Appendix A

Environmental Noise Assessment, MDA, 26 June 2026

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MARSHALL DAY Acoustics

MORETON HILL WIND FARM
ENVIRONMENTAL NOISE ASSESSMENT

Rp 003 R03 20200545 | 26 June 2026

MARSHALL DAY Acoustics

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Project: **MORETON HILL WIND FARM**

Prepared for: **MHWF NOMINEES PTY LTD**

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Report No.: **Rp 003 R03 20200545**

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EXECUTIVE SUMMARY

This report presents the results of an assessment of environmental noise associated with the Moreton Hill Wind Farm (Project) that is proposed to be developed by MHWF NOMINEES PTY LTD.

The Project is proposed to consist of a wind farm with up to 62 multi-megawatt wind turbines, a substation and a battery energy storage system (BESS)

This assessment, prepared to inform the Project's planning application is based on a wind farm layout comprising 68 multi-megawatt wind turbines with a maximum tip height of 252 m. This provides a conservative assessment of the Project, reflecting a larger number of wind turbines than the proposed total of 62.

The actual wind turbine which would be used at the site would be determined at a later stage in the project, after the project has been granted planning approval. The final selection would be based on a range of design requirements including achieving compliance with the planning permit noise limits at surrounding noise sensitive locations (receivers). In advance of a final selection, this assessment considers a candidate wind turbine model that is representative of the size and type of wind turbine which could be used at the site. For this purpose, 2 candidate wind turbine models have been nominated by the proponent, each with a hub height of 166 m and rotor diameter of up to 172 m.

Operational noise from the proposed wind turbines has been assessed in accordance with the New Zealand Standard 6808:2010 *Acoustics – Wind farm noise* (NZS 6808), as required by the *Environment Protection Regulations 2021* (EP Regulations), the Victorian Department of Transport and Planning publication *Planning Guidelines for Development of Wind Energy Facilities* dated September 2023 and EPA-DTP Publication 3011 *Wind Energy Facility Turbine Noise – Technical Guideline* dated 20 December 2024. The operational wind farm noise assessment considers the base (minimum) noise limits determined in accordance with NZS 6808, accounting for the land zoning of the area.

Manufacturer specification data for the 2 candidate wind turbine models has been used as the basis for the assessment. The specification provides noise emission data in accordance with the international standard referenced in NZS 6808. The noise emission data is consistent with the range of values expected for comparable types of multi megawatt wind turbine models that are being considered for the site.

The noise emission data has been used with international standard ISO 9613-2:1996 *Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation* (ISO 9613-2) to predict the level of noise expected to occur at neighbouring receivers. The ISO 9613-2 standard has been applied using well-established input choices and adjustments, based on research and international guidance, that are specific to wind farm noise assessment.

The results of the noise modelling demonstrate that the predicted noise levels for the proposed wind turbine layout and candidate wind turbine models achieve the base noise limits determined in accordance with NZS 6808 at all neighbouring receivers.

The EP Regulations require operational noise of the substation and BESS, associated with the wind farm, to be assessed in accordance with EPA Publication 1826.5 *Noise limit and assessment protocol for the control of noise from commercial, industrial and trade premises and entertainment venues*, dated September 2025 (Noise Protocol). The assessment demonstrates that, based on current available information, operation of the substation and BESS can comply with noise limits determined in accordance with the Noise Protocol.

Consideration was also given to the general environmental duty introduced by the *Environment Protection Act 2017* in July 2021.

The noise assessment therefore demonstrates that the proposed Moreton Hill Wind Farm can be designed and developed to achieve Victorian policy requirements.

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1.0 INTRODUCTION

MHWF NOMINEES PTY LTD (proponent) is proposing to develop a wind farm known as the Moreton Hill Wind Farm (Project) within the Victorian local government area of the Corangamite Shire and Golden Plains Shire, approximately 5 km east of Skipton. The Project is proposed to comprise a wind farm and associated substation and battery energy storage system (BESS).

This report presents the results of an assessment of operational wind turbine noise in accordance with the New Zealand Standard 6808:2010 *Acoustics – Wind farm noise* (NZS 6808), as required by the *Environment Protection Regulations 2021* (EP Regulations), the Victorian Department of Transport and Planning publication *Planning Guidelines for Development of Wind Energy Facilities* dated September 2023 (Victorian Wind Energy Guidelines) and EPA-DTP Publication 3011 *Wind Energy Facility Turbine Noise – Technical Guideline* dated 20 December 2024.

Operational noise of the proposed substation and BESS associated with the wind farm is to be assessed in accordance with EPA Publication 1826.5 *Noise limit and assessment protocol for the control of noise from commercial, industrial and trade premises and entertainment venues* dated September 2025 (Noise Protocol), as required by the EP Regulations. The general environment duty introduced by the *Environment Protection Act 2017* (EP act) in July 2021 must also be considered.

The noise assessment presented in this report is based on:

- Operational noise limits determined in accordance with NZS 6808 and the Noise Protocol, accounting for local land zoning
- Predicted operational noise levels for the wind turbines, based on the proposed site layout and 2 candidate wind turbine models that are representative of the size and type of wind turbine that the planning application seeks consent for
- Predicted operational noise levels for the proposed substation and BESS, based on empirical noise emission data
- A comparison of the predicted noise levels with the applicable base noise limits determined in accordance with NZS 6808 and the noise limits defined by the Noise Protocol.

Acoustic terminology used in this report is presented in Appendix A.

2.0 PROJECT DESCRIPTION

The proposed Moreton Hill Wind Farm consists of a wind farm, a substation and a BESS.

The wind farm component of the Project is proposed to consist of 62 multi-megawatt wind turbines. However, as a conservative assessment, the proponent requested a 68 wind turbine layout be assessed.

The proposed wind turbine layout is illustrated in Figure 1 and the coordinates are tabulated in Appendix B.

The proponent is seeking consent for wind turbines with a maximum tip height of 252 m.

Two wind turbine models were nominated by the proponent as candidates for this assessment:

- Vestas V162-6.8MW with a power output of 6.8 MW and a rotor diameter of 162 m
- Vestas V172-7.2MW with a power output of 7.2 MW and a rotor diameter of 172 m.

Further details of the candidate wind turbine models are presented in Section 7.3.

A substation and a 100 MW / 400 MWh BESS are also proposed to be located to the south-west of the wind farm. These are illustrated in Figure 1 and the coordinates are tabulated in Appendix B.

Other Project related infrastructure on the site would include access tracks, underground cable reticulation, overhead power transmission lines and site offices.

Details of the study area and surrounding receivers are subsequently discussed in Section 5.0.

Figure 1: Project site layout – proposed wind turbines, substation and BESS

3.0 LEGISLATION AND GUIDELINES

The environmental noise assessment requirements for the Project are defined by the following:

- *Environment Protection Act 2017*
- *Environment Protection Regulations 2021*
- *Environment Reference Standard* published 25 May 2021, as amended by *Environment Reference Standard No. S158 Gazette* dated 29 March 2022
- *Planning Guidelines for Development of Wind Energy Facilities* dated September 2023
- EPA Publication 1826.5 *Noise limit and assessment protocol for the control of noise from commercial, industrial and trade premises and entertainment venues* dated September 2025
- NZS 6808:2010 *Acoustics – Wind farm noise*.

The requirements of these documents are summarised below. Additional details and extracts from these documents are provided in Appendix C.

Victorian guidelines that are relevant to the assessment are also briefly outlined below.

3.1 Environment Protection Act 2017

The *Environment Protection Act 2017* (EP Act) provides the overarching legislated protection of the environment in Victoria and establishes mandatory requirements for the control of environmental noise. The following key obligations apply under the EP Act:

- A person who is engaging in an activity that may give rise to risks of harm to human health or the environment has a general environmental duty (GED) to minimise the risk of harm, so far as reasonably practicable.
- A person must not, from a place or premises that are not residential premises, emit unreasonable noise or permit unreasonable noise to be emitted.

The risk of harm under the EP Act includes both health and amenity related noise impacts. The EP Act defines environmental noise as unreasonable if it is:

- prescribed to be unreasonable from an assessment against mandatory noise limits (see Sections 3.2, Section 3.5 and Section 3.6); or
- assessed to be unreasonable according to the following factors defined in the EP Act:
  - noise volume, intensity or duration
  - noise character
  - the time, place and other circumstances in which the noise is emitted
  - how often the noise is emitted
  - any prescribed factors relating to the noise (frequency spectrum being a prescribed factor).

3.2 Environment Protection Regulations 2021

The *Environment Protection Regulations 2021* (EP Regulations) give effect to the EP Act by establishing prescriptive requirements for a range of environmental considerations including noise. The noise requirements are defined according to the type of noise generating activity under consideration. The EP Regulations also define the types of noise sensitive areas where these requirements apply and the hours of different assessment time periods (i.e. day, evening and night).

The relevant elements of the EP Regulations are the requirements for the:

- operational noise from commercial, industrial and trade premises (industry)
- operational wind turbine noise of a wind farm.

The EP Regulations specify that the prediction, measurement, analysis and assessment of operational industry noise within a noise sensitive area must be conducted in accordance with the Noise Protocol (see Section 3.5). Noise from industry is prescribed by the EP Regulations to be unreasonable for the purposes of the EP Act if it exceeds the noise limit determined in accordance with the Noise Protocol.

In relation to wind turbine noise, the EP Regulations specify a range of requirements for the assessment, verification and ongoing management of operational wind turbine noise. Under the EP Regulations, the relevant standard specified for the assessment of wind turbine noise is NZS 6808 (see Section 3.6).

An important element of the EP Regulations with respect to wind turbine noise is the Act compliance note, which provides clarity on how a wind energy facility operator can satisfy the GED under the EP Act. [1] The Act compliance note means that demonstrating compliance with the EP Regulations also demonstrates compliance with the GED under the EP Act.

3.3 Environment Reference Standard

The *Environment Reference Standard* (ERS) was introduced under the EP Act and sets out environmental and human health outcomes that are sought to be achieved and maintained in Victoria. The outcomes are described by the ERS in terms of a collection of environmental values, indicators and objectives.

The environmental values of the ambient sound environment defined by the ERS relate to conditions that are conducive to domestic activities (conversation, recreation and sleep), learning, and appreciation and enjoyment of tranquillity in natural areas. The environmental values in most settings are defined using a quantitative indicator, and the objective for these indicators are defined according to the land use and planning zone. However, for natural areas, the indicator is qualitative and is based on an appraisal of sound quality that is conducive to human tranquillity and enjoyment of natural soundscapes.

Indicators and objectives for the ambient sound in different settings are defined to provide a basis for assessing actual and potential risks to the environment. They also provide a benchmark for comparing the state of the environment, or potential changes to the environment, to desired outcomes. However, the ERS is not a compliance standard. The primary function of the ERS is to provide an environmental assessment reporting benchmark which can be used as a reference point for decision makers to consider whether a proposal or activity is consistent with the environmental values identified in the ERS.

[1] Regulation 6 to the EP Regulations states that if a note at the foot of a provision of the regulations states 'Act compliance' followed by a reference to a section number, the regulation provision sets out the way in which a person's duty or obligation under that section of the EP Act is to be performed in relation to the matters and the extent set out in the regulation provision.

3.4 Planning Guidelines for Development of Wind Energy Facilities

The Victorian Department of Transport and Planning publication *Planning Guidelines for Development of Wind Energy Facilities* dated September 2023 (Victorian Wind Energy Guidelines) provide advice to responsible authorities, proponents and the community about suitable sites to locate wind energy facilities and to inform planning decisions about a wind energy facility proposal.

The advice includes detailed guidance on consistent methods for the assessment of wind turbine noise at the planning stage of a project. In particular, the Victorian Wind Energy Guidelines specifies that potential operational noise levels associated with proposed wind farm developments are to be assessed in accordance with NZS 6808 (see Section 3.6). Guidance is also provided on how NZS 6808 should be considered in the Victorian regulatory framework.

3.5 EPA Publication 1826.5 (Noise Protocol)

The EPA Publication 1826.5 *Noise limit and assessment protocol for the control of noise from commercial, industrial and trade premises and entertainment venues* dated September 2025 (Noise Protocol) defines a procedure for setting noise limits that apply to the operation of industry premises and entertainment venues in Victoria. The noise limits are applicable to the operational stage of the Project. Compliance with the noise limits is mandatory.

The Noise Protocol defines noise limits that are used to assess whether a noise is prescribed to be unreasonable in accordance with the EP Regulations and the EP Act.

The noise limits apply at a 'noise sensitive area', which is defined by the EP Regulations as being *within 10 metres of the outside of the external walls* of buildings including dwellings, hotels, and schools. In rural areas, noise sensitive areas also include land within the boundary of campgrounds, caravan parks and certain types of tourist establishments.

The procedures for setting noise limits are defined separately for urban and rural areas. However, in both cases, the noise limits are defined by considering the land zoning in the area and the noise environment of the receiver. Separate noise limits are defined for the day, evening and night periods.

3.6 NZS 6808

NZS 6808:2010 *Acoustics – Wind farm noise* (NZS 6808) defines a method for assessing operational wind turbine noise levels, including procedures for:

- measuring background noise levels prior to construction of a wind farm
- deriving noise criteria from measured background noise levels
- conducting post-construction measurements of wind farm noise
- assessing the character of the noise produced by the wind farm noise
- assessing post-construction noise measurements to determine compliance with the standard.

The noise criteria defined by NZS 6808 are a combination of a base (minimum) noise limit and noise limits which vary with wind speed and background noise levels. The base limit is a fixed value that is used for conditions when the background noise is low. The noise limit at each integer wind speed is then defined as the base limit or the background level plus 5 dB, whichever value is higher. The limits apply to wind turbine noise levels in the vicinity of noise sensitive locations.

The character of the wind farm sound is also assessed to determine whether adjustments should be applied to account for sounds referred to by the standard as special audible characteristics (SACs). These SACs are defined as tonality, impulsiveness and amplitude modulation. The noise level of the wind farm, adjusted where necessary for the presence of SACs, is then compared with the noise limits at each wind speed to determine the wind farm's compliance.

3.7 Related Victorian guidelines

To support the application the legislation and guidance summarised in the preceding sections, a range of Victorian publications provide additional advice on matters of interpretation and technical procedures. These publications include:

- EPA Publication 1992 *Guide to the Environment Reference Standard,* dated June 2021
- EPA Publication 1996 *Noise guideline – assessing low frequency noise,* dated June 2021
- EPA Publication 1997 *Technical guide: Measuring and analysing industry noise and music noise,* dated June 2021
- EPA-DTP Publication 3011 *Wind Energy Facility Turbine Noise* – Technical Guideline.

These guidelines are non-statutory documents which provide detailed advice for a broad range of technical considerations. Relevant aspects of these guidelines are referenced where appropriate in this assessment.

4.0 ASSESSMENT METHOD

4.1 Overview

Based on the policies and guidelines outlined in Section 3.0, assessing the operational noise levels of a proposed renewable energy project (comprising wind turbines, BESS and substation) involves:

- identifying receivers and ERS natural areas within a 3 km study area (see Section 5.0) from the Project infrastructure
- reviewing the existing noise environment in the Project area and assessing background noise levels at key receivers and ERS natural areas around the Project
- establishing suitable noise limits accounting for background noise levels and land zoning
- predicting noise levels associated with the Project, accounting for the inherent and proposed noise controls as appropriate
- assessing compliance with mandatory noise limits, where applicable
- assessing the potential for cumulative noise as a result of the Project and other existing and known developments in the surrounding area
- defining noise management measures consistent with the GED to minimise the risk of harm from Project operational noise so far as reasonably practicable.

4.2 Existing noise environment

Background noise level information is used to:

- set operational noise limits for wind turbines
- set operational noise limits for the BESS and substation
- consider the existing noise environment in natural areas where relevant.

However, in rural areas where wind farms are typically developed, the background noise level data is generally most important to the assessment of the wind turbines. This is due to the need to consider the changes in background noise levels and wind turbine noise levels for different wind conditions. Further, in rural areas, the land zoning is usually the decisive factor when setting noise limits for sources such as the BESS and substation.

Based on the above, the wind turbine noise component of the assessment, and therefore the assessment requirements of NZS 6808, are the key consideration when establishing existing noise levels.

The first step in assessing background noise levels involves determining whether background noise measurements are warranted. For this purpose, Section 7.1.4 of the standard provides the following guidance:

> *Background sound level measurements and subsequent analysis to define the relative noise limits should be carried out where wind farm sound levels of 35 dB $L_{A90(10\ min)}$ or higher are predicted for noise sensitive locations, when the wind turbines are at 95% rated power. If there are no noise sensitive locations within the 35 dB $L_{A90(10\ min)}$ predicted wind farm sound level contour then background sound level measurements are not required.*

The initial stage of an NZS 6808 assessment therefore comprises:

- preliminary wind turbine noise predictions to identify all receivers where predicted noise levels are higher than 35 dB L_{A90}
- identification of selected receivers where background noise monitoring should be undertaken prior to development of the wind farm, if required.

If monitoring is required, the surveys involve measurements of background noise levels at receivers and simultaneous measurement of wind speeds at the site of the proposed wind farm. The survey typically extends over a period of several weeks to enable a range of wind speeds and directions to be measured.

The results of the survey are then analysed to determine the trend between the background noise levels and the site wind speeds at the proposed hub height of the wind turbines. This trend defines the value of the background noise for the different wind speeds in which the wind turbines would operate. At the wind speeds when the value of the background noise is above 35 dB L_{A90} (or 30 dB L_{A90} in special circumstances where high amenity limits apply), the background noise levels are used to set the noise limits for the wind farm.

4.3 Noise predictions

Operational noise levels from the Project are predicted using:

- noise emission data for the relevant equipment (e.g. wind turbines, transformers, and inverters)
- a 3D digital model of the site and the surrounding environment
- international standards used for the calculation of environmental sound propagation.

The method selected to predict noise levels is ISO 9613-2.[2] The prediction method is consistent with the guidance provided by NZS 6808 and has been shown to provide a reliable method of predicting the typical upper levels of the wind turbine noise expected to occur in practice. The method is also referenced in the Technical Guideline.

The method is generally applied in a comparable manner to both wind turbine, BESS and substation noise levels. For example, for both types of sources, equivalent ground and atmospheric conditions are used for the calculations. However, when applied to wind turbine noise, additional and specific calculation choices apply.

Further discussion of the method and the calculation choices is provided in Appendix D.

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[2] ISO 9613-2: 1996 *Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation*

4.4 Cumulative noise

The potential for cumulative noise from the Project and other noise sources is evaluated by:

- identifying other existing and proposed developments in the area around the Project (including those in operation and approved at the time of assessment)
- identifying receivers where there is the potential for cumulative noise from the Project and other developments
- predicting noise levels from other existing and potential developments, where relevant and suitable information is available
- assessing cumulative wind turbine noise levels at the identified receivers to determine whether:
  - the Project could contribute to total wind turbine noise levels above the limits in the vicinity of other exiting wind farms
  - there is a margin below the noise limits to accommodate other potential wind farm developments, where relevant
- assessing cumulative industry noise levels at the identified receivers to determine whether:
  - the Project would contribute to total industry noise levels above the limits in the vicinity of other existing commercial, industry and trade premises
  - there is a margin below the noise limits to accommodate other potential developments, where relevant.

Specific cumulative noise study areas are not defined by the legislation and guidelines set out in Section 3.0. MDA has adopted 10 km as the study area for wind turbine noise and 5 km for substation and BESS noise. This is technically appropriate based on propagation distances associated with each noise source type. More detail is provided in Section 5.0.

5.0 STUDY AREA

The study area for the noise assessment extends to 3 km from the proposed locations of the Project wind turbines, substation and BESS. This is a nominal distance selected to enable a complete account of operational and potential cumulative noise considerations associated with the Project.

The study area is predominantly rural with the nearest townships of Linton and Skipton more than 5 km from the Project. The land in the study area is mainly designated as Farming Zone (see zoning map in Appendix E).

The types of locations within the study area where noise and vibration are assessed includes:

- noise sensitive receivers, which is any discrete location such as a residential dwelling where an assessment of noise or vibration is required
- natural areas which are considered under the ERS.

The locations of noise sensitive receivers and natural areas are identified and discussed within this section. This section also identifies the location of other potential or existing projects in or near the study area which may be relevant to the assessment of cumulative noise.

5.1 Receivers

The term *noise sensitive receiver* (receiver) is used throughout this report when referring to any building or facility where an assessment of noise is required. However, the details and types of receivers which must be considered are specific to the source of noise being assessed.

The EP Regulations specify noise requirements such as assessment procedures, the types of receivers to be assessed and different time periods which must be accounted for in the assessment. Importantly, the requirements of the EP Regulations are specific to the type of noise generating activity being assessed. For example, the types of receivers which must be considered when assessing commercial and industrial noise sources are called *noise sensitive areas*. Conversely, the procedure specified in the EP Regulations for assessing wind turbine noise requires consideration of receivers called *noise sensitive locations*. While noise sensitive areas and noise sensitive locations are broadly similar, there are slight differences between the two which relate to the types of receivers which must be considered and the specific locations where the noise limits apply.

The study area for this assessment includes all receivers identified by the proponent within 3 km of the proposed wind turbines, BESS and substation.

An important distinction when assessing wind turbine noise levels is whether the receivers are within the Project boundary, or a noise agreement is in place with the receiver landowners. In particular, NZS 6808 requires that the wind turbine noise assessment be undertaken at all receivers in the vicinity of the proposed wind farm which it defines as follows:

> *The location of a noise sensitive activity, associated with a habitable space or education space in a building not on the wind farm site. […]*
>
> *In some instances holiday cabins and camping grounds might be considered as noise sensitive locations. Matters to be considered include whether it is an established activity with existing rights.*

Further, based on the above definitions and statutory context of NZS 6808 discussed in Appendix C5, the noise limits specified in NZS 6808 only apply to the assessment of wind turbine noise levels at receivers where a noise agreement is not in place. This is also reflected in the EP Regulations which defines different noise limits for receivers located outside the Project boundary where noise agreements are in place.

Based on the above, receivers located within the Project boundary, or those located outside the Project boundary where a noise agreement is in place, are collectively referred to as stakeholder receivers.

A total of 67 receivers were identified by the proponent within 3 km of the proposed wind turbines, comprising:

- 38 non-stakeholder receivers on properties that are not associated with the Project
- 29 stakeholder receivers including:
  - 12 receivers within the Project boundary
  - 17 receivers outside the Project boundary where a noise agreement is proposed between the landowner and the proponent.

The coordinates of all assessed receivers within 3 km of the proposed wind turbines are provided in Appendix F.

A site layout plan illustrating the wind turbine layout, substation, BESS and receivers is provided in Figure 2.

5.2 Natural areas

Natural areas are a land-use category for which the ERS details desired outcomes in terms of noise level to be achieved or maintained in Victoria. 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.*

Data from the Parks and Conservation Reserves state mapping (PARKRES) has been used to identify the following natural areas within 10 km of the Project wind turbines:[3]

- Carngham Bushland Reserve
- Devils Kitchen Geological Reserve
- Happy Valley Crossing Streamside Reserve
- Happy Valley School Historic Reserve
- Linton Flora and Fauna Reserve
- Mount Bute Scenic Reserve
- Mount Erip Flora Reserve
- Skipton Court House Historic Reserve
- Skipton Streamside Reserve
- Woady Yallock River, Pitfield Streamside Reserve

The natural areas listed above are shown in Figure 3. Land within the Public Park and Recreation Zone (PPRZ) and Public Conservation and Resource Zone (PCRZ) but not identified within the PARKRES data is also presented for completeness.

[3] Data Vic webpage

Figure 2: Site map of proposed wind turbines, substation and BESS receivers

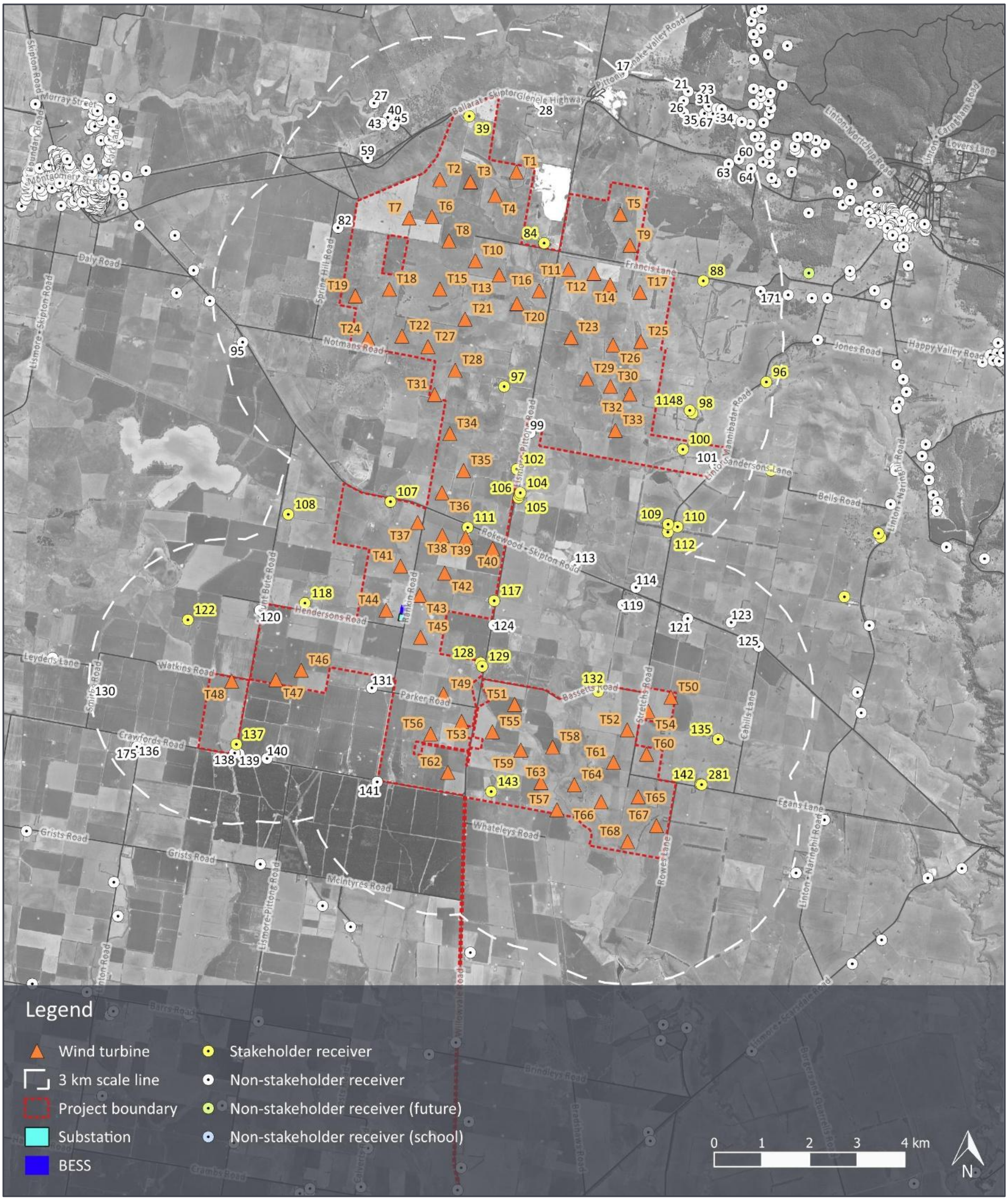
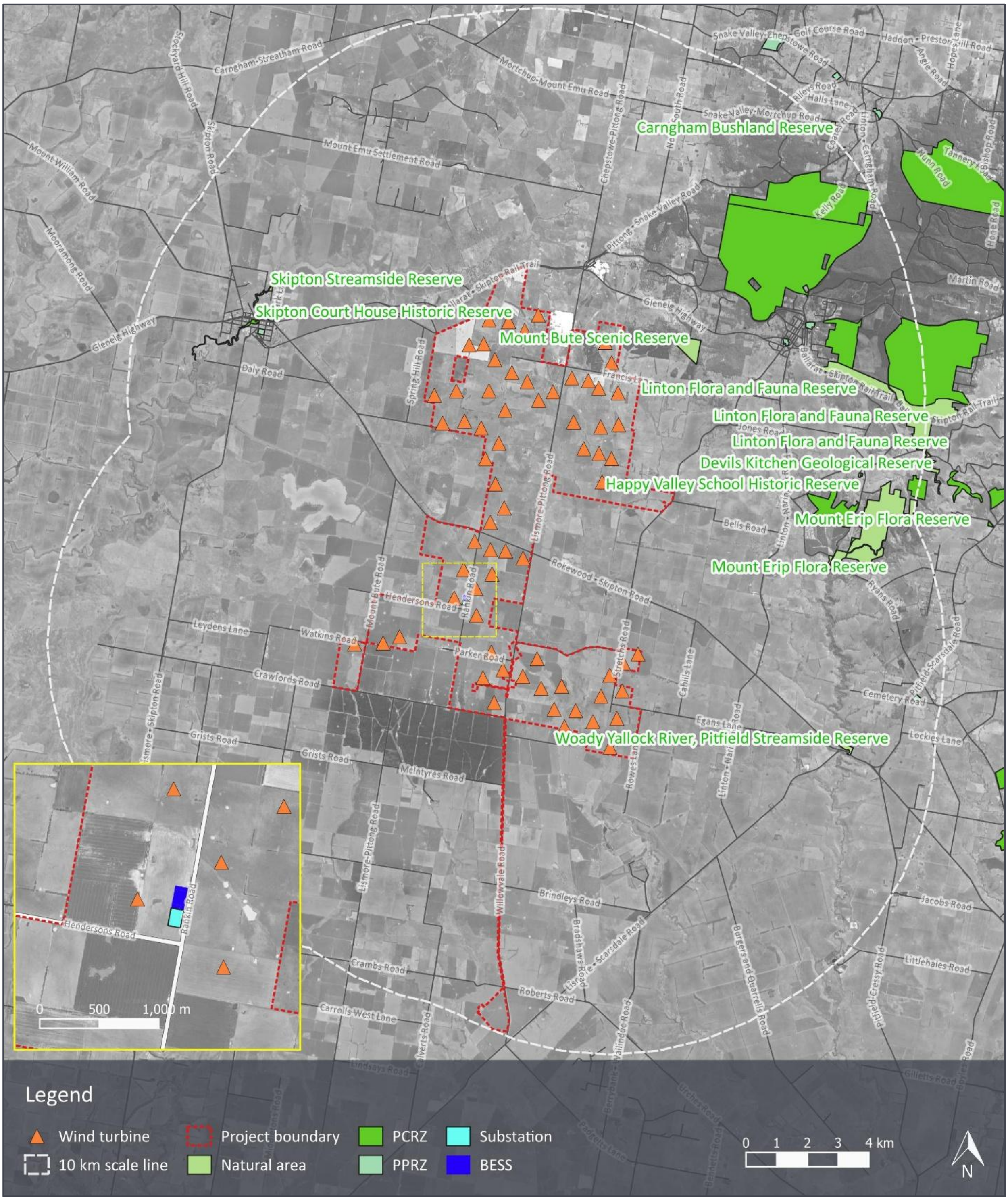


Figure 3: Site map of proposed wind turbines, substation, BESS and surrounding natural areas, PPRZ and PCRZ land



5.3 Other projects

Based on publicly available information (last accessed on 23 June 2026), 3 wind farms have been identified within 10 km of the proposed wind farm for the review of potential cumulative noise considerations. These wind farms are detailed in Table 1. [4]

Table 1: Wind farm development in the broader area around the Moreton Hill Wind Farm

Wind Farm Name	Status	Approximate distance to nearest turbine
Stockyard Hill Wind Farm	Operating	3.8 km to the north-west
Chepstowe Wind Farm	Operating	10 km to the north
Berrybank Wind Farm	Operating	10 km to the south

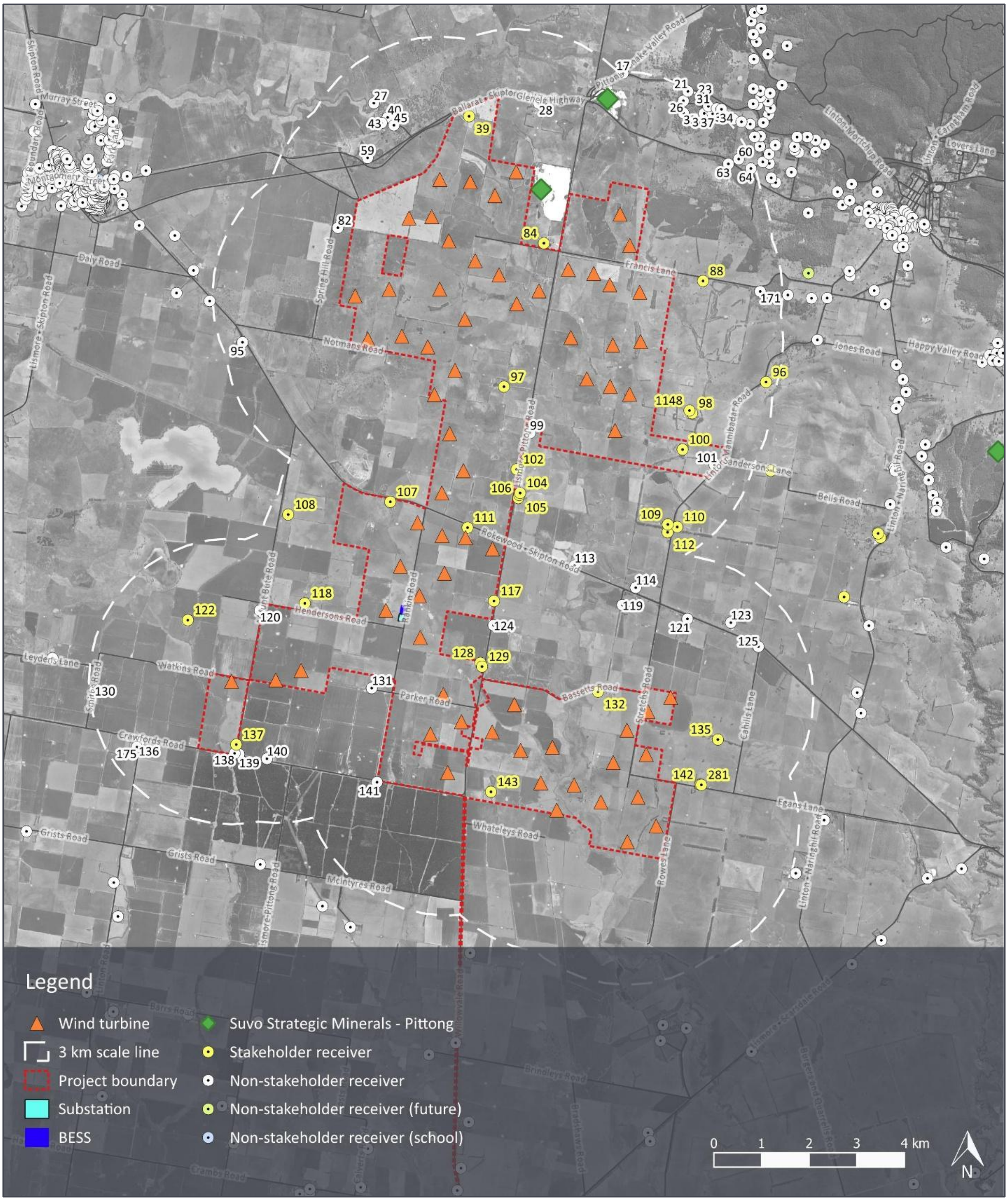
Wind farms located farther than 10 km from the proposed project, would not have cumulative effects likely to affect the assessment outcome, however, the Golden Plains Wind Farm, located 11 km to the south-east has been included for contextual information.

The only other commercial, industrial and trade (CIT) that has been identified within the study area are the 2 Suvo Strategic Minerals Pittong Operation sites, located to the north of the Project. No specific details regarding noise generating activities are known about these sites, however from review of aerial imagery it is assumed that typical mining operations would occur.

Since these sites are more than 8 km north of the proposed Project substation and BESS, cumulative noise is not expected to be material for the purpose of this assessment. As such, no cumulative assessment of noise has been carried out.

[4] Department of Transport and Planning, *Renewable Energy Projects Victoria* (weblink)

Figure 4: Other projects within study area



6.0 EXISTING NOISE ENVIRONMENT

The noise modelling results that were available at the time of the noise survey indicated predicted wind turbine noise levels between 35 and 40 dB L_{A90} at 3 non-stakeholder receivers.[5] In accordance with NZS 6808, background noise monitoring was recommended to be undertaken at these receivers.

A first background noise monitoring survey was undertaken between March and June 2024 at locations selected based on predicted noise levels presented in the EES referral noise assessment.

At the time, the proponent elected to commission a survey of background noise levels at a broader range of locations than was strictly required by NZS 6808. The objective of the noise monitoring was to obtain data that would assist with providing context to the predicted noise levels of the proposed wind farm.

Accordingly, monitoring was undertaken at 9 locations, with the background noise levels determined in accordance with NZS 6808 for the all-time and night-time periods respectively. This included 2 of the 3 receivers where predicted noise levels were between 35 and 40 dB L_{A90}.

Consent to undertake background noise monitoring was not granted at the remaining preferred receiver (99). As such, noise monitoring was undertaken in lieu at stakeholder receiver 102, located approximately 800 m south. This location was considered a representative noise environment at receiver 99.

As second background noise monitoring survey was undertaken between April and June 2025 at 3 locations:

- Repeat monitoring at receiver 113 due to equipment failure during the first survey
- Additional monitoring at receivers at receivers 112 (stakeholder) and 141.

The noise monitoring, analysis procedures and results are detailed in the background noise report. [6] The data presented in Table 2 summarises the background noise levels determined in accordance with NZS 6808 for the all-time and night-time periods. The data in these tables is provided for the key wind speeds relevant to the assessment of wind farm noise. The results for all surveyed wind speeds are illustrated in the graphical data provided for each receiver in the appendices of the background noise report.

Depending on the final wind turbine layout and model selection, additional background noise monitoring may be required prior to construction of the wind farm.

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[5] MDA Report Rp 001 R01 20200545 *Moreton Hill Wind Farm – Environmental noise assessment*, dated 19 December 2023 (EES referral noise assessment)

[6] MDA report Rp 002 R02 20200546 *Moreton Hill Wind Farm – Background noise monitoring*, dated 12 January 2026 (background noise report)

Table 2: Background noise levels, dB L_{A90} - all-time period

Receiver ID	Hub height wind speed, m/s [1]												
	3	4	5	6	7	8	9	10	11	12	13	14	15
All-time period													
28	29.0	29.1	29.5	30.2	31.1	32.2	33.3	34.4	35.5	36.4	37.1	37.5	37.5
95	27.9	28.6	29.6	30.7	32.0	33.4	34.8	36.4	37.9	39.4	40.9	42.2	43.5
102 (S)	22.8	23.3	23.9	24.7	25.6	26.7	27.9	29.2	30.5	32.0	33.5	35.0	36.6
112 (S)	25.2	25.4	26.0	26.7	27.6	28.8	30.1	31.5	33.1	34.8	36.6	38.5	40.4
113	- [2]	28.7	28.8	29.2	29.9	30.7	31.8	32.9	34.2	35.5	36.9	38.3	39.7
119	28.3	28.5	29.0	29.8	30.9	32.0	33.2	34.5	35.7	36.7	37.6	38.3	38.6
120	29.1	29.9	30.8	31.6	32.5	33.3	34.2	35.0	35.9	36.8	37.7	38.7	39.6
124	- [2]	24.2	24.3	24.8	25.6	26.6	27.9	29.3	31.0	32.8	34.6	- [3]	- [3]
131	24.7	24.9	25.4	26.1	27.0	28.1	29.4	30.9	32.6	34.3	36.2	38.2	40.3
132	24.6	25.1	26.2	27.5	29.2	31.0	32.9	34.9	36.7	38.4	39.8	40.9	41.6
141	- [2]	23.7	24.0	24.7	25.8	27.4	29.2	31.3	33.6	36.1	38.7	41.3	43.9
Night period													
28	- [2]	- [2]	23.9	24.4	25.4	26.7	28.2	29.8	31.2	32.5	33.4	33.8	- [3]
95	- [2]	19.3	19.6	20.2	21.1	22.4	24.0	25.8	27.9	30.3	32.8	35.6	38.5
102 (S)	- [2]	17.0	17.2	17.7	18.6	19.8	21.2	22.8	24.6	26.5	28.6	30.7	32.8
112 (S)	20.1	20.1	20.3	20.8	21.6	22.7	24.0	25.5	27.2	29.1	31.2	33.5	35.9
113	- [2]	24.8	24.8	25.0	25.5	26.2	27.1	28.2	29.5	30.8	32.3	33.9	35.6
119	- [2]	18.8	18.9	19.4	20.3	21.4	22.7	24.2	25.9	27.8	29.8	31.9	34.0
120	21.0	21.3	21.8	22.6	23.5	24.5	25.5	26.5	27.4	28.2	28.9	29.3	29.4
124	- [2]	19.7	19.8	20.2	20.9	22.0	23.2	24.7	26.4	28.3	30.2	- [3]	- [3]
131	- [2]	19.5	19.6	20.1	21.0	22.2	23.8	25.6	27.6	29.8	32.2	34.7	37.3
132	- [2]	18.8	18.9	19.4	20.3	21.6	23.2	25.0	26.9	29.0	31.1	33.3	35.3
141	- [2]	19.2	19.4	20.0	20.9	22.2	23.8	25.7	27.9	30.3	33.0	35.7	38.7

(S) Stakeholder receiver

1 166 m above ground level at 714476 E, 5824117 N (MGA94 Zone 54)

2 Regression lines indicate an increase of background noise levels as hub height wind speed decreases. As this feature is deemed to be an artifact of the regression analysis process due to the large scatter of points at low hub height wind speeds, the regression lines have been truncated at their lowest values.

