions that relate to noise management.
Clause 13.05-1S Noise Management has an objective to assist the management of noise effects on sensitive land uses and sets out the following strategy:

Ensure that development is not prejudiced and community amenity and human health is not adversely impacted by noise emissions.

Minimise the impact on human health from noise exposure to occupants of sensitive land uses (residential use, child care centre, school, education centre, residential aged care centre or hospital) near the transport system and other noise emission sources through suitable building siting and design (including orientation and internal layout), urban design and land use separation techniques as appropriate to the land use functions and character of the area.

Clause 13.05-1S identifies the EP Act, the EP Regulations, Noise Protocol and the ERS as relevant considerations in meeting the objective.

Clause 13.07-1S Land Use Compatibility also sets out an objective that has relevance to noise emissions, with an objective to protect community amenity, human health and safety while facilitating appropriate commercial, industrial, infrastructure or other uses with potential adverse off-site impacts. Clause 13.07-1S does not identify policies or guidelines that are relevant to noise emissions, but it is expected that the objective would be able to be addressed through consideration of the EP Act, the EP Regulations, Noise Protocol and the ERS as for Clause 13.05-1S.

Clause 52.32 of the Gannawarra and Loddon Planning Schemes address wind energy facilities such as the Project. In particular, Clause 52.32-6 states that the responsible authority should consider the following decision guidelines:

- DTP Guidelines
- NZS 6808:2010.

## 3.2 Guidelines and standards

### 3.2.1 DTP Guidelines

The DTP Guidelines are the relevant planning guidelines for wind farms in Victoria and state that, with respect to operational noise:

> A wind energy facility must comply with the noise limits in the New Zealand Standard NZS 6808:2010 Acoustics – Wind Farm Noise (the Standard).

This requirement is equivalent to that imposed by the EP Regulations.

The DTP Guidelines require that any planning permit application for a wind energy facility be accompanied by a pre-construction (predictive) noise assessment report prepared by a suitably qualified and experienced acoustician that:

- Reports on a pre-construction (predictive) noise assessment conducted following NZS 6808:2010.
- Provides an assessment of whether the proposed facility will comply with the noise limits.
- Where the proposed facility will be the subject of a wind turbine noise agreement under the EP Regulations, specifies the premises of the landowner (including any particular buildings) to which the agreement relates and provides an assessment of whether the proposed wind energy facility will comply with the modified noise limit for that facility specified in the agreement.
- Is prepared on the basis that the relevant noise standard will be NZS 6808:2010 and includes an assessment of whether a high amenity noise limit is applicable under Section 5.3 of NZS 6808:2010.

With respect to involved landowner houses, the DTP Guidelines recommend a base noise target of 45 dB $L_{A90}$, consistent with the requirements of the EP Regulations.

### 3.2.2 NZS 6808:2010

NZS 6808:2010 defines acceptable limits for wind farm noise at noise-sensitive locations as:

- For most locations:
  - a base noise limit of 40 dB $L_{A90}$ or
  - the background noise level plus 5 dB

  whichever is the greater for the given hub height wind speed.
- For locations in High Amenity areas and for wind conditions when low background sound levels are common at a noise sensitive location:
  - a base noise limit of 35 dB $L_{A90}$ or
  - the background noise level plus 5 dB

  whichever is the greater for the given hub height wind speed. For locations in High Amenity areas at higher wind speed conditions, the same noise limits apply as for all other locations (i.e. base limit of 40 dB $L_{A90}$).

NZS 6808:2010 also prescribes measurement procedures for background noise and operational wind turbine noise.

### 3.2.3 EPA Victoria Publication 2061

EPA Victoria Publication 2061 provides guidance on the application of the wind turbine noise provisions of the EP Regulations, including NZS 6808:2010, in Victoria.

Key aspects of EPA Victoria Publication 2061 that are applicable to this assessment are:

- The noise limits established under the EP Regulations and NZS 6808:2010 do not apply during construction or commissioning of a wind energy facility.
- High amenity noise limits:
  - should apply to a dwelling located in the following zones predominantly intended for residential development: Low Density Residential Zone (LDRZ), Township Zone (TZ), Rural Living Zone (RLZ), Green Wedge A Zone (GWAZ) and Rural Conservation Zone (RCZ)
  - should not apply to the Farming Zone (FZ)
  - should not be applied in any location where background sound levels are already affected by other specific sources such as road traffic noise
  - only applies for wind energy facility hub height wind speeds up to and including 6 m/s
  - is applicable only when there is no agreement made in accordance with Regulation 131A, i.e. is not applicable to involved stakeholder dwellings.
- The noise limits at a noise sensitive receiver are applicable to the cumulative sound level of all wind energy facilities affecting that receiver.

### 3.2.4 EPA Victoria Publication 3011

EPA Victoria Publication 3011 was released in December 2024 and provides guidance on the measurement of background and operational wind turbine noise, prediction of wind turbine noise and preparations of pre-construction (predictive) noise assessment reports. The guidance supplements that provided in EPA Victoria Publication 2061.

EPA Victoria Publication 3011 also provides guidance on the application of noise limits. It notes that, although no formal noise limits apply to dwellings on the wind farm site, EPA Victoria considers it good practice to set limits consistent with the limits specified under the EP Regulations for dwellings with an individual agreement, being a base limit of 45 dB $L_{A90}$.

### 3.2.5 Noise Protocol

EPA Victoria has prepared the Noise Protocol to specify methodologies for establishing noise limits for operational noise sources and for assessing noise levels against the noise limits. Compliance with the noise limits defined by the Noise Protocol is required by the EP Regulations and is expected to assist with meeting the GED during the operational phase of the Project.

The Noise Protocol is relevant to this assessment as it provides a method for the measurement of background noise, and details how noise limits for operational noise from ancillary infrastructure are to be established based on existing land zoning and background noise levels. The Noise Protocol is not applicable to the majority of construction noise and not applicable to noise associated with decommissioning. It is, however, applicable to noise associated with concrete batching plants during construction as these represent sources that may operate at a single location for an extended period of time that are deemed sufficiently similar to commercial or industrial premises.

The Noise Protocol defines different procedures for establishing noise limits depending on whether the noise sensitive receiver is located within a major urban area or rural areas. Major urban areas are defined as those locations within Melbourne's urban growth boundary or within defined areas around major regional centres. The Project and surrounding areas are located outside of the defined major urban areas and therefore the rural area methodologies require consideration.

For rural areas, the Noise Protocol primarily defines noise limits dependent on the following:

- Time of day. The same time periods are applied as for urban areas (Table 7).
- Land zoning of both the noise source and noise sensitive receiver used to determine the Zone Level.
- A distance adjustment applied to the Zone Level where a noise sensitive receiver is in a different zone to a noise source.
- Type of noise source. Specific limits are set for certain noise sources, such as utilities and earth resources.

The determination of the noise limits throughout the noise and vibration study area will vary depending on the factors above. For the Project, the noise limits for ancillary infrastructure must be established in accordance with Section 2.6 of the Noise Protocol, which applies to utilities in rural areas. For concrete batching plants, noise limits have been established using the method for commercial, industrial and trade premises.

Background noise levels may be taken into account in establishing noise limits in rural areas where the noise sensitive receiver is located within a 'background relevant area.' Background relevant areas are those rural areas where background levels may be higher than usual and include areas where road traffic is a significant audible source. This is not considered to be relevant to the Project, which is in an area removed from significant sources of background noise.

### 3.2.6 EPA Victoria Publication 1996

EPA Victoria Publication 1996 provides guidance on the assessment of low frequency noise from commercial, industrial and trade premises. As frequency spectrum is a separate prescribed factor under the Act, operational sources with the potential to produce a higher relative level of low frequency noise should be separately assessed against this guidance in addition to the noise limits applicable under the EP Regulations.

EPA Victoria Publication 1996 specifically excludes the assessment of wind turbine noise, noting that wind turbine noise is assessed against NZS 6808:2010 which states that it gives due consideration to low frequency noise from wind turbine noise.

EPA Victoria Publication 1996 defines low frequency noise as that occurring between the frequency range of 10 Hz and 160 Hz. It provides noise thresholds, in one-third octave bands, with levels above the threshold indicating a

potential risk of problematic low frequency noise that would require further consideration, investigation and potentially mitigation.

Table 8 presents the low frequency noise thresholds for predictions and measurements conducted outdoors. The outdoor threshold levels are based on indoor thresholds with an assumed façade noise reduction, as specified by EPA Victoria Publication 1996. For the purposes of this assessment, the outdoor thresholds have been adopted. Should a risk of exceedance be identified, then measures to mitigate the risk so far as reasonably practicable should be implemented prior to any further investigation against the indoor thresholds.

**Table 8 Outdoor low frequency noise thresholds**

| **Outdoor noise level in dB $L_{eq}$ at one-third octave band centre frequency in Hz** | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **10** | **12.5** | **16** | **20** | **25** | **31.5** | **40** | **50** | **63** | **80** | **100** | **125** | **160** |
| 92 | 89 | 86 | 77 | 69 | 61 | 54 | 50 | 50 | 48 | 48 | 46 | 44 |

EPA Victoria Publication 1996 notes that predictions of low frequency noise from proposed premises can be problematic and of low accuracy due to uncertainty around the source levels and limitations on some prediction methods in the low frequency range. Therefore, calculations should only be used as a screening tool to assess the risk, and uncertainty appropriately considered as part of the assessment.

# 4 Noise limits

## 4.1 Wind turbine noise

### 4.1.1 Noise-sensitive locations

As the noise predictions conducted for the Project, and as presented within this report, demonstrate that predicted wind turbine noise levels at noise-sensitive locations are no higher than 40 dB $L_{A90}$, no background noise monitoring has been conducted at this stage of the Project. Accordingly, the minimum applicable wind turbine noise limit of 40 dB $L_{A90}$ has been adopted at all operating wind speeds for this assessment as a conservative approach.