3 Regression lines indicate a decrease of background noise levels as hub height wind speed increases. As this feature is deemed to be an artifact of the regression analysis process due to the large scatter of points at high hub height wind speeds, the regression lines have been truncated at their highest values.

7.0 WIND TURBINE NOISE ASSESSMENT

7.1 Assessment criteria

The assessment criteria detailed in NZS 6808 apply to noise levels at noise sensitive locations and consist of a combination of base limits (i.e. fixed value limits irrespective of wind speed) and relative limits which are defined by an allowable margin above the background noise (i.e. limits which vary with wind speed). The value of the base limit depends on whether there are high amenity areas near the Project and whether there are receivers involved with the Project. These factors are discussed in the following subsections.

7.1.1 High amenity

In accordance with NZS 6808, an assessment is required for all receivers located within the predicted 35 dB L_{A90} contour to determine whether a high amenity noise limit may be justified. This is based on a two-step approach:

1. A land zoning review to determine whether the planning guidance for the area warrants consideration of a high amenity noise limit. If it does, then the second step should be considered.
2. A review of the relationship between the background noise levels and predicted noise levels, using the calculation set out in clause C5.3.1 of NZS 6808.

Based on the predicted noise level contours presented subsequently in Section 7.4, and the zoning map for the area presented in Appendix E, the area within the predicted 35 dB L_{A90} contour is identified as Farming Zone.

Section 5.2 of the Technical Guideline states that the high amenity limit in Victoria 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), and Green Wedge A Zone (GWAZ).
- not apply to dwellings in the Farming Zone (FZ).
- not be applied in any location where background sound levels are already affected by other specific sources such as road traffic noise, based on Section 5.3.1 of NZS 6808.
- only apply for WEF wind speeds up to and including 6 m/s during evening and night-times.
- be applicable only when there is no agreement made in accordance with regulation 131A.

Based on the above, the high amenity noise limit is not justified for the Project as all receivers within the 35 dB L_{A90} noise contour are within a Farming Zone (FZ).

7.1.2 Stakeholder receivers

Stakeholder receivers consist of receivers within the Project boundary and receivers outside the Project boundary where noise agreements are in place.

The noise limits defined in NZS 6808 do not apply at stakeholder receivers (see earlier discussion in Section 5.1 and further information in Appendix C5). However, consistent with the Victorian Wind Energy Guidelines, regulation 131BA of the EP Regulations states that receivers with a noise agreement is in place are subject to a noise limit of:

- the noise limit specified in the agreement, where a noise agreement between the owner or operator of a wind energy facility and a landowner is made before 1 November 2021
- 45 dB L_{A90} or background noise (L_{A90}) + 5 dB, whichever is the greater, where a noise agreement between the owner or operator of a wind energy facility and a landowner is made on or after 1 November 2021.

The proponent has advised that noise agreements are currently in place or proposed between the landowners and the proponent at 17 receivers outside the Project boundary, as presented in Section 5.1. The noise agreements set a limit of 45 dB or background + 5 dB, whichever is higher.

Further, consistent with the Victorian Wind Energy Guidelines, it is recommended that operational wind turbine noise levels not exceed a reference level of 45 dB L_{A90} or background noise (L_{A90}) +5 dB at the 12 stakeholder receivers within the Project boundary.

7.1.3 Applicable noise limits

Accounting for the conclusions of the assessment of high amenity detailed in the previous section, the applicable noise limits at noise sensitive locations are detailed in Table 3.

Table 3: Applicable noise limits, dB L_{A90}

Receiver status	Noise limit
Non-stakeholder	40 dB or background L_{A90} + 5 dB, whichever is the greater
Stakeholder receiver located outside the Project boundary with a noise agreement	45 dB or background L_{A90} + 5 dB, whichever is the greater
Stakeholder receiver within the Project boundary	Not applicable Reference level of 45 dB or background L_{A90} + 5 dB, whichever is the greater

At this stage in the Project, the applicable base (minimum) noise limits and reference levels presented above have been adopted for this assessment. This approach is conservative, as the background noise monitoring results only increases the noise limits above the applicable base limit values.

7.2 Candidate wind turbine models

The final wind turbine model for the site would be selected after a tender process to procure the supply of wind turbines. The final selection would be based on a range of design requirements including achieving compliance with the planning permit noise limits at surrounding receivers.

Accordingly, to assess the proposed wind turbines at this stage in the Project, it is necessary to consider candidate wind turbine models that are representative of the size and type of wind turbines being considered. The purpose of the candidate wind turbine models is to assess the viability of achieving compliance with the applicable noise limits, based on noise emission levels that are typical of the size of wind turbines being considered for the site.

For this assessment, the proponent has nominated the Vestas V162-6.8MW and Vestas V172-7.2MW as the candidate wind turbine models.

These models are variable speed wind turbines, with the speed of rotation and the amount of power generated by the turbines being regulated by control systems which vary the pitch of the wind turbine blades (the angular orientation of the blade relative to its axis).

This assessment has been based on the wind turbines operating in unconstrained modes of generation (i.e. without noise reduced operating modes) and with blade serrations. Blade serrations are now routinely used to reduce wind turbine noise emissions, and it is understood that their use is now the market standard for wind turbines being offered in the Australian market.

Details of the assessed candidate wind turbine models are provided in Table 4.

Table 4: Selected candidate wind turbine models

Item	V162-6.8MW	V172-7.2MW
Make	Vestas	Vestas
Model	V162	V172
Rotor diameter	162 m	172 m
Operating mode	PO6800 [1]	PO7200 [2]
Rated power	6.8 MW	7.2 MW
Hub height	166 m	166 m
Blade serrations	Yes	Yes
Cut-in wind speed (hub height)	3 m/s	3 m/s
Rated power wind speed (hub height)	13 m/s	13 m/s
Cut-out wind speed (hub height)	25 m/s	25 m/s

1 'PO6800' is a manufacturer designation which indicates a Power Optimisation mode to achieve a power output of 6,800 kW – this is an unconstrained mode of operation (i.e. without noise reduction)

2 'PO7200' is a manufacturer designation which indicates a Power Optimisation mode to achieve a power output of 7,200 kW – this is an unconstrained mode of operation (i.e. without noise reduction)

The hub height detailed above is suitable for noise assessment purposes. The final hub height of the selected wind turbine model may differ slightly. However, the magnitude of the potential change is expected to be minor and inconsequential with respect to predicted noise levels.

The final wind turbine hub height would be used for updated pre-construction noise modelling once the wind turbine layout has been finalised and the final wind turbine model selected (pre-construction noise modelling would be included in the noise management plan prepared in accordance with the EP Regulations).

7.3 Wind turbine noise emissions

7.3.1 Sound power levels

The noise emissions of the wind turbines are described in terms of the sound power level for different wind speeds. The sound *power* level is a measure of the total sound energy produced by each wind turbine and is distinct from the sound *pressure* level which depends on a range of factors such as the distance from the wind turbine.

Sound power level data for each candidate wind turbine model, including sound frequency characteristics, has been sourced from the manufacturers' documents listed in Table 5.

Table 5: Candidate wind turbine model specification documents

Candidate model	Document No.	Date	Title
V162-6.8MW	0111-1246_03	13 Jan 2023	*Third octave noise emission EnVentus™ V162-6.8MW 50/60 Hz*
V172-7.2MW	0128-4336_01	29 Nov 2024	*Third octave noise emission – EnVentus V172-7.2 MW 50/60 Hz*

Based on the data sourced from the manufacturer's specification, the noise modelling for this assessment involved:

- conversion of third octave band level to octave band levels
- adjustment by addition of +1.0 dB at each wind speed to provide a margin for typical values of test uncertainty.

The overall A-weighted sound power levels (including the +1 dB addition for uncertainty) as a function of hub height wind speed are presented in Table 6 with the octave band values presented in Table 7. These represent the total noise emissions of the wind turbines, including the secondary contribution of ancillary plant associated with each turbine (e.g. cooling fans).

Table 6: Sound power levels (including the +1.0 dB addition) versus hub height wind speed, dB L_{WA}

Candidate model	Hub height wind speed, m/s											
	4	5	6	7	8	9	10	11	12	13	14	15
V162-6.8MW	95.0	95.0	96.0	99.3	102.5	104.3	104.3	104.4	104.8	105.1	105.3	105.5
V172-7.2MW	98.6	98.7	100.5	103.2	106.0	108.1	108.8	108.8	108.8	108.8	108.8	108.8

Table 7: Octave band sound power levels, dB L_{WA} [1]

Candidate model	Octave band centre frequency, Hz									
	31.5	63	125	250	500	1000	2000	4000	8000	Total
V162-6.8MW[1]	76.0	88.5	96.4	99.7	100.2	98.7	94.2	86.7	76.0	105.5
V172-7.2MW[2]	79.3	90.8	97.8	102.4	101.4	102.0	100.9	99.3	86.5	108.8

1 Based on one-third octave band levels at 15 m/s

2 Based on one-third octave band levels at 10 m/s

These sound power levels are also illustrated in Appendix H.

The overall A-weighted sound power level provides a useful summary of a wind turbine's noise emission. However, when predicting noise levels at distant receivers, the frequency distribution of the sound power level must be considered. Sound attenuation over distance is frequency dependent — higher frequencies attenuate more strongly than lower frequencies, primarily through atmospheric absorption (see the air absorption coefficients in Appendix I).

Two sources with similar overall sound power levels can therefore produce different noise levels at a receiver where their spectra differ. A source with more of its sound power in the higher frequency bands loses proportionally more of that energy over the propagation path. Predicted noise levels at receivers consequently depend on the octave band spectrum of each candidate model, not on the overall A-weighted sound power level alone.

Industry research conducted with reference to sound power data for a range of wind turbine models has shown that there is not a clear relationship between wind turbine size, or power output, and the noise emission characteristics of a given wind turbine model.[7] In practice, the overall noise emissions of a wind turbine are dependent on a range of factors, including the wind turbine size and power output, and other important factors such as the blade design and rotational speed of the wind turbine. Therefore, while wind turbine sizes and power ratings of contemporary wind turbines have increased, the noise emissions of the wind turbines are comparable to, or lower than, previous generations of wind turbines as a result of design improvements (notably, measures to reduce the speed of rotation of the wind turbines, and enhanced blade design features such as serrations for noise control).

7.3.2 Special audible characteristics

Special audible characteristics relate to potential tonality, amplitude modulation and impulsiveness of a wind turbine.

Information concerning potential tonality is often limited at the planning stage of a wind farm, and test data for tonality is presently unavailable for the selected candidate wind turbine models. However, the occurrence of tonality in the noise of contemporary multi-megawatt wind turbine designs is unusual. This is supported by evidence of operational wind farms in Australia which indicates that the occurrence of tonality at receivers is atypical.

Amplitude modulation and impulsiveness are not able to be predicted, however the evidence of operational wind farms in Australia indicates that their occurrence is limited and atypical.

Given the above, adjustments for special audible characteristics have not been applied to the predicted noise levels presented in this assessment. This is consistent with the recommendations of the Technical Guideline which states that it is not necessary to apply a penalty for special audible characteristics during the prediction of wind farm noise levels.

Notwithstanding this, the subject of special audible characteristics would be addressed in subsequent assessment stages for the project, following approval of the wind farm, and again following construction of the wind farm.

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7 Van den Berg, Frits & Koppen, Erik & Boon, Jaap & Ekelschot-Smink, Madelon. - *Sound power of onshore wind turbines and its spectral distribution. Sound & Vibration. 59* - 2025

7.4 Predicted noise levels

7.4.1 Receivers

Sound levels in environmental assessment work are typically reported to the nearest integer to reflect the practical use of measurement and prediction data. However, in the case of wind farm layout design, significant layout modifications may only give rise to fractional changes in the predicted noise level. This is a result of the relatively large number of sources influencing the total predicted noise level, as well as the typical separating distances between the wind turbine locations and surrounding assessment positions. It is therefore necessary to consider the predicted noise levels at a finer resolution than can be perceived or measured in practice. It is for this reason that the levels presented in this section are reported to one decimal place.

Noise levels from the proposed wind farm have been predicted using the sound power level data detailed in Section 7.3.1 for the selected candidate wind turbine models and are summarised in Table 8 for the hub height wind speed which results in the highest predicted noise levels for each candidate wind turbine model.

Predicted noise levels at receivers within the project boundary, where noise limits do not apply, are presented for information only.

The locations of the predicted 30, 35, 40 and 45 dB L_{A90} noise contours are illustrated in Figure 5 and Figure 6, for the hub height wind speed which results in the highest predicted noise levels for each candidate wind turbine model.

Predicted noise levels for each integer wind speed are tabulated in Appendix G for all considered receivers, including receivers where the highest predicted noise level is below 30 dB L_{A90}.

Table 8: Highest predicted noise level at receivers with predicted levels 30 dB L_{A90} or above

Receiver	V162-6.8MW	V172-7.2MW
Non-stakeholder receivers		
17	28.5	30.5
21	28.7	30.8
23	28.4	30.4
26	28.8	30.8
27	31.1	33.2
28	33.1	35.3
31	28.7	30.7
35	29.3	31.4
36	29.1	31.2
37	29.0	31.1
40	32.7	34.8
43	32.8	34.9
45	33.7	35.8
59	34.3	36.5

Receiver	V162-6.8MW	V172-7.2MW
60	29.5	31.6
63	29.5	31.5
64	29.8	31.8
82	35.4	37.5
95	30.1	32.2
99	37.1	39.2
101	31.4	33.5
113	33.9	36.0
114	32.2	34.3
119	33.0	35.1
120	33.9	36.1
121	32.4	34.5
123	30.8	32.9
124	37.3	39.5
125	30.2	32.3
131	36.6	38.8
138	31.9	34.1
139	32.0	34.1
140	32.2	34.3
141	34.3	36.4
171	31.2	33.3
Stakeholder receivers outside the Project boundary		
84 (S)	40.9	43.3
88 (S)	35.1	37.3
96 (S)	30.2	32.2
98 (S)	34.6	36.7
104 (S)	37.3	39.5
105 (S)	37.4	39.6
106 (S)	37.6	39.8
108 (S)	31.8	33.9

Receiver	V162-6.8MW	V172-7.2MW
109 (S)	31.5	33.6
110 (S)	31.2	33.2
112 (S)	31.4	33.4
118 (S)	34.9	37.0
122 (S)	30.9	33.1
135 (S)	35.3	37.5
142 (S)	36.7	38.9
281 (S)	36.6	38.8
1148 (S)	34.9	37.1
Stakeholder receivers within the Project boundary		
39 (S)	35.2	37.4
97 (S)	38.7	40.9
100 (S)	34.0	36.1
102 (S)	37.4	39.6
107 (S)	39.6	41.9
111 (S)	47.0	49.7
117 (S)	38.1	40.3
128 (S)	38.9	41.1
129 (S)	39.1	41.4
132 (S)	38.5	40.8
137 (S)	32.9	35.1
143 (S)	39.4	41.7

(S) Stakeholder

The results presented in Table 8 demonstrate that wind turbine noise levels associated with the Project are predicted to comply with the noise limits for all receivers for both candidate wind turbine models. Specifically, the predicted operational wind turbine noise levels are:

- below the applicable base noise limit of 40 dB L_{A90} at all non-stakeholder receivers by at least 0.5 or 2.7 dB, depending on the candidate wind turbine model.
- below the applicable base noise limit of 45 dB L_{A90} at all stakeholder receivers outside the Project boundary by at least 1.7 or 4.1 dB, depending on the candidate wind turbine model
- below the reference base noise level of 45 dB L_{A90} at all but one stakeholder receiver within the Project boundary by at least 3.1 or 5.4 dB, depending on the candidate wind turbine model.

  The proponent advised that receiver 111 is to be demolished under contract with the landowner.

MARSHALL DAY Acoustics

Figure 5: Highest predicted noise level contours, dB L_{A90} – V162-6.8MW

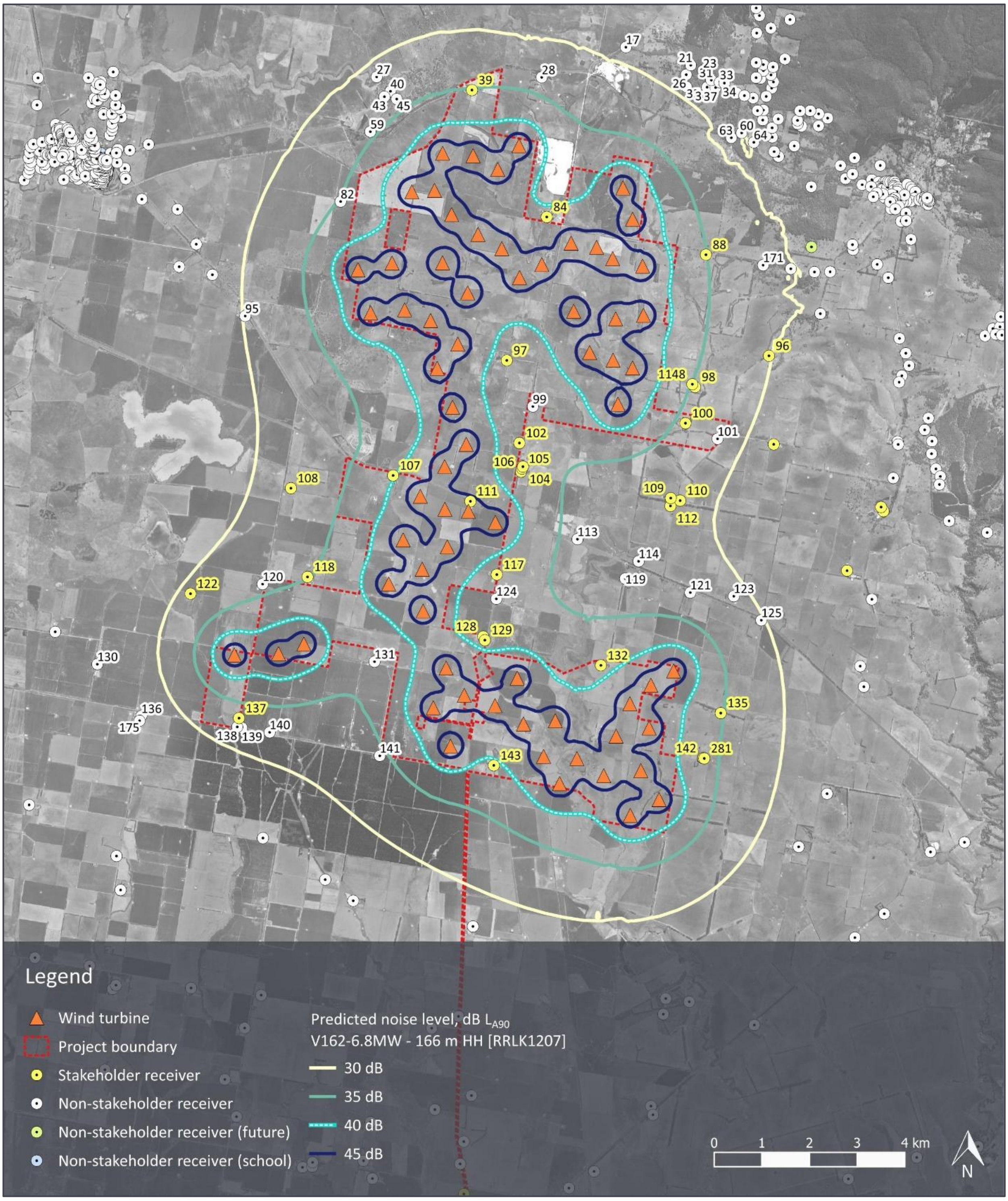
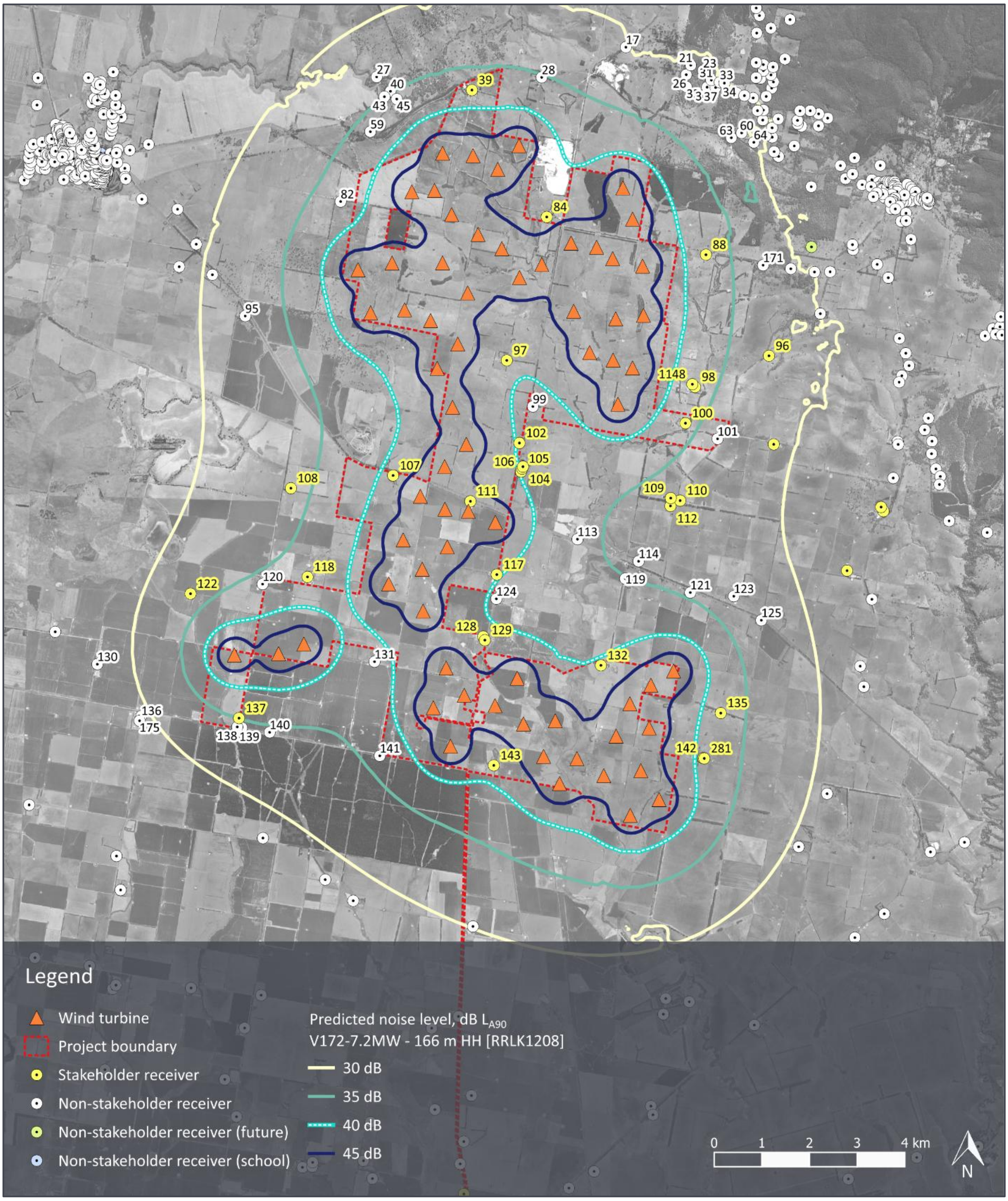


Figure 6: Highest predicted noise level contours, dB L_{A90} – V172-7.2MW



7.4.2 Natural areas

Wind turbine noise levels in natural areas that are associated with the operation of the Project are likely to be audible on some occasions at locations where the predicted wind turbine noise levels are between 30 and 40 dB L_{A90}. At locations where predicted wind turbine noise levels are higher than 40 dB L_{A90}, the Project is expected to be regularly audible when the wind turbines are operating. At locations where the predicted noise levels are approaching, or greater than 45 dB $L_{A90,}$ wind turbine noise levels would be clearly audible when the wind farm is operating.

Conversely, where the predicted noise levels are below 30 dB L_{A90}, wind turbine noise may still be audible at times, but it would be very dependent on wind conditions and the characteristics of the background environment. At levels below 30 dB L_{A90}, instances of audible wind turbine noise would usually be difficult to distinguish from the ambient sound environment. As a point of context, while the background noise monitoring was conducted at receivers rather than natural areas, the data presented in Section 6.0 provides a general indication of the range of background noise levels in the surrounding area. At wind speeds of around 7-8 m/s when the turbines are producing sound power levels approaching their maximum noise emissions, the background noise levels are typically comparable to or higher than 30 dB L_{A90}.

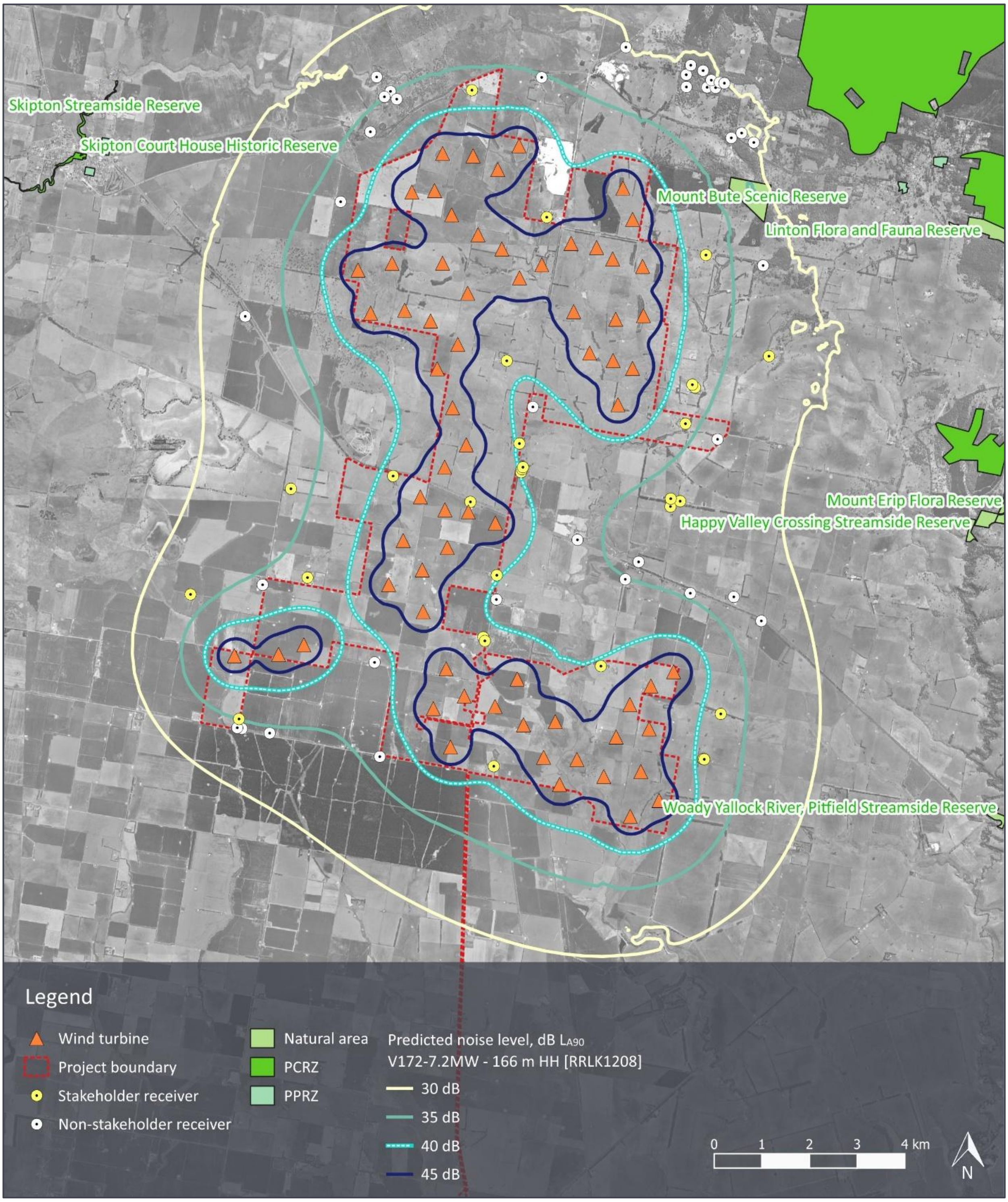
As an indication, wind turbine noise levels above 30 dB L_{A90} are predicted to occur in areas within approximately 2 km of the Project's wind turbines.

The distribution of wind turbine noise levels in the identified natural areas is presented in Figure 7 for the candidate wind turbine model resulting in the highest predicted noise levels (V172-7.2MW). The noise modelling indicates that the natural area most likely to experience regular wind turbine noise is the Mount Bute Scenic Reserve, located approximately 2.1 km from the nearest proposed wind turbine. Wind turbine noise levels are predicted approximately between 28 and 35 dB L_{A90}, depending on the candidate wind turbine model.

At farther natural areas, wind turbine noise levels are predicted below 20 dB L_{A90}.

The assessment indicates that it is unlikely that wind turbine noise in the nearby natural areas would be relevant to the ERS environmental value (i.e. a value which solely relates to the experiences of people visiting these areas).

Figure 7: Predicted operational wind turbine noise levels and identified natural areas – V172-7.2MW



7.5 Cumulative assessment

The noise limits determined in accordance with NZS 6808 apply to the total combined operational wind turbine noise level, including the contribution of any neighbouring wind farm developments. The assessment has therefore considered other wind farm projects in the surrounding area.

7.5.1 Stockyard Hill Wind Farm

The Stockyard Wind Farm commenced operation in December 2020 and comprises 149 Goldwind 3S wind turbines with a hub height of 110 m.[8]

The noise emissions for the Goldwind 3S wind turbines have been represented for this study with data sourced from the pre-development noise assessment report.[9]

The planning permit establishes a minimum operational noise limit of 40 dB for non-stakeholder receivers around the wind farm. [10]

7.5.2 Chepstowe Wind Farm

The Chepstowe Wind Farm commenced operation in April 2015 and comprises 3 Senvion MM92 wind turbines with a hub height of 80 m.[11]

The noise emissions for the Senvion MM92 wind turbines have been represented for this study with data sourced from the noise assessment report for the Maroona Wind Farm[12].

The planning permit establishes a minimum operational noise limit of 40 dB for non-stakeholder receivers around the wind farm. [13]

7.5.3 Berrybank Wind Farm

The Berrybank Wind Farm commenced operation in July 2021 and comprises 43 Vestas V136-4.2MW wind turbines with a hub height of 112 m.[14]

The noise emissions for the V136-4.2MW wind turbines have been represented for this study with data sourced from a publicly available noise assessment report[15].

The planning permit establishes a minimum operational noise limit of 40 dB for non-stakeholder receivers around the wind farm. [16]

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[8] https://www.stockyardhillwindfarm.com.au/

[9] MDA Report Rp 001 R04 20170840 *Stockyard Hill Wind Farm – Pre-development noise assessment*, dated 20 Dec. 2017

[10] Planning Permit no. PL-SP/05/0548/B

[11] https://chepstowewindfarm.com.au/

[12] MDA statement of evidence to VCAT Ev 001 2010327 dated 28 January 2011

[13] Planning Permit no. PA1676/10

[14] https://www.berrybankwindfarm.globalpower-generation.com.au/

[15] MDA Report Rp 002 R02 20180495 *BBWF – Pre-construction noise assessment*, dated 8 April 2019

[16] Planning Permit no. 20092821-A

7.5.4 Golden Plains Wind Farm

The Golden Plains Wind Farm is currently under construction, comprising up to 228 turbines with a maximum tip height of 230 m. [17]

The noise emissions for the V162-6.0MW wind turbines have been represented for this study with data sourced from a publicly available noise assessment report.[18]

The planning permit establishes a minimum operational noise limit of 40 dB for receivers around the wind farm.

7.5.5 Assessment

To inform the assessment of potential cumulative noise considerations, reference is made to Clause 5.6.4 of NZS 6808 which states:

> *For the purposes of 5.6.1, if the predicted wind farm sound levels for a new wind farm are at least 10 dB below any existing wind farm sound levels permitted by any resource consent or plan, then the cumulative effect shall not be taken into account.*

Additional contextual information is provided in the commentary to Clause 5.6.4 which notes:

> *If an existing wind farm sound level is say 40 dB and the predicted wind farm sound level for a new wind farm is say 30 dB then the combined level would be 40.4 dB. This increase of less than 0.5 dB cannot be reliably measured and would be undetectable to people, and will therefore not give rise to any adverse cumulative effect.*

Based on this guidance, a preliminary simplified assessment of potential cumulative noise considerations can be made by comparing the individual predicted 30 dB L_{A90} contours of each wind farm operating in isolation, as presented in Figure 8.

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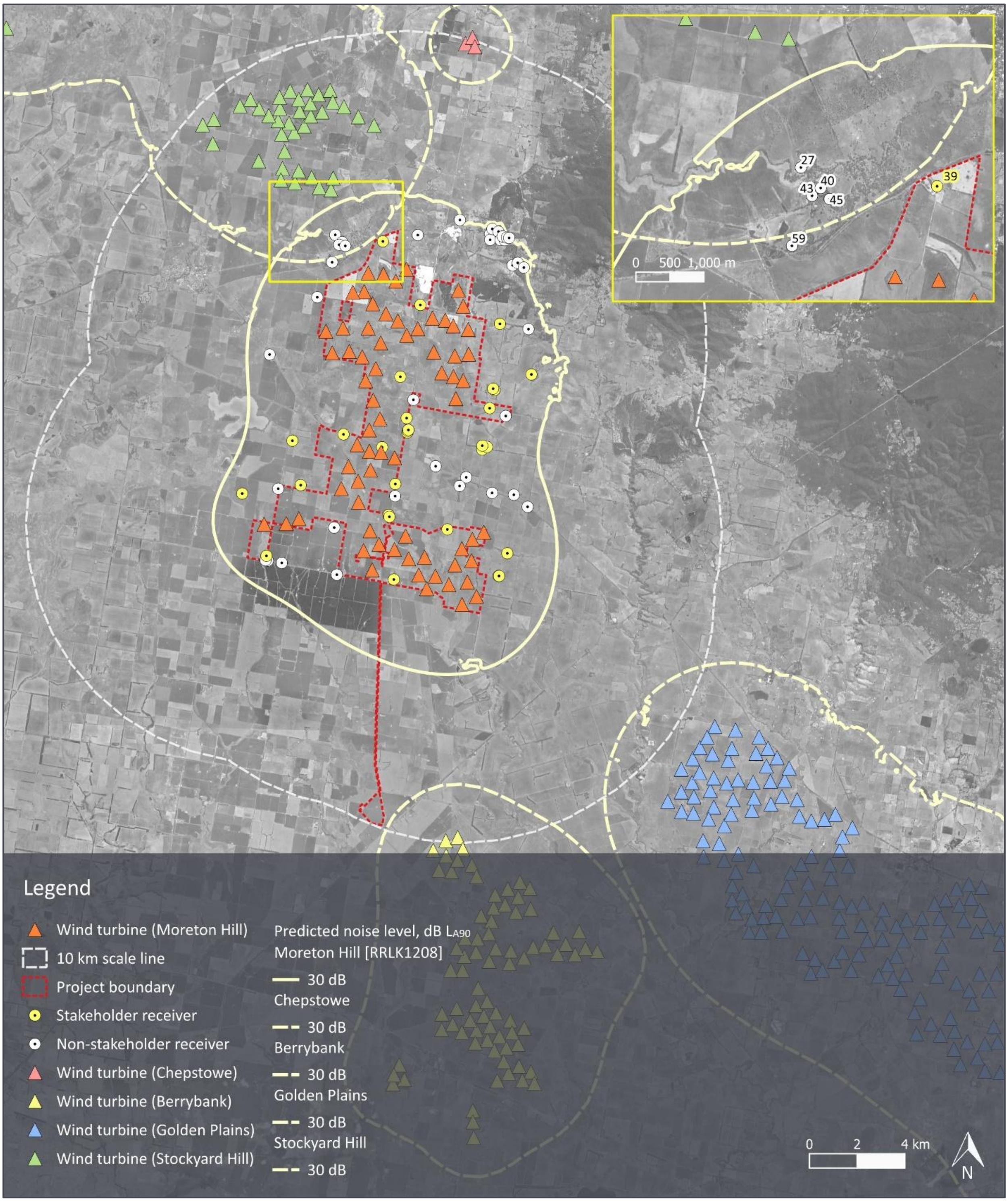
17 https://goldenplainswindfarm.com.au/about-golden-plains-wind-farm/

18 MDA Report Rp 001 R02 20200919 *Golden Plains Wind Farm - Environmental Noise Assessment*, dated 4 Jan. 2020

Figure 8: Predicted 30 dB L_{A90} contours for the Project (V172-7.2MW) and neighbouring wind farms



The results demonstrate that the predicted 30 dB L_{A90} contour of the Project (using the candidate turbine model resulting in the highest predicted noise levels, V172-7.2MW) do not overlap with the predicted 30 dB L_{A90} contour of the Berrybank, Chepstowe and Golden Plains wind farms. Based on this finding, the following can be concluded for these 3 neighbouring wind farms:

- At any receiver where the predicted noise level of one of the wind farms is between 30 and 40 dB, the predicted noise level from an adjoining wind farm will be less than 30 dB, and significantly lower in most cases
- At any receiver where the predicted noise level from one of the wind farms approaches the 40 dB base noise limit applicable to each site, the predicted noise level associated with each of neighbouring wind farms will be more than 10 dB lower. Based on the guidance of NZS 6808, the cumulative effect does not need to be taken in account for the nearest receivers to each of these wind farm developments.

The predicted noise levels therefore demonstrate that cumulative wind farm noise considerations between the Moreton Hill, Berrybank, Chepstowe and Golden Plains wind farms are not applicable. Specifically, the noise contribution of the Berrybank, Chepstowe and Golden Plains wind farms is sufficiently low to be inconsequential to the noise assessment for the Project. Conversely, the predicted noise contribution of the Project at the receivers in the vicinity of the Berrybank, Chepstowe and Golden Plains wind farms would not affect the compliance outcomes for these developments.

As a visual guide to identify potential cumulative noise considerations between the Project and the Stockyard Hill Wind Farm, the inset of Figure 8 presents the overlap area between the respective predicted 30 dB L_{A90} noise contours.

The predicted noise levels presented in Table 9, at the receivers identified in the overlap area, are for the wind speeds which give rise to the highest noise emissions from each site respectively. It is also noted that the noise level contours are predicted on the basis of downwind propagation from each turbine; in most instances where cumulative noise is considered, a noise sensitive receiver cannot be simultaneously downwind of all wind turbines of adjoining projects. The predictions are therefore conservative for the purpose of considering cumulative noise levels. [19]

Table 9: Cumulative assessment

Receiver	Predicted noise level, dB L_{A90} Moreton Hill only	Stockyard Hill only [1]	Cumulative	Change in compliance outcome due to cumulative effects
27	33.2	33.0 [2]	36.1	No
40	34.8	31.6	36.5	No
43	34.9	31.8	36.6	No
45	35.8	31.1	37.1	No

1 Sourced from MDA Report Rp 001 R04 20170840 *Stockyard Hill Wind Farm – Pre-development noise assessment*, dated 20 Dec. 2017

2 Estimated value as receiver 27 was not presented in MDA Report Rp 001 R04 20170840

It can be concluded from the above table that the compliance outcome for both the Project and the Stockyard Hill Wind Farm would not be affected by the noise contribution from the other project.

[19] By a margin of up to 3 dB when compared to downwind predictions from each wind farm individually. This is distinct to variation of noise levels when a receiver is upwind of each wind farm when noise levels would be significantly lower than the downwind predictions.

8.0 SUBSTATION AND BESS NOISE ASSESSMENT

This section presents an assessment of operational noise from the Project's substation and battery energy storage system (BESS), including potential cumulative noise considerations.

8.1 Description

Related infrastructure associated with the project is understood to comprise a substation and a 100 MW / 400 MWh BESS.

The BESS is proposed to consist of:

- 80 battery units
- 20 inverters, each connected to a medium voltage (MV) coupling transformer (5 MVA each)
- 1 high voltage (HV) transformer (125 MVA).

The substation is proposed to consist of a single 500 MVA transformer.

8.2 Assessment criteria

The following obligations apply under the EP Act and EP Regulations:

- Operation of the substation and BESS must not cause noise that is prescribed to be unreasonable or assessed to be unreasonable according to the listed factors set out in the EP Act.
- The risk of harm from noise associated with the substation and BESS must be minimised so far as reasonably practicable, in accordance with the GED under the EP Act.
- Frequency spectrum is a prescribed factor under the EP Regulations and, as a result, an objective assessment of low frequency may inform an assessment of whether the noise is unreasonable.

In terms of assessment requirements, the EP Regulations specify that the prediction, measurement, assessment and analysis of noise for commercial, industrial and trade premises must be conducted in accordance with the Noise Protocol.

The Noise Protocol procedure for determining noise limits depends on whether the noise source or the receivers are located in a rural or urban area.

In rural areas, applicable noise limits are generally based on zone levels determined according to the land zoning of the area in which the noise source and receivers are located. These zone levels are then adjusted, where appropriate, for a range of factors.

Adjustments for 'background relevant areas' are not warranted in this instance, as the background noise levels during the relevant assessment conditions for the Project's substation and BESS (i.e. low wind speeds) are low.

Considering that the land zoning is continuous between the Project's substation and BESS, and the receivers, a distance adjustment is not applicable.

The Victorian Planning Provisions include the following in its definition of a utility installation:

> *Land used* [...] *to transmit, distribute or store power, including battery storage*

As such, and considering the BESS and substation are located on land designated as Farming Zone (FZ) (see land zoning map in Appendix E), the noise limits applicable at the nearest receivers are summarised in Table 10.

Table 10: Noise Protocol time periods and noise limits, dB ENL[20]

Period	Day of week	Start time	End time	Noise limit
Day	Monday- Saturday	0700 hrs	1800 hrs	45
Evening	Monday- Saturday	1800 hrs	2200 hrs	39
	Sunday, Public holidays	0700 hrs	2200 hrs	
Night	Monday-Sunday	2200 hrs	0700 hrs	34

As the substation and the BESS have the potential to operate at any time in a 24 hour day and across 7 days a week. Meeting the applicable night-time noise limit of 34 dB ENL infers meeting the noise limits during all other time periods.

8.3 Noise emissions

8.3.1 Substation

In lieu of measured sound power level data for a specific transformer selection, reference has been made to Australian Standard AS 60076-10:2009 *Power transformers – Part 10: Determination of sound levels* (AS 60076-10:2009) which provides a method for estimating transformer sound power levels. Specifically, Figure ZA1 from AS 60076-10:2009 has been used to determine the estimated sound power level of 96 dB L_{WA} for the proposed 500 MVA transformer. This aligns with the 'reduced' maximum level as provided in the standard.

AS 60076-10:2009 does not provide estimated sound frequency spectra for transformer noise. Spectral data for the transformer was estimated by applying corrections from Table 11.27 *Location 1a for outdoor transformer noise* of Bies and Hansen to the estimated 'reduced' maximum sound power level of 96 dB L_{WA}. [21]

The maximum noise levels must be provided to the transformer manufacturer at the time of procurement.

The maximum noise levels include noise from all parts of the transformer, including the tank and cooling system. Transformers typically exhibit tonal characteristics at source. On this basis evaluation of tonality at the noise sensitive receivers must be considered. This is addressed in subsequent sections of the report.

For the purposes of noise modelling, the transformer has been located at the centre of the area designated for the substation in the absence of more detailed plans.

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[20] The effective noise level (ENL) of commercial or industrial noise determined in accordance with the Noise Protocol. This is L_{Aeq} noise level over a half-hour period, adjusted for the character of the noise.
Adjustments are made for tonality, intermittency, and impulsiveness.

[21] Bies, & Hansen, C. H. (2009). *Engineering noise control: theory and practice (Fourth edition.).* p. 601

8.3.2 Battery energy storage system

At this stage of the Project, a detailed BESS design has not been established. Preliminary information available at this stage of the project has been used to undertake a quantitative assessment of the BESS. Some of this information has been derived from generic input data provided by the proponent and has not been verified by MDA. While the current information presents the best overview of the BESS noise profile at this stage, it will be important for the proponent to validate and confirm the input assumptions as the design progresses.

In the event that material changes to the input data occur, an update of the assessment will be required.

The relevant data used for noise modelling of the BESS is summarised in

Table 11: Sound power levels for Project BESS equipment items, dB L_{WA}

Equipment item	Sound power level
Inverter	82 [1]
Battery unit	90 [2]
5 MVA transformer	76 [3]
125 MVA transformer	87 [4]

1 Octave band sound power level information provided to MDA by the proponent to represent Power Electronics 690 inverter model. The overall A-weighted sound power level has been calculated by MDA based on the octave band data provided. The source of the information has not been reviewed by MDA and the input levels are recommended to be confirmed as the design progresses.

2 CATL EnerX unit with cooling fan operating at 90% speed.

3 Sound power level derived in accordance with AS 60076-10:2009 Annex ZA 'standard' maximum with spectrum derived with reference to Bies and Hanson.

4 Sound power level derived in accordance with AS 60076-10:2009 Annex ZA 'reduced' maximum with spectrum derived with reference to Bies and Hanson.

Octave band spectral data for each of the BESS equipment items is provided in Table 12.

Table 12: BESS equipment spectral sound power data, dB L_W

	Octave band centre frequency, Hz							
Item	**31.5**	**63**	**125**	**250**	**500**	**1000**	**2000**	**4000**
Inverter	76	77	76	82	82	75	71	64
Battery unit	-	85	96	88	85	86	81	75
5 MVA transformer	-	78	80	75	75	69	64	59
125 MVA transformer	-	90	92	87	87	81	76	71

While some of the equipment may exhibit some acoustic directionality, the information available to MDA does not provide sufficient detail in order to robustly represent this in a noise model. Further, the actual effect of individual equipment directivity on the noise emissions of the site as a whole will be influenced by equipment orientation and acoustic reflections.

Therefore, each equipment item has been modelled as an omni-directional point source at the top of the equipment. This is considered a balanced approach as some directivity effects may result in reduced noise levels.

8.4 Predicted noise levels

8.4.1 Receivers

Predicted noise levels have been determined on the basis of:

- the equipment noise emission data detailed in Section 8.3.
- the ISO 9613-2 noise prediction method described in Section 4.3.

An adjustment of +2 dB has been applied to the predicted noise levels to account for tonal noise from the facility.

The nearest receivers and the predicted effective noise level (including tonality adjustment) are detailed in Table 13 accounting for the substation and each BESS scenario.

Table 13: Substation and BESS predicted noise levels, dB ENL

Receiver	Total predicted noise level [1]
118	24
124	30
128	30
129	30
131	27

1 Effective noise level including +2 dB tonality adjustment.

The results indicate cumulative noise levels from the substation and BESS are predicted below the night noise limit at the nearest receiver, by at least 4 dB.

It will be critical to review any updated information as the Project progresses to verify these conclusions. This may include updated manufacturer data for equipment (especially inverters) and/or other information relating to layouts, equipment operating duties, equipment capacity and equipment counts.

8.4.2 Natural areas

Noise associated with the operation of the substation and BESS is a relevant consideration for natural areas throughout the life of the Project.

Due to the nature of the operation of these components of the Project, the extent of the areas in which the noise could be audible has the potential to be highly variable. However, natural areas where predicted noise levels are lower than 20 dB L_{Aeq} are not likely to experience audible noise from these noise sources even when daytime background noise levels are low and conditions favour the propagation of sound from the substation and BESS locations.

The identified natural area nearest to the substation and BESS is the Mount Bute Scenic Reserve, located approximately 10 km away. Predicted noise levels from the substation and BESS at this distance are much lower than 10 dB L_{Aeq}. As such, it is unlikely that noise from the substation and BESS be audible at natural areas and would materially compromise the relevant ERS environmental values (i.e. values that solely relate to the experiences of people visiting these areas).

9.0 RECOMMENDED NOISE MANAGEMENT MEASURES

Providing that the operator of a wind energy facility complies with the requirements of Regulation 131C, their obligations with respect to the general environmental duty (GED) under the EP Act will be addressed with regard to wind turbine noise.

Specifically, the operator of the wind facility must:

- ensure that wind turbine noise complies with NZS 6808; and
- implement all applicable actions under Division 5.3 of the EP Regulations to manage and review wind turbine noise from the facility, including:
  - preparation of a noise management plan;
  - conducting noise compliance testing when the wind farm begins operating;
  - preparing annual compliance statements; and
  - conducting verification wind turbine noise monitoring every 5 years.

In addition to the above, the following noise management measures should be implemented as part of the subsequent stages of development:

- The transformer equipment should be specified and selected to achieve noise emissions not exceeding the empirical maximum ‘reduced’ values specified in AS 60076-10:2009 as summarised in Section 8.3.1 and Section 8.3.2.
- The BESS equipment should be specified and selected to achieve the lowest reasonably practicable noise emissions.
- A detailed noise assessment should be prepared by a qualified acoustic consultant, prior to construction, addressing:
  - the final wind turbine selection and layout
  - the final location and equipment selection for the substation and BESS
  - background noise monitoring at the required non-stakeholder receivers
  - compliance with the applicable noise limits at surrounding receivers
  - recommendation of reasonably practicable noise mitigation measures to control noise from the substation and BESS.
- Development of reasonably practicable construction noise mitigation and management measures to be documented in a construction environmental management plan, prior to construction.

APPENDIX A GLOSSARY OF TERMINOLOGY

Term	Definition	Abbreviation
Amplitude modulation	Sound that is characterised by a rhythmic and higher than normal rise and fall in sound level at regular intervals.	-
A-weighting	A method of adjusting sound levels to reflect the human ear's varied sensitivity to different frequencies of sound.	See discussion below this table.
A-weighted 90th centile	The A-weighted pressure level that is exceeded for 90 % of a defined measurement period. It is used to describe the underlying background sound level in the absence of a source of sound that is being investigated, as well as the sound level of steady, or semi steady, sound sources.	L_{A90}
A-weighted average noise level	The equivalent continuous (time-averaged) A-weighted sound level.	L_{Aeq}
Decibel	The unit of sound level.	dB
Hertz	The unit for describing the frequency of a sound in terms of the number of cycles per second.	Hz
Impulsiveness	Sound that is characterised by a distinct and very rapid rise in sound level (e.g. a car door closing or the impact sound of a hammer)	-
MGA94 Zone 54	Coordinates are presented in Map Grid of Australia 1994 (MGA94), Zone 54, referenced to the Geocentric Datum of Australia 1994 (GDA94)	-
Octave Band	A range of frequencies. Octave bands are referred to by their logarithmic centre frequencies, these being 31.5 Hz, 63 Hz, 125 Hz, 250 Hz, 500 Hz, 1 kHz, 2 kHz, 4 kHz, 8 kHz, and 16 kHz for the audible range of sound.	-
Sound power level	A measure of the total sound energy emitted by a source, expressed in decibels.	L_W
Sound pressure level	A measure of the level of sound expressed in decibels.	L_p
Special Audible Characteristics	A term used to define a set group of Sound characteristics that increase the likelihood of adverse reaction to the sound. The characteristics comprise tonality, impulsiveness and amplitude modulation.	SAC
Tonality	A characteristic to describe sounds which are composed of distinct and narrow groups of audible sound frequencies (e.g. whistling or humming sounds).	-

The basic quantities used within this document to describe noise adopt the conventions outlined in ISO 1996-1:2016 *Acoustics - Description measurement and assessment of environmental noise – Basic quantities and assessment procedures*. Accordingly, all frequency weighted sound pressure levels are expressed as decibels (dB) in this report. For example, sound pressure levels measured using an "A" frequency weighting are expressed as dB L_A. Alternative ways of expressing A-weighted decibels such as dBA or dB(A) are therefore not used within this report.

APPENDIX B SOURCE COORDINATES

The following table sets out the coordinates of the proposed wind turbine layout (Reference *20260107 Rev 1 G*, supplied by the proponent on 8 January 2026).

The terrain elevations for the wind turbines are based on terrain data obtained from ELVIS - Elevation and Depth - Foundation Spatial Data (downloaded on 5 May 2025).

This data may differ slightly from actual terrain elevations for each individual wind turbine; however, it provides a sufficiently accurate representation for the purpose of this assessment.

Table 14: Wind turbine coordinates – MGA94 Zone 54

Wind turbine	Easting, m	Northing, m	Terrain elevation, m
T1	717,599	5,826,548	312
T2	715,995	5,826,389	337
T3	716,634	5,826,338	327
T4	717,153	5,826,051	310
T5	719,781	5,825,662	330
T6	715,824	5,825,609	324
T7	715,349	5,825,580	349
T8	716,184	5,825,101	320
T9	719,984	5,825,006	310
T10	716,738	5,824,683	310
T11	718,692	5,824,502	295
T12	719,228	5,824,415	290
T13	717,238	5,824,385	294
T14	719,566	5,824,176	300
T15	715,993	5,824,088	312
T16	718,078	5,824,053	290
T17	720,194	5,824,020	314
T18	714,933	5,824,084	380
T19	714,217	5,823,944	369
T20	717,610	5,823,780	282
T21	716,521	5,823,458	297
T22	715,197	5,823,101	330
T23	718,747	5,823,072	290
T24	714,483	5,823,039	318
T25	720,212	5,822,987	360
T26	719,629	5,822,913	306
T27	715,742	5,822,877	319

Wind turbine	Easting, m	Northing, m	Terrain elevation, m
T28	716,313	5,822,383	310
T29	719,082	5,822,204	280
T30	719,574	5,822,047	282
T31	715,881	5,821,873	309
T32	719,982	5,821,882	300
T33	719,676	5,821,120	274
T34	716,203	5,821,056	290
T35	716,491	5,820,278	284
T36	716,037	5,819,810	295
T37	715,527	5,819,187	304
T38	716,043	5,818,915	297
T39	716,535	5,818,874	291
T40	717,102	5,818,638	288
T41	715,166	5,818,272	297
T42	716,093	5,818,125	294
T43	715,566	5,817,656	290
T44	714,863	5,817,347	295
T45	715,585	5,816,777	284
T46	713,081	5,816,085	285
T47	712,549	5,815,883	277
T48	711,621	5,815,856	269
T49	716,069	5,815,581	275
T50	720,844	5,815,519	275
T51	717,562	5,815,367	269
T52	719,927	5,814,832	270
T53	716,448	5,815,010	270
T54	720,367	5,815,222	273
T55	717,095	5,814,793	270
T56	715,799	5,814,748	270
T57	718,451	5,813,155	251
T58	718,360	5,814,473	258
T59	717,692	5,814,407	265
T60	720,331	5,814,322	267

Wind turbine	Easting, m	Northing, m	Terrain elevation, m
T61	719,638	5,814,150	262
T62	716,160	5,813,941	270
T63	718,115	5,813,727	254
T64	718,815	5,813,680	250
T65	720,157	5,813,426	260
T66	719,378	5,813,322	258
T67	720,540	5,812,821	250
T68	719,934	5,812,487	243

The following table sets out the centroid coordinates of the substation and BESS supplied by the proponent on 4 April 2025 and 9 May 2025, respectively.

Table 15: Substation and BESS coordinates – MGA94 Zone 54

Item	Easting, m	Northing, m
Substation	715,186	5,817,188
BESS	715,218	5,817,357

APPENDIX C VICTORIAN REGULATIONS AND GUIDELINES

The following publications are relevant to the assessment of operational noise from proposed renewable energy projects in Victoria:

- *Environment Protection Act 2017*
- *Environment Protection Regulations 2021*
- *Environment Reference Standard* published 25 May 2021, and as amended by *Environment Reference Standard No. S158 Gazette* dated 29 March 2022
- Victorian Department of Transport and Planning publication *Planning Guidelines for Development of Wind Energy Facilities* dated September 2023
- NZS 6808:2010 *Acoustics – Wind farm noise*
- EPA Publication 1826.5 *Noise limit and assessment protocol for the control of noise from commercial, industrial and trade premises and entertainment venues* dated September 2025.

The relevant publication for the assessment of construction noise in Victoria is the EPA Publication 1834.1 *Civil construction, building and demolition guide*, dated 12 September 2023.

There is no standard or regulation that specifies criteria for the control of construction vibration levels in Victoria. In lieu of Victorian guidance for construction vibration, reference is made to NSW guidance documents.

Details of the guidance and noise criteria provided by the above publications are provided in the following sections.

C1 Environment Protection Act 2017

The *Environment Protection Act 2017* (EP Act) provides the overarching legislative framework for the protection of the environment in Victoria.

The EP Act establishes a general environmental duty to minimise the risks of harm to human health or the environment from pollution or waste, including noise related amenity impacts, so far as reasonably practicable.

The EP Act also prohibits the emission of unreasonable noise from commercial and industrial trade premises. Specifically, the EP Act states that:

> *A person must not, from a place or premises that are not residential premises—*
>
> *(a) emit an unreasonable noise; or*
>
> *(b) permit an unreasonable noise to be emitted*

Under the EP Act, unreasonable noise means noise that:

> *(a) is unreasonable having regard to the following—*
>
> > *(i) its volume, intensity or duration;*
> >
> > *(ii) its character;*
> >
> > *(iii) the time, place and other circumstances in which it is emitted;*
> >
> > *(iv) how often it is emitted;*
> >
> > *(v) any prescribed factors; or*
>
> *(b) is prescribed to be unreasonable noise:*

Further information about noises that are prescribed to be unreasonable is separately defined in regulations made under the EP Act (see next section).

C2 Environment Protection Regulations 2021

The *Environment Protection Regulations 2021* (EP Regulations) give effect to the EP Act by establishing prescriptive requirements for a range of environmental considerations including noise.

The following sections provide details of the requirements for wind turbine noise and industry noise.

C2.1 Wind turbine noise

Part 5.3 Division 5 of the EP Regulations nominates NZS 6808 as the relevant standard for assessing operational wind turbine noise in Victoria and introduces additional provisions and requirements.

Specifically, the EP Regulations outline the following:

- Noise agreements

  An owner or operator of a wind energy facility may enter into a written agreement with a landowner to modify the noise limits.

  If a noise agreement is made after 1 November 2021, an increased base noise limit of 45 dB L_{A90} would apply. If a noise agreement was made prior to 1 November 2021, the noise limit can be modified as specified in the noise agreement.

- Wind energy facility operators' duties

  Regulation 131C establishes a duty to manage and review wind turbine noise by taking all applicable actions set in Division 5 of the EP Act.

  Regulation 131CA establishes a duty to comply with the noise limit (or the alternative monitoring point criterion if wind turbine noise is being assessed at an alternative monitoring point) determined in accordance with NZS 6808 and any applicable noise agreement.

  Providing that the operator of a wind farm complies with the requirements of regulations 131C and 131CA, their duty with respect to the general environmental duty under the EP Act has been addressed.

Details of the types of receivers to be assessed, the noise limits and the technical procedures for assessing compliance with the noise limits are separately defined in NZS 6808 (see further information in Section C5).

In accordance with the EP Regulations, noise levels from a wind farm are prescribed to be *unreasonable* for the purposes of the EP Act, if they exceed the relevant applicable noise limits.

C2.2 Industry noise

In relation to noise from commercial, industrial and trade premises (industry), the EP Regulations specify that the prediction, measurement, assessment or analysis of noise within a noise sensitive area must be conducted in accordance with the Noise Protocol (see Section C6). Noise from industry is prescribed by the EP Regulations to be unreasonable for the purposes of the EP Act if it exceeds a noise limit or alternative assessment criterion determined in accordance with the Noise Protocol.

The noise limits apply at locations referred to as noise sensitive areas which are defined by the EP Regulations as:

(a) that part of the land within the boundary of a parcel of land that is—

(i) within 10 metres of the outside of the external walls of any of the following buildings—

(A) a dwelling (including a residential care facility but not including a caretaker's house);

(B) a residential building;

(C) a noise sensitive residential use[22]*; or*

(ii) within 10 metres of the outside of the external walls of any dormitory, ward, bedroom or living room of one or more of the following buildings—

(A) a caretaker's house;

(B) a hospital;

(C) a hotel;

(D) a residential hotel;

(E) a motel;

(F) a specialist disability accommodation;

(G) a corrective institution;

(H) a tourist establishment;

(I) a retirement village;

(J) a residential village; or

(iii) within 10 metres of the outside of the external walls of a classroom or any room in which learning occurs in the following buildings (during their operating hours)—

(A) a child care centre;

(B) a kindergarten;

(C) a primary school;

(D) a secondary school; or

(b) subject to paragraph (c), in the case of a rural area only, that part of the land within the boundary of—

(i) a tourist establishment; or

(ii) a campground; or

(iii) a caravan park; or

---

[22] *Noise sensitive residential use* […] *means a community care accommodation, dependent person's unit, dwelling, residential aged care facility, residential village, retirement village or rooming house*

(c) *despite paragraph (b), in the case of a rural area only, where an outdoor entertainment event or outdoor entertainment venue is being operated, that part of the land within the boundary of the following are not noise sensitive areas for the purposes of that event or venue—*

(i) a tourist establishment;

(ii) a campground;

(iii) a caravan park;

C3 Environment Reference Standard

The *Environment Reference Standard* (ERS) is a legislative instrument made under the EP Act which sets out environmental values for ambient sound that are sought to be achieved and maintained in Victoria and standards to support those values. The indicators and objectives within the standard provide a benchmark for comparing desired outcomes to the actual state of the environment, and a basis for assessing actual and potential risks to the environmental values.

The ERS is an environmental benchmark. It brings together a collection of environmental values, indicators and objectives that describe environmental and human health outcomes to be achieved or maintained in the whole or in parts of Victoria. These values, indicators and objectives are used to assess and report on changing environmental conditions by providing a reference point for decision makers to consider whether a proposal or activity is consistent with the environmental values identified in the ERS. The ERS also allows decision makers to evaluate potential impacts on human health and the environment that may result from a proposal or activity. The ERS does not specify requirements that must be met by environmental managers or other duty holders.

The ERS is primarily relevant for aspects of the environment that are not the subject of prescriptive regulation. These aspects include the noise from commercial premises and construction activities in natural areas, or the additional noise from public roads as a result of traffic associated with commercial activities.

Further, in the situations where the ERS is a relevant consideration, it is important to note that the ERS is not a compliance standard. Specifically, the values listed within the ERS are not prescribed noise limits, nor are they design criteria for proposed development.

Indicators and objectives within the ERS are generally not relevant considerations where they relate to an aspect of the environment that is the subject of prescriptive regulation. For example, the ambient sound indicators and objectives will not be relevant when considering noise from wind turbines and commercial, industrial and trade premises at noise sensitive areas, as defined in the EP Regulations. This is because noise in these circumstances is regulated by specific provisions and noise limits in the EP Regulations and the associated Noise Protocol and NZS 6808.

The environmental values presented in the ERS and a description of each is provided in Table 16.

Table 16: Environmental values of the ambient sound environment

Environmental value	Description of environmental value
Sleep during the night	An ambient sound environment that supports sleep during the night
Domestic and 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 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.

The ERS land use categories and their descriptions are provided in Table 17.

Table 17: Land use categories for the ambient sound environment

Land use category	General description	Planning zones
Category I	An urban form with distinctive features or characteristics of taller buildings, high commercial and residential intensity and high site coverage.	Industrial Zone 1 (IN1Z) Industrial Zone 2 (IN2Z) Port Zone (PZ) Road 1 Zone (RDZ1) Capital City Zone (CCZ) Docklands Zone (DZ)
Category II	Medium rise building form with a strong urban or commercial character. Typically contains mixed land uses including activity centres and larger consolidated sites, and an active public realm.	Industrial Zone 3 (IN3Z) Commercial 1 Zone (C1Z) Commercial 2 Zone (C2Z) Commercial 3 Zone (C3Z) Activity Centre Zone (ACZ) Mixed Use Zone (MUZ) Road 2 Zone (RDZ2)
Category III	Lower rise building form including lower density residential development and detached housing typical of suburban residential settings or in towns of district or regional significance.	Residential Growth Zone (RGZ) General Residential Zone (GRZ) Neighbourhood Residential Zone (NRZ) Urban Floodway Zone (UFZ) Public Park and Recreation Zone (PPRZ) Urban Growth Zone (UGZ) [1]
Category IV	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.	Low Density Residential Zone (LDRZ) Township Zone (TZ) Rural Living Zone (RLZ) Green Wedge A Zone (GWAZ) Rural Conservation Zone (RCZ) Public Conservation and Resource Zone (PCRZ) Green Wedge Zone (GWZ) Farming Zone (FZ) Rural Activity Zone (RAZ)

Land use category	General description	Planning zones
Category V	Unique combinations of landscape, biodiversity and geodiversity. These natural areas typically provide undisturbed species habitat and enable people to see and interact with native vegetation and wildlife.	Natural areas are classified as land within Category V irrespective of the planning zones that apply to that land.
Category I, II, III or IV depending on surrounding land uses and the intent of the specific planning zone (which may have a diversity of uses) as specified in a schedule to the planning zone		Comprehensive Development Zone (CDZ) Priority Development Zone (PDZ) Special Use Zone (SUZ) Public Use Zone (PUZ)

1 Urban Growth Zone (UGZ) is a Category III land use until the relevant precinct structure plan is adopted, at which time the approved land uses will determine the land use category.

The ERS indicators and objectives relevant to each land use category are described in Table 18.

Table 18: Indicators and objectives for the ambient sound environment

Land use category	Indicators	Objectives
Category I	Outdoor $L_{Aeq,8h}$ from 2200 hrs to 0600 hrs	55 dB L_{Aeq}
	Outdoor $L_{Aeq,16hr}$ from 0600 hrs to 2200 hrs	60 dB L_{Aeq}
Category II	Outdoor $L_{Aeq,8h}$ from 2200 hrs to 0600 hrs	50 dB L_{Aeq}
	Outdoor $L_{Aeq,16hr}$ from 0600 hrs to 2200 hrs	55 dB L_{Aeq}
Category III	Outdoor $L_{Aeq,8h}$ from 2200 hrs to 0600 hrs	40 dB L_{Aeq}
	Outdoor $L_{Aeq,16hr}$ from 0600 hrs to 2200 hrs	50 dB L_{Aeq}
Category IV	Outdoor $L_{Aeq,8h}$ from 2200 hrs to 0600 hrs	35 dB L_{Aeq}
	Outdoor $L_{Aeq,16hr}$ from 0600 hrs to 2200 hrs	40 dB L_{Aeq}
Category V	Qualitative	A sound quality that is conducive to human tranquillity and enjoyment having regard to the ambient natural soundscape

Natural areas are a land-use category for which the ERS details desired outcomes in terms of noise level to be achieved or maintained in Victoria. 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*.

C4 Victorian Wind Energy Guidelines

The Victorian Department of Transport and Planning publication *Planning Guidelines for Development of Wind Energy Facilities* dated September 2023 (Victorian Wind Energy Guidelines) provide advice to responsible authorities, proponents and the community about suitable sites to locate wind energy facilities and to inform planning decisions about a wind energy facility proposal.

The Victorian Wind Energy Guidelines set out:

- *a framework to provide a consistent and balanced approach to the assessment of wind energy projects across the state*
- *a set of consistent operational performance standards to inform the assessment and operation of a wind energy facility project*
- *guidance as to how planning permit application requirements might be met*
- *a framework for the regulation of wind turbine noise.*

Section 4.3.2 of the Victorian Wind Energy Guidelines outlines the application requirements for a wind energy facility. Specifically, to following written reports are required to be submitted to address potential noise impacts:

- *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 New Zealand Standard NZS6808:2010, Acoustics – Wind Farm Noise*
  - *provides an assessment of whether the proposed wind energy facility will comply with the noise limit for that facility*
  - *where the proposed wind energy facility will be the subject of a wind turbine noise agreement under the Environment Protection Regulations 2021, specifies the premises of the relevant 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 the New Zealand Standard NZS6808:2010, Acoustics – Wind Farm Noise and includes an assessment of whether a high amenity noise limit is applicable under Section 5.3 of the standard.*
- *A report prepared by an environmental auditor appointed under Part 8.3 of the Environment Protection Act 2017 that verifies whether or not the pre-construction (predictive) noise assessment was conducted under New Zealand Standard NZS6808:2010, Acoustics – Wind Farm Noise*

Section 5 of the Victorian Wind Energy Guidelines outlines the key criteria for evaluating the planning merits of a wind energy facility. The following guidance is provided for the assessment of noise levels from proposed new wind farm developments:

> *A wind energy facility must comply with the noise limits in the New Zealand Standard NZS 6808:2010 Acoustics – Wind Farm Noise (the Standard).* […]
>
> *The Standard specifies a general 40 decibel limit (40 dB $L_{A90(10min)}$) for wind energy facility sound levels outdoors at noise sensitive locations, or that the sound level should not exceed the background sound level by more than five decibels (referred to as 'background sound level +5 dB'), whichever is the greater.* […]

Noise sensitive locations are defined in the Standard as, "The location of a noise sensitive activity, associated with a habitable space or education space in a building not on a wind farm site", and include:

- *any part of land zoned predominantly for residential use*
- *residential land uses included in the accommodation group at clause 73.03, Land use terms of the VPP and all planning schemes*
- *education and child care uses included in the child care centre group and education centre group at clause 73.03 of the of the VPP and all planning schemes.*

A 45-decibel limit is recommended for stakeholder dwellings. A stakeholder dwelling is a dwelling located on the same land as the wind energy facility, or one that has an agreement with the wind energy facility to exceed the noise limit. […]

Under Section 5.3 of the Standard, a 'high amenity noise limit' of 35 decibels may be justified in special circumstances. All wind energy facility applications must be assessed using Section 5.3 of the Standard to determine whether a high amenity noise limit is justified for specific locations, following procedures outlined in 5.3.1 of the Standard. Guidance can be found on this issue in the VCAT determination for the Cherry Tree Wind Farm[23].

Measurement and compliance assessment methods are set out in the Standard. The assessment must be made without relying on noise reduction operation modes to achieve compliance.

It is noted that although the Victorian Wind Energy Guidelines specifically refer to receivers within the Project boundary and/or with a noise agreement in place as 'stakeholder dwellings', they have been referred to as *involved receivers* within this report. This has been done at the request of the proponent to minimise the potential for misinterpretation of terminology by the reader. Similarly, receivers outside of the Project boundary and without a noise agreement have been referred to as *non-involved receivers.*

Clause 73.03 of the Victoria Planning Provisions (VPP) defines *Accommodation* as *land used to accommodate persons* and lists the following uses:

• *Camping and caravan park*	• *Host farm*
• *Corrective institution*	• *Residential aged care facility*
• *Dependent person's unit*	• *Residential building*
• *Dwelling*	• *Residential village*
• *Group accommodation*	• *Retirement village*

Consideration must also be given to whether a high amenity noise limit is warranted to reflect special circumstances at specific locations.

23 *Cherry Tree Wind Farm v Mitchell Shire Council* (2013)

C5 NZS 6808

NZS 6808 provides methods for the prediction, measurement, and assessment of sound from wind turbines. The following sections provide an overview of the objectives of NZS 6808 and the key elements of the standard's assessment procedures.

C5.1 Objectives

The foreword of NZS 6808 provides guidance about the objectives of the noise limits outlined within the standard:

> *Wind farm sound may be audible at times at noise sensitive locations, and this Standard does not set limits that provide absolute protection for residents from audible wind farm sound. Guidance is provided on noise limits that are considered reasonable for protecting sleep and amenity from wind farm sound received at noise sensitive locations.*

The *Outcome Statement* of NZS 6808 then goes on to provide information about the objective of the standard in a planning context:

> *This Standard provides suitable methods for the prediction, measurement, and assessment of sound from wind turbines. In the context of the* [New Zealand] *Resource Management Act, application of this Standard will provide reasonable protection of health and amenity at noise sensitive locations.*

Section C1.1 of the standard provides further information about the intent of the standard, which is:

> [...] *to avoid adverse noise effects on people caused by the operation of wind farms while enabling sustainable management of natural wind resources.*

Based on the objectives outlined above, NZS 6808 addresses health and amenity considerations at noise sensitive locations by specifying noise limits which are to be used to assess wind farm noise.

C5.2 Noise sensitive locations

The provisions of NZS 6808 are intended to protect noise sensitive locations (also generally referred to as *receivers* herein) that existed before the development of a wind farm. Noise sensitive locations are defined by the Standard as:

> *The location of a noise sensitive activity, associated with a habitable space or education space in a building not on the wind farm site. Noise sensitive locations include:*
>
> *(a) Any part of land zoned predominantly for residential use in a district plan;*
>
> *(b) Any point within the notional boundary of buildings containing spaces defined in (c) to (f);*
>
> *(c) Any habitable space in a residential building including rest homes or groups of buildings for the elderly or people with disabilities …*
>
> *(d) Teaching areas and sleeping rooms in educational institutions …*
>
> *(e) Teaching areas and sleeping rooms in buildings for licensed kindergartens, childcare, and day-care centres; and*
>
> *(f) Temporary accommodation including in hotels, motels, hostels, halls of residence, boarding houses, and guest houses.*
>
> *In some instances holiday cabins and camping grounds might be considered as noise sensitive locations. Matters to be considered include whether it is an established activity with existing rights.*

For the purposes of an assessment according to the Standard, the notional boundary is defined as:

> *A line 20 metres from any side of a dwelling or other building used for a noise sensitive activity or the legal boundary where this is closer to such a building.*

NZS 6808 was prepared to provide methods of assessment in the statutory context of New Zealand. Specifically, NZS 6808 notes that in the context of the New Zealand Resource Management Act, application of the Standard will provide reasonable protection of health and amenity at noise sensitive locations. This is an important point of context, as the New Zealand Resource Act states:

> *(3)(a)(ii): A consent authority must not, when considering an application, have regard to any effect on a person who has given written approval to the application.*

Based on the above definitions and statutory context, noise predictions are normally prepared for involved receivers irrespective of whether they are inside or outside of the Project boundary. However, the noise limits specified in the Standard are not applied to these locations on account of their participation with the Project.

C5.3 Noise limit

Section 5.2 *Noise limit* of NZS 6808 defines acceptable noise limits as follows:

> *As a guide to the limits of acceptability at a noise sensitive location, at any wind speed wind farm sound levels ($L_{A90(10\,min)}$) should not exceed the background sound level by more than 5 dB, or a level of 40 dB $L_{A90(10\,min)}$, whichever is the greater.*

This arrangement of limits requires the noise associated with a wind farm to be restricted to a permissible margin above background noise, except in instances when both the background and source noise levels are low. In this respect, the criteria indicate that it is not necessary to continue to adhere to a margin above background when the background noise levels are below the range of 30–35 dB.

The criteria specified in NZS 6808 apply to the combined noise level of all wind farms influencing the environment at a receiver. Specifically, section 5.6.1 states:

> *The noise limits … should apply to the cumulative sound level of all wind farms affecting any noise sensitive location.*

C5.4 High amenity

Section 5.3.1 of NZS 6808 states that the base noise limit of 40 dB L_{A90} is *appropriate for protection of sleep, health, and amenity of residents at most noise sensitive locations*. It goes on to note that the application of a high amenity noise limit may require additional consideration:

> […] *In special circumstances at some noise sensitive locations a more stringent noise limit may be justified to afford a greater degree of protection of amenity during evening and night-time. A high amenity noise limit should be considered where a plan promotes a higher degree of protection of amenity related to the sound environment of a particular area, for example where evening and night-time noise limits in the plan for general sound sources are more stringent than 40 dB $L_{Aeq(15\,min)}$ or 40 dBA L_{10}. A high amenity noise limit should not be applied in any location where background sound levels, assessed in accordance with section 7, are already affected by other specific sources, such as road traffic sound.*

The definition of the high amenity noise limit provided in NZS 6808 is specific to New Zealand planning legislation and guidelines. A degree of interpretation is therefore required when determining how to apply the concept of high amenity in Victoria, as informed by the Victorian Wind Energy Guidelines and EPA-DTP Publication 3011 *Wind Energy Facility Turbine Noise – Technical Guideline* dated 20 December 2024.

In accordance with Section 5.3 of NZS 6808, if a high amenity noise limit is justified, wind farm noise levels (L_{A90}) during evening and nigh-time periods should not exceed the background noise level (L_{A90}) by more than 5 dB or 35 dB L_{A90}, whichever is the greater. The standard recommends that this reduced noise limit would typically apply for wind speeds below 6 m/s at hub height. A high amenity noise limit is not applicable during the daytime period.

The method for assessing the applicability of the high amenity noise limit, detailed in NZS 6808, is a two-step approach as follows:

1. Determination of whether the planning guidance for the area warrants consideration of a high amenity noise limit

   First and foremost, for a high amenity noise limit to be considered, the land zoning of a receiver must promote a higher degree of acoustic amenity.

2. Evaluation of whether a high amenity noise limit is justified

   Following the guidance presented in C5.3.1, if the planning guidance for the area warrants consideration of a high amenity noise limit, and the receiver is located within the predicted 35 dB L_{A90} noise contour, then a calculation should be undertaken to determine whether background noise levels are sufficiently low.

C5.5 Special audible characteristics

Section 5.4.2 of NZS 6808 requires the following:

> *Wind turbine sound levels with special audible characteristics (such as tonality, impulsiveness and amplitude modulation) shall be adjusted by arithmetically adding up to +6dB to the measured level at the noise sensitive location.*

Notwithstanding this, the standard requires that wind farms be designed with no special audible characteristics at nearby residential properties while concurrently noting in Section 5.4.1 that:

> […] *as special audible characteristics cannot always be predicted, consideration shall be given to whether there are any special audible characteristics of the wind farm sound when comparing measured levels with noise limits.*

NZS 6808 emphasises assessment of special audible characteristics during the post-construction measurement phase of a project. An indication of the potential for tonality to be a characteristic of the noise emission from the assessed turbine model is sometimes available from tonality audibility assessments conducted as part of manufacturer turbine noise emission testing. However, this data is frequently not available at the planning stage of an assessment.

C6 EPA Publication 1826.5 (Noise Protocol)

EPA Publication 1826.5 *Noise limit and assessment protocol for the control of noise from commercial, industrial and trade premises and entertainment venues* (Noise Protocol) sets noise limits that apply to commercial, industrial and trade premises and entertainment venues in Victoria. Compliance with the noise limits is mandatory under the EP Act.

The proposed on-site substation and BESS are considered a *commercial, industrial and trade premises* under the EP Act.

The Noise Protocol prescribes noise limits that are used to assess whether a noise is prescribed to be unreasonable in accordance with the EP Regulations. The noise limits apply at a noise sensitive area, which is defined in Section 4 of the EP Regulations as being *within 10 metres of the outside of the external walls* of buildings including dwellings, hotels, schools. In rural areas only, noise sensitive areas also include land within the boundaries of tourist establishments, campgrounds, and caravan parks.

The procedures for setting noise limits are defined separately for urban and rural areas. However, in both cases, the noise limits are defined by considering the land zoning in the area and the noise environment of the receiver. The noise limits are defined separately for day, evening and night periods.

In contrast to NZS 6808 and Part 5.3 Division 5 of the EP Regulations, the Noise Protocol does not differentiate between involved and non-involved receivers.

The measurement and analysis procedures outlined in the Noise Protocol include adjustments which are to be applied to noise that is characterised by audible tones, impulses or intermittency.

APPENDIX D NOISE PREDICTION MODEL

D1 Key operational noise prediction elements

Key elements of the method used for predicting operational wind turbine noise from the Project are summarised in Table 19.