Section 7.4 of EPA Victoria Publication 3011 provides the following guidance with respect to the need for background noise monitoring at this stage of a wind energy facility:

> The background sound levels, and operational wind turbine noise are required to be measured to confirm compliance with the noise limits.
>
> Full sound level measurements are not required if, in accordance with section 7.1.2 of NZS 6808:2010, the WEF developer elects to adopt a WEF noise limit of 40 dBLA90(10 min) at all operating wind speeds and conducts on/off compliance tests (except if SACs are detected).
>
> Background sound level measurements adopted for the post-construction compliance analysis should be from within approximately 5 years of the post-construction measurements. Where necessary, additional pre-construction background sound level measurements should be undertaken to provide contemporary background sound level measurements prior to construction of the WEF. It is not expected that new background sound level measurements would be required for preparation of the annual statement (Reg.131F) or Wind turbine noise monitoring undertaken under regulation Reg.131G.

Consistent with the above and the conservative approach adopted in this assessment by adopting the minimum applicable noise limit of 40 dB $L_{A90}$, it is expected that, should the Project be approved, the wind farm operator would either:

- Commission background noise monitoring as per NZS 6808:2010 to establish background noise levels and, if justified by the background noise monitoring, noise limits that are higher than 40 dB $L_{A90}$. This would typically be done as part of an updated pre-construction noise assessment that considers the final selected wind turbine model and layout, and would typically occur within five years of the planned timeframe for post-construction measurements as per the recommendations of EPA Victoria Publication 3011.
- Elect to undertake on/off testing as per NZS 6808:2010 to confirm compliance with the applicable noise limits.

### 4.1.2 High amenity noise limit

As per the requirements of the DTP Guidelines and NZS 6808:2010, consideration must be given as to whether there are high amenity areas (as defined by NZS 6808:2010) relevant to the Project.

With respect to high amenity areas, the definition of high amenity areas is relevant to the New Zealand planning system and not directly translatable to Victorian planning schemes. However, the approach of the Victorian Civil and Administrative Tribunal (VCAT) in their determination on the Cherry Tree Wind Farm was that areas allocated for farming use would not be considered to be High Amenity. The DTP Guidelines reference the Cherry Tree Wind Farm decision with respect to High Amenity areas.

Further Victorian guidance was provided by the Planning Panel for the Golden Plains Wind Farm, where it was deemed that noise-sensitive land uses located in a TZ and LDRZ should be deemed high amenity, but that those noise-sensitive land uses in FZ were not high amenity areas for the purposes of NZS 6808:2010.

The above VCAT and Planning Panel conclusions have since been supplemented by EPA Victoria Guidelines 2061 and 3011, which state that high amenity noise limits:

- Should apply to any non-involved dwellings in LDRZ, TZ, RLZ, GWAZ and RCZ.
- Should not apply to any dwellings in a FZ.

The Gannawarra and Loddon Planning Schemes define the area in which the Project and nearest noise-sensitive locations are located as a FZ. Therefore, the high amenity noise limit is not applicable to the nearest noise-sensitive locations. There are no zones that would be considered to be high amenity in accordance with the definition of EPA Victoria Guidelines 2061 within 5 km of the Project boundary.

Under the ERS, which sets an environmental value of human tranquillity and enjoyment outdoors in natural areas, it is possible that consideration could be given to the public campground in Leaghur State Park as a high amenity area. However, the campground is outside of the predicted 35 dB $L_{A90}$ noise contour from the Project and, therefore, is not required to be considered for the application of high amenity as per C5.3.1(a) of NZS 6808:2010. It is noted that, with predicted noise levels below 35 dB $L_{A90}$ at the maximum wind turbine sound power level, compliance would be predicted with the high amenity limit (which would only apply up to a wind speed of 6 m/s) regardless.

### 4.1.3 Involved stakeholder dwellings

The 17 identified involved stakeholder dwellings are located within the Project site boundary. NZS 6808:2010 excludes dwellings on a wind farm site from the definition of noise-sensitive location and, therefore, no noise limits are applied under NZS 6808:2010.

For the purposes of this assessment, predicted noise levels at these dwellings have been presented and compared against the 45 dB noise target recommended by the DTP Guidelines.

## 4.2 Ancillary infrastructure

The ancillary infrastructure sites are all located in a Farming Zone under the relevant planning scheme, as are the nearest noise-sensitive locations to each site. Therefore, the applicable noise limits, as defined for utilities where the noise source and receiver in a Farming Zone by the Noise Protocol, are as set out in Table 9.

**Table 9 Noise limits for ancillary infrastructure**

| Phase | Description | Noise limit, dB $L_{Aeq,30min}$ |
|---|---|---|
| Day | Weekdays and Saturdays, 7 am to 6 pm | 45 |
| Evening | Weekdays and Saturdays, 6 pm to 10 pm<br>Sundays and public holidays, 7 am to 10 pm | 39 |
| Night | 10 pm to 7 am any day | 34 |

It is noted that, unlike for wind turbine noise, there is no exemption for ancillary infrastructure noise limits under the EP Regulations. Therefore, these noise limits should be complied with at both noise-sensitive locations and involved stakeholder locations.

# 5 Wind turbine noise assessment

## 5.1 Noise prediction methodology

To predict wind turbine noise levels from the Project, an environmental noise model has been developed in SoundPlan version 9.1 environmental noise prediction software. The noise model implements the ISO 9613-2:2024[5] prediction algorithm.

In accordance with standard prediction procedures for wind farm noise as set out in ISO 9613-2:2024, predictions have been undertaken on the basis of the following parameters consistent with the recommendations of EPA Victoria Publication 3011:

- topography, as sourced from the DTP Spatial Datamart on 21 March 2025
- ground absorption factor of 50% representing mixed reflective and absorptive ground
- Project wind turbine locations as per the coordinates detailed in Appendix A received 26 May 2025
- noise-sensitive locations as per the coordinates detailed in Appendix B
- 194 m hub height Project turbines with a rotor diameter of 172 m and sound power levels as per Table 2
- sensitive receivers at 4 m above ground as per the recommendations of ISO 9613-2:2024
- a +3 dB correction applied to the predicted noise levels from any wind turbine where concave topography is predicted between it and the receiver location as defined by the UK Institute of Acoustics *A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise* (Good Practice Guide)
- temperature of 10˚C and relative humidity of 70%
- sound propagating downwind, meteorological correction $C_{met}$ = 0
- topographical shielding limited to 2 dB, assessed based on the wind turbine tip height.

The air absorption values from ISO 9613-2:2024 have been adopted for the purposes of predicting noise levels from the Project. Air absorption is dependent on the assumed temperature and humidity and therefore the relevant air absorption values for this assessment are shown in Table 10.

**Table 10 Air absorption attenuation coefficients**

| Conditions | Atmospheric attenuation in dB/km for octave band centre frequency in Hz | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 63 | 125 | 250 | 500 | 1000 | 2000 | 4000 | 8000 |
| Temperature 10˚C<br>Rel humidity 70% | 0.1 | 0.4 | 1.0 | 1.9 | 3.7 | 9.7 | 32.8 | 117 |

The noise prediction methodology adopted is expected to result in wind turbine noise predictions that are approximately 1.5 to 2 dB higher than would be measured when applying the wind turbine noise measurement methodology specified by NZS 6808:2010. This is because:



[5] International Standard 9613-2:2024 *Acoustics - Attenuation of sound during propagation outdoors - Part 2: Engineering method for the prediction of sound pressure levels outdoors*

- A previous Australian study[6] conducted by Resonate staff has shown that wind turbine noise predictions using a receiver height of 1.5 m above ground accurately predict downwind noise levels for Australian sites with relatively flat topography when using the wind turbine noise measurement methods applied in Australia that use the $L_{A90}$ metric as per NZS 6808:2010.
- Increasing the receiver height to 4 m as recommended by ISO 9613-2:2024 increases the predicted noise levels by approximately 1.5 dB in comparison to predictions using a receiver height of 1.5 m.
- The receiver height of 4 m is understood to be based on the recommendations of the Good Practice Guide. However, the Good Practice Guide also recommends that 2 dB be subtracted from predicted noise levels to adjust predicted $L_{Aeq}$ noise levels to the assessed $L_{A90}$ noise levels. This correction has conservatively not been adopted for this assessment.

A detailed discussion of uncertainty with respect to the adopted noise prediction methodology is provided in Appendix C.

## 5.2 Predicted noise levels at noise-sensitive locations

Predicted Project wind turbine noise levels for each noise-sensitive location are presented in Appendix B. A noise contour map showing the wind turbine noise predictions is included in Appendix D.

NZS 6808:2010 requires that consideration be given to sensitive receivers within the 35 dB $L_{A90}$ noise contour. Based on the wind turbine noise predictions from the Project, a total of nine noise-sensitive locations were identified within the 35 dB $L_{A90}$ predicted noise contour for the Vestas V172-7.2MW turbine. The predicted noise levels at these locations are shown in Table 11.

**Table 11 Predicted wind turbine noise levels at noise-sensitive locations within 35 dB LA90 noise contour**

| Noise-sensitive location | Distance to nearest wind turbine, m | Predicted Project noise level, dB $L_{A90}$ | Minimum noise limit, dB $L_{A90}$ |
|---|---|---|---|
| 49 | 2485 | 35 | 40 |
| 51 | 2076 | 36 | 40 |
| 52 | 2042 | 36 | 40 |
| 62 | 2010 | 37 | 40 |
| 63 | 2010 | 37 | 40 |
| 64 | 1803 | 37 | 40 |
| 65 | 1982 | 36 | 40 |
| 92 | 2070 | 35 | 40 |
| 93 | 2065 | 35 | 40 |

The predicted noise levels at all sensitive receivers are below 40 dB $L_{A90}$ at all noise-sensitive locations, with a maximum predicted wind turbine noise level of 37 dB at any location.



[6] Evans T & Cooper J, 2012, *Comparison of predicted and measured wind farm noise levels and implications for assessments of new wind farms*, Acoustics Australia, vol. 40, no. 1, pp 28-36.

It is noted that these predictions are based on candidate wind turbine selections that are considered to be representative of the current range of turbines, and this is reflected in the range of predicted wind farm noise levels. As the Project develops post-approval and the wind turbine type and layout is confirmed, an updated Pre-Construction Noise Assessment should be prepared to confirm how the selected wind turbine type and layout will achieve compliance with the applicable noise limits.

## 5.3 Predicted noise levels at natural areas

The natural areas identified in Section 2.3 are shown on the wind turbine noise contour maps included in Appendix D, with Figure D2 showing predicted noise contour maps with the identified natural areas. Table 12 provides a discussion of the predicted wind turbine noise levels at each of the natural areas.

**Table 12 Predicted wind turbine noise levels at natural areas**

| Area | Discussion |
|---|---|
| Leaghur State Park PCRZ including campground CG1 | Predicted wind turbine noise levels are typically 30 dB $L_{A90}$ or below. While wind turbine noise levels may be audible at times when the hub height wind speed is high, this level of noise is expected to be lower than the typical ambient noise levels in the PCRZ, particularly with wind blowing through the vegetation in the PCRZ.<br>For the campground area CG1 at the south end of Lake Meran, where people may congregate for the longest period of time, the predicted noise levels are 31 dB $L_{A90}$ at the maximum wind turbine sound power level. This is 9 dB lower than the equivalent limit that applies to residential land uses. Additionally, even if the campground were to be considered a potential high amenity area under NZS 6808:2010, the predicted noise levels even at maximum wind turbine sound power output are 4 dB below the high amenity limit of 35 dB. |
| Great Spectacle Lake and Little Spectacle Lake PCRZ | The majority of the PCRZ sits outside of the predicted 40 dB $L_{A90}$ noise contour, with a small area to the west extending to the 45 dB $L_{A90}$ noise contour. This level of noise is expected to be audible within the PCRZ, however would be limited to times of higher wind speeds, when it is reasonable to expect that there would be wind blowing through vegetation in the reserve as well to create background noise.<br>No campground was identified within the PCRZ such that people would only be expected to be in the area for limited periods of time and carrying out recreational activities. |
| Round Lake and Tobacco Lake PCRZ | Predicted wind turbine noise levels at 35 dB $L_{A90}$ or below. While wind turbine noise levels may be audible at times when the hub height wind speed is high, this level of noise is expected to be lower than the typical ambient noise levels in the PCRZ, particularly with wind blowing through the vegetation in the PCRZ.<br>No campground was identified within the PCRZ such that people would only be expected to be in the area for limited periods of time and carrying out recreational activities. |
| Little Lake PCRZ | Predicted wind turbine noise levels at 33 dB $L_{A90}$ or below. While wind turbine noise levels may be audible at times when the hub height wind speed is high, this level of noise is expected to be lower than the typical ambient noise levels in the PCRZ, particularly with wind blowing through the vegetation in the PCRZ.<br>No campground was identified within the PCRZ such that people would only be expected to be in the area for limited periods of time and carrying out recreational activities. |

| Area | Discussion |
|---|---|
| Quambatook I208 Bushland Reserve PCRZ | The PCRZ sits between the predicted 40 dB $L_{A90}$ noise contour at its western end and extend towards the 50 dB $L_{A90}$ noise contour at its eastern end where it is within 400 m of the nearest Project wind turbines. This level of noise is expected to be audible within the PCRZ, however would be limited to times of higher wind speeds, when it is reasonable to expect that there would be wind blowing through vegetation in the reserve as well to create background noise.<br>No campground was identified within the PCRZ such that people would only be expected to be in the area for limited periods of time and carrying out recreational activities. |
| Gredgwin Bushland Reserve PCRZ | Predicted wind turbine noise levels at 35 dB $L_{A90}$ or below. While wind turbine noise levels may be audible at times when the hub height wind speed is high, this level of noise is expected to be lower than the typical ambient noise levels in the PCRZ, particularly with wind blowing through the vegetation in the PCRZ.<br>No campground was identified within the PCRZ such that people would only be expected to be in the area for limited periods of time and carrying out recreational activities. |

## 5.4 Predicted noise levels at involved stakeholders

Predicted Project wind turbine noise levels for each involved stakeholder location are presented in Table 13. A noise contour map showing the wind turbine noise predictions is included in Appendix D.

**Table 13 Predicted wind turbine noise levels at involved stakeholders**

| Involved stakeholder | Distance to nearest wind turbine, m | Predicted Project noise level, dB $L_{A90}$ | DTP Guidelines recommended target noise level, dB $L_{A90}$ |
|---|---|---|---|
| 50 | 1113 | 38 | 45 |
| 53 | 1518 | 38 | 45 |
| 69 | 1231 | 41 | 45 |
| 80 | 838 | 44 | 45 |
| 100 | 993 | 43 | 45 |
| 101[1] | 671 | 42 | 45 |
| 105 | 1364 | 41 | 45 |
| 108 | 857 | 43 | 45 |
| 115 | 1367 | 37 | 45 |
| 117[1] | 693 | 44 | 45 |
| 121 | 883 | 42 | 45 |
| 126 | 1513 | 40 | 45 |
| 127 | 1527 | 40 | 45 |
| 137 | 1573 | 35 | 45 |
| 139 | 1573 | 36 | 45 |

| Involved stakeholder | Distance to nearest wind turbine, m | Predicted Project noise level, dB $L_{A90}$ | DTP Guidelines recommended target noise level, dB $L_{A90}$ |
|---|---|---|---|
| 143 | 1750 | 36 | 45 |
| 146 | 1931 | 35 | 45 |

(1) It is understood that this house is currently unlived in but has been assessed regardless.

The predicted noise levels at all involved stakeholders are below the 45 dB $L_{A90}$ noise target recommended by the DTP Guidelines. It is noted that are number of these involved stakeholder locations are within the Project boundary such that they are not considered as noise-sensitive locations by NZS 6808:2010, however predicted noise levels remain below 45 dB regardless.

## 5.5 Special audible characteristics

NZS 6808:2010 advises that, if wind turbine noise levels exhibit special audible characteristics such as tonality, impulsiveness and amplitude modulation, then a penalty should be applied to the noise level. Consistent with the recommended approach of EPA Victoria Publication 3011, the predictions shown in this assessment are based on the wind turbine noise levels at residences containing no characteristics that would attract a penalty in accordance with NZS 6808:2010.

Special audible characteristics are not possible to assess in detail at this preliminary stage as information is generally not available from turbine manufacturers. In the relatively unusual event that special audible characteristics are detectable at residences, the occurrence will also involve a complex relationship between the wind turbine noise and the background noise environment that is best assessed through measurements.

Special audible characteristics from wind farms at residences are, in our experience, a relatively uncommon occurrence in Australia and, where they have occurred, they have generally occurred infrequently and under specific conditions. As such, it is considered reasonable to assume that they will not occur for the purposes of this preliminary noise assessment.

Should the Project be approved, special audible characteristics would need to be considered during any post-construction compliance monitoring for the Project, as is required by NZS 6808:2010. In the event that special audible characteristics are detected, the site will need to achieve compliance with the noise limits including the appropriate penalty for the detected characteristics when assessed in accordance with NZS 6808:2010.

## 5.6 Summary and recommendations

The assessment of wind turbine noise has concluded that the Project can comply with the minimum applicable noise limit of 40 dB $L_{A90}$ at the nearest noise-sensitive locations.

The assessment is based on a candidate wind turbine model and layout that may be subject to further refinement post-approval. In accordance with EPA Victoria Publication 3011 it is recommended that prior to the commencement of construction of the Project:

- A Pre-Construction Noise Assessment be prepared that reflects the final wind turbine selection and design.
- The Pre-Construction Noise Assessment should include background noise monitoring conducted at representative noise-sensitive locations within the predicted 35 dB $L_{A90}$ noise contour consistent with NZS 6808:2010.

In addition to the above, it is noted that compliance with the EP Regulations will also necessitate:

- A post-construction noise assessment to be conducted for the Project by a suitably qualified and experienced acoustician within 12 months of operations commencing.
- MWWF to prepare an implement a Noise Management Plan prior to the commencement of operation.
- MWWF to provide annual statements to EPA Victoria once the Project commences operation detailing noise complaints, evidence that operating modes have been complied with, and details of maintenance activities and any noise remediation actions.
- MWWF to engage a suitably qualified and experienced acoustic consultant to undertake monitoring procedures every five years from the start of operation to ensure that the wind turbine noise complies with the noise limits or, if the assessment is conducted at an alternative monitoring location, the applicable alternative monitoring point criteria.

As per Regulation 131C of the EP Regulations, compliance with the NZS 6808:2010 noise limits and the above items would demonstrate compliance with the GED with respect to wind turbine noise emissions.

# 6 Ancillary infrastructure noise assessment

## 6.1 Noise prediction methodology

To predict wind turbine noise levels from the Project, an environmental noise model has been developed in SoundPlan version 9.1 environmental noise prediction software. The noise model implements the ISO 9613-2:2024 prediction algorithm.

In accordance with standard prediction procedures for wind farm noise as set out in ISO 9613-2:2024, predictions have been undertaken on the basis of the following parameters:

- topography, as sourced from the DTP Spatial Datamart on 21 March 2025
- ground absorption factor of 0% around the BESS and substation site representing reflective ground such as paving or concrete
- ground absorption factor of 70% representing 70% absorptive and 30% reflective ground, considered typical of rural grassland and farming areas in Victoria
- ancillary infrastructure sites as shown on Figure 1, with both Option 1A and Option 2 assessed
- noise-sensitive locations as per the coordinates detailed in Appendix B
- sound power levels for ancillary infrastructure as per Table 3 and Table 4
- transformers located centrally within each collector station modelled at a height of 4 m above ground level
- battery packs distributed across the BESS area and modelled at a height of 3.3 m above ground level based on the Tesla Megapack 2XL recommendations
- sensitive receivers at 1.5 m above ground
- temperature of 10˚C and relative humidity of 70%
- sound propagating downwind, meteorological correction $C_{met}$ = 0
- a +2 dB tonal adjustment has been applied with consideration of previous experience of tonal noise from electrical infrastructure and the likelihood of it only being just perceptible at significant distance.