Table 19: Operational noise prediction elements

Detail	Description
Software	Proprietary noise modelling software SoundPLANnoise version 9.1
Method	ISO 9613-2: 1996 *Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation* (ISO 9613-2:1996) Specific to wind turbine noise predictions, adjustments to the ISO 9613-2:1996 method are applied on the basis of the guidance contained in the UK Institute of Acoustics publication *A good practice guide to the application of ETSU-R-97 for the assessment and rating of wind turbine noise* (UK Institute of Acoustics guidance). The adjustments are applied within the SoundPLANnoise modelling software and relate to the influence of terrain screening and ground effects on sound propagation. Specific details of adjustments are noted below and are discussed below.
Source characterisation	Each source of operational noise is modelled as a point source of sound. The total sound of the component of the wind farm being modelled (e.g. wind turbines, transformers) is then calculated on the basis of simultaneous operation of all elements (e.g. all wind turbines, all equipment associated with quarrying activities) and summing the contribution of each. To model the wind turbine noise, the following specific procedures are noted: • Calculations of wind turbine to receiver distances and average sound propagation heights are made on the basis of the point source being located at the position of the hub of the wind turbine. • Calculations of terrain related screening are made on the basis of the point source being located at the maximum tip height of each wind turbine. Further discussion of terrain screening effects is provided below.
Terrain data	10 m resolution within the site and surrounds, obtained from ELVIS - Elevation and Depth - Foundation Spatial Data.
Terrain effects (turbine-specific procedures)	Adjustments for the effects of terrain are determined and applied on the basis of the UK Institute of Acoustics guidance and research outlined below. • Valley effects: +3 dB is applied to the calculated noise level of a wind turbine when a significant valley exists between the wind turbine and calculation point. A significant valley is determined to exist when the actual mean sound propagation height between the turbine and calculation point is 50 % greater than would occur if the ground were flat. • Terrain screening effects: only calculated if the terrain blocks line of sight between the maximum tip height of the turbine and the calculation point. The value of the screening effect is limited to a maximum value of -2 dB. The Project is located in a relatively flat area characterised by little variations in ground elevation between the wind turbines and surrounding receivers. Based on comparison of predicted noise levels with and without terrain elevation data included, terrain effects ranging between -1.5 dB and +1.1 dB were calculated for receivers within 5 km of the proposed wind turbines. For reference purposes, the ground elevations at the turbines and receivers are tabled in Appendix B and Appendix F, respectively. The topography of the site is depicted in the elevation map provided in Appendix H.

Detail	Description
Ground conditions	Ground factor of G = 0.5 based on the UK Institute of Acoustics guidance and research outlined below. The ground around the site corresponds to acoustically soft conditions (G = 1) according to ISO 9613-2:1996. The adopted value of G = 0.5 assumes that 50% of the ground cover is acoustically hard (G = 0) to account for variations in ground porosity and provide a cautious representation of ground effects.
Atmospheric conditions	Temperature: 10°C, relative humidity 70%, and atmospheric pressure 101.325 kPa These represent conditions which result in relatively low levels of atmospheric sound absorption. The calculations are based on sound speed profiles which increase the propagation of sound from each turbine to each receiver, whether as a result of thermal inversions or wind directed toward each calculation point. [24]
Receiver heights	1.5 m above ground level Specific to wind turbine noise predictions, the UK Institute of Acoustics guidance refers to receiver heights of 4 m, and this guidance has subsequently been documented in international standards and, most recently, the EPA Publication 3011 *Wind Energy Facility Turbine Noise – Technical Guideline* dated 20 December 2024 (Technical Guideline). The UK Institute of Acoustics guidance was written as a complete approach to the prediction of wind turbine noise in the context of the regulatory requirements in the UK. Specifically, the method is for the prediction of the L_{A90} wind turbine noise levels for short-term downwind conditions. Conceptually, this is directly relevant to a planning stage assessment of a wind farm under NZS 6808:2010 *Acoustics – Wind farm noise* (NZS 6808), as the assessment is intended to represent typical worst case L_{A90} noise levels of a wind farm. However, an important technical detail is that application of the complete method is incompatible with NZS 6808. This is because the UK Institute of Acoustics guidance specifies that the calculation should include subtraction of 2 dB to account for the difference between the equivalent noise level that the sound power level of the turbines is determined from, and the L_{A90} noise measurement metric. However, NZS 6808 specifically states that predictions based on the sound power levels, without adjustment between L_{Aeq} and L_{A90} noise levels, shall be taken as representative of the L_{A90} noise levels. As a result, adoption of a 4 m receiver height in the context of an NZS 6808 assessment would result in a significantly more conservative assessment than an assessment based on the complete prediction method outlined in the UK Institute of Acoustics guidance. For this reason, noise predictions in Australia have generally been based on a lower prediction height of 1.5 m, but without any adjustment between L_{Aeq} and L_{A90} noise levels. The difference between predicted noise levels at 1.5 m and 4 m varies between sites but is generally comparable to the 2 dB value factored in the UK Institute of Acoustics guidance. As a result, the effect of a lower receiver height is balanced out by not applying an L_{Aeq} to L_{A90} correction, resulting in similar predicted noise levels.

[24] The sound speed profile defines the rate of change in the speed of sound with increasing height above ground

D2 Operational wind turbine noise prediction overview

In Australia, noise predictions are typically calculated using ISO 9613-2:1996 *Acoustics – Attenuation of sound during propagation outdoors - Part 2: General method of calculation* (ISO 9613-2:1996) with a set of conservative assumptions tailored to wind turbine noise assessment, as detailed in UK Institute of Acoustics publication *A good practice guide to the application of ETSU-R-97 for the assessment and rating of wind turbine noise* (UK Institute of Acoustics guidance).

A revised version of the standard, ISO 9613-2:2024, was published earlier in 2024 based on broadly equivalent procedures to ISO 9613-2:1996, subject to refinements, clarifications, and supplementary advice for different types of sources.[25] Notably, ISO 9613-2:2024 introduces an informative annex on wind turbine noise modelling to reflect the recommendations of the UK Institute of Acoustics guidance.

ISO 9613-2:1996 has been used for this assessment for consistency with previous iterations of the noise model for this project.

The use of this standard is supported by international research publications, measurement studies conducted by Marshall Day Acoustics and direct reference to the standard in NZS 6808, the South Australian EPA *Wind farms environmental noise guidelines* and the Queensland *Planning Guideline - State code 23: Wind farm development*.

The standard specifies an engineering method for calculating noise at a known distance from a variety of sources under meteorological conditions favourable to sound propagation. The standard defines favourable conditions as downwind propagation where the source blows from the source to the receiver within an angle of ±45 degrees from a line connecting the source to the receiver, at wind speeds between approximately 1 m/s and 5 m/s, measured at a height of 3 m to 11 m above the ground. Equivalently, the method accounts for average propagation under a well-developed moderate ground based thermal inversion. In this respect, it is noted that at the wind speeds relevant to noise emissions from wind turbines, atmospheric conditions do not favour the development of thermal inversions throughout the propagation path from the source to the receiver.

To calculate far-field noise levels according to the ISO 9613-2, the noise emissions of each wind turbine are firstly characterised in the form of octave band frequency levels. A series of octave band attenuation factors are then calculated for a range of effects including:

- geometric divergence
- air absorption
- reflecting obstacles
- screening
- vegetation
- ground reflections.

The octave band attenuation factors are then applied to the noise emission data to determine the corresponding octave band and total calculated noise level at receivers.

Calculating the attenuation factors for each effect requires a relevant description of the environment into which the sound propagation such as the physical dimensions of the environment, atmospheric conditions and the characteristics of the ground between the source and the receiver.

[25] ISO 9613-2:2024 *Acoustics — Attenuation of sound during propagation outdoors Part 2: Engineering method for the prediction of sound pressure levels outdoors*

Wind farm noise propagation has been the subject of considerable research in recent years. These studies have provided support for the reliability of engineering methods such as ISO 9613-2:1996 when a certain set of input parameters are chosen in combination. Specifically, the studies to date tend to support that the assignment of a ground absorption factor of G = 0.5 for the source, middle and receiver ground regions between a wind farm and a calculation point tends to provide a reliable representation of the upper noise levels expected in practice, when modelled in combination with other key assumptions; specifically all wind turbines operating at identical wind speeds, emitting sound levels equal to the test measured levels plus a margin for uncertainty (or guaranteed values), at a temperature of 10^{o}C and relative humidity of 70% to 80%, with specific adjustments for screening and ground effects as a result of the ground terrain profile.

In support of the use of ISO 9613-2:1996 and the choice of G = 0.5 as an appropriate ground characterisation, the following references are noted:

- A factor of G = 0.5 is frequently applied in Australia for general environmental noise modelling purposes as a way of accounting for the potential mix of ground porosity which may occur in regions of dry/compacted soils or in regions where persistent damp conditions may be relevant
- NZS 6808 refers to ISO 9613-2:1996 as an appropriate prediction method for wind farm noise, and notes that soft ground conditions should be characterised by a ground factor of G = 0.5
- In 1998, a comprehensive study (commonly cited as the Joule Report), part funded by the European Commission found that the ISO 9613-2:1996 model provided a robust representation of upper noise levels which may occur in practice and provided a closer agreement between predicted and measured noise levels than alternative methods such as CONCAWE and ENM. Specifically, the report indicated the ISO 9613-2:1996 method generally tends to marginally over predict noise levels expected in practice
- The UK Institute of Acoustics journal dated March/April 2009 published a joint agreement between practitioners in the field of wind farm noise assessment (UK IOA 2009 joint agreement), including consultants routinely employed on behalf of both developers and community opposition groups, and indicated the ISO 9613-2:1996 method as the appropriate standard and specifically designated G = 0.5 as the appropriate ground characterisation. This agreement was subsequently reflected in the recommendations detailed in the UK Institute of Acoustics guidance.

A range of measurement and prediction studies for wind farms in which Marshall Day Acoustics' staff have been involved in have provided further support for the use of ISO 9613-2:1996 and G = 0.5 as an appropriate representation of typical upper noise levels expected to occur in practice. [26, 27, 28]

The findings of these studies demonstrate the suitability of the ISO 9613-2:1996 method to predict the propagation of wind turbine noise for:

- the types of noise source heights associated with a modern wind farm, extending the scope of application of the method beyond the 30 m maximum source heights considered in ISO 9613-2:1996
- the types of environments in which wind farms are typically developed, and the range of atmospheric conditions and wind speeds typically observed around wind farm sites.

  Importantly, this supports the extended scope of application to wind speeds in excess of 5 m/s.

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[26] Bullmore, Adcock, Jiggins & Cand – *Wind Farm Noise Predictions: The Risks of Conservatism*; Presented at the Second International Meeting on Wind turbine Noise in Lyon, France September 2007.

[27] Bullmore, Adcock, Jiggins & Cand – *Wind Farm Noise Predictions and Comparisons with Measurements*; Presented at the Third International Meeting on Wind turbine Noise in Aalborg, Denmark June 2009.

[28] Delaire, Griffin, & Walsh – *Comparison of predicted wind farm noise emission and measured post-construction noise levels at the Portland Wind Energy Project in Victoria, Australia*; Presented at the Fourth International Meeting on Wind turbine Noise in Rome, April 2011.

In addition to the choice of ground factor referred to above, adjustments to ISO 9613-2:1996 for screening and valleys effects are applied based on recommendations of the Joule Report, UK IOA 2009 joint agreement and the UK Institute of Acoustics guidance. The following adjustments are applied to the calculations:

- screening effects as a result of terrain are limited to 2 dB
- screening effects are assessed based on each wind turbine being represented by a single noise source located at the maximum tip height of the wind turbine rotor
- an adjustment of 3 dB is added to the predicted noise contribution of a wind turbine if the terrain between the wind turbine and receiver in question is characterised by a significant valley.

  A significant valley is defined as a situation where the mean sound propagation height is at least 50 % greater than it would be otherwise over flat ground.

The adjustments detailed above are implemented in the wind turbine calculation procedure of the SoundPLANnoise 9.1 software used to conduct the noise modelling. The software uses these definitions in conjunction with the digital terrain model of the site to evaluate the path between each wind turbine and receiver pairing, and then subsequently applies the adjustments to each wind turbine’s predicted noise contribution where appropriate.

D3 Operational wind turbine noise uncertainty

Guidance on uncertainty in wind farm noise assessment is provided in Appendix C of NZS 6808.

The guidance in Appendix C is designated as *informative*, meaning that the content is only for information and its provisions do not form part of the mandatory requirements of the standard. Notwithstanding this, Appendix C notes that it is good practice to state the uncertainty and confidence level for all sound levels.

Uncertainty in environmental noise modelling is typically addressed in one of two ways:

1. Mean predicted noise levels: selection of mean input values and modelling parameters to calculate a mean predicted noise level. The combined uncertainty relating to the inputs and prediction method is then assessed and used to consider how noise levels in practice could differ from the predicted noise levels.
2. Upper predicted noise levels: selection of conservative input values and modelling parameters to calculate the upper predicted noise levels, inherently accounting for uncertainty in the modelling. Noise levels in practice are then expected to be lower than predicted by the modelling.

NZS 6808 Appendix C notes that uncertainty should be determined in accordance with the procedures outlined in Craven and Kerry[29]. However, the procedures referenced in Craven and Kerry are primarily applicable to measurements rather than noise modelling. The procedures are also based on the calculation of uncertainty values which are more relevant when considering mean assessment values.

The approach to uncertainty adopted for this assessment is based on calculation of upper predicted noise levels. This approach is consistent with the UK Institute of Acoustics guidance on wind turbine noise modelling which addresses uncertainty by describing procedures for the calculation of upper predicted noise levels based on conservative input selections. With this approach, it is not necessary to apply uncertainty margins to the predicted noise levels. Noise levels associated with operation of the wind farm when measured and assessed in accordance with NZS 6808 are expected to be lower than the predictions. This finding is supported by extensive post-construction noise compliance monitoring undertaken at wind farm sites across Australia. Further, Appendix C notes that when comparing a sound level with an applicable noise limit, the sound level should be deemed to comply if it is equal to or less than the noise limit and does not specify the addition or subtraction of uncertainties.

Notwithstanding the above, the elements of the modelling which may give rise to uncertainty can be considered in the context of the framework outlined in Craven and Kerry. Specifically, the procedures in Craven and Kerry suggest considering uncertainty in sections related to source, transmission and receiver. The source and transmission considerations are directly relevant to noise modelling and are discussed further below. The section related to receiver uncertainty in Craven and Kerry is solely concerned with measurement related uncertainties (e.g. instrumentation uncertainty and background noise influences) and is therefore not relevant to the noise modelling.

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[29] Craven, N J, and Kerry, G. *A good practice guide on the sources and magnitude of uncertainty arising in the practical measurement of environmental noise*. University of Salford. 2001

Source uncertainties (sound power levels)

The source levels of each wind turbine are characterised in terms of the sound power levels determined in accordance with IEC 61400-11. The results of sound power testing in accordance with this standard are typically characterised by an uncertainty margin of approximately ±1 dB. To reflect this, the sound power data sourced from the manufacturer's documentation has been factored in the noise modelling as follows:

- The manufacturer data has been adjusted by the addition of +1 dB at all wind speeds.
- All turbines are assumed to simultaneously emit sound power levels at the uncertainty adjusted values.

Uncertainty relating to the frequency characteristics of the wind turbine's noise emissions was also addressed by identifying the wind speed with the most unfavourable spectrum profile (i.e. the spectrum profile which would result in the highest predicted noise levels) and then applying the same profile to every wind speed.

Transmission uncertainties (prediction method)

The ISO 9613-2:1996 prediction method indicates an uncertainty margin of the order of ±3 dB in relation to calculated noise levels at distances between 100 m and 1,000 m for situations with an average propagation height between 5 m and 30 m (noting the information provided earlier in this appendix regarding the validation work undertaken to support the application of ISO 9613-2:1996 to greater propagation heights). However, the uncertainty margins are noted for a prediction in accordance with the inputs described in ISO 9613-2:1996. A strict application of ISO 9613-2:1996 would involve designating a ground factor of G = 1 (instead of the more conservative G = 0.5 ground factor used in the calculations) to represent the porous ground conditions around the site which ISO 9613-2:1996 defines as follows:

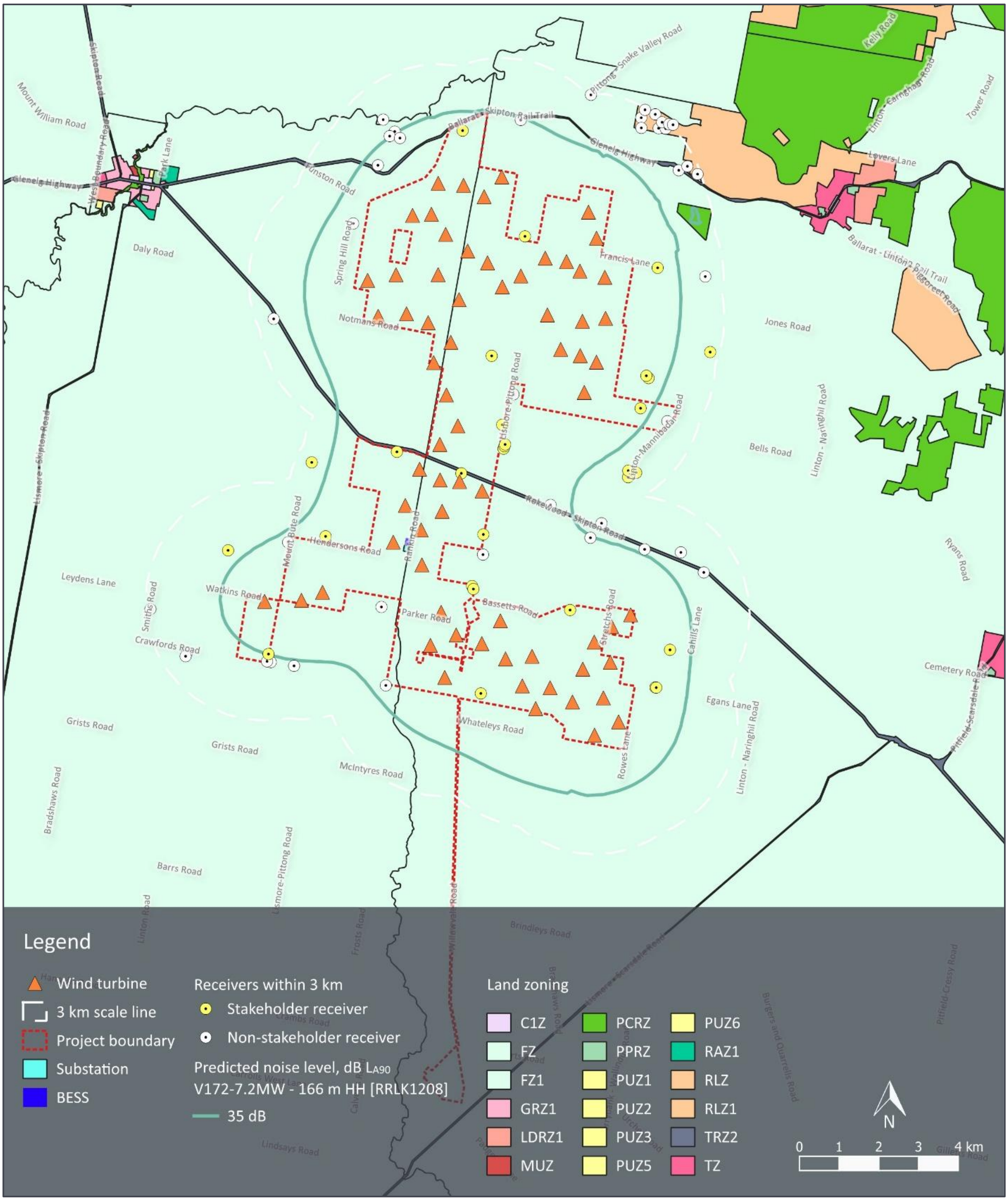
> ***Porous ground****, which includes ground covered by grass, trees or other vegetation, and all other ground surfaces suitable for the growth of vegetation, such as farming land. For porous ground G = 1.*

A prediction based on a ground factor of G = 1, instead of G = 0.5 used in the modelling, would typically result in predicted noise levels approximately 3 dB lower, thus effectively offsetting the quoted uncertainty margin. This also does not account for the other conservative aspects of the model, such as the assumption that each receiver is simultaneously downwind of every wind turbine at all times and consistent atmospheric conditions which result in minimal atmospheric absorption.

It is not possible to specify exact uncertainty margins for the conservative prediction approach adopted for the assessment. However, based on experience and the published studies referenced earlier in this appendix, the uncertainty in short term measured noise levels under downwind conditions is typically of the order of ±2 dB. This reduces to reduces to ±1 dB or less when comparing predictions with measured noise levels determined in accordance with NZS 6808 which are based on the analysis of aggregated data for a range of atmospheric conditions.

APPENDIX E ZONING MAP

Figure 9: Zoning map for the Project and surrounding area



APPENDIX F RECEIVER COORDINATES

The following table sets out the assessed receivers considered in the environmental noise assessment. (Reference *20250331*, supplied by the proponent on 3 April 2025).

Table 20: Receivers within 3 km of the proposed wind turbines – MGA94 Zone 54

Receiver	Easting, m	Northing, m	Terrain elevation, m	Distance to the nearest wind turbine, m	Nearest wind turbine	Land zoning
Non-stakeholder receiver						
17	719,844	5,828,616	365	2,960	T5	FZ
21	721,206	5,828,238	400	2,949	T5	RLZ1
23	721,465	5,828,124	392	2,988	T5	RLZ1
26	721,111	5,828,039	368	2,729	T5	RLZ1
27	714,610	5,827,991	310	2,125	T2	FZ
28	718,076	5,827,983	350	1,521	T1	FZ
31	721,637	5,827,925	402	2,932	T5	RLZ1
35	721,114	5,827,783	360	2,511	T5	RLZ1
36	721,549	5,827,775	400	2,760	T5	RLZ1
37	721,728	5,827,767	413	2,872	T5	RLZ1
40	714,900	5,827,690	321	1,709	T2	FZ1
43	714,773	5,827,576	320	1,712	T2	FZ1
45	715,032	5,827,527	326	1,500	T2	FZ1
59	714,478	5,826,842	330	1,543	T7	FZ1
60	722,274	5,826,816	408	2,752	T5	FZ
63	722,057	5,826,715	384	2,513	T5	FZ
64	722,530	5,826,618	435	2,915	T5	RLZ1
82	713,854	5,825,375	368	1,486	T19	FZ1
95	711,851	5,822,972	314	2,563	T19	FZ1
99	717,891	5,821,072	276	1,618	T35	FZ
101	721,769	5,820,394	276	2,221	T33	FZ
113	718,827	5,818,286	265	1,768	T40	FZ
114	720,111	5,817,823	271	2,424	T50	FZ
119	719,831	5,817,458	270	2,195	T50	FZ
120	712,214	5,817,344	295	1,508	T47	FZ1
121	721,196	5,817,167	279	1,693	T50	FZ
123	722,110	5,817,090	291	2,024	T50	FZ
124	717,124	5,817,035	280	1,509	T42	FZ

Receiver	Easting, m	Northing, m	Terrain elevation, m	Distance to the nearest wind turbine, m	Nearest wind turbine	Land zoning
125	722,687	5,816,586	292	2,135	T50	FZ
130	708,745	5,815,662	289	2,887	T48	FZ1
131	714,565	5,815,715	280	1,481	T45	FZ1
136	709,668	5,814,572	267	2,343	T48	FZ1
138	711,683	5,814,345	260	1,521	T48	FZ1
139	711,778	5,814,327	260	1,546	T48	FZ1
140	712,363	5,814,232	261	1,669	T47	FZ1
141	714,676	5,813,739	263	1,507	T62	FZ1
171	722,725	5,824,039	368	2,536	T17	FZ
175	709,631	5,814,475	266	2,428	T48	FZ1
Stakeholder receiver outside the Project boundary						
84 (S)	718,182	5,825,051	303	768	T11	FZ
88 (S)	721,525	5,824,258	303	1,362	T17	FZ
96 (S)	722,848	5,822,136	310	2,774	T25	FZ
98 (S)	721,296	5,821,482	284	1,382	T32	FZ
104 (S)	717,682	5,819,809	276	1,290	T35	FZ
105 (S)	717,665	5,819,766	277	1,272	T40	FZ
106 (S)	717,643	5,819,703	279	1,206	T40	FZ
108 (S)	712,809	5,819,357	306	2,600	T41	FZ1
109 (S)	720,785	5,819,149	271	2,268	T33	FZ
110 (S)	720,983	5,819,096	273	2,414	T33	FZ
112 (S)	720,780	5,818,984	272	2,409	T33	FZ
118 (S)	713,158	5,817,494	303	1,421	T46	FZ1
122 (S)	710,701	5,817,142	276	1,589	T48	FZ1
135 (S)	721,836	5,814,636	267	1,338	T50	FZ
142 (S)	721,466	5,813,689	262	1,280	T67	FZ
281 (S)	721,489	5,813,684	261	1,293	T67	FZ
1148 (S)	721,239	5,821,540	290	1,313	T32	FZ

Receiver	Easting, m	Northing, m	Terrain elevation, m	Distance to the nearest wind turbine, m	Nearest wind turbine	Land zoning
Stakeholder receiver within the Project boundary						
39 (S)	716,611	5,827,715	345	1,387	T3	FZ1
97 (S)	717,343	5,822,040	285	1,097	T28	FZ
100 (S)	721,095	5,820,721	273	1,483	T33	FZ
102 (S)	717,608	5,820,305	274	1,129	T35	FZ
107 (S)	714,955	5,819,624	326	738	T37	FZ1
111 (S)	716,578	5,819,082	292	269	T39	FZ
117 (S)	717,133	5,817,543	282	1,108	T40	FZ
128 (S)	716,848	5,816,242	276	1,035	T49	FZ
129 (S)	716,882	5,816,167	274	1,015	T49	FZ
132 (S)	719,318	5,815,638	263	1,023	T52	FZ
137 (S)	711,720	5,814,529	261	1,340	T48	FZ1
143 (S)	717,070	5,813,538	270	1,009	T62	FZ

(S) Stakeholder

APPENDIX G TABULATED PREDICTED NOISE LEVEL DATA

Table 21: Predicted noise levels, dB L_{A90} – V162-6.8MW

Receiver	Hub-height wind speed, m/s											
	4	5	6	7	8	9	10	11	12	13	14	15
Non-stakeholder receivers												
17	18.0	18.0	19.0	22.3	25.5	27.3	27.3	27.4	27.8	28.1	28.3	28.5
21	18.2	18.2	19.2	22.5	25.7	27.5	27.5	27.6	28.0	28.3	28.5	28.7
23	17.9	17.9	18.9	22.2	25.4	27.2	27.2	27.3	27.7	28.0	28.2	28.4
26	18.3	18.3	19.3	22.6	25.8	27.6	27.6	27.7	28.1	28.4	28.6	28.8
27	20.6	20.6	21.6	24.9	28.1	29.9	29.9	30.0	30.4	30.7	30.9	31.1
28	22.6	22.6	23.6	26.9	30.1	31.9	31.9	32.0	32.4	32.7	32.9	33.1
31	18.2	18.2	19.2	22.5	25.7	27.5	27.5	27.6	28.0	28.3	28.5	28.7
35	18.8	18.8	19.8	23.1	26.3	28.1	28.1	28.2	28.6	28.9	29.1	29.3
36	18.6	18.6	19.6	22.9	26.1	27.9	27.9	28.0	28.4	28.7	28.9	29.1
37	18.5	18.5	19.5	22.8	26.0	27.8	27.8	27.9	28.3	28.6	28.8	29.0
40	22.2	22.2	23.2	26.5	29.7	31.5	31.5	31.6	32.0	32.3	32.5	32.7
43	22.3	22.3	23.3	26.6	29.8	31.6	31.6	31.7	32.1	32.4	32.6	32.8
45	23.2	23.2	24.2	27.5	30.7	32.5	32.5	32.6	33.0	33.3	33.5	33.7
59	23.8	23.8	24.8	28.1	31.3	33.1	33.1	33.2	33.6	33.9	34.1	34.3
60	19.0	19.0	20.0	23.3	26.5	28.3	28.3	28.4	28.8	29.1	29.3	29.5
63	19.0	19.0	20.0	23.3	26.5	28.3	28.3	28.4	28.8	29.1	29.3	29.5
64	19.3	19.3	20.3	23.6	26.8	28.6	28.6	28.7	29.1	29.4	29.6	29.8
82	24.9	24.9	25.9	29.2	32.4	34.2	34.2	34.3	34.7	35.0	35.2	35.4
95	19.6	19.6	20.6	23.9	27.1	28.9	28.9	29.0	29.4	29.7	29.9	30.1
99	26.6	26.6	27.6	30.9	34.1	35.9	35.9	36.0	36.4	36.7	36.9	37.1
101	20.9	20.9	21.9	25.2	28.4	30.2	30.2	30.3	30.7	31.0	31.2	31.4
113	23.4	23.4	24.4	27.7	30.9	32.7	32.7	32.8	33.2	33.5	33.7	33.9
114	21.7	21.7	22.7	26.0	29.2	31.0	31.0	31.1	31.5	31.8	32.0	32.2
119	22.5	22.5	23.5	26.8	30.0	31.8	31.8	31.9	32.3	32.6	32.8	33.0
120	23.4	23.4	24.4	27.7	30.9	32.7	32.7	32.8	33.2	33.5	33.7	33.9
121	21.9	21.9	22.9	26.2	29.4	31.2	31.2	31.3	31.7	32.0	32.2	32.4
123	20.3	20.3	21.3	24.6	27.8	29.6	29.6	29.7	30.1	30.4	30.6	30.8
124	26.8	26.8	27.8	31.1	34.3	36.1	36.1	36.2	36.6	36.9	37.1	37.3
125	19.7	19.7	20.7	24.0	27.2	29.0	29.0	29.1	29.5	29.8	30.0	30.2

Receiver	Hub-height wind speed, m/s											
	4	5	6	7	8	9	10	11	12	13	14	15
130	15.3	15.3	16.3	19.6	22.8	24.6	24.6	24.7	25.1	25.4	25.6	25.8
131	26.1	26.1	27.1	30.4	33.6	35.4	35.4	35.5	35.9	36.2	36.4	36.6
136	16.8	16.8	17.8	21.1	24.3	26.1	26.1	26.2	26.6	26.9	27.1	27.3
138	21.4	21.4	22.4	25.7	28.9	30.7	30.7	30.8	31.2	31.5	31.7	31.9
139	21.5	21.5	22.5	25.8	29.0	30.8	30.8	30.9	31.3	31.6	31.8	32.0
140	21.7	21.7	22.7	26.0	29.2	31.0	31.0	31.1	31.5	31.8	32.0	32.2
141	23.8	23.8	24.8	28.1	31.3	33.1	33.1	33.2	33.6	33.9	34.1	34.3
171	20.7	20.7	21.7	25.0	28.2	30.0	30.0	30.1	30.5	30.8	31.0	31.2
175	16.6	16.6	17.6	20.9	24.1	25.9	25.9	26.0	26.4	26.7	26.9	27.1
Stakeholder receivers outside the Project boundary												
84 (S)	30.4	30.4	31.4	34.7	37.9	39.7	39.7	39.8	40.2	40.5	40.7	40.9
88 (S)	24.6	24.6	25.6	28.9	32.1	33.9	33.9	34.0	34.4	34.7	34.9	35.1
96 (S)	19.7	19.7	20.7	24.0	27.2	29.0	29.0	29.1	29.5	29.8	30.0	30.2
98 (S)	24.1	24.1	25.1	28.4	31.6	33.4	33.4	33.5	33.9	34.2	34.4	34.6
104 (S)	26.8	26.8	27.8	31.1	34.3	36.1	36.1	36.2	36.6	36.9	37.1	37.3
105 (S)	26.9	26.9	27.9	31.2	34.4	36.2	36.2	36.3	36.7	37.0	37.2	37.4
106 (S)	27.1	27.1	28.1	31.4	34.6	36.4	36.4	36.5	36.9	37.2	37.4	37.6
108 (S)	21.3	21.3	22.3	25.6	28.8	30.6	30.6	30.7	31.1	31.4	31.6	31.8
109 (S)	21.0	21.0	22.0	25.3	28.5	30.3	30.3	30.4	30.8	31.1	31.3	31.5
110 (S)	20.7	20.7	21.7	25.0	28.2	30.0	30.0	30.1	30.5	30.8	31.0	31.2
112 (S)	20.9	20.9	21.9	25.2	28.4	30.2	30.2	30.3	30.7	31.0	31.2	31.4
118 (S)	24.4	24.4	25.4	28.7	31.9	33.7	33.7	33.8	34.2	34.5	34.7	34.9
122 (S)	20.4	20.4	21.4	24.7	27.9	29.7	29.7	29.8	30.2	30.5	30.7	30.9
135 (S)	24.8	24.8	25.8	29.1	32.3	34.1	34.1	34.2	34.6	34.9	35.1	35.3
142 (S)	26.2	26.2	27.2	30.5	33.7	35.5	35.5	35.6	36.0	36.3	36.5	36.7
281 (S)	26.1	26.1	27.1	30.4	33.6	35.4	35.4	35.5	35.9	36.2	36.4	36.6
1148 (S)	24.4	24.4	25.4	28.7	31.9	33.7	33.7	33.8	34.2	34.5	34.7	34.9

Receiver	Hub-height wind speed, m/s											
	4	5	6	7	8	9	10	11	12	13	14	15
Stakeholder receivers within the Project boundary												
39 (S)	24.7	24.7	25.7	29.0	32.2	34.0	34.0	34.1	34.5	34.8	35.0	35.2
97 (S)	28.2	28.2	29.2	32.5	35.7	37.5	37.5	37.6	38.0	38.3	38.5	38.7
100 (S)	23.5	23.5	24.5	27.8	31.0	32.8	32.8	32.9	33.3	33.6	33.8	34.0
102 (S)	26.9	26.9	27.9	31.2	34.4	36.2	36.2	36.3	36.7	37.0	37.2	37.4
107 (S)	29.1	29.1	30.1	33.4	36.6	38.4	38.4	38.5	38.9	39.2	39.4	39.6
111 (S)	36.5	36.5	37.5	40.8	44.0	45.8	45.8	45.9	46.3	46.6	46.8	47.0
117 (S)	27.6	27.6	28.6	31.9	35.1	36.9	36.9	37.0	37.4	37.7	37.9	38.1
128 (S)	28.4	28.4	29.4	32.7	35.9	37.7	37.7	37.8	38.2	38.5	38.7	38.9
129 (S)	28.6	28.6	29.6	32.9	36.1	37.9	37.9	38.0	38.4	38.7	38.9	39.1
132 (S)	28.0	28.0	29.0	32.3	35.5	37.3	37.3	37.4	37.8	38.1	38.3	38.5
137 (S)	22.4	22.4	23.4	26.7	29.9	31.7	31.7	31.8	32.2	32.5	32.7	32.9
143 (S)	28.9	28.9	29.9	33.2	36.4	38.2	38.2	38.3	38.7	39.0	39.2	39.4

(S) Stakeholder

Table 22: Predicted noise levels, dB L_{A90} – V172-7.2MW

Receiver	Hub-height wind speed, m/s											
	4	5	6	7	8	9	10	11	12	13	14	15
Non-stakeholder receivers												
17	20.3	20.4	22.2	24.9	27.7	29.8	30.5	30.5	30.5	30.5	30.5	30.5
21	20.6	20.7	22.5	25.2	28.0	30.1	30.8	30.8	30.8	30.8	30.8	30.8
23	20.2	20.3	22.1	24.8	27.6	29.7	30.4	30.4	30.4	30.4	30.4	30.4
26	20.6	20.7	22.5	25.2	28.0	30.1	30.8	30.8	30.8	30.8	30.8	30.8
27	23.0	23.1	24.9	27.6	30.4	32.5	33.2	33.2	33.2	33.2	33.2	33.2
28	25.1	25.2	27.0	29.7	32.5	34.6	35.3	35.3	35.3	35.3	35.3	35.3
31	20.5	20.6	22.4	25.1	27.9	30.0	30.7	30.7	30.7	30.7	30.7	30.7
35	21.2	21.3	23.1	25.8	28.6	30.7	31.4	31.4	31.4	31.4	31.4	31.4
36	21.0	21.1	22.9	25.6	28.4	30.5	31.2	31.2	31.2	31.2	31.2	31.2
37	20.9	21.0	22.8	25.5	28.3	30.4	31.1	31.1	31.1	31.1	31.1	31.1
40	24.6	24.7	26.5	29.2	32.0	34.1	34.8	34.8	34.8	34.8	34.8	34.8
43	24.7	24.8	26.6	29.3	32.1	34.2	34.9	34.9	34.9	34.9	34.9	34.9
45	25.6	25.7	27.5	30.2	33.0	35.1	35.8	35.8	35.8	35.8	35.8	35.8
59	26.3	26.4	28.2	30.9	33.7	35.8	36.5	36.5	36.5	36.5	36.5	36.5