## 6.2 Predicted noise levels at residential land uses

Table 14 presents the highest predicted noise levels from the ancillary infrastructure sites, for both Option 1A and Option B, at any involved stakeholder dwelling and any non-involved noise-sensitive location without an involvement in the Project.

**Table 14 Highest predicted noise levels for ancillary infrastructure**

| Time period | Highest predicted noise levels | Noise limit, dB $L_{Aeq,30min}$ |
|---|---|---|
| **Option 1A** | | |
| Day / Evening | Involved stakeholder, Receiver ID 100: 39 dB $L_{Aeq,30min}$ | 39 (Evening) |
| | Non-involved noise sensitive location, Receiver ID 65: 23 dB $L_{Aeq,30min}$ | 39 (Evening) |
| Night | Involved stakeholder, Receiver ID 100: 33 dB $L_{Aeq,30min}$ | 34 |
| | Non-involved noise sensitive location, Receiver ID 65: 18 dB $L_{Aeq,30min}$ | 34 |
| **Option B** | | |
| Day / Evening | Involved stakeholder, Receiver ID 108: 33 dB $L_{Aeq,30min}$ | 39 (Evening) |
| | Non-involved noise sensitive location, Receiver ID 114: 25 dB $L_{Aeq,30min}$ | 39 (Evening) |

| Time period | Highest predicted noise levels | Noise limit, dB $L_{Aeq,30min}$ |
|---|---|---|
| Night | Involved stakeholder, Receiver ID 108: 28 dB $L_{Aeq,30min}$ | 34 |
| | Non-involved noise sensitive location, Receiver ID 114: 20 dB $L_{Aeq,30min}$ | 34 |

The predicted noise levels for both options are compliant with the applicable noise limits at the nearest involved stakeholders and are 14 dB or more below the applicable noise limits at the nearest non-involved receiver.

Option B results in a greater margin of predicted noise level compliance at the nearest involved stakeholder locations due to a greater separation distance to the nearest involved stakeholder dwelling. It is noted that involved stakeholders would not necessarily be subject to any exemption from the noise limits under the EP Regulations for ancillary infrastructure noise and, therefore, it is assumed that compliance with the noise limits would be necessary at involved stakeholder dwellings.

## 6.3 Noise character



### 6.3.1 Tonality

The assessment presented in Section 6.2 is based on a +2 dB tonal adjustment being applied to the predicted noise levels, typical of BESS infrastructure in our experience. BESS noise at distance is typically dominated by noise associated by cooling systems which do not tend to have a significant tonal component.

While transformer noise can contain tonal noise at 100 Hz, and harmonics such as 200 Hz, that could attract a higher tonal penalty in isolation, the predicted noise levels from the BESS and transformers based on this preliminary assessment indicate that, for Option 1A and for Receiver 100 with the highest predicted noise levels:

- The predicted noise level from the transformer is more than 9 dB below the predicted noise level from the BESS in the 125 Hz and 250 Hz octave bands during Day / Evening.
- The predicted noise level from the transformer is more than 3 dB below the predicted noise level from the BESS in the 125 Hz and 250 Hz octave bands during Night.

As such, tonal noise from the transformer at 100 Hz and harmonics is not expected to be prominent when the BESS is operating at typical maximum capacity and overall noise levels are at their highest, and the +2 dB tonal adjustment for just detectable tonality is considered appropriate at this stage of the assessment. It is noted that this would need to be reviewed as part of the detailed design noise assessment recommended in Section 6.5.

Note that, at times when the wind turbines are operating, the noise level from the wind turbines would be expected to mask any tonal noise from the ancillary infrastructure such that no tonal adjustment would apply to noise from ancillary infrastructure. At these times, no tonal adjustment would be expected to apply, and the ancillary infrastructure noise predictions would therefore be lower.

### 6.3.2 Low frequency noise

Table 15 presents the predicted low frequency noise levels for ancillary infrastructure when the Noise Protocol noise limit is achieved compares them to the outdoor low frequency noise thresholds from EPA Victoria Publication 1996. The predictions are shown for the nearest involved stakeholder dwellings for each option (Receiver 100 for Option 1A and Receiver 108 for Option B), and the predicted low frequency noise levels for the more distant non-involved noise-sensitive locations would be significantly lower. The assessment has only been carried out to a frequency of 25 Hz

due to the lower risk of low frequency noise below 25 Hz for electrical infrastructure, and because there is no manufacturer data for frequencies below this.

**Table 15 Highest predicted low frequency noise levels for ancillary infrastructure at Receiver ID 100**

| Situation | Outdoor noise level in dB $L_{eq}$ at one-third octave band centre frequency in Hz | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 10 | 12.5 | 16 | 20 | 25 | 31.5 | 40 | 50 | 63 | 80 | 100 | 125 | 160 |
| **Option 1A – Receiver 100** | | | | | | | | | | | | | |
| *Threshold* | *92* | *89* | *86* | *77* | *69* | *61* | *54* | *50* | *50* | *48* | *48* | *46* | *44* |
| Day / Evening | -[1] | -[1] | -[1] | -[1] | 47 | 47 | 47 | 46 | 46 | 46 | 35 | 35 | 35 |
| Night | -[1] | -[1] | -[1] | -[1] | 44 | 44 | 44 | 43 | 43 | 43 | 34 | 34 | 34 |
| **Option B – Receiver 108** | | | | | | | | | | | | | |
| *Threshold* | *92* | *89* | *86* | *77* | *69* | *61* | *54* | *50* | *50* | *48* | *48* | *46* | *44* |
| Day / Evening | -[1] | -[1] | -[1] | -[1] | 43 | 43 | 43 | 42 | 42 | 42 | 30 | 30 | 30 |
| Night | -[1] | -[1] | -[1] | -[1] | 40 | 40 | 40 | 39 | 39 | 39 | 29 | 29 | 29 |

(1) No manufacturer data at these frequencies. However, low risk of problematic low frequency noise in this range given predicted overall noise levels at other frequencies.

Based on the ancillary infrastructure noise assessment, it is expected that ancillary infrastructure for the Project can be designed such that environmental noise levels are below the applicable noise limits and in a manner such that there is a low risk of problematic low frequency noise as defined by EPA Victoria Publication 1996.

## 6.4 Predicted noise levels at natural areas

Noise levels from the ancillary infrastructure at natural areas are expected to be significantly lower than that from wind turbine noise (discussed in Section 5.3) considering that the ancillary infrastructure is over 8 km (Option 1A) or over 3.5 km (Option B) from the nearest identified natural areas. As such, no additional impact is anticipated to natural areas from the ancillary infrastructure noise emissions.

## 6.5 Summary and recommendations

The assessment of ancillary infrastructure noise has concluded that the Project can comply with the applicable Noise Protocol noise limits and that the risk of problematic low frequency noise can be managed through appropriate equipment selection and site design.

As required by the GED, noise emissions from ancillary infrastructure should be reduced so far as reasonably practicable. This would need to be addressed through detailed design, and may include any or all of the following measures:

- Maximising the distance between major ancillary infrastructure noise sources and noise sensitive locations.
- Considering the sound power level, and any information on noise character such as tonality, of BESS equipment in procurement decisions.
- Selection of transformers with reduced maximum sound power levels if deemed reasonably practicable to do so.
- Using existing site features or other available noise barriers (e.g. fire walls) to provide acoustic shielding between ancillary infrastructure and noise sensitive locations.

- Constructing new shielding features, such as earth berms or noise barriers where reasonably practicable to do so.

Due to the preliminary nature of this assessment, and the variation that can exist in sound power levels for BESS equipment in particular, it is recommended that an updated Pre-Construction Noise Assessment for ancillary infrastructure be prepared once the detailed design and selection of the ancillary infrastructure is confirmed. This assessment would recommend measures to avoid unreasonable noise and assist in addressing the GED.

# 7 Construction and commissioning noise

## 7.1 Construction phase

The GED and unreasonable noise provisions under the EP Act apply to noise generated during the Project construction phase, however the noise limits under the EP Regulations do not.

Neither the DTP Guidelines nor the Gannawarra and Loddon Planning Schemes require an assessment of construction phase noise for a Planning Permit application and, therefore, a detailed assessment of construction noise is outside of the scope of this assessment. However, in our experience and considering the normally large separation distances to noise sensitive areas around wind energy projects, construction phase noise can normally be effectively managed through the application of typical measures such as the following:

- Carrying out works in accordance with guidance set out in EPA Victoria Publication 1834.1 *Civil construction, building and demolition guide* (EPA Victoria Publication 1834.1).
- Scheduling works during Normal Working Hours, being from 7 am to 6 pm Mondays to Friday and 7 am to 1 pm Saturdays where practicable.
- Ensuring out of hours works meet the definitions of Unavoidable Works, Managed-Impact Works or Low Noise Impact Work as set out in EPA Victoria Publication 1834.1.
- Planning works to avoid or minimise impacts so far as reasonably practicable, including locating site compounds and laydown areas away from residential receivers and natural areas.
- Planning site access routes to minimise truck traffic on non-arterial roads near residential receivers.
- Selecting quieter construction methods where reasonable and feasible to do so.
- Considering the noise generated by construction plant and equipment in procurement and rental decisions.
- Using non-tonal reversing beepers where noise from reversing activities may be audible at residential receivers.
- Maintaining equipment and vehicles in good working condition.
- Providing training on noise reduction measures to staff as part of the staff induction.
- Confirming noise mitigation and management measures being implemented on site to staff during pre-start briefings.
- Providing prior notification of works to potentially affected land uses.
- Consulting with residential receivers to determine any times at which they may be more sensitive to noise and avoiding noisy works during those times.
- Assessing noise associated with fixed concrete batching plants and implementing controls such that noise emissions remain below the applicable Noise Protocol noise limits during operating hours.

It is recommended that, prior to construction of the Project commencing, a Construction Noise Management Plan be developed to identify measures to be implemented to reduce the impact of construction noise so far as reasonably practicable. The Construction Noise Management Plan should sit as a sub-plan to the Construction Environmental Management Plan and should be implemented during construction.

## 7.2 Commissioning phase

Noise associated with wind turbine commissioning is not subject to the noise limits set under the EP Regulations as per EPA Victoria Publication 3011. However, the GED and unreasonable noise provisions under the EP Act apply.

EPA Victoria Publication 3011 notes that:

> During the period between any wind turbine first generating power and the post-construction compliance assessment, the WEF operator should ensure that the wind turbine sound levels are consistent with the sound levels modelled as part of the approval process. During commissioning, to help manage risks of non-compliance where predicted wind farm sound levels

are close to the noise limits, it is good practice to conduct initial wind turbine sound level measurements following the operation of the first turbines to verify the predicted levels.

Measures to assess and manage wind turbine noise during commissioning would need to be incorporated into the Noise Management Plan to be prepared to address the EP Regulations.

# 8 Conclusion

This report presents an environmental noise assessment of the proposed Meering West Wind Farm, considering operational wind turbine noise and ancillary infrastructure noise.

Based on the candidate wind turbine selection and proposed 164 wind turbine layout, operational wind turbine noise levels were predicted and assessed against the minimum applicable noise limit of 40 dB $L_{A90}$ that applies under the DTP Guidelines, EP Regulations and NZS 6808:2010. A total of nine noise-sensitive locations were identified within the predicted 35 dB $L_{A90}$ noise contour with predicted wind turbine noise levels being 37 dB or below at all of these locations. As such, it is expected that the Project is capable of complying with the applicable noise limits under NZS 6808:2010 subject to appropriate turbine selection during detailed design. Predicted wind turbine noise levels at involved stakeholder locations were also below 45 dB in all cases.

The assessment of ancillary infrastructure noise has concluded that the Project is capable of complying with the applicable Noise Protocol noise limits for both ancillary infrastructure options assessed, and that the risk of problematic low frequency noise can be managed through appropriate equipment selection and site design.

Wind turbine noise emissions and ancillary infrastructure noise was also considered at identified natural areas as defined in the Gannawarra and Loddon Planning Schemes. While wind turbine noise is expected to be audible during periods of higher wind speeds, it is reasonable to expect that there would be wind blowing through vegetation in the natural areas as well at these times to create background noise. One campground was identified at Lake Meran, as part of the Leaghur State Park PCRZ, with predicted noise levels at the campground being 31 dB $L_{A90}$ and 4 dB below the limit recommended for high amenity areas in NZS 6808:2010 even with the wind turbines operating at their maximum sound power level. No campgrounds were identified within other natural areas such that people would only be expected to be in the area for limited periods of time and carrying out recreational activities.

The assessment is based on a candidate wind turbine model, ancillary infrastructure selection and layout that may be subject to further refinement post-approval. It is recommended that, prior to the commencement of construction of the Project and in addition to the obligations that exist for wind energy facilities under the EP Regulations:

- A Construction Noise Management Plan be developed to identify measures to be implemented to reduce the impact of construction noise so far as reasonably practicable. The Construction Noise Management Plan should sit as a sub-plan to the Construction Environmental Management Plan and should be implemented during construction.
- A Pre-Construction Noise Assessment be prepared that reflects the final wind turbine selection and design.
- The Pre-Construction Noise Assessment should include background noise monitoring conducted at representative noise-sensitive locations within the predicted 35 dB $L_{A90}$ noise contour consistent with NZS 6808:2010.
- A Pre-Construction Noise Assessment also be prepared for the final ancillary infrastructure selection and design.

# Appendix A—Wind turbine coordinates

**Table A1 Project WTG coordinates as MGA Zone 54**

| ID | Easting | Northing | ID | Easting | Northing |
|---|---|---|---|---|---|
| WTG1 | 752122 | 6035222 | WTG30 | 741725 | 6030024 |
| WTG2 | 751201 | 6034632 | WTG31 | 744475 | 6029985 |
| WTG3 | 751810 | 6033823 | WTG32 | 743276 | 6029953 |
| WTG4 | 751348 | 6033291 | WTG33 | 747378 | 6029797 |
| WTG5 | 752216 | 6033148 | WTG34 | 748762 | 6029775 |
| WTG6 | 743210 | 6032861 | WTG35 | 746058 | 6029745 |
| WTG7 | 745188 | 6032218 | WTG36 | 750809 | 6029635 |
| WTG8 | 743886 | 6032200 | WTG37 | 739572 | 6029354 |
| WTG9 | 742561 | 6032049 | WTG38 | 749569 | 6029315 |
| WTG10 | 752448 | 6031728 | WTG39 | 740987 | 6029314 |
| WTG11 | 750857 | 6031599 | WTG40 | 743820 | 6029231 |
| WTG12 | 744705 | 6031482 | WTG41 | 745231 | 6029193 |
| WTG13 | 743169 | 6031376 | WTG42 | 746584 | 6029128 |
| WTG14 | 745999 | 6031295 | WTG43 | 748008 | 6029111 |
| WTG15 | 748476 | 6030918 | WTG44 | 740259 | 6028627 |
| WTG16 | 751600 | 6031135 | WTG45 | 750173 | 6028602 |
| WTG17 | 750134 | 6030987 | WTG46 | 738912 | 6028258 |
| WTG18 | 739612 | 6030769 | WTG47 | 743093 | 6028544 |
| WTG19 | 741022 | 6030636 | WTG48 | 744532 | 6028509 |
| WTG20 | 743857 | 6030648 | WTG49 | 745918 | 6028465 |
| WTG21 | 749193 | 6030642 | WTG50 | 747367 | 6028446 |
| WTG22 | 742377 | 6030638 | WTG51 | 748744 | 6028334 |
| WTG23 | 750837 | 6030601 | WTG52 | 741668 | 6028371 |
| WTG24 | 745181 | 6030599 | WTG53 | 740882 | 6028040 |
| WTG25 | 746600 | 6030424 | WTG54 | 739544 | 6027810 |
| WTG26 | 748078 | 6030244 | WTG55 | 742361 | 6027859 |
| WTG27 | 738885 | 6030082 | WTG56 | 743800 | 6027812 |
| WTG28 | 750058 | 6030127 | WTG57 | 745193 | 6027778 |
| WTG29 | 740301 | 6030034 | WTG58 | 746690 | 6027628 |

| ID | Easting | Northing | ID | Easting | Northing |
|---|---|---|---|---|---|
| WTG59 | 748031 | 6027690 | WTG91 | 749352 | 6024781 |
| WTG61 | 738947 | 6027251 | WTG92 | 737308 | 6024463 |
| WTG62 | 740151 | 6027213 | WTG93 | 738723 | 6024423 |
| WTG63 | 742989 | 6027102 | WTG94 | 740137 | 6024344 |
| WTG64 | 744434 | 6027095 | WTG95 | 741669 | 6024391 |
| WTG65 | 745971 | 6027055 | WTG96 | 745917 | 6024181 |
| WTG66 | 747079 | 6026950 | WTG97 | 747228 | 6024177 |
| WTG67 | 748705 | 6027081 | WTG98 | 748708 | 6024221 |
| WTG68 | 738204 | 6026627 | WTG99 | 735211 | 6023861 |
| WTG69 | 739573 | 6026575 | WTG100 | 736580 | 6023748 |
| WTG70 | 740819 | 6026545 | WTG101 | 737996 | 6023737 |
| WTG71 | 743841 | 6026472 | WTG102 | 739283 | 6023694 |
| WTG72 | 745178 | 6026346 | WTG103 | 740825 | 6023655 |
| WTG73 | 746549 | 6026307 | WTG104 | 742240 | 6023621 |
| WTG74 | 747772 | 6026284 | WTG105 | 747864 | 6023561 |
| WTG75 | 749208 | 6026239 | WTG106 | 745072 | 6023536 |
| WTG76 | 750683 | 6026187 | WTG107 | 746544 | 6023519 |
| WTG77 | 738756 | 6025838 | WTG108 | 743695 | 6023539 |
| WTG78 | 740178 | 6025797 | WTG109 | 749327 | 6023412 |
| WTG79 | 745854 | 6025639 | WTG110 | 734697 | 6023095 |
| WTG80 | 748635 | 6025630 | WTG111 | 735825 | 6023071 |
| WTG81 | 741737 | 6025609 | WTG112 | 739854 | 6023093 |
| WTG82 | 747265 | 6025697 | WTG113 | 738683 | 6023008 |
| WTG83 | 750084 | 6025593 | WTG114 | 737472 | 6023003 |
| WTG84 | 738210 | 6025122 | WTG115 | 741610 | 6022921 |
| WTG85 | 739451 | 6025110 | WTG116 | 742927 | 6022884 |
| WTG86 | 735196 | 6025056 | WTG117 | 744342 | 6022844 |
| WTG87 | 740823 | 6025036 | WTG118 | 746589 | 6022723 |
| WTG88 | 742281 | 6024975 | WTG119 | 740700 | 6022548 |
| WTG89 | 746559 | 6024999 | WTG120 | 735179 | 6022368 |
| WTG90 | 747920 | 6024825 | WTG121 | 733574 | 6022332 |

| ID | Easting | Northing | ID | Easting | Northing |
|---|---|---|---|---|---|
| WTG122 | 737955 | 6022321 | WTG144 | 731606 | 6020117 |
| WTG123 | 739366 | 6022169 | WTG145 | 744367 | 6020281 |
| WTG124 | 742199 | 6022200 | WTG146 | 747087 | 6019940 |
| WTG125 | 743614 | 6022159 | WTG147 | 733646 | 6019627 |
| WTG126 | 737381 | 6021682 | WTG148 | 735045 | 6019572 |
| WTG127 | 734404 | 6021604 | WTG149 | 736483 | 6019524 |
| WTG128 | 738631 | 6021594 | WTG150 | 738101 | 6019520 |
| WTG129 | 735674 | 6021595 | WTG151 | 730832 | 6019377 |
| WTG130 | 742879 | 6021465 | WTG152 | 732233 | 6019336 |
| WTG131 | 732631 | 6021447 | WTG153 | 746405 | 6019164 |
| WTG132 | 747391 | 6021445 | WTG154 | 737030 | 6018880 |
| WTG133 | 744395 | 6021429 | WTG155 | 734356 | 6018840 |
| WTG134 | 737920 | 6021004 | WTG156 | 735759 | 6018832 |
| WTG135 | 735171 | 6020966 | WTG157 | 738777 | 6018975 |
| WTG136 | 739272 | 6020905 | WTG158 | 733115 | 6018762 |
| WTG137 | 743313 | 6020692 | WTG159 | 745594 | 6018534 |
| WTG138 | 747906 | 6020621 | WTG160 | 747048 | 6018467 |
| WTG139 | 732897 | 6020340 | WTG161 | 735013 | 6018104 |
| WTG140 | 734357 | 6020291 | WTG162 | 736220 | 6018041 |
| WTG141 | 735771 | 6020252 | WTG163 | 733777 | 6017996 |
| WTG142 | 737186 | 6020213 | WTG164 | 737223 | 6018003 |
| WTG143 | 738648 | 6020173 | WTG165 | 746378 | 6017824 |