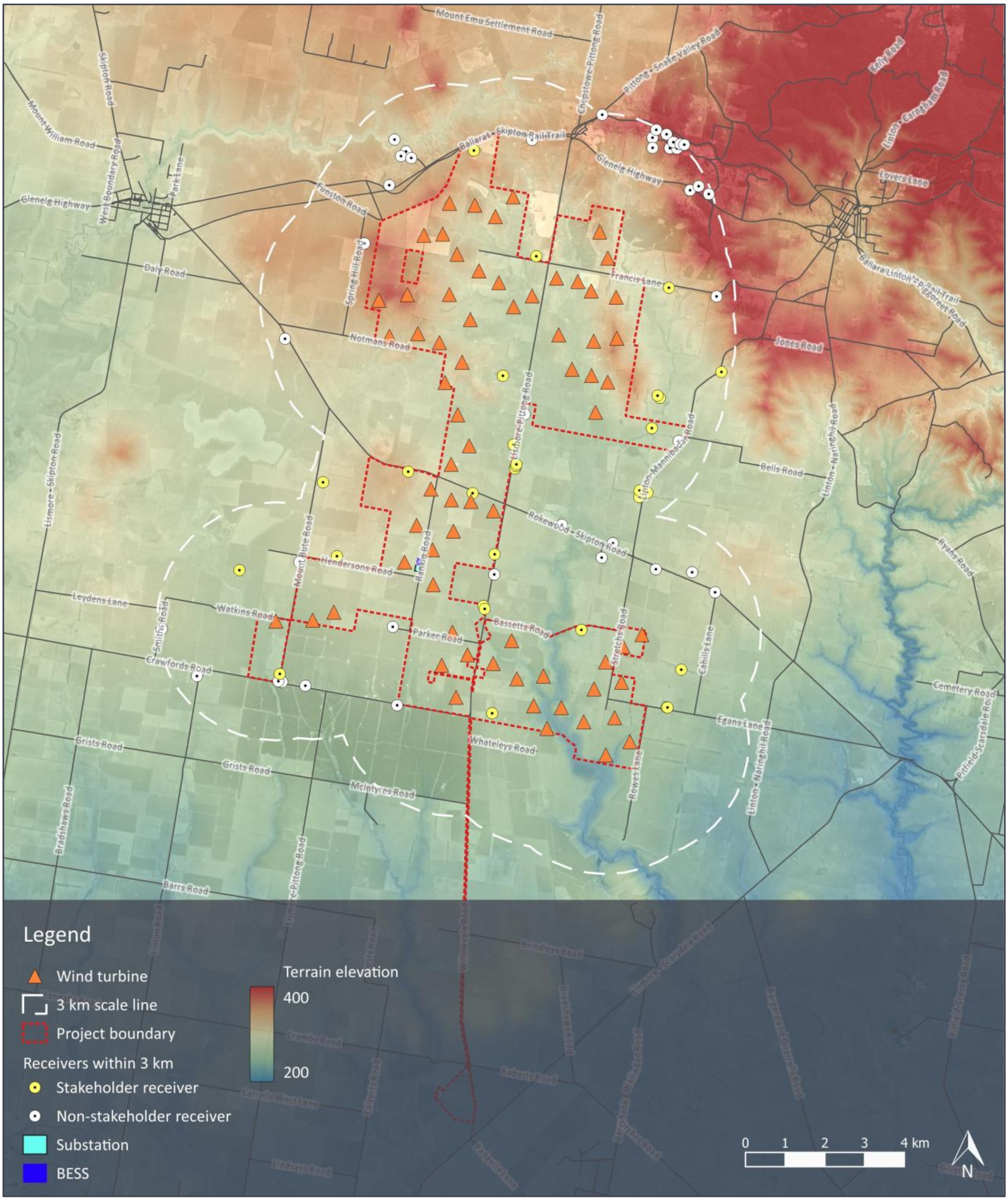
Receiver	Hub-height wind speed, m/s											
	4	5	6	7	8	9	10	11	12	13	14	15
60	21.4	21.5	23.3	26.0	28.8	30.9	31.6	31.6	31.6	31.6	31.6	31.6
63	21.3	21.4	23.2	25.9	28.7	30.8	31.5	31.5	31.5	31.5	31.5	31.5
64	21.6	21.7	23.5	26.2	29.0	31.1	31.8	31.8	31.8	31.8	31.8	31.8
82	27.3	27.4	29.2	31.9	34.7	36.8	37.5	37.5	37.5	37.5	37.5	37.5
95	22.0	22.1	23.9	26.6	29.4	31.5	32.2	32.2	32.2	32.2	32.2	32.2
99	29.0	29.1	30.9	33.6	36.4	38.5	39.2	39.2	39.2	39.2	39.2	39.2
101	23.3	23.4	25.2	27.9	30.7	32.8	33.5	33.5	33.5	33.5	33.5	33.5
113	25.8	25.9	27.7	30.4	33.2	35.3	36.0	36.0	36.0	36.0	36.0	36.0
114	24.1	24.2	26.0	28.7	31.5	33.6	34.3	34.3	34.3	34.3	34.3	34.3
119	24.9	25.0	26.8	29.5	32.3	34.4	35.1	35.1	35.1	35.1	35.1	35.1
120	25.9	26.0	27.8	30.5	33.3	35.4	36.1	36.1	36.1	36.1	36.1	36.1
121	24.3	24.4	26.2	28.9	31.7	33.8	34.5	34.5	34.5	34.5	34.5	34.5
123	22.7	22.8	24.6	27.3	30.1	32.2	32.9	32.9	32.9	32.9	32.9	32.9
124	29.3	29.4	31.2	33.9	36.7	38.8	39.5	39.5	39.5	39.5	39.5	39.5
125	22.1	22.2	24.0	26.7	29.5	31.6	32.3	32.3	32.3	32.3	32.3	32.3
130	17.7	17.8	19.6	22.3	25.1	27.2	27.9	27.9	27.9	27.9	27.9	27.9
131	28.6	28.7	30.5	33.2	36.0	38.1	38.8	38.8	38.8	38.8	38.8	38.8
136	19.2	19.3	21.1	23.8	26.6	28.7	29.4	29.4	29.4	29.4	29.4	29.4
138	23.9	24.0	25.8	28.5	31.3	33.4	34.1	34.1	34.1	34.1	34.1	34.1
139	23.9	24.0	25.8	28.5	31.3	33.4	34.1	34.1	34.1	34.1	34.1	34.1
140	24.1	24.2	26.0	28.7	31.5	33.6	34.3	34.3	34.3	34.3	34.3	34.3
141	26.2	26.3	28.1	30.8	33.6	35.7	36.4	36.4	36.4	36.4	36.4	36.4
171	23.1	23.2	25.0	27.7	30.5	32.6	33.3	33.3	33.3	33.3	33.3	33.3
175	18.9	19.0	20.8	23.5	26.3	28.4	29.1	29.1	29.1	29.1	29.1	29.1
Stakeholder receivers outside the Project boundary												
84 (S)	33.1	33.2	35.0	37.7	40.5	42.6	43.3	43.3	43.3	43.3	43.3	43.3
88 (S)	27.1	27.2	29.0	31.7	34.5	36.6	37.3	37.3	37.3	37.3	37.3	37.3
96 (S)	22.0	22.1	23.9	26.6	29.4	31.5	32.2	32.2	32.2	32.2	32.2	32.2
98 (S)	26.5	26.6	28.4	31.1	33.9	36.0	36.7	36.7	36.7	36.7	36.7	36.7
104 (S)	29.3	29.4	31.2	33.9	36.7	38.8	39.5	39.5	39.5	39.5	39.5	39.5
105 (S)	29.4	29.5	31.3	34.0	36.8	38.9	39.6	39.6	39.6	39.6	39.6	39.6
106 (S)	29.6	29.7	31.5	34.2	37.0	39.1	39.8	39.8	39.8	39.8	39.8	39.8

Receiver	Hub-height wind speed, m/s											
	4	5	6	7	8	9	10	11	12	13	14	15
108 (S)	23.7	23.8	25.6	28.3	31.1	33.2	33.9	33.9	33.9	33.9	33.9	33.9
109 (S)	23.4	23.5	25.3	28.0	30.8	32.9	33.6	33.6	33.6	33.6	33.6	33.6
110 (S)	23.0	23.1	24.9	27.6	30.4	32.5	33.2	33.2	33.2	33.2	33.2	33.2
112 (S)	23.2	23.3	25.1	27.8	30.6	32.7	33.4	33.4	33.4	33.4	33.4	33.4
118 (S)	26.8	26.9	28.7	31.4	34.2	36.3	37.0	37.0	37.0	37.0	37.0	37.0
122 (S)	22.9	23.0	24.8	27.5	30.3	32.4	33.1	33.1	33.1	33.1	33.1	33.1
135 (S)	27.3	27.4	29.2	31.9	34.7	36.8	37.5	37.5	37.5	37.5	37.5	37.5
142 (S)	28.7	28.8	30.6	33.3	36.1	38.2	38.9	38.9	38.9	38.9	38.9	38.9
281 (S)	28.6	28.7	30.5	33.2	36.0	38.1	38.8	38.8	38.8	38.8	38.8	38.8
1148 (S)	26.9	27.0	28.8	31.5	34.3	36.4	37.1	37.1	37.1	37.1	37.1	37.1
Stakeholder receivers within the Project boundary												
39 (S)	27.2	27.3	29.1	31.8	34.6	36.7	37.4	37.4	37.4	37.4	37.4	37.4
97 (S)	30.7	30.8	32.6	35.3	38.1	40.2	40.9	40.9	40.9	40.9	40.9	40.9
100 (S)	25.9	26.0	27.8	30.5	33.3	35.4	36.1	36.1	36.1	36.1	36.1	36.1
102 (S)	29.4	29.5	31.3	34.0	36.8	38.9	39.6	39.6	39.6	39.6	39.6	39.6
107 (S)	31.7	31.8	33.6	36.3	39.1	41.2	41.9	41.9	41.9	41.9	41.9	41.9
111 (S)	39.5	39.6	41.4	44.1	46.9	49.0	49.7	49.7	49.7	49.7	49.7	49.7
117 (S)	30.1	30.2	32.0	34.7	37.5	39.6	40.3	40.3	40.3	40.3	40.3	40.3
128 (S)	30.9	31.0	32.8	35.5	38.3	40.4	41.1	41.1	41.1	41.1	41.1	41.1
129 (S)	31.2	31.3	33.1	35.8	38.6	40.7	41.4	41.4	41.4	41.4	41.4	41.4
132 (S)	30.6	30.7	32.5	35.2	38.0	40.1	40.8	40.8	40.8	40.8	40.8	40.8
137 (S)	24.9	25.0	26.8	29.5	32.3	34.4	35.1	35.1	35.1	35.1	35.1	35.1
143 (S)	31.5	31.6	33.4	36.1	38.9	41.0	41.7	41.7	41.7	41.7	41.7	41.7

(S) Stakeholder

APPENDIX H SITE TOPOGRAPHY

Figure 10: Terrain elevation map for the Project and surrounding area



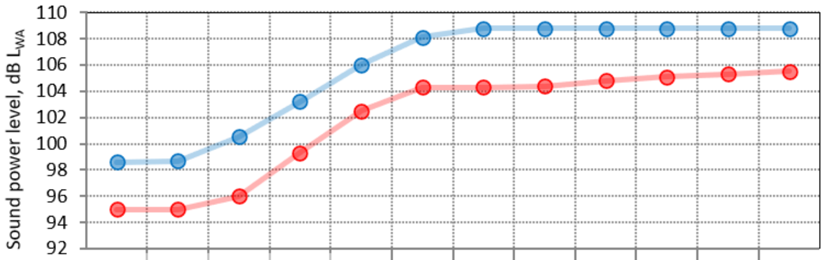
APPENDIX I NZS 6808 DOCUMENTATION

(a) Map of the site showing topography, turbines and residential properties: See Appendix H

(b) Noise sensitive locations: See Section 5.1 and Appendix F

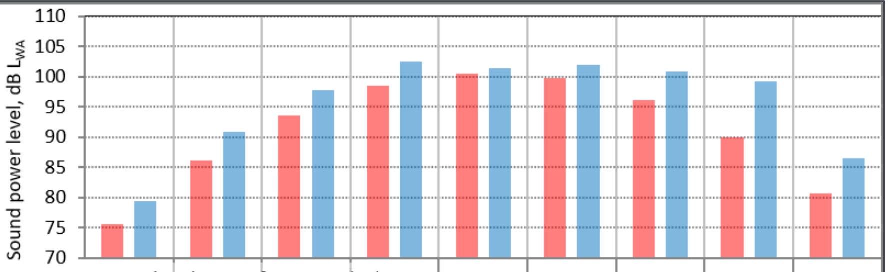
(c) Wind turbine sound power levels, dB L_{WA} (refer to Section 7.3.1)

Sound power levels (manufacturer specification +1 dB margin for uncertainty), dB L_{WA}



Hub height wind speed, m/s	4	5	6	7	8	9	10	11	12	13	14	15
V162-6.8MW	95.0	95.0	96.0	99.3	102.5	104.3	104.3	104.4	104.8	105.1	105.3	105.5
V172-7.2MW	98.6	98.7	100.5	103.2	106.0	108.1	108.8	108.8	108.8	108.8	108.8	108.8

Reference octave band spectra adjusted to the highest sound power level detailed above, dB L_{WA}



Octave band centre frequency (Hz)	31.5	63	125	250	500	1000	2000	4000	8000
V162-6.8MW	75.6	86.0	93.6	98.4	100.5	99.7	96.2	89.8	80.7
V172-7.2MW	79.3	90.8	97.8	102.4	101.4	102.0	100.9	99.3	86.5

(d) Wind turbine model: See Table 4 of Section 7.3

(e) Turbine hub height: See Table 4 of Section 7.3

(f) Distance of noise sensitive locations from the wind turbines: See Appendix F

(g) Calculation procedure used: ISO 9613-2 prediction algorithm as implemented in SoundPLANnoise v9.1 (See Section 4.3 and Appendix D)

(h) Meteorological conditions assumed: See Appendix D

(i) Air absorption parameters:

	Octave band mid frequency, Hz							
Description	**63**	**125**	**250**	**500**	**1,000**	**2,000**	**4,000**	**8,000**
Atmospheric attenuation, dB/km	0.12	0.41	1.04	1.93	3.66	9.66	32.8	116.9

(j) Topography/screening: 10 m resolution elevation contours – See Appendix H

(k) Predicted far-field wind farm sound levels: See Section 7.4 and Appendix G.

Appendix B

Auditor Verification Pre-Construction Noise Assessment, T&T, 26 June 2026

umwelt

Pre-construction noise assessment

Before you read this document

This document contains reports about predicted noise from a planned wind energy facility.

Wind turbine noise must not exceed levels set in regulations. These technical reports are prepared to accompany the wind energy facility planning application. They provide evidence that noise levels have been predicted and assessed as part of planning for new facilities.

The information below will help you understand:

- why these reports are produced
- who's involved and what their roles are
- where they fit in broader system that aims to protect the community and environment.

These are the first of many noise assessments:

Planning | Construction | Operation | Decomissioning

Pre-construction (predictive) noise assessment reports

This aims to predict noise emissions from wind turbines in accordance with the relevant noise standard. This report contains the assessment, predictive results and may include recommendations.

Verification report

This confirms if the assessment methods used in the above report comply with those in the relevant noise standard.

These reports do not approve the construction or operation of a wind energy facility.

Who's involved at this stage:

Wind energy facility

- Must meet regulatory requirements
- Engages both:
  - a suitably qualified acoustician
  - an EPA-appointed environmental auditor.

Acoustician

- Predicts and assesses wind turbine noise against the relevant noise standard
- Completes the pre-construction (predictive) noise assessment report.

Environmental auditor

- Independently verifies the pre-construction (predictive) noise assessment report
- Determines if the assessment methods comply with the relevant noise standard
- Completes the verification report
- While environmental auditors are appointed by EPA, they are independent and are not employed by EPA.

Department of Transport and Planning

- Administers the planning application process for a wind energy facility
- These reports will be considered when determining a planning application
- Minister for Planning is the responsible authority for a wind energy facility planning application
- For more information, go to **dtp.vic.gov.au.**

For further information about how we regulate wind turbine noise visit our **website**.

epa.vic.gov.au

Environment Protection Authority Victoria
GPO Box 4395, Melbourne VIC 3001
1300 372 842

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REPORT

Moreton Hill Wind Farm

Auditor Verification of Pre-Construction Noise Assessment

Prepared for
MHWF Nominees Pty Ltd

Prepared by
Tonkin & Taylor Pty Ltd

Date
30 June 2026

Job Number
1098622 v3.0

Together we create and sustain a better world
www.tonkintaylor.com

Document control

Title: Moreton Hill Wind Farm – Auditor Verification of Pre-Construction Noise Assessment					
Date	**Version**	**Description**	**Prepared by:**	**Reviewed by:**	**Authorised by:**
26/08/25	1	Final	L Leitch T Kortegast	D Humpheson	T Kortegast
16/12/25	1.1	Updated report references	L Leitch T Kortegast	D Humpheson	T Kortegast
10/02/26	2.0	Update following minor WEF layout revision	D Humpheson T Kortegast	L Leitch	T Kortegast
30/06/26	3.0	Update following addition of second candidate turbine	L Leitch T Kortegast	D Humpheson	T Kortegast

Distribution:

MHWF Nominees Pty Ltd 1 PDF copy

Tonkin & Taylor Pty Ltd (FILE) 1 electronic copy

Table of contents

1 Introduction

1.1 Purpose

Mr Anthony Kortegast of Tonkin & Taylor Pty Ltd (**T+T**), an EPA Victoria appointed Environmental Auditor (Industrial Facilities), has been engaged by MHWF Nominees Pty Ltd to verify a Pre-Construction Noise Assessment report (**PCNA**) prepared for the Moreton Hill Wind Farm[1] (**MHWF**), located in Corangamite Shire and Golden Plains Shire in Victoria, approximately 35 km southwest of Ballarat.

The EP Regulations 2021 require that Wind Energy Facility (**WEF**) operators must engage an environmental auditor to prepare a report verifying, where relevant, that:

- The post-construction noise assessment conducted for a WEF is conducted in accordance with the New Zealand Standard **NZS 6808:2010** *Acoustics – Wind farm noise* (Regulation 131D(2).
- The noise management plan (**NMP**) prepared for the WEF is in accordance with Regulation 131E(2).
- 5-yearly monitoring reports are in accordance with Regulation 131G(2).

Hence, while verification of a pre-construction noise assessment by an environmental auditor is not required by EP Regulations 131A to 131H, Clause 52.32 of the Victoria Planning Provisions requires that an environmental auditor, appointed under Part 8.3 of the Environment Protection Act 2017, verifies whether the pre-construction (predictive) noise assessment was conducted in accordance with NZS 6808:2010.

Verification of the PCNA Report has been undertaken by Mr Kortegast (the **Auditor**) with the input of his expert support team as noted below, both of whom have extensive windfarm noise monitoring and permitting experience, including verification reviews:

- Ms Lindsay Leitch, Senior Acoustics Specialist at T+T, BSc(Hons), MIOA[2], MASNZ.[3]
- Mr Darran Humpheson, Technical Director of Acoustics at T+T, BSc(Hons), MSc, MIOA, MASNZ.

The Auditor and his support team are familiar with the regulatory framework for windfarm noise management in Victoria and the associated EPA auditor guidance that has been published, specifically:

- **Verification and review for wind energy facilities** (Environmental Auditor Guidelines), EPA Publication 1692.1, December 2024; and
- **Wind Energy Facility Turbine noise** – Technical Guideline, EPA Publication 3011, December 2024.

This guidance has informed the structure of this verification report in relation to the PCNA.

1.2 Version

This Version 3.0 MHWF verification report updates the previous verification to reflect the assessment of an additional wind turbine in the most recent PCNA Report. The Vestas V162-6.8 MW turbine remains unchanged. The Vestas V172-7.2 MW turbine has been included as an additional assessed turbine.

[1] https://www.squadronenergy.com/our-projects/moreton-hill-wind-farm
[2] Member of the Institute of Acoustics.
[3] Member of the Acoustical Society of New Zealand.

1.3 MHWF reports

The primary document which has been reviewed is:

- ***Moreton Hill Wind Farm - Environmental noise assessment,*** Marshall Day Acoustics, reference Rp 003 R03 20200545, 26 June 2026 (**2026 PCNA Report**) (attached at Appendix B)

Additional reports which have been viewed and referenced are:

- ***Moreton Hill Wind Farm - Background noise monitoring.*** Marshall Day Acoustics, reference Rp 002 R02 20200545, 12 January 2026 (**BG Report**).
- ***Vestas document*** no 0111-1246_03 'Third octave noise emission' EnVentus™ V162-6.8MW 50/60 Hz dated 2023-01-13.
- ***Australian Radio Towers Group*** – Moreton Hill 1x160 m Met Mast Installation, 18 April 2024.
- ***CWP Renewables Pty Ltd*** – LiDAR Installation Report, 7 July 2022.

While we have not viewed similar Vestas documentation for the V172 turbine, the 2026 PCNA Report includes relevant third octave noise data for the second candidate turbine.

We have relied on the information as presented within the 2026 PCNA Report for our verification review, including its technical appendices. We have also relied on the BG Report as the 2026 PCNA Report references the results of noise and wind data measurements.

1.4 Project history and operational status

The proposed MHWF is at the planning and approvals stage, with the EES Referral and EPBC Referral already submitted. The Minister of Planning has determined that the Project does not require an EES and as such, EPA permitting assessments have been prepared. This includes preparation of the PCNA.

The Project is for 62 wind turbines; however, for the PCNA a conservative scenario based on 68 turbines has been assessed. Within the Project boundary a substation and Battery Energy Storage System (**BESS**) are also proposed.

As is common in pre-construction noise assessments, one or more candidate turbines are assessed which for MHWF includes the following wind turbines:

- Vestas V162-6.8MW
- Vestas V172-7.2MW

2 Regulatory framework and guidance

2.1 Background

The background to the current WEF regulatory framework and the basis for the Environment Protection Regulations is set out in the publication ***Wind Energy Facility Turbine noise – technical Guideline***, EPA Publication 3011, December 2024.

As set out in the ***Environmental Auditor Guidelines – Verification and review for wind energy facilities***, EPA Publication 1692.1, December 2024, the regulatory framework was altered such that operational WEF noise became regulated under the Environment Protection Act 2017 with the detailed requirements set out in the Environment Protection Regulations 2021. At that point the environmental audit regime under (prior) permit conditions ceased, and the General Environmental Duty (**GED**) and unreasonable noise provisions of the EP Act came into effect. The EP Regulations 2021 were also updated to set out the requirements for environmental auditor verifications for the pre-/post-construction noise assessment, noise management plan (**NMP**) if applicable, and five yearly wind turbine noise monitoring reports (only required when the WEF is operating).

2.1.1 Other relevant documents

Other documents relevant to understanding the Victorian regulatory framework and referenced for this verification of the PCNA are as follows:

- ***Environment Reference Standard*** *(25 May 2021), as amended by Environment Reference Standard No. S158 Gazette. 29 March 2022* (the **ERS**).
- ***Environment Protection Amendment (Wind Turbine Noise) Regulations 2022.***
- ***Policy and planning guidelines for development of wind energy facilities in Victoria, Victorian Department of Environment, Land, Water and Planning, November 2021.***
- ***New Zealand Standard 6808:2010 - Acoustics – Wind farm noise.***
- ***Environmental Auditor Guidelines for the Preparation of Environmental Audit Reports on Risk to the Environment****, EPA Publication 952.5.*
- **Noise limit and assessment protocol for the control of noise from commercial, industrial and trade premises and entertainment venues** (Noise Protocol), EPA Publication 1826.5, September 2025.[4]
- ***Environmental Auditor Guidelines for Conducting Environmental Audits****, EPA Publication 953.2.*

In addition, reference is made to the United Kingdom Institute of Acoustics Good Practice Guides (**UK IoA GPG**) for wind turbine noise[5].

2.2 Verification requirements

Section 3.1 of EPA Publication 1692.1 notes that the verification is to be conducted in a manner deemed appropriate by the environmental auditor and would typically include the following steps:

1. Familiarisation with the WEF development proposal and planned operation.
2. Inspection of the WEF project site and the surrounding environment.
3. Assessment of the rigour of the process used to identify surrounding noise sensitive locations.

[4] Relevant for the assessment of non-turbine noise.
[5] https://www.ioa.org.uk/publications/wind-turbine-noise

4 Review of the pre-construction noise assessment considering the WEF development proposal and operations including:
   – Turbine technical specifications and power ratings;
   – Tower locations;
   – Topography maps and aerial imagery; and
   – Any other relevant factors.
5 Review of background noise assessments (where available).
6 Technical verification of the predictive noise assessment, including:
   – Methodology applied to conduct the assessment;
   – Review manufacturer's or turbine technical reports on representative sound power and frequency spectrums produced by the turbines;
   – Noise monitoring equipment and parameters used;
   – Interrogated the rigor of the modelling selected parameters and processes;
   – Sound modelling programs and input data employed;
   – Relevance of a high amenity noise limit; and cumulative noise from other WEF considerations;
   – Appropriate and reasonable accounting for uncertainty within the assessment;
   – Compliance limits, including where there is a wind turbine noise agreement, specified in the noise assessment report; and
   – Verification that the assessment was conducted in line with the relevant noise standard.
7 Review of identified potential noise impacts and any operational plans to manage the impacts (e.g. select turbines operating in reduced power modes during certain wind conditions) that are proposed as part of the WEF permit application.
8 Require clarification on mapped noise sensitive locations[6].
9 Risk assessment, including a qualitative statement on the risk of non-compliance.

For completeness, this verification review also considers the assessment of operational noise from the ancillary infrastructure for the WEF, namely:

- Substation; and
- 100 MW / 400 MWh BESS.

Construction noise has also been verified.

2.3 Report structure and scope

EPA Publication 1692.1 was issued in December 2024 and provides comprehensive guidelines for WEF audit reports. The requirements of EPA Publication 1692.1 have been incorporated into this verification report.

This verification report has been structured, as detailed below, to follow the process and analysis steps set out in the EPA WEF guidance. Appendix A of this report includes the EPA checklist which has been populated with our observations/findings.

1 Proposed WEF development including turbine specification – **Section 3.1**
2 Inspection of the WEF project site – **Section 3.2**
3 Verification of the identification of noise sensitive locations – **Section 3.3**

[6] This should include verification of stakeholder noise agreements, see Section 3.3 of EPA Publication 1692.1.

4 Review of the PCNA considering the WEF development proposal and operations – **Section 3.4**

5 Review of background noise assessments and determination of noise limits – **Section 3.5**

6 Verification of the predictive noise assessment (**Section 3.6**), including:

   a Methodology applied to conduct the assessment – **Section 3.6.1**

   b Review of manufacturer's sound power level data – **Section 3.6.2**

   c Modelling parameters and processes – **Section 3.6.3**

   d Sound modelling program and input data – **Section 3.6.4**

   e High amenity noise limit – **Section 3.6.5**

   f Cumulative noise – **Section 3.6.6**

   g Uncertainty accounting – **Section 3.6.7**

   h Verification that the assessment has been conducted in line with the NZS 6808:2010 – **Section 3.6.8**

7 Require clarification on mapped noise sensitive locations – **Section 3.7**

8 Review identified noise impacts and any operational plans to manage these – **Section 3.7**

9 Review of ancillary infrastructure (BESS and substation) – **Section 3.9**

10 Review of construction – **Section 3.10**

11 Risk assessment – **Section 3.11**

12 Auditor comments and recommendations, if applicable – **Section 4**

13 Auditor verification statement – **Section 5**

3 Verification analysis

3.1 Proposed WEF development

The proposed MHWF comprises a wind farm, substation and BESS, as well as associated infrastructure including access tracks, underground cable reticulation, overhead power transmission lines and site offices. It is located within the Corangamite Shire and Golden Plains Shire, approximately 35 km southwest of Ballarat. The nearest townships are Skipton and Linton, approximately 5 km to the west and east of the Project site, respectively.

The overall capacity of the wind farm will be approximately 420 MW from 62 turbines. The candidate turbines for the PCNA are the Vestas V162-6.8MW and Vestas V172-7.2MW. Details of the turbine and the overall wind farm are included in Table 3.1.

While the Project is for up to 62 wind turbines, the PCNA has assessed an additional 6 turbines (68 in total). The Auditor agrees with the 2026 PCNA Report that the reported noise level predictions represent a conservative assessment scenario.

Table 3.1: Turbine specifications

	Overall wind farm	Candidate turbine 1	Candidate turbine 2
Turbine	Not specified	Vestas V162-6.8MW	Vestas V172-7.2MW
Capacity (MW)	420 total from 62 turbines	6.8	7.2
Hub height (m)	Not specified	166	166
Rotor diameter (m)	Not specified	162	172
Tip height (m)	252	~247*	~252*
Cut-in wind speed (m/s)	Not specified	3	3
Rated wind speed (m/s)	Not specified	13	13
Cut-out wind speed (m/s)	Not specified	25	25
Sound power level dB LWA	Not specified	105.5 dB @ 15 m/s	108.8 dB @ 10 m/s
Operating mode	Not specified	PO6800 (not limited)	PO7200 (not limited)

* Based on other dimensions provided

The BESS facility will have a rated power of up to 100 MW. It will be located adjacent to the substation site. Associated infrastructure includes access tracks, underground cables, overhead power transmission lines and site offices.

The proposed layout of the MHWF and surrounding receivers is shown in Figure 3.1 below.

Figure 3.1: Site layout plan (source: Figure 2 of the PCNA).

Five neighbouring wind farms have been identified, with the closest being Stockyard Hill Wind Farm 3.8 km to the north-west. All other wind farms are 10 km or more from the MHWF site.

3.2 Project site inspection

The site visit was undertaken on 12 May 2025 and comprised driving around the site perimeter, and to the extent possible, through the project area. The site area has been overlaid on a map image, with the route driven and reference photo points indicated as P1 to P5 – see Appendix C.

Commencing in Skipton township the route driven was:

- From Skipton east along the Glenelg Highway (B160) to the intersection with the Pittong-Lismore Rd.
- South along the Pittong-Lismore Rd (passing the Suvo Industries kaolin quarry) to the intersection with the Rokewood-Skipton Rd.
- West on the Rokewood-Skipton Rd as far as DE Quarries and returning to the Pittong-Lismore Rd intersection.
- South on the Pittong-Lismore Rd to Crawfords Rd then west along Crawfords Rd as far as Lintons Rd.
- East then north up the Pittong-Lismore Rd back to the B160 then east to the Flagstaff Hill lookout. The Flagstaff Hill lookout provides a full panorama view of the site to the west.

The project area is an irregular shape approximately 14 km long north-south and varying from less than 1 km to up to 8 km wide from east-west. The site is oriented approximately north south along and either side of the Pittong-Lismore Rd, south of the B160. The B160 runs along a prominent ridgeline and the site is in a shallow valley on topography that generally rises from south to north.

The site is mostly open farmland with significant areas of shelter belts and plantation forestry. Parts of the site are screened by rising ground and shelter belts, particularly from the east.

The drive through enabled the bulk of the central site area to be viewed, with the central and northern parts visible from the C143. The best perspective of the landform is provided by the panorama from the Flagstaff Hill lookout which shows the entire project area in the middle distance (refer Photo 5).

3.3 Noise sensitive locations

The PCNA has initially identified noise sensitive locations (receivers) within 3 km of the proposed turbine locations and electrical infrastructure (substation and BESS). The PCNA has then predicted the 35 dB LA90 contour for the wind turbines. This contour is comfortably within this 3 km buffer, hence this would be expected to capture all applicable receivers. A similar distance has been used to capture all relevant receivers for electrical infrastructure noise, noting that the same receivers will be affected by wind turbine noise.

The PCNA identifies stakeholder receivers as those noise sensitive locations where a noise agreement is in place, regardless of whether the receivers are inside or outside the Project boundary. The PCNA states that a total of 67 receivers were identified within 3 km of the proposed wind turbines, comprising:

- 38 non-stakeholder receivers on properties that are not associated with the Project.
- 29 stakeholder receivers including:
  - 12 receivers within the Project boundary.
  - 17 receivers outside the Project boundary where a noise agreement is proposed between the landowner and MHWF Nominees Pty Ltd.

The Auditor notes that the dwelling at receiver 111 (included as a stakeholder within the Project boundary) is under contract with the landowner to be demolished.

Natural areas within 10 km of the turbine locations were also considered in the PCNA – as required by the ERS. Ten natural areas were identified.

3.4 WEF development proposal

3.4.1 Turbine technical specifications

Two candidate turbines are proposed for the Project: the Vestas V162-6.8MW and the Vestas V172-7.2MW, see Table 3.1 above. The Auditor is unable to provide comment as to whether this represents a worst-case scenario for the predicted sound levels, but the sound power level appears to be representative of similar sized turbines. The assumed sound power level of the newly assessed turbine (candidate turbine 2) is 3.3 dB higher than the original (candidate 1) turbine.

3.4.2 Tower locations

The general layout of the Project is shown in Figure 2 of the PCNA (reproduced as Figure 3.1 above), with coordinates of the turbines presented in Appendix B of the PCNA. The PCNA layout is based on 68 wind turbines, whereas the final layout will be for up to 62 turbines. The Auditor understands that the final layout may change but will be within the parameters of the PCNA, albeit with 62 rather than 68 wind turbines. The Auditor agrees with the 2026 PCNA Report that the reported noise level predictions based on a 68 wind turbine layout and two wind turbine types represent a conservative assessment scenario.

3.4.3 Topography and aerial imagery

The Auditor has viewed aerial imagery of the site and surrounding area.

Topography of the site and surrounding area is shown in Appendix H of the PCNA. 10 m contours were used for the modelling (see Appendix H for terrain imagery and Appendix D for noise prediction details – use of terrain data) which the Auditor considers sufficiently fine resolution for the local topography.

3.5 Background noise assessments and determination of noise limits

3.5.1 Background noise assessment

The 35 dB LA90 predicted wind turbine noise contour encompasses four non-stakeholder receivers. In accordance with NZS 6808:2010, background noise monitoring is required at these four receivers. MHWF Nominees Pty Ltd elected to undertake noise monitoring at 9 locations in 2024 and a further three locations in 2025 (April to June 2025). The Auditor considers that the election to undertake more comprehensive monitoring than required by NZS 6808:2010 represents a thorough assessment of the background noise environment across the Project site.

The BG Report provides detailed information on the background noise monitoring, including:

- Description of the noise monitoring equipment including ancillary equipment.
- The location of noise monitoring positions.
- Time and duration of the monitoring period.
- Averaging period for noise measurements.

The Auditor considers that comprehensive information has been provided in the BG report regarding the locations of the noise monitoring (coordinates and photographs in Appendices F to P) as well as the equipment used.

The background noise assessment is also dependent on wind data. Wind data was derived from two sources:

1 For the periods of 1 March to 28 April 2024 and 2 May to 7 June 2024, site wind speed data was sourced from a Windcube LiDAR located within the project site area.
2 For the period of 23 April to 5 June 2025, site wind speed data was sourced from a meteorological mast located within the project site area.

While the Auditor notes that there is a separation of ~6 km between the two wind data monitoring locations, MHWF Nominees Pty Ltd has confirmed that due to flat/gently undulating nature of the terrain and consistent terrain features (open farmland), the wind speed difference between the two locations can be considered negligible for the purposes of the background noise study and the PCNA.

As required by NZS 6808:2010 wind speed data at hub height, i.e. 166 m, was provided to Marshall Day Acoustics. This data was based on an analysis conducted by Squadron Energy Pty Ltd using site-specific wind shear calculations as noted in Appendix D of the BG Report – the methodology being based on Method B of the IOA GPG Note 4. Further information requested by the Auditor and provided by MHWF Nominees Pty Ltd provides the technical specification of the LiDAR and met mast (number and height of anemometers) – as sourced from the two wind reports referenced in Section 1.3[7].

The Auditor considers that the approach to the background noise and wind measurements is in general accordance with NZS 6808:2010.

3.5.2 Noise limits

The PNCA uses noise limits determined in accordance with NZS 6808:2010, accounting for the land zoning of the area – see Section 3.6.5 below re high amenity limit.

Applicable noise limits are presented in Table 3 of the PCNA for the background monitoring locations. The Project has adopted the base (minimum) noise limits (fixed limits) irrespective of wind speed. The background noise monitoring results does show that background LA90 + 5 dB limits would be greater than the base noise limits at certain wind speeds. By adopting the base noise limits an element of conservatism is provided for non-stakeholder receivers at the higher wind speeds (>12 m/s for certain locations).

The Auditor agrees with the applicable limits, which are:

- Non-stakeholder – 40 dB across all wind speeds.
- Stakeholder outside the Project boundary with a noise agreement – 45 dB across all wind speeds.

The Auditor agrees with the noise limits used in the 2026 PCNA Report.

3.6 Verification of predictive noise assessment

3.6.1 Assessment methodology

In general, the Auditor considers the assessment methodology to be consistent with NZS 6808:2010 and well documented.

[7] Australian Radio Towers Group report and CWP Renewables Pty Ltd report.

3.6.2 Sound power level data

A maximum sound power level of 104.5 dB LWA is quoted in the Vestas documentation for the V162 PO6800 with serrated trailing edge blades. 1 dB has been added to this value in the PCNA to allow for uncertainty, which the Auditor agrees is a reasonable approach. The maximum resulting LWA is 105.5 dB and occurs at a wind speed of 15 m/s. The corresponding values for the V172-7.2MW are 107.8 dB at 10 m/s (provided by Vestas), with 1 dB added resulting in 108.8 dB LWA used in the assessment.

The Vestas documents contain third-octave band frequency data for a range of turbine configurations. The octave band values quoted in Appendix I of the PCNA match the Vestas data for the V162-6.8NW turbine (when converted to single octave bands and having included the 1 dB uncertainty factor). We have not undertaken a similar comparison of the V172-7.2MW turbine.

The spectral data for the V172-7.2 MW turbine indicate a relatively greater proportion of sound energy at frequencies above 1 kHz compared to the V162-6.8 MW turbine. This spectral difference contributes to the modelled receiver levels, which differ by less than the overall LWA difference of 3.3 dB between the two turbine models.

3.6.3 Modelling parameters and processes

The prediction method from ISO 9613-2:1996 is used within SoundPLAN modelling software. The PCNA discusses the limitations and uncertainties of the prediction method in Appendices D1, D2 and D3. The procedures adopted follow best practice, which includes the recommendations of the UK IoA GPG.

Other parameters are listed in Appendix D of the PCNA. The Auditor has no issues to raise regarding these.

3.6.4 Sound modelling program and input data

Appendix D of the PCNA states that the assessment uses SoundPLAN v9.1 proprietary noise modelling software. SoundPLAN is industry standard and considered appropriate for the purpose.

Details of the modelling inputs are listed in Appendix D of the PCNA. The Auditor confirms that the modelling program and modelling assumptions outlined in Appendix E2 are appropriate and consistent with current best practice.

3.6.5 High amenity noise limit

The site and surrounding area are zoned Farming (FZ), as set out in Section 7.1.1 of the PCNA. The Auditor agrees that a high amenity noise limit is not warranted, which is in accordance with EPA Publication 3011. The base noise limit is therefore 40 dB LA90 at all wind speeds for non-involved / non-stakeholder receivers.

3.6.6 Cumulative noise

The PCNA identifies approved and operating projects within 10 km of the Project – as shown in Figure 7 of the PCNA. Of relevance for cumulative noise are:

- Stockyard Hill Wind Farm (~4 km) - operational
- Chepstowe Wind Farm (~10 km) - operational
- Berrybank Wind Farm (~10 km) - operational
- Golden Plains Wind Farm (~11 km) - currently under construction and partially operational

The cumulative assessment was undertaken initially by comparing the predicted 30 dB LA90 contours for each wind farm. Where these do not overlap, it can be assumed that the cumulative noise will not affect compliance and further assessment is not required. The Auditor agrees with this approach.

The area between MHWF and Stockyard Hill Wind Farm where the 30 dB LA90 contours were found to overlap was assessed in more detail and also found not to affect compliance (at either WEF).

Cumulative noise from different aspects of the development (turbines, substation and BESS) are harder to assess since different methodologies apply. This falls outside the scope of this verification, however, the Auditor notes that under worst-case conditions wind turbine noise (as quoted in the PCNA) will be higher, and that the overall increase in noise will be negligible.

3.6.7 Uncertainty accounting

Uncertainty of the predicted noise levels is addressed in Appendix D3 of the PCNA. The assessment mainly relies on the increased sound power level to address uncertainty. The general modelling approach is conservative, such as the modelling of downwind conditions in all directions which is not realistic under real-world conditions, and the assumption that all turbines are producing the maximum sound power level simultaneously.

The overall uncertainty in the modelled sound transmission is expected to be ±1 dB. The Auditor agrees that uncertainty has been accounted for.

Wind data has been sourced from two locations within the Project boundary. The Auditor agrees with MHWF Nominees Pty Ltd that the wind speed difference between the two locations can be considered negligible for the purposes of the background noise study. Wind speed data at hub height has been derived using either LiDAR or by extrapolation using appropriate wind shear calculations.

The Auditor considers that uncertainty in the noise and wind data has been adequately addressed in the assessment.

3.6.8 NZS 6808:2010

The requirements of NZS 6808:2010 are listed in the compliance table which is included at Appendix A of this verification report - as per the requirements of EPA Publication 1692.1. Auditor comments are provided in the compliance table, as appropriate, for each relevant clause of NZS 6808:2010.

3.7 Noise sensitive locations

Noise sensitive locations appear to have been appropriately identified in the PCNA. From a high-level inspection of the aerial imagery, the Auditor has not identified any inconsistencies.

The Auditor has not reviewed stakeholder agreements and relies on the information contained in the PCNA as to which receivers are stakeholders, i.e. those receivers with a noise agreement.

3.8 Noise impacts

The PCNA lists the requirements relating to noise impacts under the relevant legislation (EP Act 2017, Environment Reference Standard, and Victorian Wind Energy Guidelines). The PCNA has not considered noise impacts other than through compliance with noise limits. The Auditor considers this is an acceptable approach and resulting noise effects are likely to be reasonable.

Table 8 of the PCNA details the highest predicted noise levels at non-stakeholder and stakeholder receivers. In summary:

- All non-stakeholder receivers are predicted to experience worst-case noise levels of less than 40 dB for either candidate turbine. The highest predicted noise level is 39.2 dB at receiver 99 from the V172-7.2MW.
- The highest predicted noise level at a stakeholder receiver outside the Project boundary is 43.3 dB (V172 at 10 m/s) or 40.9 dB LA90 (V162 at 15 m/s) at 84(S). No other stakeholder in this category is predicted to experience a noise level of 40 dB or above.
- The highest predicted noise level at a stakeholder receiver inside the Project boundary is 49.7 dB (V172 at 10 m/s) or 47 dB LA90 (V162 at 15 m/s) at 111(S). It is understood from the PCNA that receiver 111(S) is to be demolished under contract with the landowner. The highest predicted noise level for other stakeholder receivers within the Project boundary is 41.9 dB (V172 at 10 m/s).

The PCNA concludes that the wind turbine noise levels are predicted to comply with the noise limits for all receivers (40 dB for non-stakeholders and 45 dB for stakeholders). The Auditor agrees with this statement based on the information reviewed in the PCNA and BG reports.

3.9 BESS and substation

The BESS and substation are co-located with the Project's boundary and noise has been assessed in the PCNA against the appropriate limits from EPA Publication 1826.5 - Noise Protocol (with no correction for background noise – 'background relevant areas'). The most stringent limit is the night period limit at the closest receivers (118, 124, 128, 129 and 131). Even allowing a +2 dB penalty for potential tonality, predicted effective noise levels are found to be at least 4 dB below the applicable night period limit of 34 dB LAeq(30min).