Resonate



# Appendix B—Receiver locations and predicted wind turbine noise levels

**Table B1 Noise-sensitive location and involved stakeholder coordinates as GDA2020 MGA Zone 54, and predicted wind turbine noise levels**

| ID | Status | Easting | Northing | Distance to nearest wind turbine, m | Minimum noise limit, dB $L_{A90}$ | Predicted wind turbine noise level, dB $L_{A90}$ |
|---|---|---|---|---|---|---|
| 1 | Noise-sensitive location | 754864 | 6040379 | 5840 | 40 | 23 |
| 2 | Noise-sensitive location | 739892 | 6040212 | 8065 | 40 | 24 |
| 3 | Noise-sensitive location | 750653 | 6039936 | 4937 | 40 | 26 |
| 4 | Noise-sensitive location | 745140 | 6039535 | 6948 | 40 | 26 |
| 5 | Noise-sensitive location | 754411 | 6039350 | 4720 | 40 | 25 |
| 6 | Noise-sensitive location | 760795 | 6039284 | 9577 | 40 | 20 |
| 7 | Noise-sensitive location | 749065 | 6039125 | 4958 | 40 | 27 |
| 8 | Noise-sensitive location | 757544 | 6039096 | 6663 | 40 | 23 |
| 9 | Noise-sensitive location | 757317 | 6039046 | 6450 | 40 | 23 |
| 10 | Noise-sensitive location | 758647 | 6038877 | 7479 | 40 | 22 |
| 11 | Noise-sensitive location | 759742 | 6038439 | 8271 | 40 | 21 |
| 12 | Noise-sensitive location | 759527 | 6038423 | 8067 | 40 | 22 |
| 13 | Noise-sensitive location | 759949 | 6038404 | 8449 | 40 | 21 |
| 14 | Noise-sensitive location | 757897 | 6038228 | 6510 | 40 | 23 |
| 15 | Noise-sensitive location | 742939 | 6038224 | 5370 | 40 | 27 |
| 16 | Noise-sensitive location | 758344 | 6037992 | 6810 | 40 | 23 |
| 17 | Noise-sensitive location | 746313 | 6037970 | 5861 | 40 | 28 |
| 18 | Noise-sensitive location | 746260 | 6037938 | 5820 | 40 | 28 |
| 19 | Noise-sensitive location | 738905 | 6037906 | 6632 | 40 | 26 |
| 20 | Noise-sensitive location | 759421 | 6037507 | 7648 | 40 | 22 |
| 21 | Noise-sensitive location | 751384 | 6037377 | 2278 | 40 | 31 |
| 22 | Noise-sensitive location | 755364 | 6037191 | 3793 | 40 | 27 |
| 23 | Noise-sensitive location | 750795 | 6037122 | 2317 | 40 | 31 |
| 24 | Noise-sensitive location | 757981 | 6037069 | 6143 | 40 | 24 |
| 25 | Noise-sensitive location | 749160 | 6037030 | 3149 | 40 | 30 |
| 26 | Noise-sensitive location | 749160 | 6037030 | 3149 | 40 | 30 |

| ID | Status | Easting | Northing | Distance to nearest wind turbine, m | Minimum noise limit, dB $L_{A90}$ | Predicted wind turbine noise level, dB $L_{A90}$ |
|---|---|---|---|---|---|---|
| 27 | Noise-sensitive location | 758274 | 6037021 | 6409 | 40 | 23 |
| 28 | Noise-sensitive location | 753693 | 6036953 | 2337 | 40 | 30 |
| 29 | Noise-sensitive location | 761204 | 6036633 | 9191 | 40 | 21 |
| 30 | Noise-sensitive location | 746035 | 6036493 | 4358 | 40 | 30 |
| 31 | Noise-sensitive location | 738971 | 6036120 | 5347 | 40 | 28 |
| 32 | Noise-sensitive location | 742879 | 6035707 | 2866 | 40 | 31 |
| 33 | Noise-sensitive location | 759770 | 6035670 | 7661 | 40 | 23 |
| 34 | Noise-sensitive location | 756085 | 6035634 | 3984 | 40 | 27 |
| 35 | Noise-sensitive location | 760436 | 6035556 | 8320 | 40 | 22 |
| 36 | Noise-sensitive location | 760028 | 6035435 | 7909 | 40 | 23 |
| 37 | Noise-sensitive location | 740951 | 6035317 | 3337 | 40 | 31 |
| 38 | Noise-sensitive location | 744623 | 6035219 | 2750 | 40 | 33 |
| 39 | Noise-sensitive location | 754788 | 6034942 | 2680 | 40 | 31 |
| 40 | Noise-sensitive location | 736143 | 6034934 | 5420 | 40 | 28 |
| 41 | Noise-sensitive location | 757474 | 6034685 | 5379 | 40 | 26 |
| 42 | Noise-sensitive location | 759452 | 6034637 | 7353 | 40 | 23 |
| 43 | Noise-sensitive location | 733238 | 6034636 | 7254 | 40 | 26 |
| 44 | Noise-sensitive location | 760165 | 6034633 | 8064 | 40 | 23 |
| 45 | Noise-sensitive location | 757981 | 6034565 | 5895 | 40 | 25 |
| 46 | Noise-sensitive location | 756615 | 6034554 | 4542 | 40 | 27 |
| 47 | Noise-sensitive location | 734800 | 6034110 | 5737 | 40 | 27 |
| 49 | Noise-sensitive location | 748835 | 6033877 | 2484 | 40 | 35 |
| 51 | Noise-sensitive location | 749339 | 6033717 | 2054 | 40 | 36 |
| 52 | Noise-sensitive location | 749380 | 6033710 | 2012 | 40 | 36 |
| 54 | Noise-sensitive location | 757178 | 6033626 | 4985 | 40 | 27 |
| 55 | Noise-sensitive location | 757381 | 6033583 | 5183 | 40 | 26 |
| 56 | Noise-sensitive location | 757022 | 6033530 | 4821 | 40 | 27 |
| 57 | Noise-sensitive location | 757291 | 6033517 | 5088 | 40 | 27 |
| 58 | Noise-sensitive location | 756674 | 6033435 | 4467 | 40 | 28 |
| 59 | Noise-sensitive location | 734168 | 6033188 | 5647 | 40 | 27 |

| ID | Status | Easting | Northing | Distance to nearest wind turbine, m | Minimum noise limit, dB $L_{A90}$ | Predicted wind turbine noise level, dB $L_{A90}$ |
|---|---|---|---|---|---|---|
| 60 | Noise-sensitive location | 754242 | 6033152 | 2026 | 40 | 34 |
| 61 | Noise-sensitive location | 757611 | 6033022 | 5323 | 40 | 26 |
| 62 | Noise-sensitive location | 747361 | 6032873 | 2085 | 40 | 37 |
| 63 | Noise-sensitive location | 747361 | 6032873 | 2085 | 40 | 37 |
| 64 | Noise-sensitive location | 749249 | 6032869 | 2049 | 40 | 37 |
| 65 | Noise-sensitive location | 740497 | 6032640 | 2069 | 40 | 36 |
| 66 | Noise-sensitive location | 759041 | 6032391 | 6626 | 40 | 25 |
| 67 | Noise-sensitive location | 755398 | 6032091 | 2972 | 40 | 31 |
| 68 | Noise-sensitive location | 754678 | 6031694 | 2230 | 40 | 33 |
| 70 | Noise-sensitive location | 758094 | 6031201 | 5671 | 40 | 26 |
| 71 | Noise-sensitive location | 754952 | 6031068 | 2590 | 40 | 32 |
| 73 | Noise-sensitive location | 755448 | 6030952 | 3099 | 40 | 30 |
| 74 | Noise-sensitive location | 763648 | 6030773 | 11241 | 40 | 20 |
| 75 | Noise-sensitive location | 757504 | 6030451 | 5215 | 40 | 27 |
| 76 | Noise-sensitive location | 736536 | 6030374 | 2367 | 40 | 34 |
| 77 | Noise-sensitive location | 729180 | 6030059 | 7824 | 40 | 25 |
| 78 | Noise-sensitive location | 757170 | 6029835 | 5087 | 40 | 27 |
| 81 | Noise-sensitive location | 756985 | 6029231 | 5179 | 40 | 27 |
| 82 | Noise-sensitive location | 754374 | 6029112 | 3249 | 40 | 32 |
| 83 | Noise-sensitive location | 754411 | 6029084 | 3293 | 40 | 32 |
| 84 | Noise-sensitive location | 754660 | 6029016 | 3500 | 40 | 31 |
| 85 | Noise-sensitive location | 754645 | 6028798 | 3663 | 40 | 31 |
| 86 | Noise-sensitive location | 753830 | 6028564 | 3205 | 40 | 33 |
| 88 | Noise-sensitive location | 754289 | 6028241 | 3749 | 40 | 31 |
| 89 | Noise-sensitive location | 753065 | 6027536 | 2737 | 40 | 34 |
| 90 | Noise-sensitive location | 759224 | 6027294 | 8098 | 40 | 24 |
| 91 | Noise-sensitive location | 752849 | 6027166 | 2377 | 40 | 34 |
| 92 | Noise-sensitive location | 735502 | 6027105 | 2072 | 40 | 35 |
| 93 | Noise-sensitive location | 735507 | 6027099 | 2066 | 40 | 35 |
| 94 | Noise-sensitive location | 753541 | 6027090 | 2997 | 40 | 32 |

| ID | Status | Easting | Northing | Distance to nearest wind turbine, m | Minimum noise limit, dB $L_{A90}$ | Predicted wind turbine noise level, dB $L_{A90}$ |
|---|---|---|---|---|---|---|
| 95 | Noise-sensitive location | 752708 | 6027067 | 2208 | 40 | 34 |
| 96 | Noise-sensitive location | 753275 | 6027052 | 2733 | 40 | 33 |
| 97 | Noise-sensitive location | 753637 | 6026910 | 3041 | 40 | 32 |
| 98 | Noise-sensitive location | 752700 | 6026852 | 2124 | 40 | 34 |
| 99 | Noise-sensitive location | 727283 | 6026757 | 7536 | 40 | 25 |
| 102 | Noise-sensitive location | 753011 | 6025456 | 2440 | 40 | 33 |
| 103 | Noise-sensitive location | 761020 | 6025442 | 10364 | 40 | 22 |
| 104 | Noise-sensitive location | 758457 | 6025354 | 7819 | 40 | 25 |
| 106 | Noise-sensitive location | 753501 | 6024986 | 3063 | 40 | 31 |
| 107 | Noise-sensitive location | 752170 | 6024573 | 2195 | 40 | 34 |
| 109 | Noise-sensitive location | 730796 | 6024221 | 3326 | 40 | 31 |
| 110 | Noise-sensitive location | 757800 | 6024208 | 7387 | 40 | 25 |
| 111 | Noise-sensitive location | 757892 | 6024189 | 7481 | 40 | 25 |
| 112 | Noise-sensitive location | 762055 | 6023985 | 11583 | 40 | 21 |
| 113 | Noise-sensitive location | 730434 | 6023676 | 3129 | 40 | 31 |
| 114 | Noise-sensitive location | 731402 | 6023591 | 2471 | 40 | 34 |
| 118 | Noise-sensitive location | 756755 | 6022883 | 6913 | 40 | 26 |
| 119 | Noise-sensitive location | 758949 | 6022874 | 8905 | 40 | 24 |
| 120 | Noise-sensitive location | 728028 | 6022848 | 4462 | 40 | 28 |
| 124 | Noise-sensitive location | 724776 | 6021936 | 6575 | 40 | 24 |
| 125 | Noise-sensitive location | 757952 | 6021848 | 8466 | 40 | 24 |
| 128 | Noise-sensitive location | 725446 | 6021000 | 5625 | 40 | 25 |
| 129 | Noise-sensitive location | 756340 | 6020937 | 7437 | 40 | 25 |
| 130 | Noise-sensitive location | 757202 | 6020857 | 8279 | 40 | 25 |
| 131 | Noise-sensitive location | 756146 | 6020308 | 7492 | 40 | 25 |
| 133 | Noise-sensitive location | 751688 | 6019255 | 4021 | 40 | 30 |
| 134 | Noise-sensitive location | 756840 | 6018787 | 8822 | 40 | 24 |
| 135 | Noise-sensitive location | 741975 | 6018213 | 2817 | 40 | 34 |
| 136 | Noise-sensitive location | 757931 | 6017587 | 10390 | 40 | 23 |
| 138 | Noise-sensitive location | 748142 | 6016668 | 2105 | 40 | 33 |

| ID | Status | Easting | Northing | Distance to nearest wind turbine, m | Minimum noise limit, dB $L_{A90}$ | Predicted wind turbine noise level, dB $L_{A90}$ |
|---|---|---|---|---|---|---|
| 140 | Noise-sensitive location | 731971 | 6016422 | 2396 | 40 | 33 |
| 141 | Noise-sensitive location | 721765 | 6016395 | 9545 | 40 | 20 |
| 142 | Noise-sensitive location | 750782 | 6016341 | 4297 | 40 | 28 |
| 144 | Noise-sensitive location | 731289 | 6016242 | 3044 | 40 | 32 |
| 145 | Noise-sensitive location | 744820 | 6016186 | 2260 | 40 | 33 |
| 147 | Noise-sensitive location | 750550 | 6015861 | 4365 | 40 | 28 |
| 149 | Noise-sensitive location | 741911 | 6015590 | 4613 | 40 | 30 |
| 150 | Noise-sensitive location | 744616 | 6015112 | 3234 | 40 | 30 |
| 151 | Noise-sensitive location | 757208 | 6015108 | 10701 | 40 | 22 |
| 152 | Noise-sensitive location | 756323 | 6015087 | 9871 | 40 | 22 |
| 153 | Noise-sensitive location | 738710 | 6014900 | 3441 | 40 | 31 |
| 154 | Noise-sensitive location | 750304 | 6014516 | 5120 | 40 | 26 |
| 155 | Noise-sensitive location | 754506 | 6013942 | 8723 | 40 | 23 |
| 156 | Noise-sensitive location | 747737 | 6013864 | 4186 | 40 | 27 |
| 157 | Noise-sensitive location | 745352 | 6013750 | 4201 | 40 | 28 |
| 158 | Noise-sensitive location | 751107 | 6013710 | 6253 | 40 | 25 |
| 159 | Noise-sensitive location | 748867 | 6013050 | 5383 | 40 | 26 |
| 160 | Noise-sensitive location | 730043 | 6012884 | 6330 | 40 | 25 |
| 161 | Noise-sensitive location | 756237 | 6012767 | 10813 | 40 | 21 |
| 162 | Noise-sensitive location | 727237 | 6012608 | 7665 | 40 | 23 |
| 163 | Noise-sensitive location | 736895 | 6011926 | 6086 | 40 | 27 |
| 164 | Noise-sensitive location | 754732 | 6011891 | 10113 | 40 | 22 |
| 165 | Noise-sensitive location | 740817 | 6011886 | 7094 | 40 | 26 |
| 166 | Noise-sensitive location | 739269 | 6011537 | 6782 | 40 | 26 |
| 167 | Noise-sensitive location | 723829 | 6011502 | 10539 | 40 | 20 |
| 168 | Noise-sensitive location | 721972 | 6011185 | 12067 | 40 | 18 |
| 169 | Noise-sensitive location | 737072 | 6010954 | 7050 | 40 | 25 |
| 170 | Noise-sensitive location | 744457 | 6010042 | 8015 | 40 | 24 |
| 171 | Noise-sensitive location | 730713 | 6009804 | 8746 | 40 | 23 |
| 172 | Noise-sensitive location | 742961 | 6009647 | 8862 | 40 | 24 |

| ID | Status | Easting | Northing | Distance to nearest wind turbine, m | Minimum noise limit, dB $L_{A90}$ | Predicted wind turbine noise level, dB $L_{A90}$ |
|---|---|---|---|---|---|---|
| 173 | Noise-sensitive location | 741554 | 6009598 | 9455 | 40 | 24 |
| 174 | Noise-sensitive location | 747230 | 6009565 | 8302 | 40 | 23 |
| 175 | Noise-sensitive location | 744494 | 6009428 | 8604 | 40 | 23 |
| 176 | Noise-sensitive location | 752232 | 6009307 | 10334 | 40 | 21 |
| 177 | Noise-sensitive location | 747419 | 6009305 | 8582 | 40 | 23 |
| 178 | Noise-sensitive location | 747527 | 6009195 | 8705 | 40 | 22 |
| 179 | Noise-sensitive location | 754766 | 6009078 | 12118 | 40 | 20 |
| 180 | Noise-sensitive location | 747514 | 6008035 | 9854 | 40 | 22 |
| 181 | Noise-sensitive location | 743671 | 6007927 | 10260 | 40 | 22 |
| 182 | Noise-sensitive location | 747197 | 6007898 | 9959 | 40 | 22 |
| 183 | Noise-sensitive location | 749986 | 6019911 | 2197 | 40 | 33 |
| CG1 | Lake Meran campsite | 753345 | 6024490 | 3157 | 40 | 31 |
| 50 | Involved landowner | 753173 | 6033720 | 1115 | 45 | 38 |
| 53 | Involved landowner | 744630 | 6033631 | 1519 | 45 | 38 |
| 69 | Involved landowner | 747323 | 6031552 | 1316 | 45 | 41 |
| 80 | Involved landowner | 742121 | 6029286 | 837 | 45 | 44 |
| 100 | Involved landowner | 741811 | 6026602 | 994 | 45 | 43 |
| 101 | Involved landowner | 750989 | 6025591 | 670 | 45 | 42 |
| 105 | Involved landowner | 743855 | 6025110 | 1362 | 45 | 41 |
| 108 | Involved landowner | 735843 | 6024443 | 859 | 45 | 43 |
| 115 | Involved landowner | 750695 | 6023410 | 1368 | 45 | 37 |
| 117 | Involved landowner | 745695 | 6023233 | 693 | 45 | 44 |
| 121 | Involved landowner | 747419 | 6022329 | 884 | 45 | 42 |
| 126 | Involved landowner | 740745 | 6021138 | 1411 | 45 | 40 |
| 127 | Involved landowner | 745891 | 6021121 | 1527 | 45 | 40 |
| 137 | Involved landowner | 738782 | 6016714 | 2023 | 45 | 35 |
| 139 | Involved landowner | 734213 | 6016486 | 1572 | 45 | 36 |
| 143 | Involved landowner | 736264 | 6016293 | 1749 | 45 | 36 |
| 146 | Involved landowner | 736295 | 6016113 | 1930 | 45 | 35 |
| 148 | Involved landowner | 735291 | 6015748 | 2372 | 40 | 34 |

# Appendix C—Wind turbine noise prediction uncertainty



## Introduction

Appendix C of NZS 6808:2010 recommends that an assessment of uncertainty be included in any noise assessment conducted under the Standard. The discussion in NZS 6808:2010 relates primarily to measurement uncertainty, which is not relevant to this assessment. However, some discussion of the uncertainty associated with the predicted noise levels can be provided at the design stage.