The correct noise limits have been determined, and the assumptions and methodology all appear reasonable. The Auditor has confidence that compliance is achievable based on typical worse case conditions (all electrical plant operating during the night period at maximum operating load).

3.10 Construction

The 2026 PCNA Report does not include a detailed construction noise assessment, as is typical for pre-construction assessments. However, high-level construction noise management measures are presented in Section 9 of the PCNA, and should be included in a construction environmental management plan. Construction noise is expected to represent a limited risk factor, and it can be adequately managed.

3.11 Risk assessment

Appendix D3 of the PCNA sets out a well-reasoned discussion of the uncertainty in the noise predictions, which mainly comes down to confidence in the sound power levels. This is the primary risk in the assessment with regards to uncertainties.

As the Project has adopted the base (minimum) noise limits (fixed limits), any uncertainty in wind speed data (which could influence the wind varying background noise levels) is relatively immaterial as compliance can be comfortably achieved with a headroom of ~3 dB for non-stakeholders and ~4 dB for all retained stakeholder receivers (based on maximum LWA of 105.5 dB).

Operational noise effects will be managed through the NMP, in accordance with EP Regulations, ensuring risks are minimised as far as reasonably practicable.

Recommended noise management measures are included in Section 9 of the PCNA. These include:

- NMP - identifies risks and outlines procedures for monitoring, complaint handling, and remediation.
- Post-construction compliance testing - confirms actual noise levels match predicted levels once the wind farm is operational.
- Annual compliance statements - tracks ongoing performance and community feedback.
- Five-yearly verification monitoring - periodic reassessment to ensure long-term compliance.
- Substation and BESS - transformer and BESS noise control achieve the lowest reasonably practicable noise emissions.
- Construction phase - implementation of a Construction Environmental Management Plan.

The Auditor considers that project risks have been identified and accounted for within the 2026 PCNA Report.

4 Auditor comments and recommendations

4.1 Auditor comments

The Auditor raised one observation regarding wind speed data which was addressed by MHWF Nominees Pty Ltd – see Section 3.5.1 above. This resulted in the provision of the two wind reports[8] noted in Section 1.3 above. No further comments are made.

4.2 Auditor recommendations

The Auditor makes no specific recommendations in relation to the 26 June 2026 Pre-Construction Noise Assessment report.

[8] Australian Radio Towers Group report and CWP Renewables Pty Ltd report.

5 Auditor verification statement

I, Anthony P. Kortegast of Tonkin & Taylor Pty Ltd, an Environmental Auditor – Industrial Facilities (appointed pursuant to the Environment Protection Act 2017; "the Act"), having:

1. been requested by MHWF Nominees Pty Ltd to verify a Pre-Construction Noise Assessment report for the Moreton Hill Wind Farm (the **2026 PCNA**).
2. and having considered the following documents:

   – ***Wind Energy Facility Turbine noise – Technical Guideline***, EPA Publication 3011, December 2024.
   – ***Environmental Auditor Guidelines – Verification and review for wind energy facilities***, EPA Publication 1692.1, December 2024,
   – ***New Zealand Standard 6808:2010 - Acoustics – Wind farm noise***

   and having considered the following additional documents:

   – ***Environment Protection Act 2017 (the Act)*** *– in particular the General Environmental Duty (GED)*
   – ***Environment Protection Regulations 2021***
   – ***Environment Protection Amendment (Wind Turbine Noise) Regulations 2022***
   – ***Policy and planning guidelines for development of wind energy facilities in Victoria, Victorian Department of Environment, Land, Water and Planning****, November 2021*
   – ***Environmental Auditor Guidelines for the Preparation of Environmental Audit Reports on Risk to the Environment****, EPA Publication 952.5*
   – **Noise limit and assessment protocol for the control of noise from commercial, industrial and trade premises and entertainment venues**, EPA Publication 1826.5, September 2025
   – ***Environmental Auditor Guidelines for Conducting Environmental Audits,*** *EPA Publication 953.2*

HEREBY DECLARE that I am of the opinion that:

i The 2026 PCNA report (Marshall Day Acoustics reference Rp 003 R02 20200545, 12 January 2026) includes the information specified in NZS 6808:2010, EPA Publication 3011 and EPA Publication 1692.1.

ii The 2026 PCNA adequately addresses and meets the intent and required outcomes of EPA Publication 1692.1 and specifically the requirements of NZS 6808:2010.

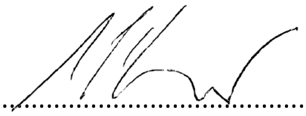
Dated: 30 June 2026

Signed:

Mr Anthony P. Kortegast
Environmental Auditor (Industrial Facilities)

Appointed pursuant to the Environment Protection Act 2017

Report prepared by:



Anthony Kortegast
EPA Appointed Industrial Facilities Auditor

Expert support input by:

Lindsay Leitch, Senior Acoustics Specialist

Darran Humpheson, Technical Director of Acoustics

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Appendix A Minimum requirement pre construction verification checklist

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From Appendix B of EPA 1692.1 Environmental Auditor Guidelines – Verification and review for wind energy facilities, with cross reference to reviewed reports. Colour coding for compliance:

Orange	Additional information or clarification requested
Yellow	Comment only
Green	No further action
Grey	N/A

Table Appendix B.1 : Verification check list

EP Regulations 2021	Requirement	Reference from information source	Assessment / observations / conclusions	Compliance
131A	Wind turbine noise agreement	-	Reliant on PCNA report for noise agreements	Yes
131B	Relevant noise standard	PCNA		Yes
131BA	Noise limit	PCNA		Yes
131BB	Alternative monitoring point	N/A		N/A

NZS 6808:2010 section / clause	NZS 6808:2010 requirement	Reference from information source	Assessment / observations / conclusions	Compliance
Definitions	Measurement time: 10 min accuracy 1% i.e. 6s	-	Not specified but tolerance of SLMs used are expected to be well within this range	Yes
	Noise limit: not to be exceeded	-	NZS 6808:2010 Base noise limit of 40 dB LA90 for all wind speeds	Yes
	Notional boundary: a line 20 m from any side of a noise sensitive location	PCNA		
	Post-installation sound level: A-weighted L90 centile level	PCNA		
	Cut-in speed typical: 4 m/s. Shut down 25 m/s	PCNA		
3.1	Metric for wind farm sound: A-weighted L90 centile level i.e. dB L90(10min)	PCNA		
3.2	Determine location of 35 dB contour	PCNA	Initial screening uses 3 km buffer from turbines, subsequently 35 dB LA90 contour predicted.	Yes
	Determine wind farm noise limits	PCNA	All time and night-periods assessed	Yes
	Refine predictions at each noise sensitive location	PCNA		Yes
4.1.1	Audibility	-	PCNA could include comment on audibility	N/A
4.2	Reverse sensitivity	-	Not addressed	N/A
	Nomination of a 40 dB wind farm sound level contour and the 35 dB contour	-	Not addressed	Yes
5	Noise limits			
5.1.2	Upper limit at residential location of 40 dB L90	PCNA	Base limit of 40 dB being used	Yes

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NZS 6808:2010 section / clause	NZS 6808:2010 requirement	Reference from information source	Assessment / observations / conclusions	Compliance
5.1.4	The use of a background +5 dB limit means that the wind farm sound may be the dominant sound heard at a noise sensitive location for a significant proportion of the time when the wind farm is operating			N/A
5.2	Wind farm sounds (as L90 10min) should not exceed background by more than 5 dB or a level of 40 dB LA90 10min, whichever is the greater at the notional boundary of any noise-sensitive location	PCNA	Compliant with base limit of 40 dB (45 dB for stakeholders)	Yes
5.3	Background are commonly less than 25 dB when predicted to exceed by 10 dB or more	-	Not commented on. Some BG levels below 25 dB and some less than 20 dB	N/A
	Higher degree of protection of amenity required	PCNA	Not required - Farming Zone	N/A
5.3.2	Lowest stated level is 35 dB or 5 dB above background if above 35 dB L90 10 min	PCNA	Noise limits are 40 dB across all wind speeds - base noise limits	Yes
5.6.1	Limits apply to cumulative levels of all wind farms	PCNA		Yes
5.6.2	Staging of a wind farm is not to affect pre-wind farm background readings	N/A		N/A
5.6.3	Where a new wind farm will impact on the same noise sensitive locations as an existing wind farm, the assessment of background sound should exclude wind farm sound generated by all existing wind farms	PCNA	Cumulative wind farm noise assessed - 3 operating and one under construction - only one ~3km away	Yes
5.6.4	If predicted wind farm sound levels for a new wind farm are at least 10 dB below an existing wind farm, then the cumulative effect shall not be taken into account	PCNA		Yes
6	Predictions			
6.1.1	Predictions of sound levels from wind farms should be used to determine their environmental noise impact before installation takes place. This includes initial predictions to identify noise sensitive locations that might be exposed to a wind farm sound level greater than 35 dB LA90(10 min) at 95 % rated power, and then predictions to establish the likely wind farm sound levels at each of these locations	BG, PCNA	Comprehensive assessment following best practice - details provided in PCNA	Yes
	No other noise sensitive locations at risk to be within the 35 dB LA90(10min) contour when considering uncertainty of the predictions	BG	Sound power level +1 dB used for predictions. Receivers outside 35 dB LA90 contour included in predictions. Vestas turbine likely to be indicative of 'noiser' turbines	Yes
6.2	Obtain from manufacturer obtained in accord with IEC 61400 11. Requires SPL to be measured against a wind speed of 10 m AGL converted to Hub Height	PCNA	Data included in report but no manufacturer's report - but data in PCNA matches data held by Auditor	Yes
7.1	Locations			
7.1.2	(a) Has the operator chosen to adopt a noise limit of 40 dB for all wind speeds?	PCNA		Yes

NZS 6808:2010 section / clause	NZS 6808:2010 requirement	Reference from information source	Assessment / observations / conclusions	Compliance
	(b) Has the operator agreed to conduct on/off testing if required	N/A		N/A
7.1.3	Have noise sensitive locations been clearly identified?	PCNA		Yes
7.1.4	Have background sound level measurements been appropriately established and representative of the noise sensitive locations: proximity and character	BG	Recorded in Background Rpt	Yes
	When and where were they taken.		Recorded in Background Rpt	Yes
	Were predictions at 95 % rated power made in deriving 35 dB LA90 (10 min) contour background levels	PCNA		Yes
	If there are no noise sensitive locations within the 35 dB LA90(10 min) predicted wind farm sound level contour, then background sound level measurements are not required	BG		N/A
7.1.5	If there are a group of noise-sensitive location, are the locations selected representative of the group in terms of proximity and character	BG	Detailed in Background Report	Yes
7.1.6	Selected on wind farm side of buildings. >3.5 m from significant reflecting surfaces. Not near streams nor watercourses where possible (or substantiated if not)	BG		Yes
7.2	Sound data			
7.2.1	Made during a representative range of wind speeds and durations from cut-in to rated power.	BG		N/A
	For dual speed turbines, include cut-in wind speed for the higher generating capacity			N/A
C7.2.1	The background and operational wind turbine sound levels should be determined at all integer hub height wind speeds representative of the typical site exposure, including between cut-in of the turbines and the rated power of the turbines	BG	Background noise levels only	Yes
7.2.2	Sound measured in accordance with NZS 6801:2010 [2008]			Yes
	Measurement time intervals of 10 minutes	BG		Yes
7.2.3	Instrument used shall meet requirements of Section 5 of NZS 6801	BG		Yes
7.2.3	Microphone protected from extraneous wind sound by wind shield in accordance with NZS 6801:2010	BG		Yes
	SLM with low noise floor as necessary	BG		Yes
7.2.4	Extraneous sounds caused by events, including precipitation, insects, fauna and so on, should, as far as is practical for an unattended monitoring exercise, be identified and removed from the data set	BG		Yes
7.3	Wind data			

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NZS 6808:2010 section / clause	NZS 6808:2010 requirement	Reference from information source	Assessment / observations / conclusions	Compliance
7.3.1	Concurrent measurements of wind speed and direction taken from a known height preferable the wind turbine hub	BG	Two methods used to derive wind data	Yes
7.3.2	If wind speeds are not taken from hub height… predictions may be used from wind shear relationships: at least two heights	BG		Yes
7.3.3	Same location and height used for before and after installation where not impacted by turbines	BG		N/A
7.3.3	If a high amenity noise limit is applied the wind farm wind speed threshold should be determined at this same wind speed measurement position	N/A		N/A
7.4	Background measurements			
7.4.1	Background SLM to be plotted against the hub-height wind speeds to obtain a scatter plot	BG		Yes
7.4.1	Use separate scatter plots for difference conditions including wind directions and times-of-day if there are markedly different groups in the scatter plot of all valid data	BG	screening of data does not show diferent trends in the data	N/A
7.4.2	Find the regression curve that gives the best correlation coefficient between the sound level and wind speed for each scatter plot and use it to describe the average background sound level at different wind speeds	BG	screening of data does not show diferent trends in the data	N/A
C7.4.2	It may be appropriate to use bin analysis procedure where the fitted regression curve may be influenced by a limited number of data points	N/A	Adequate data recorded	N/A
7.4.3	If there is a poor correlation between wind speed and sound level, further investigation of wind conditions should be undertaken e.g. wind flow modelling, local knowledge, site observations or local wind monitoring	N/A		N/A
7.4.4	Where multiple regressions are indicated and several regression curves obtained, noise limits should be set on the basis of each regression curve derived. Where not practical, use the most stringent regression curve with lowest sound levels	N/A		N/A
7.6	Compliance assessment			
7.6.1	The 35 dB wind farm sound level contour shall be predicted and measurements made at noise sensitive locations within this contour	PCNA		Yes
7.6.2	Compare the best-fit regression lines of the background sound levels and the regression curves of the wind farm sound levels adjusted for any special audible characteristics (at the wind speed at which it is assessed) at each noise-sensitive location	BG	Graphs and tabulated data	Yes

NZS 6808:2010 section / clause	NZS 6808:2010 requirement	Reference from information source	Assessment / observations / conclusions	Compliance
7.6.3	If background sound levels were not measured prior to installation, it may be necessary to obtain background sound level measurements for limited periods at critical wind speeds. These may be for a limited range of wind speeds and directions while the wind turbines are not operation, i.e. on/off testing to get a representative number of measurement	BG	BG data recorded	N/A
7.6.4	Establishing compliance at one point in time does not negate the need for further testing at a later date		Post-construction monitoring will be required.	N/A
7.7	ON/OFF testing	N/A		N/A
8	Documentation			
8.1	Predictions:			
	Any report of wind farm sound level predictions in accordance with this Standard shall refer to the 2010 Standard and provide the following:			
	(a) A map showing the topography (contour lines) in the vicinity of the wind farm, the position of the wind turbines, and noise-sensitive locations	PCNA		Yes
	(b) Noise sensitive locations for which wind farm sound levels are calculated	PCNA s5.1, Appendix F		Yes
	(c) Wind turbine sound power levels	PCNA Appendix I	candidate turbine used	Yes
	(d) The make and model of the wind turbines		candidate turbine used	Yes
	(e) The hub-height of the wind turbines		candidate turbine used	Yes
	(f) Distance of noise sensitive locations from the wind turbines	PCNA Appendix F		Yes
	(g) Calculation procedure used	PCNA Appendix D		Yes
	(h) Meteorological conditions assumed	PCNA Appendix D		Yes
	(i) Air absorption parameters used	PCNA Appendix I		Yes
	(j) Ground attenuation parameters used			Yes
	(k) Topography / screening assumed, and	PCNA Appendix H		Yes
	(l) Predicted far-field wind farm sound levels			Yes
8.2	Background sound levels			
	Report of the background sound level measurements and compliance assessments to provide:			
	(a) Description of the sound monitoring equipment including ancillary equipment	BG		Yes
	(b) The location of sound monitoring positions	BG		Yes
	(c) Description of the anemometry equipment including the height AGL of the anemometer	BG	Supported by additional details	Yes
	(d) Position of wind speed measurements	BG		Yes
	(e) Time and duration of the monitoring period	BG		Yes
	(f) Averaging period for both sound and wind speed measurements	BG		Yes

NZS 6808:2010 section / clause	NZS 6808:2010 requirement	Reference from information source	Assessment / observations / conclusions	Compliance
	(g) Atmospheric conditions: the wind speed and direction at the wind farm position	BG		Yes

Appendix B PCNA for Moreton Hill Wind Farm

MARSHALL DAY Acoustics

MORETON HILL WIND FARM
ENVIRONMENTAL NOISE ASSESSMENT

Rp 003 R03 20200545 | 26 June 2026

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Project: **MORETON HILL WIND FARM**

Prepared for: **MHWF NOMINEES PTY LTD**

Attention: **Peter Lausberg**

Report No.: **Rp 003 R03 20200545**

Document Control

Status:	Rev:	Comments	Date:	Author:	Reviewer:
Complete	-	Issued to client	23 Aug 2025	L. Kemp	C. Delaire
Complete	01	Updated layout	7 Jan 2026	C. Delaire	P. Frampton
Complete	02	Updated layout	12 Jan 2026	P. Frampton	-
Complete	03	Updated to include V172-7.2MW candidate wind turbine model	26 Jun 2026	C. Delaire	L. Kemp

EXECUTIVE SUMMARY

This report presents the results of an assessment of environmental noise associated with the Moreton Hill Wind Farm (Project) that is proposed to be developed by MHWF NOMINEES PTY LTD.

The Project is proposed to consist of a wind farm with up to 62 multi-megawatt wind turbines, a substation and a battery energy storage system (BESS)

This assessment, prepared to inform the Project's planning application is based on a wind farm layout comprising 68 multi-megawatt wind turbines with a maximum tip height of 252 m. This provides a conservative assessment of the Project, reflecting a larger number of wind turbines than the proposed total of 62.

The actual wind turbine which would be used at the site would be determined at a later stage in the project, after the project has been granted planning approval. The final selection would be based on a range of design requirements including achieving compliance with the planning permit noise limits at surrounding noise sensitive locations (receivers). In advance of a final selection, this assessment considers a candidate wind turbine model that is representative of the size and type of wind turbine which could be used at the site. For this purpose, 2 candidate wind turbine models have been nominated by the proponent, each with a hub height of 166 m and rotor diameter of up to 172 m.

Operational noise from the proposed wind turbines has been assessed in accordance with the New Zealand Standard 6808:2010 *Acoustics – Wind farm noise* (NZS 6808), as required by the *Environment Protection Regulations 2021* (EP Regulations), the Victorian Department of Transport and Planning publication *Planning Guidelines for Development of Wind Energy Facilities* dated September 2023 and EPA-DTP Publication 3011 *Wind Energy Facility Turbine Noise – Technical Guideline* dated 20 December 2024. The operational wind farm noise assessment considers the base (minimum) noise limits determined in accordance with NZS 6808, accounting for the land zoning of the area.

Manufacturer specification data for the 2 candidate wind turbine models has been used as the basis for the assessment. The specification provides noise emission data in accordance with the international standard referenced in NZS 6808. The noise emission data is consistent with the range of values expected for comparable types of multi megawatt wind turbine models that are being considered for the site.

The noise emission data has been used with international standard ISO 9613-2:1996 *Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation* (ISO 9613-2) to predict the level of noise expected to occur at neighbouring receivers. The ISO 9613-2 standard has been applied using well-established input choices and adjustments, based on research and international guidance, that are specific to wind farm noise assessment.

The results of the noise modelling demonstrate that the predicted noise levels for the proposed wind turbine layout and candidate wind turbine models achieve the base noise limits determined in accordance with NZS 6808 at all neighbouring receivers.

The EP Regulations require operational noise of the substation and BESS, associated with the wind farm, to be assessed in accordance with EPA Publication 1826.5 *Noise limit and assessment protocol for the control of noise from commercial, industrial and trade premises and entertainment venues*, dated September 2025 (Noise Protocol). The assessment demonstrates that, based on current available information, operation of the substation and BESS can comply with noise limits determined in accordance with the Noise Protocol.

Consideration was also given to the general environmental duty introduced by the *Environment Protection Act 2017* in July 2021.

The noise assessment therefore demonstrates that the proposed Moreton Hill Wind Farm can be designed and developed to achieve Victorian policy requirements.

MARSHALL DAY Acoustics

TABLE OF CONTENTS

1.0 INTRODUCTION

MHWF NOMINEES PTY LTD (proponent) is proposing to develop a wind farm known as the Moreton Hill Wind Farm (Project) within the Victorian local government area of the Corangamite Shire and Golden Plains Shire, approximately 5 km east of Skipton. The Project is proposed to comprise a wind farm and associated substation and battery energy storage system (BESS).

This report presents the results of an assessment of operational wind turbine noise in accordance with the New Zealand Standard 6808:2010 *Acoustics – Wind farm noise* (NZS 6808), as required by the *Environment Protection Regulations 2021* (EP Regulations), the Victorian Department of Transport and Planning publication *Planning Guidelines for Development of Wind Energy Facilities* dated September 2023 (Victorian Wind Energy Guidelines) and EPA-DTP Publication 3011 *Wind Energy Facility Turbine Noise – Technical Guideline* dated 20 December 2024.

Operational noise of the proposed substation and BESS associated with the wind farm is to be assessed in accordance with EPA Publication 1826.5 *Noise limit and assessment protocol for the control of noise from commercial, industrial and trade premises and entertainment venues* dated September 2025 (Noise Protocol), as required by the EP Regulations. The general environment duty introduced by the *Environment Protection Act 2017* (EP act) in July 2021 must also be considered.

The noise assessment presented in this report is based on:

- Operational noise limits determined in accordance with NZS 6808 and the Noise Protocol, accounting for local land zoning
- Predicted operational noise levels for the wind turbines, based on the proposed site layout and 2 candidate wind turbine models that are representative of the size and type of wind turbine that the planning application seeks consent for
- Predicted operational noise levels for the proposed substation and BESS, based on empirical noise emission data
- A comparison of the predicted noise levels with the applicable base noise limits determined in accordance with NZS 6808 and the noise limits defined by the Noise Protocol.

Acoustic terminology used in this report is presented in Appendix A.

2.0 PROJECT DESCRIPTION

The proposed Moreton Hill Wind Farm consists of a wind farm, a substation and a BESS.

The wind farm component of the Project is proposed to consist of 62 multi-megawatt wind turbines. However, as a conservative assessment, the proponent requested a 68 wind turbine layout be assessed.

The proposed wind turbine layout is illustrated in Figure 1 and the coordinates are tabulated in Appendix B.

The proponent is seeking consent for wind turbines with a maximum tip height of 252 m.

Two wind turbine models were nominated by the proponent as candidates for this assessment:

- Vestas V162-6.8MW with a power output of 6.8 MW and a rotor diameter of 162 m
- Vestas V172-7.2MW with a power output of 7.2 MW and a rotor diameter of 172 m.

Further details of the candidate wind turbine models are presented in Section 7.3.

A substation and a 100 MW / 400 MWh BESS are also proposed to be located to the south-west of the wind farm. These are illustrated in Figure 1 and the coordinates are tabulated in Appendix B.

Other Project related infrastructure on the site would include access tracks, underground cable reticulation, overhead power transmission lines and site offices.

Details of the study area and surrounding receivers are subsequently discussed in Section 5.0.

Figure 1: Project site layout – proposed wind turbines, substation and BESS

3.0 LEGISLATION AND GUIDELINES

The environmental noise assessment requirements for the Project are defined by the following:

- *Environment Protection Act 2017*
- *Environment Protection Regulations 2021*
- *Environment Reference Standard* published 25 May 2021, as amended by *Environment Reference Standard No. S158 Gazette* dated 29 March 2022
- *Planning Guidelines for Development of Wind Energy Facilities* dated September 2023
- EPA Publication 1826.5 *Noise limit and assessment protocol for the control of noise from commercial, industrial and trade premises and entertainment venues* dated September 2025
- NZS 6808:2010 *Acoustics – Wind farm noise*.

The requirements of these documents are summarised below. Additional details and extracts from these documents are provided in Appendix C.

Victorian guidelines that are relevant to the assessment are also briefly outlined below.

3.1 Environment Protection Act 2017

The *Environment Protection Act 2017* (EP Act) provides the overarching legislated protection of the environment in Victoria and establishes mandatory requirements for the control of environmental noise. The following key obligations apply under the EP Act:

- A person who is engaging in an activity that may give rise to risks of harm to human health or the environment has a general environmental duty (GED) to minimise the risk of harm, so far as reasonably practicable.
- A person must not, from a place or premises that are not residential premises, emit unreasonable noise or permit unreasonable noise to be emitted.

The risk of harm under the EP Act includes both health and amenity related noise impacts. The EP Act defines environmental noise as unreasonable if it is:

- prescribed to be unreasonable from an assessment against mandatory noise limits (see Sections 3.2, Section 3.5 and Section 3.6); or
- assessed to be unreasonable according to the following factors defined in the EP Act:
  - noise volume, intensity or duration
  - noise character
  - the time, place and other circumstances in which the noise is emitted
  - how often the noise is emitted
  - any prescribed factors relating to the noise (frequency spectrum being a prescribed factor).

3.2 Environment Protection Regulations 2021

The *Environment Protection Regulations 2021* (EP Regulations) give effect to the EP Act by establishing prescriptive requirements for a range of environmental considerations including noise. The noise requirements are defined according to the type of noise generating activity under consideration. The EP Regulations also define the types of noise sensitive areas where these requirements apply and the hours of different assessment time periods (i.e. day, evening and night).

The relevant elements of the EP Regulations are the requirements for the:

- operational noise from commercial, industrial and trade premises (industry)
- operational wind turbine noise of a wind farm.

The EP Regulations specify that the prediction, measurement, analysis and assessment of operational industry noise within a noise sensitive area must be conducted in accordance with the Noise Protocol (see Section 3.5). Noise from industry is prescribed by the EP Regulations to be unreasonable for the purposes of the EP Act if it exceeds the noise limit determined in accordance with the Noise Protocol.

In relation to wind turbine noise, the EP Regulations specify a range of requirements for the assessment, verification and ongoing management of operational wind turbine noise. Under the EP Regulations, the relevant standard specified for the assessment of wind turbine noise is NZS 6808 (see Section 3.6).

An important element of the EP Regulations with respect to wind turbine noise is the Act compliance note, which provides clarity on how a wind energy facility operator can satisfy the GED under the EP Act. [1] The Act compliance note means that demonstrating compliance with the EP Regulations also demonstrates compliance with the GED under the EP Act.

3.3 Environment Reference Standard

The *Environment Reference Standard* (ERS) was introduced under the EP Act and sets out environmental and human health outcomes that are sought to be achieved and maintained in Victoria. The outcomes are described by the ERS in terms of a collection of environmental values, indicators and objectives.

The environmental values of the ambient sound environment defined by the ERS relate to conditions that are conducive to domestic activities (conversation, recreation and sleep), learning, and appreciation and enjoyment of tranquillity in natural areas. The environmental values in most settings are defined using a quantitative indicator, and the objective for these indicators are defined according to the land use and planning zone. However, for natural areas, the indicator is qualitative and is based on an appraisal of sound quality that is conducive to human tranquillity and enjoyment of natural soundscapes.

Indicators and objectives for the ambient sound in different settings are defined to provide a basis for assessing actual and potential risks to the environment. They also provide a benchmark for comparing the state of the environment, or potential changes to the environment, to desired outcomes. However, the ERS is not a compliance standard. The primary function of the ERS is to provide an environmental assessment reporting benchmark which can be used as a reference point for decision makers to consider whether a proposal or activity is consistent with the environmental values identified in the ERS.

[1] Regulation 6 to the EP Regulations states that if a note at the foot of a provision of the regulations states 'Act compliance' followed by a reference to a section number, the regulation provision sets out the way in which a person's duty or obligation under that section of the EP Act is to be performed in relation to the matters and the extent set out in the regulation provision.

3.4 Planning Guidelines for Development of Wind Energy Facilities

The Victorian Department of Transport and Planning publication *Planning Guidelines for Development of Wind Energy Facilities* dated September 2023 (Victorian Wind Energy Guidelines) provide advice to responsible authorities, proponents and the community about suitable sites to locate wind energy facilities and to inform planning decisions about a wind energy facility proposal.

The advice includes detailed guidance on consistent methods for the assessment of wind turbine noise at the planning stage of a project. In particular, the Victorian Wind Energy Guidelines specifies that potential operational noise levels associated with proposed wind farm developments are to be assessed in accordance with NZS 6808 (see Section 3.6). Guidance is also provided on how NZS 6808 should be considered in the Victorian regulatory framework.

3.5 EPA Publication 1826.5 (Noise Protocol)

The EPA Publication 1826.5 *Noise limit and assessment protocol for the control of noise from commercial, industrial and trade premises and entertainment venues* dated September 2025 (Noise Protocol) defines a procedure for setting noise limits that apply to the operation of industry premises and entertainment venues in Victoria. The noise limits are applicable to the operational stage of the Project. Compliance with the noise limits is mandatory.

The Noise Protocol defines noise limits that are used to assess whether a noise is prescribed to be unreasonable in accordance with the EP Regulations and the EP Act.

The noise limits apply at a 'noise sensitive area', which is defined by the EP Regulations as being *within 10 metres of the outside of the external walls* of buildings including dwellings, hotels, and schools. In rural areas, noise sensitive areas also include land within the boundary of campgrounds, caravan parks and certain types of tourist establishments.

The procedures for setting noise limits are defined separately for urban and rural areas. However, in both cases, the noise limits are defined by considering the land zoning in the area and the noise environment of the receiver. Separate noise limits are defined for the day, evening and night periods.

3.6 NZS 6808

NZS 6808:2010 *Acoustics – Wind farm noise* (NZS 6808) defines a method for assessing operational wind turbine noise levels, including procedures for:

- measuring background noise levels prior to construction of a wind farm
- deriving noise criteria from measured background noise levels
- conducting post-construction measurements of wind farm noise
- assessing the character of the noise produced by the wind farm noise
- assessing post-construction noise measurements to determine compliance with the standard.

The noise criteria defined by NZS 6808 are a combination of a base (minimum) noise limit and noise limits which vary with wind speed and background noise levels. The base limit is a fixed value that is used for conditions when the background noise is low. The noise limit at each integer wind speed is then defined as the base limit or the background level plus 5 dB, whichever value is higher. The limits apply to wind turbine noise levels in the vicinity of noise sensitive locations.

The character of the wind farm sound is also assessed to determine whether adjustments should be applied to account for sounds referred to by the standard as special audible characteristics (SACs). These SACs are defined as tonality, impulsiveness and amplitude modulation. The noise level of the wind farm, adjusted where necessary for the presence of SACs, is then compared with the noise limits at each wind speed to determine the wind farm's compliance.

3.7 Related Victorian guidelines

To support the application the legislation and guidance summarised in the preceding sections, a range of Victorian publications provide additional advice on matters of interpretation and technical procedures. These publications include:

- EPA Publication 1992 *Guide to the Environment Reference Standard,* dated June 2021
- EPA Publication 1996 *Noise guideline – assessing low frequency noise,* dated June 2021
- EPA Publication 1997 *Technical guide: Measuring and analysing industry noise and music noise,* dated June 2021
- EPA-DTP Publication 3011 *Wind Energy Facility Turbine Noise* – Technical Guideline.

These guidelines are non-statutory documents which provide detailed advice for a broad range of technical considerations. Relevant aspects of these guidelines are referenced where appropriate in this assessment.

4.0 ASSESSMENT METHOD

4.1 Overview

Based on the policies and guidelines outlined in Section 3.0, assessing the operational noise levels of a proposed renewable energy project (comprising wind turbines, BESS and substation) involves:

- identifying receivers and ERS natural areas within a 3 km study area (see Section 5.0) from the Project infrastructure
- reviewing the existing noise environment in the Project area and assessing background noise levels at key receivers and ERS natural areas around the Project
- establishing suitable noise limits accounting for background noise levels and land zoning
- predicting noise levels associated with the Project, accounting for the inherent and proposed noise controls as appropriate
- assessing compliance with mandatory noise limits, where applicable
- assessing the potential for cumulative noise as a result of the Project and other existing and known developments in the surrounding area
- defining noise management measures consistent with the GED to minimise the risk of harm from Project operational noise so far as reasonably practicable.

4.2 Existing noise environment

Background noise level information is used to:

- set operational noise limits for wind turbines
- set operational noise limits for the BESS and substation
- consider the existing noise environment in natural areas where relevant.

However, in rural areas where wind farms are typically developed, the background noise level data is generally most important to the assessment of the wind turbines. This is due to the need to consider the changes in background noise levels and wind turbine noise levels for different wind conditions. Further, in rural areas, the land zoning is usually the decisive factor when setting noise limits for sources such as the BESS and substation.

Based on the above, the wind turbine noise component of the assessment, and therefore the assessment requirements of NZS 6808, are the key consideration when establishing existing noise levels.

The first step in assessing background noise levels involves determining whether background noise measurements are warranted. For this purpose, Section 7.1.4 of the standard provides the following guidance:

> *Background sound level measurements and subsequent analysis to define the relative noise limits should be carried out where wind farm sound levels of 35 dB $L_{A90(10\,min)}$ or higher are predicted for noise sensitive locations, when the wind turbines are at 95% rated power. If there are no noise sensitive locations within the 35 dB $L_{A90(10\,min)}$ predicted wind farm sound level contour then background sound level measurements are not required.*

The initial stage of an NZS 6808 assessment therefore comprises:

- preliminary wind turbine noise predictions to identify all receivers where predicted noise levels are higher than 35 dB L_{A90}
- identification of selected receivers where background noise monitoring should be undertaken prior to development of the wind farm, if required.

If monitoring is required, the surveys involve measurements of background noise levels at receivers and simultaneous measurement of wind speeds at the site of the proposed wind farm. The survey typically extends over a period of several weeks to enable a range of wind speeds and directions to be measured.

The results of the survey are then analysed to determine the trend between the background noise levels and the site wind speeds at the proposed hub height of the wind turbines. This trend defines the value of the background noise for the different wind speeds in which the wind turbines would operate. At the wind speeds when the value of the background noise is above 35 dB L_{A90} (or 30 dB L_{A90} in special circumstances where high amenity limits apply), the background noise levels are used to set the noise limits for the wind farm.

4.3 Noise predictions

Operational noise levels from the Project are predicted using:

- noise emission data for the relevant equipment (e.g. wind turbines, transformers, and inverters)
- a 3D digital model of the site and the surrounding environment
- international standards used for the calculation of environmental sound propagation.

The method selected to predict noise levels is ISO 9613-2.[2] The prediction method is consistent with the guidance provided by NZS 6808 and has been shown to provide a reliable method of predicting the typical upper levels of the wind turbine noise expected to occur in practice. The method is also referenced in the Technical Guideline.

The method is generally applied in a comparable manner to both wind turbine, BESS and substation noise levels. For example, for both types of sources, equivalent ground and atmospheric conditions are used for the calculations. However, when applied to wind turbine noise, additional and specific calculation choices apply.

Further discussion of the method and the calculation choices is provided in Appendix D.

[2] ISO 9613-2: 1996 *Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation*

4.4 Cumulative noise

The potential for cumulative noise from the Project and other noise sources is evaluated by:

- identifying other existing and proposed developments in the area around the Project (including those in operation and approved at the time of assessment)
- identifying receivers where there is the potential for cumulative noise from the Project and other developments
- predicting noise levels from other existing and potential developments, where relevant and suitable information is available
- assessing cumulative wind turbine noise levels at the identified receivers to determine whether:
  - the Project could contribute to total wind turbine noise levels above the limits in the vicinity of other exiting wind farms
  - there is a margin below the noise limits to accommodate other potential wind farm developments, where relevant
- assessing cumulative industry noise levels at the identified receivers to determine whether:
  - the Project would contribute to total industry noise levels above the limits in the vicinity of other existing commercial, industry and trade premises
  - there is a margin below the noise limits to accommodate other potential developments, where relevant.

Specific cumulative noise study areas are not defined by the legislation and guidelines set out in Section 3.0. MDA has adopted 10 km as the study area for wind turbine noise and 5 km for substation and BESS noise. This is technically appropriate based on propagation distances associated with each noise source type. More detail is provided in Section 5.0.

5.0 STUDY AREA

The study area for the noise assessment extends to 3 km from the proposed locations of the Project wind turbines, substation and BESS. This is a nominal distance selected to enable a complete account of operational and potential cumulative noise considerations associated with the Project.

The study area is predominantly rural with the nearest townships of Linton and Skipton more than 5 km from the Project. The land in the study area is mainly designated as Farming Zone (see zoning map in Appendix E).

The types of locations within the study area where noise and vibration are assessed includes:

- noise sensitive receivers, which is any discrete location such as a residential dwelling where an assessment of noise or vibration is required
- natural areas which are considered under the ERS.

The locations of noise sensitive receivers and natural areas are identified and discussed within this section. This section also identifies the location of other potential or existing projects in or near the study area which may be relevant to the assessment of cumulative noise.

5.1 Receivers

The term *noise sensitive receiver* (receiver) is used throughout this report when referring to any building or facility where an assessment of noise is required. However, the details and types of receivers which must be considered are specific to the source of noise being assessed.

The EP Regulations specify noise requirements such as assessment procedures, the types of receivers to be assessed and different time periods which must be accounted for in the assessment. Importantly, the requirements of the EP Regulations are specific to the type of noise generating activity being assessed. For example, the types of receivers which must be considered when assessing commercial and industrial noise sources are called *noise sensitive areas*. Conversely, the procedure specified in the EP Regulations for assessing wind turbine noise requires consideration of receivers called *noise sensitive locations*. While noise sensitive areas and noise sensitive locations are broadly similar, there are slight differences between the two which relate to the types of receivers which must be considered and the specific locations where the noise limits apply.

The study area for this assessment includes all receivers identified by the proponent within 3 km of the proposed wind turbines, BESS and substation.

An important distinction when assessing wind turbine noise levels is whether the receivers are within the Project boundary, or a noise agreement is in place with the receiver landowners. In particular, NZS 6808 requires that the wind turbine noise assessment be undertaken at all receivers in the vicinity of the proposed wind farm which it defines as follows:

> *The location of a noise sensitive activity, associated with a habitable space or education space in a building not on the wind farm site. […]*
>
> *In some instances holiday cabins and camping grounds might be considered as noise sensitive locations. Matters to be considered include whether it is an established activity with existing rights.*

Further, based on the above definitions and statutory context of NZS 6808 discussed in Appendix C5, the noise limits specified in NZS 6808 only apply to the assessment of wind turbine noise levels at receivers where a noise agreement is not in place. This is also reflected in the EP Regulations which defines different noise limits for receivers located outside the Project boundary where noise agreements are in place.

Based on the above, receivers located within the Project boundary, or those located outside the Project boundary where a noise agreement is in place, are collectively referred to as stakeholder receivers.

A total of 67 receivers were identified by the proponent within 3 km of the proposed wind turbines, comprising:

- 38 non-stakeholder receivers on properties that are not associated with the Project
- 29 stakeholder receivers including:
  - 12 receivers within the Project boundary
  - 17 receivers outside the Project boundary where a noise agreement is proposed between the landowner and the proponent.

The coordinates of all assessed receivers within 3 km of the proposed wind turbines are provided in Appendix F.

A site layout plan illustrating the wind turbine layout, substation, BESS and receivers is provided in Figure 2.

5.2 Natural areas

Natural areas are a land-use category for which the ERS details desired outcomes in terms of noise level to be achieved or maintained in Victoria. 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.*

Data from the Parks and Conservation Reserves state mapping (PARKRES) has been used to identify the following natural areas within 10 km of the Project wind turbines:[3]

- Carngham Bushland Reserve
- Devils Kitchen Geological Reserve
- Happy Valley Crossing Streamside Reserve
- Happy Valley School Historic Reserve
- Linton Flora and Fauna Reserve
- Mount Bute Scenic Reserve
- Mount Erip Flora Reserve
- Skipton Court House Historic Reserve
- Skipton Streamside Reserve
- Woady Yallock River, Pitfield Streamside Reserve

The natural areas listed above are shown in Figure 3. Land within the Public Park and Recreation Zone (PPRZ) and Public Conservation and Resource Zone (PCRZ) but not identified within the PARKRES data is also presented for completeness.