Uncertainty in the predicted wind farm noise levels is a result of two main factors:

- uncertainty inherent in the prediction methodology
- uncertainty in the assumed sound power levels of the wind turbines.

Uncertainty in other inputs, such as the position of wind turbines and the location of residences, may also exist but are likely to have an insignificant impact on the prediction uncertainty as small changes in position do not result in any noticeable change in predicted noise levels when the distance between source and receiver is over 1 km.

## Uncertainty in predictions

ISO 9613-2:2024, the basis of the prediction methodology adopted in this report, provides a discussion on general uncertainty associated with the propagation algorithm and advises a typical accuracy of overall A-weighted noise levels of ±3 dB at distances of up to 1 km from the source. It does not advise on the accuracy of predictions at distances further than this.

With respect to wind turbine noise specifically, Annex D7 of ISO 9613-2:2024 states the following:

> The recommendations described in this annex are consistent with predicting the most probable value that would be measured with the modelled environmental conditions (e.g., wind speed dependent sound power level). Different studies have compared in detail measurements of operational turbines and predictions with different parameters and the current consensus is that for propagation over porous ground conditions:
>
> - modelling with $G$=0 with positive adjustments on the source levels (e.g. uncertainty margin) can overstate measured levels;
> - modelling with $G$=0,5 without positive adjustments can understate the measured values.

In considering the above, it should be noted that the ISO 9613-2 accuracy must be understood in the context of how wind turbine noise is measured and assessed in Victoria. Given the use of NZS 6808:2010, the following factors reduce the uncertainty of wind farm noise predictions or tend the predictions towards conservatism thereby reducing the likelihood of any under-prediction:

- ISO 9613-2:2024 is based on the prediction of $L_{Aeq}$ noise levels and not $L_{A90}$ noise levels, whereas NZS 6808:2010 requires the assessment of $L_{A90}$ noise levels. It is commonly accepted for wind turbine noise that the $L_{Aeq}$ level will be in the order of 2 dB above the $L_{A90}$ noise level, such that predictions using ISO 9613-2:2024 without any adjustment for this factor would tend towards conservatism. No adjustment factor has been applied in this assessment to account for that.
- NZS 6808:2010 requires that wind farm noise levels are assessed based on a large number of 10-minute data points (at least 1440 data points) that are correlated with wind speed, with an average noise level determined for each wind speed. In practice, this reduces the uncertainty associated with predictions due to the large number of data points that would be collected and averaged during any measurement campaign. A study

performed on Australian wind farms[7] that examined the difference between predicted noise levels using ISO 9613-2 with a receiver height of 1.5 m and measured downwind noise levels in general accordance with NZS 6808:2010 found that the predictions were within ±1 dB for sloping or relatively flat sites when appropriate prediction parameters were used.

- The predictions are based on downwind conditions – that is, where the residence is downwind of the nearest wind turbines. NZS 6808:2010 does not specifically require the assessment to be carried out for downwind conditions unless measured noise levels are clearly higher under these conditions and so, if compliance measurements include periods where there are some crosswind or upwind conditions, then the measured noise level would be lower. This may increase the conservatism of the predictions.

### Uncertainty in sound power levels

Sound power levels of wind turbines are quantified in accordance with measurement standard IEC 61400-11 Edition 3.0 *Wind turbines – Part 11: Acoustic noise measurement techniques* (IEC 61400-11). The measurement process includes quantification of the uncertainty in the sound power level at each wind speed as documented in IEC 61400 11, this uncertainty is typically small and in the order of 1 dB or lower.

Uncertainty factors have been included in the assumed sound power levels in this noise assessment to account for this potential error in accordance with advice from the wind turbine suppliers.

### Summary

Appendix C of NZS 6808:2010 states that, when comparing a sound level with the applicable noise limit, the sound level is deemed to comply if the sound level is equal to or less than the limit. It should be deemed not to comply if the sound level is greater than the noise limit, regardless of the uncertainty. It also advises that, where compliance or non-compliance is 'marginal and contested', steps should be taken to reduce the uncertainty, where practical.

Given the methods by which wind turbine noise is measured in Victoria and previous assessments of wind turbine noise modelling accuracy, the uncertainty associated with the predicted noise levels is considered small. Assumptions in the prediction methodology tend to be conservative and therefore may offset any uncertainty, tending towards over prediction of noise levels at residences, and the assumed wind turbine sound power levels for the candidate models include a factor for uncertainty in accordance with the supplier advice.



[7] Evans T & Cooper J, 2012, *Comparison of predicted and measured wind farm noise levels and implications for assessments of new wind farms*, Acoustics Australia, vol. 40, no. 1, pp 28-36.

# Appendix D—Wind turbine noise contour maps

# MEERING WEST WIND FARM

## Meering West, VIC
## Figure D1: Predicted wind turbine noise levels and noise-sensitive locations based on Vestas V172-7.2MW WTG

| | |
|---|---|
| PROJECT NUMBER | M240298 |
| DRAWN BY | TE |
| DATE | April 2026 |
| CLIENT | Aurecon |
| AERIAL IMAGERY | (c) Google |

**Legend**

- Project area
- WTG

Dwelling

- Landowner
- Noise-Sensitive Location

Predicted wind turbine noise level, dB LA90

- 30 dB
- 35 dB
- 40 dB
- 45 dB

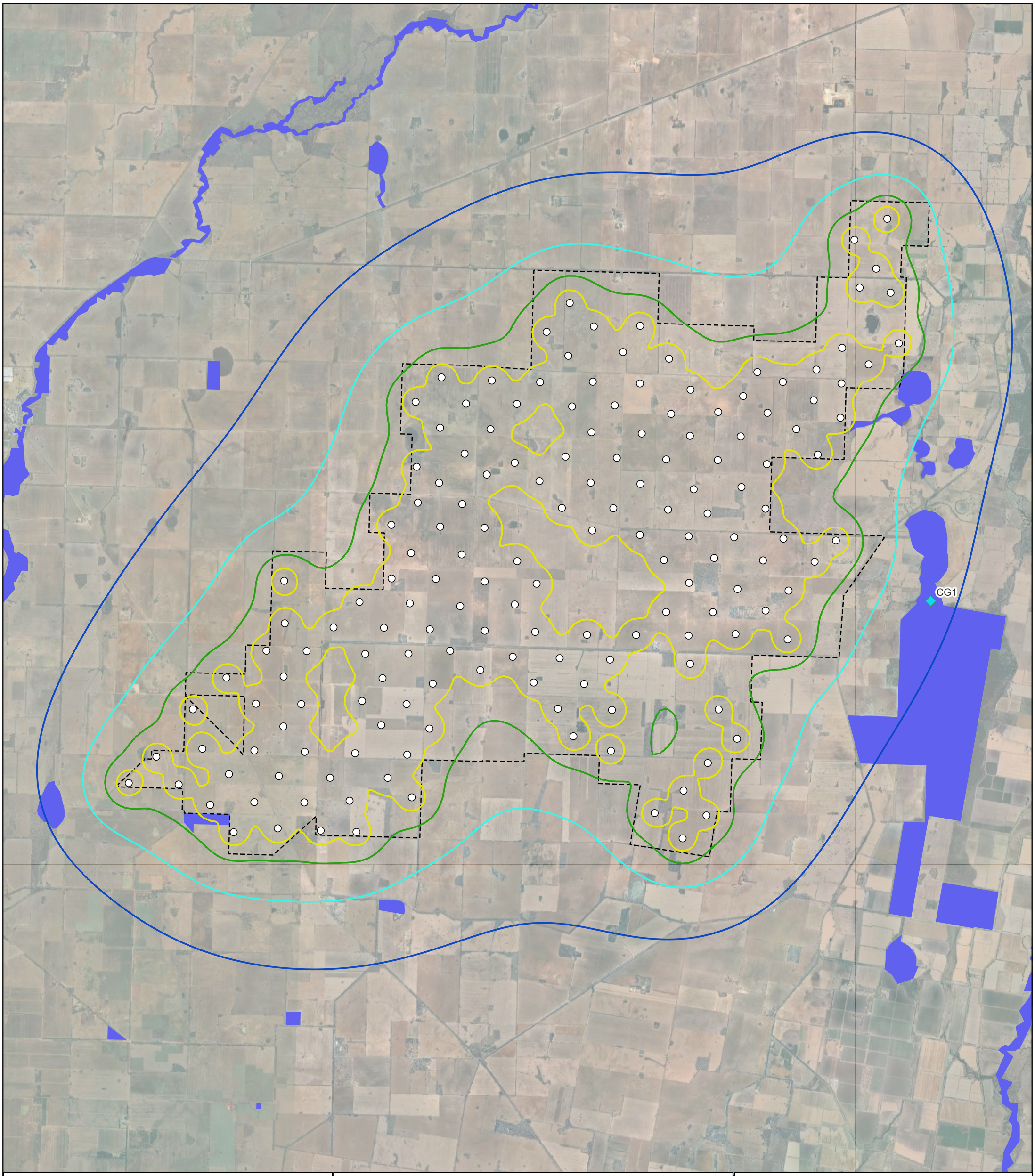
ADVERTISED PLAN



0 2 4 6 km

Datum GDA20 MGA Zone 54

Resonate




# MEERING WEST WIND FARM

## Meering West, VIC
## Figure D2: Predicted wind turbine noise levels and natural areas based on Vestas V172-7.2MW WTG

| | |
|---|---|
| PROJECT NUMBER | M240298 |
| DRAWN BY | TE |
| DATE | April 2026 |
| CLIENT | Aurecon |
| AERIAL IMAGERY | (c) Google |

**Legend**

- Project area
- WTG
- Campground

ERS Natural Area

- Natural Area (PCRZ)

Predicted wind turbine noise level, dB LA90

- 30 dB
- 35 dB
- 40 dB
- 45 dB



0 2 4 6 km

Datum GDA20 MGA Zone 54



Resonate