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3 Data Vic webpage

Figure 2: Site map of proposed wind turbines, substation and BESS receivers

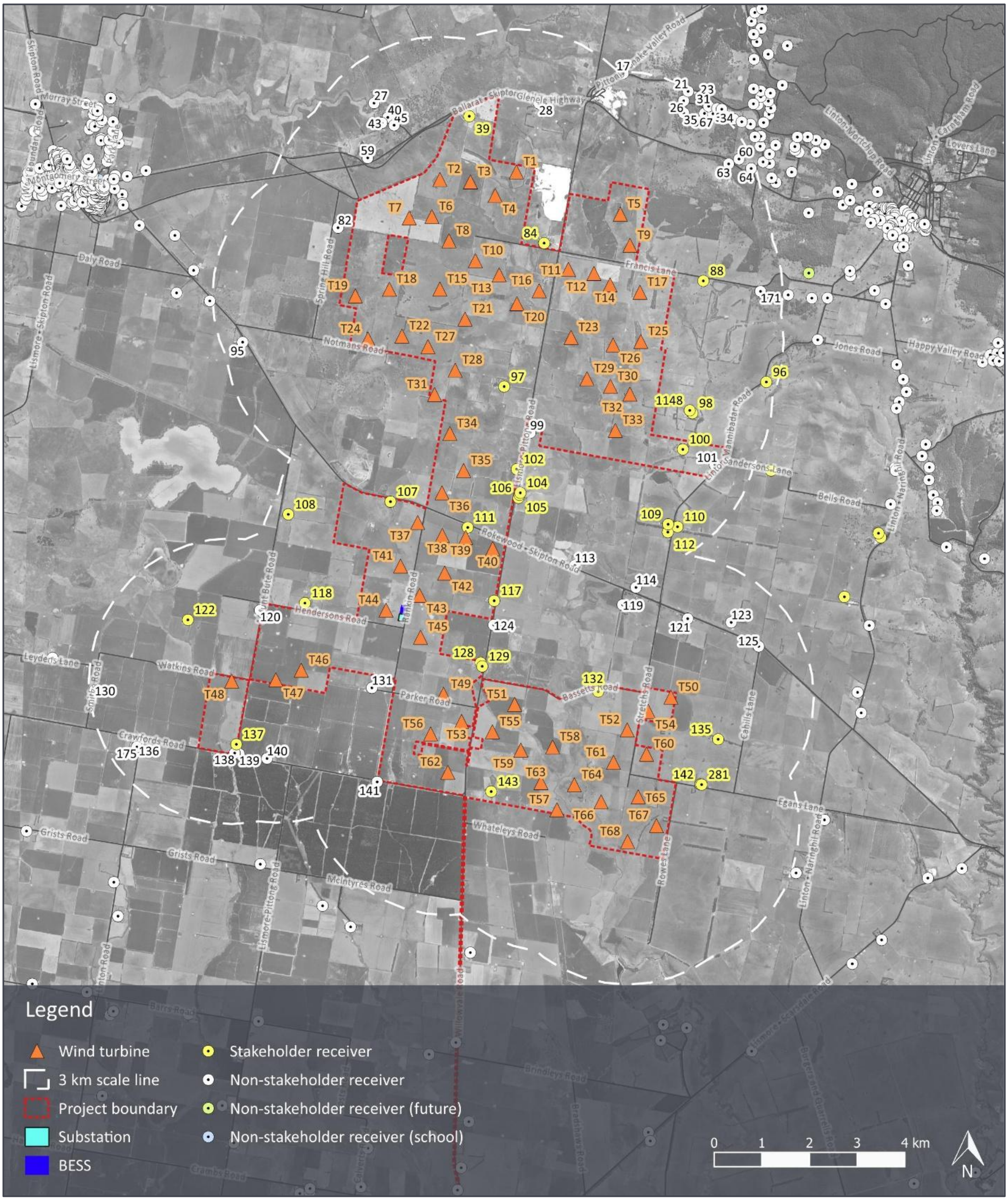
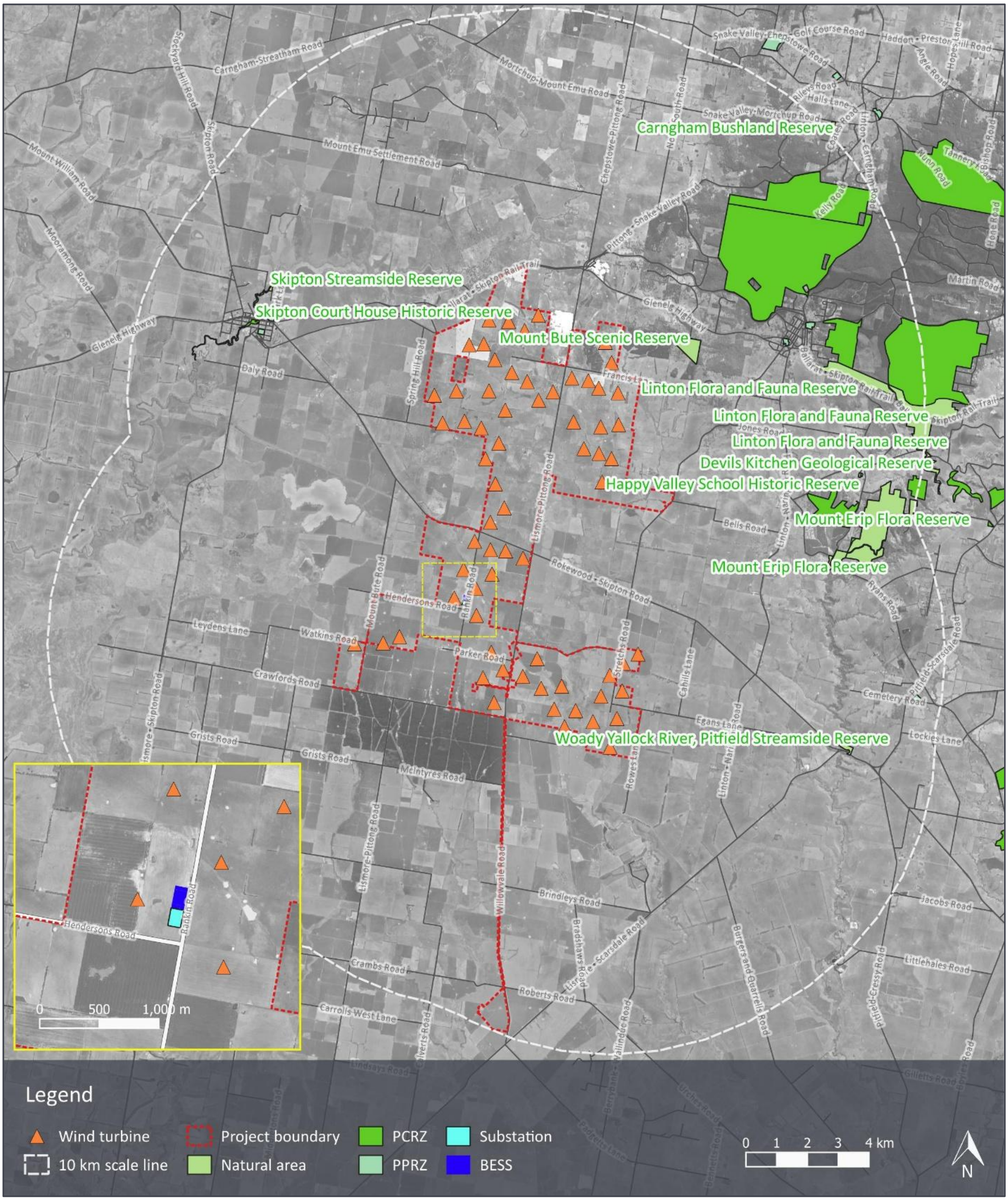


Figure 3: Site map of proposed wind turbines, substation, BESS and surrounding natural areas, PPRZ and PCRZ land



5.3 Other projects

Based on publicly available information (last accessed on 23 June 2026), 3 wind farms have been identified within 10 km of the proposed wind farm for the review of potential cumulative noise considerations. These wind farms are detailed in Table 1. [4]

Table 1: Wind farm development in the broader area around the Moreton Hill Wind Farm

Wind Farm Name	Status	Approximate distance to nearest turbine
Stockyard Hill Wind Farm	Operating	3.8 km to the north-west
Chepstowe Wind Farm	Operating	10 km to the north
Berrybank Wind Farm	Operating	10 km to the south

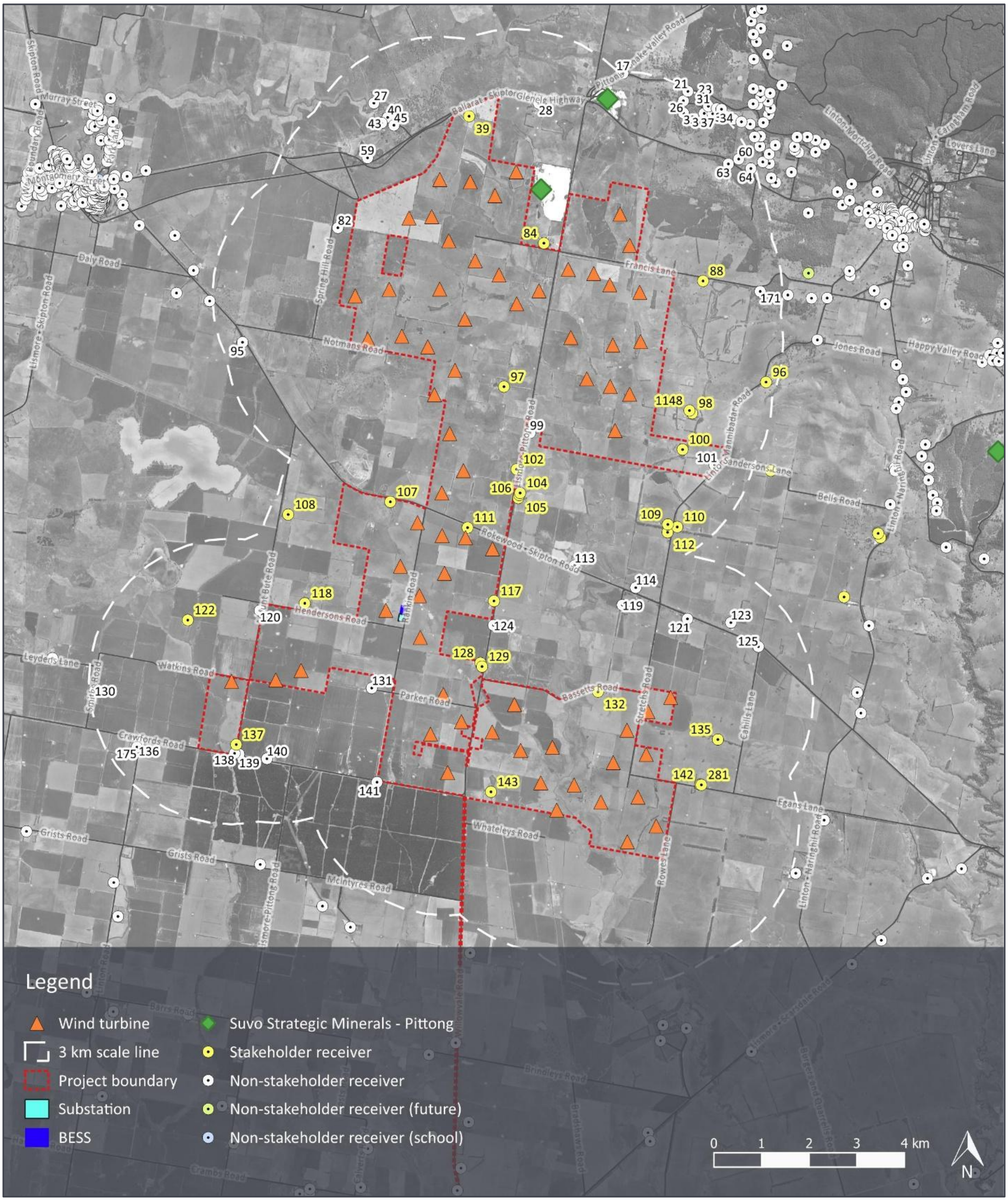
Wind farms located farther than 10 km from the proposed project, would not have cumulative effects likely to affect the assessment outcome, however, the Golden Plains Wind Farm, located 11 km to the south-east has been included for contextual information.

The only other commercial, industrial and trade (CIT) that has been identified within the study area are the 2 Suvo Strategic Minerals Pittong Operation sites, located to the north of the Project. No specific details regarding noise generating activities are known about these sites, however from review of aerial imagery it is assumed that typical mining operations would occur.

Since these sites are more than 8 km north of the proposed Project substation and BESS, cumulative noise is not expected to be material for the purpose of this assessment. As such, no cumulative assessment of noise has been carried out.

[4] Department of Transport and Planning, *Renewable Energy Projects Victoria* (weblink)

Figure 4: Other projects within study area



6.0 EXISTING NOISE ENVIRONMENT

The noise modelling results that were available at the time of the noise survey indicated predicted wind turbine noise levels between 35 and 40 dB L_{A90} at 3 non-stakeholder receivers.[5] In accordance with NZS 6808, background noise monitoring was recommended to be undertaken at these receivers.

A first background noise monitoring survey was undertaken between March and June 2024 at locations selected based on predicted noise levels presented in the EES referral noise assessment.

At the time, the proponent elected to commission a survey of background noise levels at a broader range of locations than was strictly required by NZS 6808. The objective of the noise monitoring was to obtain data that would assist with providing context to the predicted noise levels of the proposed wind farm.

Accordingly, monitoring was undertaken at 9 locations, with the background noise levels determined in accordance with NZS 6808 for the all-time and night-time periods respectively. This included 2 of the 3 receivers where predicted noise levels were between 35 and 40 dB L_{A90}.

Consent to undertake background noise monitoring was not granted at the remaining preferred receiver (99). As such, noise monitoring was undertaken in lieu at stakeholder receiver 102, located approximately 800 m south. This location was considered a representative noise environment at receiver 99.

As second background noise monitoring survey was undertaken between April and June 2025 at 3 locations:

- Repeat monitoring at receiver 113 due to equipment failure during the first survey
- Additional monitoring at receivers at receivers 112 (stakeholder) and 141.

The noise monitoring, analysis procedures and results are detailed in the background noise report. [6] The data presented in Table 2 summarises the background noise levels determined in accordance with NZS 6808 for the all-time and night-time periods. The data in these tables is provided for the key wind speeds relevant to the assessment of wind farm noise. The results for all surveyed wind speeds are illustrated in the graphical data provided for each receiver in the appendices of the background noise report.

Depending on the final wind turbine layout and model selection, additional background noise monitoring may be required prior to construction of the wind farm.

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[5] MDA Report Rp 001 R01 20200545 *Moreton Hill Wind Farm – Environmental noise assessment*, dated 19 December 2023 (EES referral noise assessment)

[6] MDA report Rp 002 R02 20200546 *Moreton Hill Wind Farm – Background noise monitoring*, dated 12 January 2026 (background noise report)

Table 2: Background noise levels, dB L_{A90} - all-time period

Receiver ID	Hub height wind speed, m/s [1]												
	3	4	5	6	7	8	9	10	11	12	13	14	15
All-time period													
28	29.0	29.1	29.5	30.2	31.1	32.2	33.3	34.4	35.5	36.4	37.1	37.5	37.5
95	27.9	28.6	29.6	30.7	32.0	33.4	34.8	36.4	37.9	39.4	40.9	42.2	43.5
102 (S)	22.8	23.3	23.9	24.7	25.6	26.7	27.9	29.2	30.5	32.0	33.5	35.0	36.6
112 (S)	25.2	25.4	26.0	26.7	27.6	28.8	30.1	31.5	33.1	34.8	36.6	38.5	40.4
113	- [2]	28.7	28.8	29.2	29.9	30.7	31.8	32.9	34.2	35.5	36.9	38.3	39.7
119	28.3	28.5	29.0	29.8	30.9	32.0	33.2	34.5	35.7	36.7	37.6	38.3	38.6
120	29.1	29.9	30.8	31.6	32.5	33.3	34.2	35.0	35.9	36.8	37.7	38.7	39.6
124	- [2]	24.2	24.3	24.8	25.6	26.6	27.9	29.3	31.0	32.8	34.6	- [3]	- [3]
131	24.7	24.9	25.4	26.1	27.0	28.1	29.4	30.9	32.6	34.3	36.2	38.2	40.3
132	24.6	25.1	26.2	27.5	29.2	31.0	32.9	34.9	36.7	38.4	39.8	40.9	41.6
141	- [2]	23.7	24.0	24.7	25.8	27.4	29.2	31.3	33.6	36.1	38.7	41.3	43.9
Night period													
28	- [2]	- [2]	23.9	24.4	25.4	26.7	28.2	29.8	31.2	32.5	33.4	33.8	- [3]
95	- [2]	19.3	19.6	20.2	21.1	22.4	24.0	25.8	27.9	30.3	32.8	35.6	38.5
102 (S)	- [2]	17.0	17.2	17.7	18.6	19.8	21.2	22.8	24.6	26.5	28.6	30.7	32.8
112 (S)	20.1	20.1	20.3	20.8	21.6	22.7	24.0	25.5	27.2	29.1	31.2	33.5	35.9
113	- [2]	24.8	24.8	25.0	25.5	26.2	27.1	28.2	29.5	30.8	32.3	33.9	35.6
119	- [2]	18.8	18.9	19.4	20.3	21.4	22.7	24.2	25.9	27.8	29.8	31.9	34.0
120	21.0	21.3	21.8	22.6	23.5	24.5	25.5	26.5	27.4	28.2	28.9	29.3	29.4
124	- [2]	19.7	19.8	20.2	20.9	22.0	23.2	24.7	26.4	28.3	30.2	- [3]	- [3]
131	- [2]	19.5	19.6	20.1	21.0	22.2	23.8	25.6	27.6	29.8	32.2	34.7	37.3
132	- [2]	18.8	18.9	19.4	20.3	21.6	23.2	25.0	26.9	29.0	31.1	33.3	35.3
141	- [2]	19.2	19.4	20.0	20.9	22.2	23.8	25.7	27.9	30.3	33.0	35.7	38.7

(S) Stakeholder receiver

1 166 m above ground level at 714476 E, 5824117 N (MGA94 Zone 54)

2 Regression lines indicate an increase of background noise levels as hub height wind speed decreases. As this feature is deemed to be an artifact of the regression analysis process due to the large scatter of points at low hub height wind speeds, the regression lines have been truncated at their lowest values.

3 Regression lines indicate a decrease of background noise levels as hub height wind speed increases. As this feature is deemed to be an artifact of the regression analysis process due to the large scatter of points at high hub height wind speeds, the regression lines have been truncated at their highest values.

7.0 WIND TURBINE NOISE ASSESSMENT

7.1 Assessment criteria

The assessment criteria detailed in NZS 6808 apply to noise levels at noise sensitive locations and consist of a combination of base limits (i.e. fixed value limits irrespective of wind speed) and relative limits which are defined by an allowable margin above the background noise (i.e. limits which vary with wind speed). The value of the base limit depends on whether there are high amenity areas near the Project and whether there are receivers involved with the Project. These factors are discussed in the following subsections.

7.1.1 High amenity

In accordance with NZS 6808, an assessment is required for all receivers located within the predicted 35 dB L_{A90} contour to determine whether a high amenity noise limit may be justified. This is based on a two-step approach:

1. A land zoning review to determine whether the planning guidance for the area warrants consideration of a high amenity noise limit. If it does, then the second step should be considered.
2. A review of the relationship between the background noise levels and predicted noise levels, using the calculation set out in clause C5.3.1 of NZS 6808.

Based on the predicted noise level contours presented subsequently in Section 7.4, and the zoning map for the area presented in Appendix E, the area within the predicted 35 dB L_{A90} contour is identified as Farming Zone.

Section 5.2 of the Technical Guideline states that the high amenity limit in Victoria 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), and Green Wedge A Zone (GWAZ).
- not apply to dwellings in the Farming Zone (FZ).
- not be applied in any location where background sound levels are already affected by other specific sources such as road traffic noise, based on Section 5.3.1 of NZS 6808.
- only apply for WEF wind speeds up to and including 6 m/s during evening and night-times.
- be applicable only when there is no agreement made in accordance with regulation 131A.

Based on the above, the high amenity noise limit is not justified for the Project as all receivers within the 35 dB L_{A90} noise contour are within a Farming Zone (FZ).

7.1.2 Stakeholder receivers

Stakeholder receivers consist of receivers within the Project boundary and receivers outside the Project boundary where noise agreements are in place.

The noise limits defined in NZS 6808 do not apply at stakeholder receivers (see earlier discussion in Section 5.1 and further information in Appendix C5). However, consistent with the Victorian Wind Energy Guidelines, regulation 131BA of the EP Regulations states that receivers with a noise agreement is in place are subject to a noise limit of:

- the noise limit specified in the agreement, where a noise agreement between the owner or operator of a wind energy facility and a landowner is made before 1 November 2021
- 45 dB L_{A90} or background noise (L_{A90}) + 5 dB, whichever is the greater, where a noise agreement between the owner or operator of a wind energy facility and a landowner is made on or after 1 November 2021.

The proponent has advised that noise agreements are currently in place or proposed between the landowners and the proponent at 17 receivers outside the Project boundary, as presented in Section 5.1. The noise agreements set a limit of 45 dB or background + 5 dB, whichever is higher.

Further, consistent with the Victorian Wind Energy Guidelines, it is recommended that operational wind turbine noise levels not exceed a reference level of 45 dB L_{A90} or background noise (L_{A90}) +5 dB at the 12 stakeholder receivers within the Project boundary.

7.1.3 Applicable noise limits

Accounting for the conclusions of the assessment of high amenity detailed in the previous section, the applicable noise limits at noise sensitive locations are detailed in Table 3.

Table 3: Applicable noise limits, dB L_{A90}

Receiver status	Noise limit
Non-stakeholder	40 dB or background L_{A90} + 5 dB, whichever is the greater
Stakeholder receiver located outside the Project boundary with a noise agreement	45 dB or background L_{A90} + 5 dB, whichever is the greater
Stakeholder receiver within the Project boundary	Not applicable Reference level of 45 dB or background L_{A90} + 5 dB, whichever is the greater

At this stage in the Project, the applicable base (minimum) noise limits and reference levels presented above have been adopted for this assessment. This approach is conservative, as the background noise monitoring results only increases the noise limits above the applicable base limit values.

7.2 Candidate wind turbine models

The final wind turbine model for the site would be selected after a tender process to procure the supply of wind turbines. The final selection would be based on a range of design requirements including achieving compliance with the planning permit noise limits at surrounding receivers.

Accordingly, to assess the proposed wind turbines at this stage in the Project, it is necessary to consider candidate wind turbine models that are representative of the size and type of wind turbines being considered. The purpose of the candidate wind turbine models is to assess the viability of achieving compliance with the applicable noise limits, based on noise emission levels that are typical of the size of wind turbines being considered for the site.

For this assessment, the proponent has nominated the Vestas V162-6.8MW and Vestas V172-7.2MW as the candidate wind turbine models.

These models are variable speed wind turbines, with the speed of rotation and the amount of power generated by the turbines being regulated by control systems which vary the pitch of the wind turbine blades (the angular orientation of the blade relative to its axis).

This assessment has been based on the wind turbines operating in unconstrained modes of generation (i.e. without noise reduced operating modes) and with blade serrations. Blade serrations are now routinely used to reduce wind turbine noise emissions, and it is understood that their use is now the market standard for wind turbines being offered in the Australian market.

Details of the assessed candidate wind turbine models are provided in Table 4.

Table 4: Selected candidate wind turbine models

Item	V162-6.8MW	V172-7.2MW
Make	Vestas	Vestas
Model	V162	V172
Rotor diameter	162 m	172 m
Operating mode	PO6800 [1]	PO7200 [2]
Rated power	6.8 MW	7.2 MW
Hub height	166 m	166 m
Blade serrations	Yes	Yes
Cut-in wind speed (hub height)	3 m/s	3 m/s
Rated power wind speed (hub height)	13 m/s	13 m/s
Cut-out wind speed (hub height)	25 m/s	25 m/s

1 'PO6800' is a manufacturer designation which indicates a Power Optimisation mode to achieve a power output of 6,800 kW – this is an unconstrained mode of operation (i.e. without noise reduction)

2 'PO7200' is a manufacturer designation which indicates a Power Optimisation mode to achieve a power output of 7,200 kW – this is an unconstrained mode of operation (i.e. without noise reduction)

The hub height detailed above is suitable for noise assessment purposes. The final hub height of the selected wind turbine model may differ slightly. However, the magnitude of the potential change is expected to be minor and inconsequential with respect to predicted noise levels.

The final wind turbine hub height would be used for updated pre-construction noise modelling once the wind turbine layout has been finalised and the final wind turbine model selected (pre-construction noise modelling would be included in the noise management plan prepared in accordance with the EP Regulations).

7.3 Wind turbine noise emissions

7.3.1 Sound power levels

The noise emissions of the wind turbines are described in terms of the sound power level for different wind speeds. The sound *power* level is a measure of the total sound energy produced by each wind turbine and is distinct from the sound *pressure* level which depends on a range of factors such as the distance from the wind turbine.

Sound power level data for each candidate wind turbine model, including sound frequency characteristics, has been sourced from the manufacturers' documents listed in Table 5.

Table 5: Candidate wind turbine model specification documents

Candidate model	Document No.	Date	Title
V162-6.8MW	0111-1246_03	13 Jan 2023	*Third octave noise emission EnVentus™ V162-6.8MW 50/60 Hz*
V172-7.2MW	0128-4336_01	29 Nov 2024	*Third octave noise emission – EnVentus V172-7.2 MW 50/60 Hz*

Based on the data sourced from the manufacturer's specification, the noise modelling for this assessment involved:

- conversion of third octave band level to octave band levels
- adjustment by addition of +1.0 dB at each wind speed to provide a margin for typical values of test uncertainty.

The overall A-weighted sound power levels (including the +1 dB addition for uncertainty) as a function of hub height wind speed are presented in Table 6 with the octave band values presented in Table 7. These represent the total noise emissions of the wind turbines, including the secondary contribution of ancillary plant associated with each turbine (e.g. cooling fans).

Table 6: Sound power levels (including the +1.0 dB addition) versus hub height wind speed, dB L_{WA}

Candidate model	Hub height wind speed, m/s											
	4	5	6	7	8	9	10	11	12	13	14	15
V162-6.8MW	95.0	95.0	96.0	99.3	102.5	104.3	104.3	104.4	104.8	105.1	105.3	105.5
V172-7.2MW	98.6	98.7	100.5	103.2	106.0	108.1	108.8	108.8	108.8	108.8	108.8	108.8

Table 7: Octave band sound power levels, dB L_{WA} [1]

Candidate model	Octave band centre frequency, Hz									
	31.5	63	125	250	500	1000	2000	4000	8000	Total
V162-6.8MW[1]	76.0	88.5	96.4	99.7	100.2	98.7	94.2	86.7	76.0	105.5
V172-7.2MW[2]	79.3	90.8	97.8	102.4	101.4	102.0	100.9	99.3	86.5	108.8

1 Based on one-third octave band levels at 15 m/s

2 Based on one-third octave band levels at 10 m/s

These sound power levels are also illustrated in Appendix H.

The overall A-weighted sound power level provides a useful summary of a wind turbine's noise emission. However, when predicting noise levels at distant receivers, the frequency distribution of the sound power level must be considered. Sound attenuation over distance is frequency dependent — higher frequencies attenuate more strongly than lower frequencies, primarily through atmospheric absorption (see the air absorption coefficients in Appendix I).

Two sources with similar overall sound power levels can therefore produce different noise levels at a receiver where their spectra differ. A source with more of its sound power in the higher frequency bands loses proportionally more of that energy over the propagation path. Predicted noise levels at receivers consequently depend on the octave band spectrum of each candidate model, not on the overall A-weighted sound power level alone.

Industry research conducted with reference to sound power data for a range of wind turbine models has shown that there is not a clear relationship between wind turbine size, or power output, and the noise emission characteristics of a given wind turbine model.[7] In practice, the overall noise emissions of a wind turbine are dependent on a range of factors, including the wind turbine size and power output, and other important factors such as the blade design and rotational speed of the wind turbine. Therefore, while wind turbine sizes and power ratings of contemporary wind turbines have increased, the noise emissions of the wind turbines are comparable to, or lower than, previous generations of wind turbines as a result of design improvements (notably, measures to reduce the speed of rotation of the wind turbines, and enhanced blade design features such as serrations for noise control).

7.3.2 Special audible characteristics

Special audible characteristics relate to potential tonality, amplitude modulation and impulsiveness of a wind turbine.

Information concerning potential tonality is often limited at the planning stage of a wind farm, and test data for tonality is presently unavailable for the selected candidate wind turbine models. However, the occurrence of tonality in the noise of contemporary multi-megawatt wind turbine designs is unusual. This is supported by evidence of operational wind farms in Australia which indicates that the occurrence of tonality at receivers is atypical.

Amplitude modulation and impulsiveness are not able to be predicted, however the evidence of operational wind farms in Australia indicates that their occurrence is limited and atypical.

Given the above, adjustments for special audible characteristics have not been applied to the predicted noise levels presented in this assessment. This is consistent with the recommendations of the Technical Guideline which states that it is not necessary to apply a penalty for special audible characteristics during the prediction of wind farm noise levels.

Notwithstanding this, the subject of special audible characteristics would be addressed in subsequent assessment stages for the project, following approval of the wind farm, and again following construction of the wind farm.

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7 Van den Berg, Frits & Koppen, Erik & Boon, Jaap & Ekelschot-Smink, Madelon. - *Sound power of onshore wind turbines and its spectral distribution. Sound & Vibration. 59* - 2025

7.4 Predicted noise levels

7.4.1 Receivers

Sound levels in environmental assessment work are typically reported to the nearest integer to reflect the practical use of measurement and prediction data. However, in the case of wind farm layout design, significant layout modifications may only give rise to fractional changes in the predicted noise level. This is a result of the relatively large number of sources influencing the total predicted noise level, as well as the typical separating distances between the wind turbine locations and surrounding assessment positions. It is therefore necessary to consider the predicted noise levels at a finer resolution than can be perceived or measured in practice. It is for this reason that the levels presented in this section are reported to one decimal place.

Noise levels from the proposed wind farm have been predicted using the sound power level data detailed in Section 7.3.1 for the selected candidate wind turbine models and are summarised in Table 8 for the hub height wind speed which results in the highest predicted noise levels for each candidate wind turbine model.

Predicted noise levels at receivers within the project boundary, where noise limits do not apply, are presented for information only.

The locations of the predicted 30, 35, 40 and 45 dB L_{A90} noise contours are illustrated in Figure 5 and Figure 6, for the hub height wind speed which results in the highest predicted noise levels for each candidate wind turbine model.

Predicted noise levels for each integer wind speed are tabulated in Appendix G for all considered receivers, including receivers where the highest predicted noise level is below 30 dB L_{A90}.

Table 8: Highest predicted noise level at receivers with predicted levels 30 dB L_{A90} or above

Receiver	V162-6.8MW	V172-7.2MW
Non-stakeholder receivers		
17	28.5	30.5
21	28.7	30.8
23	28.4	30.4
26	28.8	30.8
27	31.1	33.2
28	33.1	35.3
31	28.7	30.7
35	29.3	31.4
36	29.1	31.2
37	29.0	31.1
40	32.7	34.8
43	32.8	34.9
45	33.7	35.8
59	34.3	36.5

Receiver	V162-6.8MW	V172-7.2MW
60	29.5	31.6
63	29.5	31.5
64	29.8	31.8
82	35.4	37.5
95	30.1	32.2
99	37.1	39.2
101	31.4	33.5
113	33.9	36.0
114	32.2	34.3
119	33.0	35.1
120	33.9	36.1
121	32.4	34.5
123	30.8	32.9
124	37.3	39.5
125	30.2	32.3
131	36.6	38.8
138	31.9	34.1
139	32.0	34.1
140	32.2	34.3
141	34.3	36.4
171	31.2	33.3
Stakeholder receivers outside the Project boundary		
84 (S)	40.9	43.3
88 (S)	35.1	37.3
96 (S)	30.2	32.2
98 (S)	34.6	36.7
104 (S)	37.3	39.5
105 (S)	37.4	39.6
106 (S)	37.6	39.8
108 (S)	31.8	33.9

Receiver	V162-6.8MW	V172-7.2MW
109 (S)	31.5	33.6
110 (S)	31.2	33.2
112 (S)	31.4	33.4
118 (S)	34.9	37.0
122 (S)	30.9	33.1
135 (S)	35.3	37.5
142 (S)	36.7	38.9
281 (S)	36.6	38.8
1148 (S)	34.9	37.1
Stakeholder receivers within the Project boundary		
39 (S)	35.2	37.4
97 (S)	38.7	40.9
100 (S)	34.0	36.1
102 (S)	37.4	39.6
107 (S)	39.6	41.9
111 (S)	47.0	49.7
117 (S)	38.1	40.3
128 (S)	38.9	41.1
129 (S)	39.1	41.4
132 (S)	38.5	40.8
137 (S)	32.9	35.1
143 (S)	39.4	41.7

(S) Stakeholder

The results presented in Table 8 demonstrate that wind turbine noise levels associated with the Project are predicted to comply with the noise limits for all receivers for both candidate wind turbine models. Specifically, the predicted operational wind turbine noise levels are:

- below the applicable base noise limit of 40 dB L_{A90} at all non-stakeholder receivers by at least 0.5 or 2.7 dB, depending on the candidate wind turbine model.
- below the applicable base noise limit of 45 dB L_{A90} at all stakeholder receivers outside the Project boundary by at least 1.7 or 4.1 dB, depending on the candidate wind turbine model
- below the reference base noise level of 45 dB L_{A90} at all but one stakeholder receiver within the Project boundary by at least 3.1 or 5.4 dB, depending on the candidate wind turbine model.

  The proponent advised that receiver 111 is to be demolished under contract with the landowner.

Figure 5: Highest predicted noise level contours, dB L_{A90} – V162-6.8MW

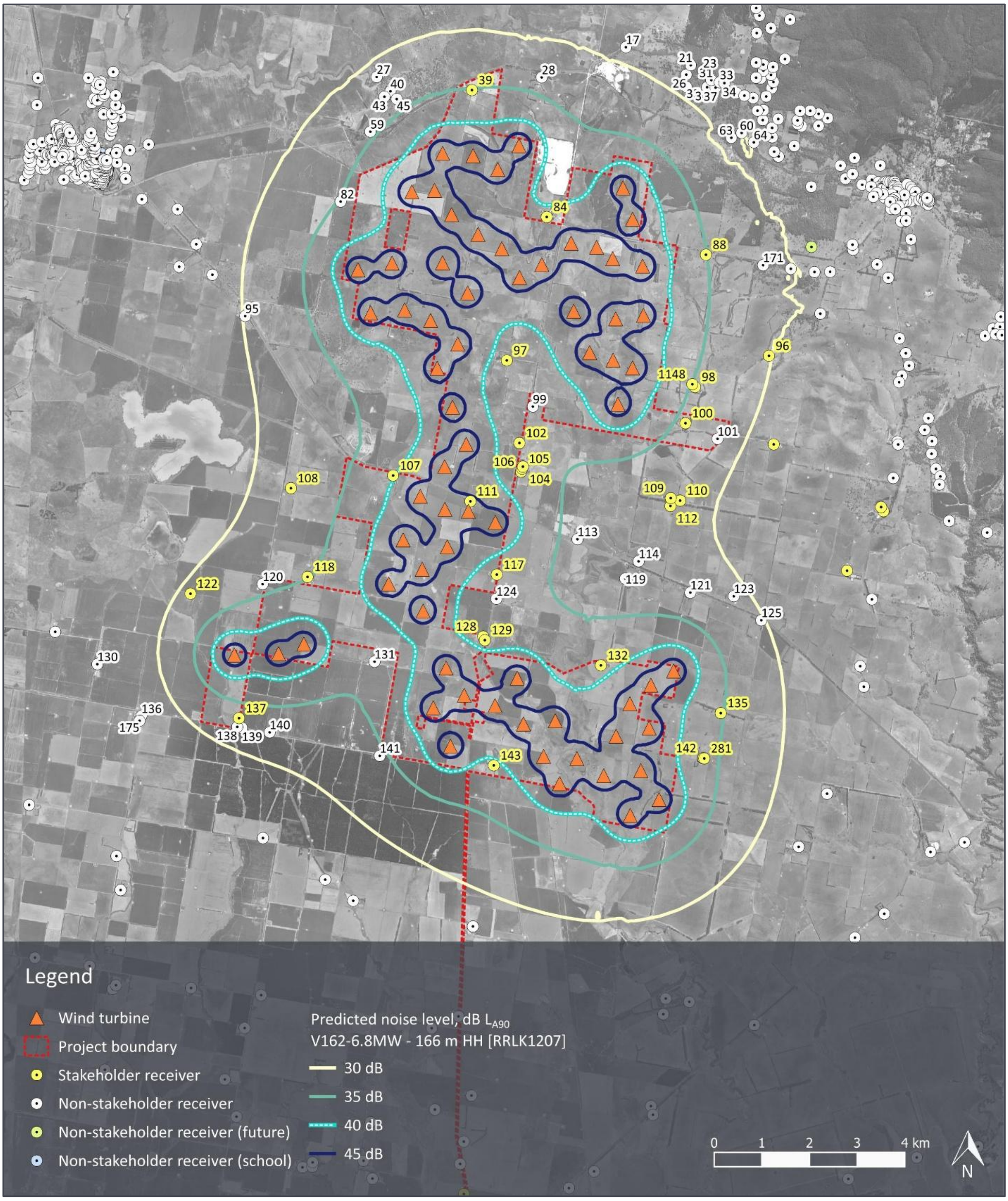
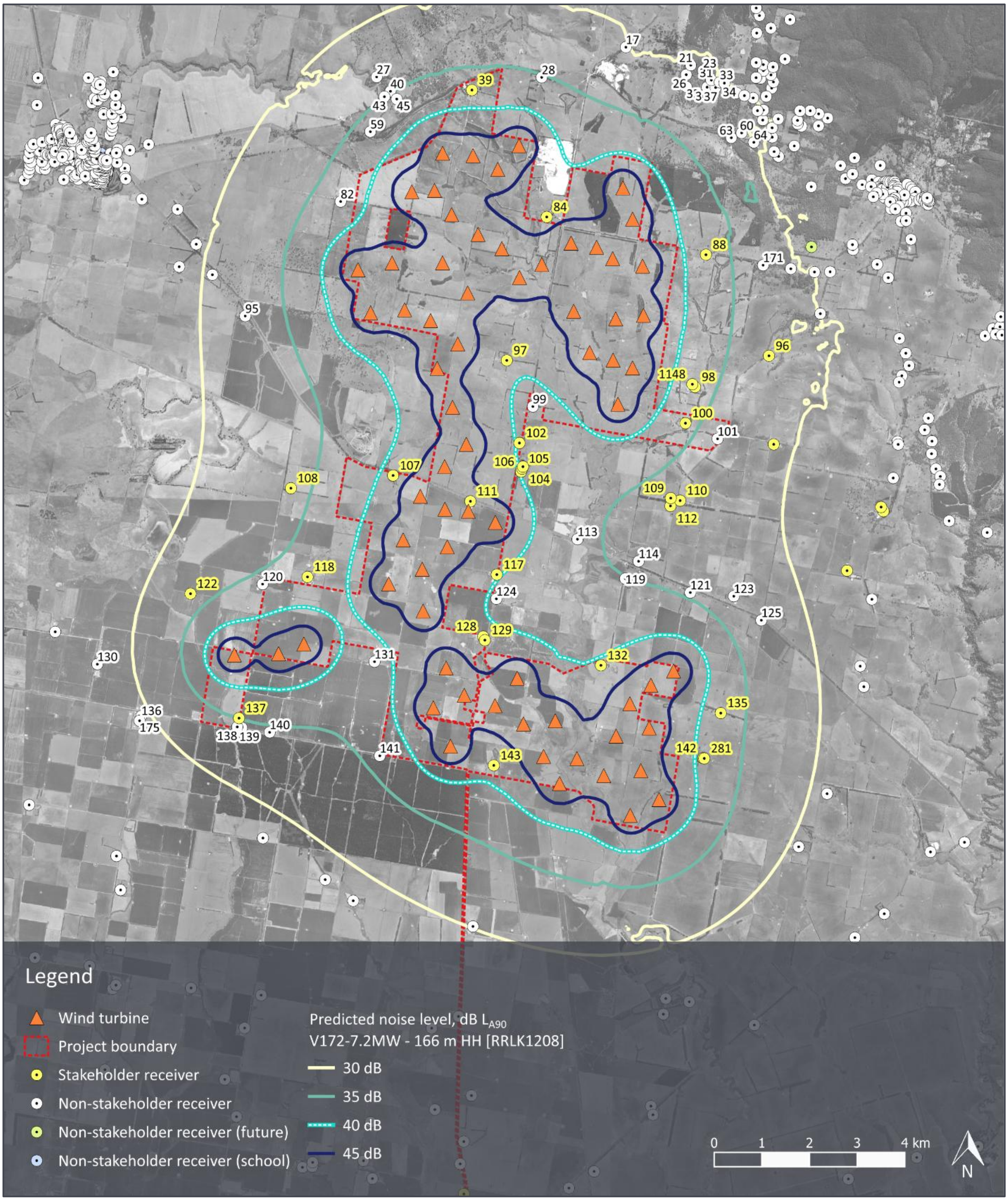


Figure 6: Highest predicted noise level contours, dB L_{A90} – V172-7.2MW



7.4.2 Natural areas

Wind turbine noise levels in natural areas that are associated with the operation of the Project are likely to be audible on some occasions at locations where the predicted wind turbine noise levels are between 30 and 40 dB L_{A90}. At locations where predicted wind turbine noise levels are higher than 40 dB L_{A90}, the Project is expected to be regularly audible when the wind turbines are operating. At locations where the predicted noise levels are approaching, or greater than 45 dB $L_{A90,}$ wind turbine noise levels would be clearly audible when the wind farm is operating.

Conversely, where the predicted noise levels are below 30 dB L_{A90}, wind turbine noise may still be audible at times, but it would be very dependent on wind conditions and the characteristics of the background environment. At levels below 30 dB L_{A90}, instances of audible wind turbine noise would usually be difficult to distinguish from the ambient sound environment. As a point of context, while the background noise monitoring was conducted at receivers rather than natural areas, the data presented in Section 6.0 provides a general indication of the range of background noise levels in the surrounding area. At wind speeds of around 7-8 m/s when the turbines are producing sound power levels approaching their maximum noise emissions, the background noise levels are typically comparable to or higher than 30 dB L_{A90}.

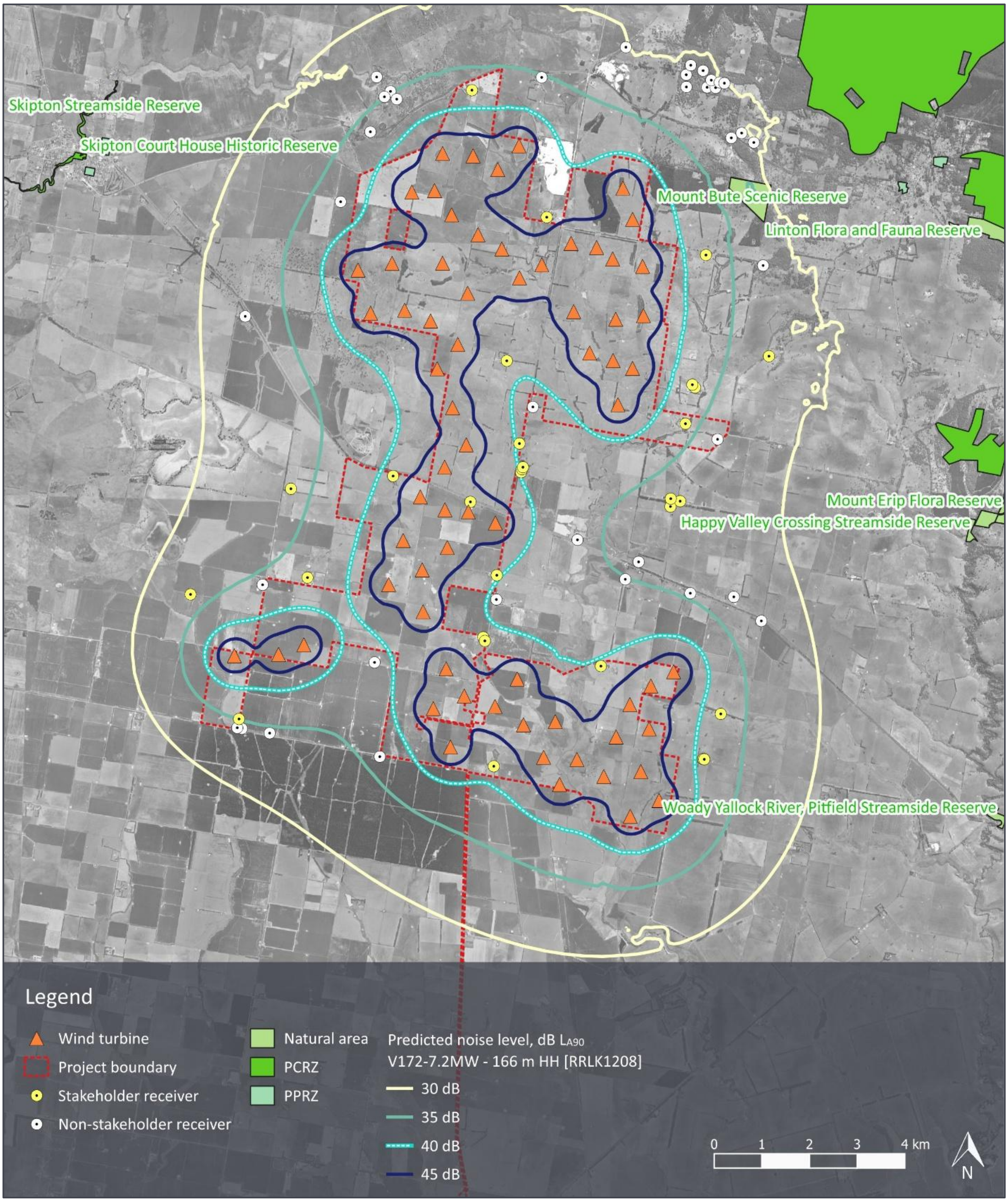
As an indication, wind turbine noise levels above 30 dB L_{A90} are predicted to occur in areas within approximately 2 km of the Project's wind turbines.

The distribution of wind turbine noise levels in the identified natural areas is presented in Figure 7 for the candidate wind turbine model resulting in the highest predicted noise levels (V172-7.2MW). The noise modelling indicates that the natural area most likely to experience regular wind turbine noise is the Mount Bute Scenic Reserve, located approximately 2.1 km from the nearest proposed wind turbine. Wind turbine noise levels are predicted approximately between 28 and 35 dB L_{A90}, depending on the candidate wind turbine model.

At farther natural areas, wind turbine noise levels are predicted below 20 dB L_{A90}.

The assessment indicates that it is unlikely that wind turbine noise in the nearby natural areas would be relevant to the ERS environmental value (i.e. a value which solely relates to the experiences of people visiting these areas).

Figure 7: Predicted operational wind turbine noise levels and identified natural areas – V172-7.2MW



7.5 Cumulative assessment

The noise limits determined in accordance with NZS 6808 apply to the total combined operational wind turbine noise level, including the contribution of any neighbouring wind farm developments. The assessment has therefore considered other wind farm projects in the surrounding area.

7.5.1 Stockyard Hill Wind Farm

The Stockyard Wind Farm commenced operation in December 2020 and comprises 149 Goldwind 3S wind turbines with a hub height of 110 m.[8]

The noise emissions for the Goldwind 3S wind turbines have been represented for this study with data sourced from the pre-development noise assessment report.[9]

The planning permit establishes a minimum operational noise limit of 40 dB for non-stakeholder receivers around the wind farm. [10]

7.5.2 Chepstowe Wind Farm

The Chepstowe Wind Farm commenced operation in April 2015 and comprises 3 Senvion MM92 wind turbines with a hub height of 80 m.[11]

The noise emissions for the Senvion MM92 wind turbines have been represented for this study with data sourced from the noise assessment report for the Maroona Wind Farm[12].

The planning permit establishes a minimum operational noise limit of 40 dB for non-stakeholder receivers around the wind farm. [13]

7.5.3 Berrybank Wind Farm

The Berrybank Wind Farm commenced operation in July 2021 and comprises 43 Vestas V136-4.2MW wind turbines with a hub height of 112 m.[14]

The noise emissions for the V136-4.2MW wind turbines have been represented for this study with data sourced from a publicly available noise assessment report[15].

The planning permit establishes a minimum operational noise limit of 40 dB for non-stakeholder receivers around the wind farm. [16]

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8 https://www.stockyardhillwindfarm.com.au/

9 MDA Report Rp 001 R04 20170840 *Stockyard Hill Wind Farm – Pre-development noise assessment*, dated 20 Dec. 2017

10 Planning Permit no. PL-SP/05/0548/B

11 https://chepstowewindfarm.com.au/

12 MDA statement of evidence to VCAT Ev 001 2010327 dated 28 January 2011

13 Planning Permit no. PA1676/10

14 https://www.berrybankwindfarm.globalpower-generation.com.au/

15 MDA Report Rp 002 R02 20180495 *BBWF – Pre-construction noise assessment*, dated 8 April 2019

16 Planning Permit no. 20092821-A

7.5.4 Golden Plains Wind Farm

The Golden Plains Wind Farm is currently under construction, comprising up to 228 turbines with a maximum tip height of 230 m. [17]

The noise emissions for the V162-6.0MW wind turbines have been represented for this study with data sourced from a publicly available noise assessment report.[18]

The planning permit establishes a minimum operational noise limit of 40 dB for receivers around the wind farm.

7.5.5 Assessment

To inform the assessment of potential cumulative noise considerations, reference is made to Clause 5.6.4 of NZS 6808 which states:

> *For the purposes of 5.6.1, if the predicted wind farm sound levels for a new wind farm are at least 10 dB below any existing wind farm sound levels permitted by any resource consent or plan, then the cumulative effect shall not be taken into account.*

Additional contextual information is provided in the commentary to Clause 5.6.4 which notes:

> *If an existing wind farm sound level is say 40 dB and the predicted wind farm sound level for a new wind farm is say 30 dB then the combined level would be 40.4 dB. This increase of less than 0.5 dB cannot be reliably measured and would be undetectable to people, and will therefore not give rise to any adverse cumulative effect.*

Based on this guidance, a preliminary simplified assessment of potential cumulative noise considerations can be made by comparing the individual predicted 30 dB L_{A90} contours of each wind farm operating in isolation, as presented in Figure 8.

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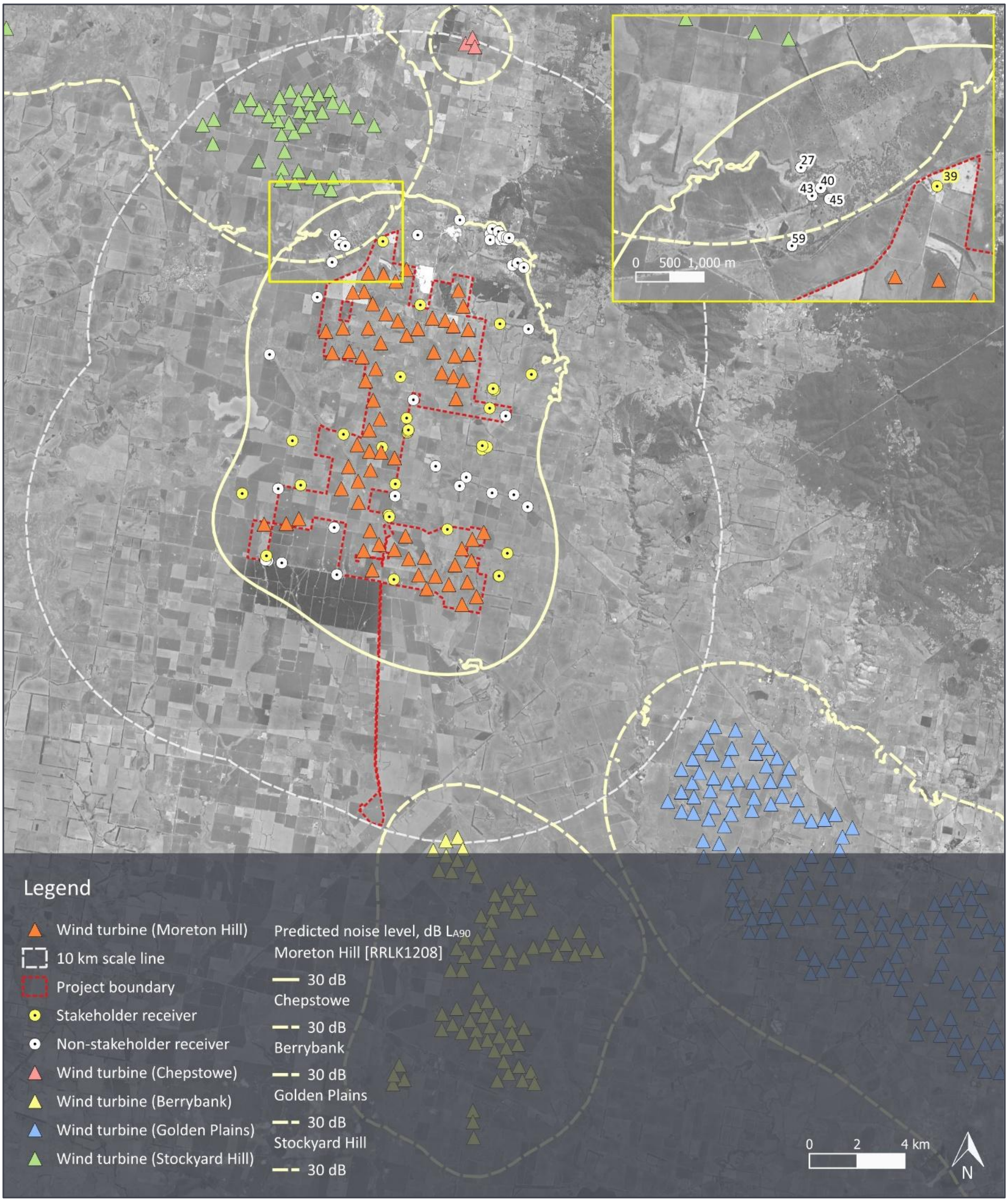
17 https://goldenplainswindfarm.com.au/about-golden-plains-wind-farm/

18 MDA Report Rp 001 R02 20200919 *Golden Plains Wind Farm - Environmental Noise Assessment*, dated 4 Jan. 2020

Figure 8: Predicted 30 dB L_{A90} contours for the Project (V172-7.2MW) and neighbouring wind farms



The results demonstrate that the predicted 30 dB L_{A90} contour of the Project (using the candidate turbine model resulting in the highest predicted noise levels, V172-7.2MW) do not overlap with the predicted 30 dB L_{A90} contour of the Berrybank, Chepstowe and Golden Plains wind farms. Based on this finding, the following can be concluded for these 3 neighbouring wind farms:

- At any receiver where the predicted noise level of one of the wind farms is between 30 and 40 dB, the predicted noise level from an adjoining wind farm will be less than 30 dB, and significantly lower in most cases
- At any receiver where the predicted noise level from one of the wind farms approaches the 40 dB base noise limit applicable to each site, the predicted noise level associated with each of neighbouring wind farms will be more than 10 dB lower. Based on the guidance of NZS 6808, the cumulative effect does not need to be taken in account for the nearest receivers to each of these wind farm developments.

The predicted noise levels therefore demonstrate that cumulative wind farm noise considerations between the Moreton Hill, Berrybank, Chepstowe and Golden Plains wind farms are not applicable. Specifically, the noise contribution of the Berrybank, Chepstowe and Golden Plains wind farms is sufficiently low to be inconsequential to the noise assessment for the Project. Conversely, the predicted noise contribution of the Project at the receivers in the vicinity of the Berrybank, Chepstowe and Golden Plains wind farms would not affect the compliance outcomes for these developments.

As a visual guide to identify potential cumulative noise considerations between the Project and the Stockyard Hill Wind Farm, the inset of Figure 8 presents the overlap area between the respective predicted 30 dB L_{A90} noise contours.

The predicted noise levels presented in Table 9, at the receivers identified in the overlap area, are for the wind speeds which give rise to the highest noise emissions from each site respectively. It is also noted that the noise level contours are predicted on the basis of downwind propagation from each turbine; in most instances where cumulative noise is considered, a noise sensitive receiver cannot be simultaneously downwind of all wind turbines of adjoining projects. The predictions are therefore conservative for the purpose of considering cumulative noise levels. [19]

Table 9: Cumulative assessment

Receiver	Predicted noise level, dB L_{A90} Moreton Hill only	Stockyard Hill only [1]	Cumulative	Change in compliance outcome due to cumulative effects
27	33.2	33.0 [2]	36.1	No
40	34.8	31.6	36.5	No
43	34.9	31.8	36.6	No
45	35.8	31.1	37.1	No

1 Sourced from MDA Report Rp 001 R04 20170840 *Stockyard Hill Wind Farm – Pre-development noise assessment*, dated 20 Dec. 2017

2 Estimated value as receiver 27 was not presented in MDA Report Rp 001 R04 20170840

It can be concluded from the above table that the compliance outcome for both the Project and the Stockyard Hill Wind Farm would not be affected by the noise contribution from the other project.

19 By a margin of up to 3 dB when compared to downwind predictions from each wind farm individually. This is distinct to variation of noise levels when a receiver is upwind of each wind farm when noise levels would be significantly lower than the downwind predictions.

8.0 SUBSTATION AND BESS NOISE ASSESSMENT

This section presents an assessment of operational noise from the Project's substation and battery energy storage system (BESS), including potential cumulative noise considerations.

8.1 Description

Related infrastructure associated with the project is understood to comprise a substation and a 100 MW / 400 MWh BESS.

The BESS is proposed to consist of:

- 80 battery units
- 20 inverters, each connected to a medium voltage (MV) coupling transformer (5 MVA each)
- 1 high voltage (HV) transformer (125 MVA).

The substation is proposed to consist of a single 500 MVA transformer.

8.2 Assessment criteria

The following obligations apply under the EP Act and EP Regulations:

- Operation of the substation and BESS must not cause noise that is prescribed to be unreasonable or assessed to be unreasonable according to the listed factors set out in the EP Act.
- The risk of harm from noise associated with the substation and BESS must be minimised so far as reasonably practicable, in accordance with the GED under the EP Act.
- Frequency spectrum is a prescribed factor under the EP Regulations and, as a result, an objective assessment of low frequency may inform an assessment of whether the noise is unreasonable.

In terms of assessment requirements, the EP Regulations specify that the prediction, measurement, assessment and analysis of noise for commercial, industrial and trade premises must be conducted in accordance with the Noise Protocol.

The Noise Protocol procedure for determining noise limits depends on whether the noise source or the receivers are located in a rural or urban area.

In rural areas, applicable noise limits are generally based on zone levels determined according to the land zoning of the area in which the noise source and receivers are located. These zone levels are then adjusted, where appropriate, for a range of factors.

Adjustments for 'background relevant areas' are not warranted in this instance, as the background noise levels during the relevant assessment conditions for the Project's substation and BESS (i.e. low wind speeds) are low.

Considering that the land zoning is continuous between the Project's substation and BESS, and the receivers, a distance adjustment is not applicable.

The Victorian Planning Provisions include the following in its definition of a utility installation:

> *Land used* [...] *to transmit, distribute or store power, including battery storage*

As such, and considering the BESS and substation are located on land designated as Farming Zone (FZ) (see land zoning map in Appendix E), the noise limits applicable at the nearest receivers are summarised in Table 10.

Table 10: Noise Protocol time periods and noise limits, dB ENL[20]

Period	Day of week	Start time	End time	Noise limit
Day	Monday- Saturday	0700 hrs	1800 hrs	45
Evening	Monday- Saturday	1800 hrs	2200 hrs	39
	Sunday, Public holidays	0700 hrs	2200 hrs	
Night	Monday-Sunday	2200 hrs	0700 hrs	34

As the substation and the BESS have the potential to operate at any time in a 24 hour day and across 7 days a week. Meeting the applicable night-time noise limit of 34 dB ENL infers meeting the noise limits during all other time periods.

8.3 Noise emissions

8.3.1 Substation

In lieu of measured sound power level data for a specific transformer selection, reference has been made to Australian Standard AS 60076-10:2009 *Power transformers – Part 10: Determination of sound levels* (AS 60076-10:2009) which provides a method for estimating transformer sound power levels. Specifically, Figure ZA1 from AS 60076-10:2009 has been used to determine the estimated sound power level of 96 dB L_{WA} for the proposed 500 MVA transformer. This aligns with the 'reduced' maximum level as provided in the standard.

AS 60076-10:2009 does not provide estimated sound frequency spectra for transformer noise. Spectral data for the transformer was estimated by applying corrections from Table 11.27 *Location 1a for outdoor transformer noise* of Bies and Hansen to the estimated 'reduced' maximum sound power level of 96 dB L_{WA}. [21]

The maximum noise levels must be provided to the transformer manufacturer at the time of procurement.

The maximum noise levels include noise from all parts of the transformer, including the tank and cooling system. Transformers typically exhibit tonal characteristics at source. On this basis evaluation of tonality at the noise sensitive receivers must be considered. This is addressed in subsequent sections of the report.

For the purposes of noise modelling, the transformer has been located at the centre of the area designated for the substation in the absence of more detailed plans.

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[20] The effective noise level (ENL) of commercial or industrial noise determined in accordance with the Noise Protocol. This is L_{Aeq} noise level over a half-hour period, adjusted for the character of the noise. Adjustments are made for tonality, intermittency, and impulsiveness.

[21] Bies, & Hansen, C. H. (2009). *Engineering noise control: theory and practice (Fourth edition.).* p. 601

8.3.2 Battery energy storage system

At this stage of the Project, a detailed BESS design has not been established. Preliminary information available at this stage of the project has been used to undertake a quantitative assessment of the BESS. Some of this information has been derived from generic input data provided by the proponent and has not been verified by MDA. While the current information presents the best overview of the BESS noise profile at this stage, it will be important for the proponent to validate and confirm the input assumptions as the design progresses.

In the event that material changes to the input data occur, an update of the assessment will be required.

The relevant data used for noise modelling of the BESS is summarised in

Table 11: Sound power levels for Project BESS equipment items, dB L_{WA}

Equipment item	Sound power level
Inverter	82 [1]
Battery unit	90 [2]
5 MVA transformer	76 [3]
125 MVA transformer	87 [4]

1 Octave band sound power level information provided to MDA by the proponent to represent Power Electronics 690 inverter model. The overall A-weighted sound power level has been calculated by MDA based on the octave band data provided. The source of the information has not been reviewed by MDA and the input levels are recommended to be confirmed as the design progresses.

2 CATL EnerX unit with cooling fan operating at 90% speed.

3 Sound power level derived in accordance with AS 60076-10:2009 Annex ZA 'standard' maximum with spectrum derived with reference to Bies and Hanson.

4 Sound power level derived in accordance with AS 60076-10:2009 Annex ZA 'reduced' maximum with spectrum derived with reference to Bies and Hanson.

Octave band spectral data for each of the BESS equipment items is provided in Table 12.

Table 12: BESS equipment spectral sound power data, dB L_W

	Octave band centre frequency, Hz							
Item	**31.5**	**63**	**125**	**250**	**500**	**1000**	**2000**	**4000**
Inverter	76	77	76	82	82	75	71	64
Battery unit	-	85	96	88	85	86	81	75
5 MVA transformer	-	78	80	75	75	69	64	59
125 MVA transformer	-	90	92	87	87	81	76	71

While some of the equipment may exhibit some acoustic directionality, the information available to MDA does not provide sufficient detail in order to robustly represent this in a noise model. Further, the actual effect of individual equipment directivity on the noise emissions of the site as a whole will be influenced by equipment orientation and acoustic reflections.

Therefore, each equipment item has been modelled as an omni-directional point source at the top of the equipment. This is considered a balanced approach as some directivity effects may result in reduced noise levels.

8.4 Predicted noise levels

8.4.1 Receivers

Predicted noise levels have been determined on the basis of:

- the equipment noise emission data detailed in Section 8.3.
- the ISO 9613-2 noise prediction method described in Section 4.3.

An adjustment of +2 dB has been applied to the predicted noise levels to account for tonal noise from the facility.

The nearest receivers and the predicted effective noise level (including tonality adjustment) are detailed in Table 13 accounting for the substation and each BESS scenario.

Table 13: Substation and BESS predicted noise levels, dB ENL

Receiver	Total predicted noise level [1]
118	24
124	30
128	30
129	30
131	27

1 Effective noise level including +2 dB tonality adjustment.

The results indicate cumulative noise levels from the substation and BESS are predicted below the night noise limit at the nearest receiver, by at least 4 dB.

It will be critical to review any updated information as the Project progresses to verify these conclusions. This may include updated manufacturer data for equipment (especially inverters) and/or other information relating to layouts, equipment operating duties, equipment capacity and equipment counts.

8.4.2 Natural areas

Noise associated with the operation of the substation and BESS is a relevant consideration for natural areas throughout the life of the Project.

Due to the nature of the operation of these components of the Project, the extent of the areas in which the noise could be audible has the potential to be highly variable. However, natural areas where predicted noise levels are lower than 20 dB L_{Aeq} are not likely to experience audible noise from these noise sources even when daytime background noise levels are low and conditions favour the propagation of sound from the substation and BESS locations.

The identified natural area nearest to the substation and BESS is the Mount Bute Scenic Reserve, located approximately 10 km away. Predicted noise levels from the substation and BESS at this distance are much lower than 10 dB L_{Aeq}. As such, it is unlikely that noise from the substation and BESS be audible at natural areas and would materially compromise the relevant ERS environmental values (i.e. values that solely relate to the experiences of people visiting these areas).

9.0 RECOMMENDED NOISE MANAGEMENT MEASURES

Providing that the operator of a wind energy facility complies with the requirements of Regulation 131C, their obligations with respect to the general environmental duty (GED) under the EP Act will be addressed with regard to wind turbine noise.

Specifically, the operator of the wind facility must:

- ensure that wind turbine noise complies with NZS 6808; and
- implement all applicable actions under Division 5.3 of the EP Regulations to manage and review wind turbine noise from the facility, including:
  - preparation of a noise management plan;
  - conducting noise compliance testing when the wind farm begins operating;
  - preparing annual compliance statements; and
  - conducting verification wind turbine noise monitoring every 5 years.

In addition to the above, the following noise management measures should be implemented as part of the subsequent stages of development:

- The transformer equipment should be specified and selected to achieve noise emissions not exceeding the empirical maximum 'reduced' values specified in AS 60076-10:2009 as summarised in Section 8.3.1 and Section 8.3.2.
- The BESS equipment should be specified and selected to achieve the lowest reasonably practicable noise emissions.
- A detailed noise assessment should be prepared by a qualified acoustic consultant, prior to construction, addressing:
  - the final wind turbine selection and layout
  - the final location and equipment selection for the substation and BESS
  - background noise monitoring at the required non-stakeholder receivers
  - compliance with the applicable noise limits at surrounding receivers
  - recommendation of reasonably practicable noise mitigation measures to control noise from the substation and BESS.
- Development of reasonably practicable construction noise mitigation and management measures to be documented in a construction environmental management plan, prior to construction.

APPENDIX A GLOSSARY OF TERMINOLOGY

Term	Definition	Abbreviation
Amplitude modulation	Sound that is characterised by a rhythmic and higher than normal rise and fall in sound level at regular intervals.	-
A-weighting	A method of adjusting sound levels to reflect the human ear's varied sensitivity to different frequencies of sound.	See discussion below this table.
A-weighted 90^{th} centile	The A-weighted pressure level that is exceeded for 90 % of a defined measurement period. It is used to describe the underlying background sound level in the absence of a source of sound that is being investigated, as well as the sound level of steady, or semi steady, sound sources.	L_{A90}
A-weighted average noise level	The equivalent continuous (time-averaged) A-weighted sound level.	L_{Aeq}
Decibel	The unit of sound level.	dB
Hertz	The unit for describing the frequency of a sound in terms of the number of cycles per second.	Hz
Impulsiveness	Sound that is characterised by a distinct and very rapid rise in sound level (e.g. a car door closing or the impact sound of a hammer)	-
MGA94 Zone 54	Coordinates are presented in Map Grid of Australia 1994 (MGA94), Zone 54, referenced to the Geocentric Datum of Australia 1994 (GDA94)	-
Octave Band	A range of frequencies. Octave bands are referred to by their logarithmic centre frequencies, these being 31.5 Hz, 63 Hz, 125 Hz, 250 Hz, 500 Hz, 1 kHz, 2 kHz, 4 kHz, 8 kHz, and 16 kHz for the audible range of sound.	-
Sound power level	A measure of the total sound energy emitted by a source, expressed in decibels.	L_W
Sound pressure level	A measure of the level of sound expressed in decibels.	L_p
Special Audible Characteristics	A term used to define a set group of Sound characteristics that increase the likelihood of adverse reaction to the sound. The characteristics comprise tonality, impulsiveness and amplitude modulation.	SAC
Tonality	A characteristic to describe sounds which are composed of distinct and narrow groups of audible sound frequencies (e.g. whistling or humming sounds).	-

The basic quantities used within this document to describe noise adopt the conventions outlined in ISO 1996-1:2016 *Acoustics - Description measurement and assessment of environmental noise – Basic quantities and assessment procedures*. Accordingly, all frequency weighted sound pressure levels are expressed as decibels (dB) in this report. For example, sound pressure levels measured using an "A" frequency weighting are expressed as dB L_A. Alternative ways of expressing A-weighted decibels such as dBA or dB(A) are therefore not used within this report.

APPENDIX B SOURCE COORDINATES

The following table sets out the coordinates of the proposed wind turbine layout (Reference *20260107 Rev 1 G*, supplied by the proponent on 8 January 2026).

The terrain elevations for the wind turbines are based on terrain data obtained from ELVIS - Elevation and Depth - Foundation Spatial Data (downloaded on 5 May 2025).

This data may differ slightly from actual terrain elevations for each individual wind turbine; however, it provides a sufficiently accurate representation for the purpose of this assessment.

Table 14: Wind turbine coordinates – MGA94 Zone 54

Wind turbine	Easting, m	Northing, m	Terrain elevation, m
T1	717,599	5,826,548	312
T2	715,995	5,826,389	337
T3	716,634	5,826,338	327
T4	717,153	5,826,051	310
T5	719,781	5,825,662	330
T6	715,824	5,825,609	324
T7	715,349	5,825,580	349
T8	716,184	5,825,101	320
T9	719,984	5,825,006	310
T10	716,738	5,824,683	310
T11	718,692	5,824,502	295
T12	719,228	5,824,415	290
T13	717,238	5,824,385	294
T14	719,566	5,824,176	300
T15	715,993	5,824,088	312
T16	718,078	5,824,053	290
T17	720,194	5,824,020	314
T18	714,933	5,824,084	380
T19	714,217	5,823,944	369
T20	717,610	5,823,780	282
T21	716,521	5,823,458	297
T22	715,197	5,823,101	330
T23	718,747	5,823,072	290
T24	714,483	5,823,039	318
T25	720,212	5,822,987	360
T26	719,629	5,822,913	306
T27	715,742	5,822,877	319

Wind turbine	Easting, m	Northing, m	Terrain elevation, m
T28	716,313	5,822,383	310
T29	719,082	5,822,204	280
T30	719,574	5,822,047	282
T31	715,881	5,821,873	309
T32	719,982	5,821,882	300
T33	719,676	5,821,120	274
T34	716,203	5,821,056	290
T35	716,491	5,820,278	284
T36	716,037	5,819,810	295
T37	715,527	5,819,187	304
T38	716,043	5,818,915	297
T39	716,535	5,818,874	291
T40	717,102	5,818,638	288
T41	715,166	5,818,272	297
T42	716,093	5,818,125	294
T43	715,566	5,817,656	290
T44	714,863	5,817,347	295
T45	715,585	5,816,777	284
T46	713,081	5,816,085	285
T47	712,549	5,815,883	277
T48	711,621	5,815,856	269
T49	716,069	5,815,581	275
T50	720,844	5,815,519	275
T51	717,562	5,815,367	269
T52	719,927	5,814,832	270
T53	716,448	5,815,010	270
T54	720,367	5,815,222	273
T55	717,095	5,814,793	270
T56	715,799	5,814,748	270
T57	718,451	5,813,155	251
T58	718,360	5,814,473	258
T59	717,692	5,814,407	265
T60	720,331	5,814,322	267

Wind turbine	Easting, m	Northing, m	Terrain elevation, m
T61	719,638	5,814,150	262
T62	716,160	5,813,941	270
T63	718,115	5,813,727	254
T64	718,815	5,813,680	250
T65	720,157	5,813,426	260
T66	719,378	5,813,322	258
T67	720,540	5,812,821	250
T68	719,934	5,812,487	243

The following table sets out the centroid coordinates of the substation and BESS supplied by the proponent on 4 April 2025 and 9 May 2025, respectively.

Table 15: Substation and BESS coordinates – MGA94 Zone 54

Item	Easting, m	Northing, m
Substation	715,186	5,817,188
BESS	715,218	5,817,357

APPENDIX C VICTORIAN REGULATIONS AND GUIDELINES

The following publications are relevant to the assessment of operational noise from proposed renewable energy projects in Victoria:

- *Environment Protection Act 2017*
- *Environment Protection Regulations 2021*
- *Environment Reference Standard* published 25 May 2021, and as amended by *Environment Reference Standard No. S158 Gazette* dated 29 March 2022
- Victorian Department of Transport and Planning publication *Planning Guidelines for Development of Wind Energy Facilities* dated September 2023
- NZS 6808:2010 *Acoustics – Wind farm noise*
- EPA Publication 1826.5 *Noise limit and assessment protocol for the control of noise from commercial, industrial and trade premises and entertainment venues* dated September 2025.

The relevant publication for the assessment of construction noise in Victoria is the EPA Publication 1834.1 *Civil construction, building and demolition guide*, dated 12 September 2023.

There is no standard or regulation that specifies criteria for the control of construction vibration levels in Victoria. In lieu of Victorian guidance for construction vibration, reference is made to NSW guidance documents.

Details of the guidance and noise criteria provided by the above publications are provided in the following sections.

C1 Environment Protection Act 2017

The *Environment Protection Act 2017* (EP Act) provides the overarching legislative framework for the protection of the environment in Victoria.

The EP Act establishes a general environmental duty to minimise the risks of harm to human health or the environment from pollution or waste, including noise related amenity impacts, so far as reasonably practicable.

The EP Act also prohibits the emission of unreasonable noise from commercial and industrial trade premises. Specifically, the EP Act states that:

> *A person must not, from a place or premises that are not residential premises—*
>
> *(a) emit an unreasonable noise; or*
>
> *(b) permit an unreasonable noise to be emitted*

Under the EP Act, unreasonable noise means noise that:

> *(a) is unreasonable having regard to the following—*
>
> > *(i) its volume, intensity or duration;*
> >
> > *(ii) its character;*
> >
> > *(iii) the time, place and other circumstances in which it is emitted;*
> >
> > *(iv) how often it is emitted;*
> >
> > *(v) any prescribed factors; or*
>
> *(b) is prescribed to be unreasonable noise:*

Further information about noises that are prescribed to be unreasonable is separately defined in regulations made under the EP Act (see next section).

C2 Environment Protection Regulations 2021

The *Environment Protection Regulations 2021* (EP Regulations) give effect to the EP Act by establishing prescriptive requirements for a range of environmental considerations including noise.

The following sections provide details of the requirements for wind turbine noise and industry noise.

C2.1 Wind turbine noise

Part 5.3 Division 5 of the EP Regulations nominates NZS 6808 as the relevant standard for assessing operational wind turbine noise in Victoria and introduces additional provisions and requirements.

Specifically, the EP Regulations outline the following:

- Noise agreements

  An owner or operator of a wind energy facility may enter into a written agreement with a landowner to modify the noise limits.

  If a noise agreement is made after 1 November 2021, an increased base noise limit of 45 dB L_{A90} would apply. If a noise agreement was made prior to 1 November 2021, the noise limit can be modified as specified in the noise agreement.

- Wind energy facility operators' duties

  Regulation 131C establishes a duty to manage and review wind turbine noise by taking all applicable actions set in Division 5 of the EP Act.

  Regulation 131CA establishes a duty to comply with the noise limit (or the alternative monitoring point criterion if wind turbine noise is being assessed at an alternative monitoring point) determined in accordance with NZS 6808 and any applicable noise agreement.

  Providing that the operator of a wind farm complies with the requirements of regulations 131C and 131CA, their duty with respect to the general environmental duty under the EP Act has been addressed.

Details of the types of receivers to be assessed, the noise limits and the technical procedures for assessing compliance with the noise limits are separately defined in NZS 6808 (see further information in Section C5).

In accordance with the EP Regulations, noise levels from a wind farm are prescribed to be *unreasonable* for the purposes of the EP Act, if they exceed the relevant applicable noise limits.

C2.2 Industry noise

In relation to noise from commercial, industrial and trade premises (industry), the EP Regulations specify that the prediction, measurement, assessment or analysis of noise within a noise sensitive area must be conducted in accordance with the Noise Protocol (see Section C6). Noise from industry is prescribed by the EP Regulations to be unreasonable for the purposes of the EP Act if it exceeds a noise limit or alternative assessment criterion determined in accordance with the Noise Protocol.

The noise limits apply at locations referred to as noise sensitive areas which are defined by the EP Regulations as:

(a) that part of the land within the boundary of a parcel of land that is—

(i) within 10 metres of the outside of the external walls of any of the following buildings—

(A) a dwelling (including a residential care facility but not including a caretaker's house);

(B) a residential building;

(C) a noise sensitive residential use[22]*; or*

(ii) within 10 metres of the outside of the external walls of any dormitory, ward, bedroom or living room of one or more of the following buildings—

(A) a caretaker's house;

(B) a hospital;

(C) a hotel;

(D) a residential hotel;

(E) a motel;

(F) a specialist disability accommodation;

(G) a corrective institution;

(H) a tourist establishment;

(I) a retirement village;

(J) a residential village; or

(iii) within 10 metres of the outside of the external walls of a classroom or any room in which learning occurs in the following buildings (during their operating hours)—

(A) a child care centre;

(B) a kindergarten;

(C) a primary school;

(D) a secondary school; or

(b) subject to paragraph (c), in the case of a rural area only, that part of the land within the boundary of—

(i) a tourist establishment; or

(ii) a campground; or

(iii) a caravan park; or

---

[22] *Noise sensitive residential use* […] *means a community care accommodation, dependent person's unit, dwelling, residential aged care facility, residential village, retirement village or rooming house*

(c) *despite paragraph (b), in the case of a rural area only, where an outdoor entertainment event or outdoor entertainment venue is being operated, that part of the land within the boundary of the following are not noise sensitive areas for the purposes of that event or venue—*

(i) a tourist establishment;

(ii) a campground;

(iii) a caravan park;

C3 Environment Reference Standard

The *Environment Reference Standard* (ERS) is a legislative instrument made under the EP Act which sets out environmental values for ambient sound that are sought to be achieved and maintained in Victoria and standards to support those values. The indicators and objectives within the standard provide a benchmark for comparing desired outcomes to the actual state of the environment, and a basis for assessing actual and potential risks to the environmental values.

The ERS is an environmental benchmark. It brings together a collection of environmental values, indicators and objectives that describe environmental and human health outcomes to be achieved or maintained in the whole or in parts of Victoria. These values, indicators and objectives are used to assess and report on changing environmental conditions by providing a reference point for decision makers to consider whether a proposal or activity is consistent with the environmental values identified in the ERS. The ERS also allows decision makers to evaluate potential impacts on human health and the environment that may result from a proposal or activity. The ERS does not specify requirements that must be met by environmental managers or other duty holders.

The ERS is primarily relevant for aspects of the environment that are not the subject of prescriptive regulation. These aspects include the noise from commercial premises and construction activities in natural areas, or the additional noise from public roads as a result of traffic associated with commercial activities.

Further, in the situations where the ERS is a relevant consideration, it is important to note that the ERS is not a compliance standard. Specifically, the values listed within the ERS are not prescribed noise limits, nor are they design criteria for proposed development.

Indicators and objectives within the ERS are generally not relevant considerations where they relate to an aspect of the environment that is the subject of prescriptive regulation. For example, the ambient sound indicators and objectives will not be relevant when considering noise from wind turbines and commercial, industrial and trade premises at noise sensitive areas, as defined in the EP Regulations. This is because noise in these circumstances is regulated by specific provisions and noise limits in the EP Regulations and the associated Noise Protocol and NZS 6808.

The environmental values presented in the ERS and a description of each is provided in Table 16.

Table 16: Environmental values of the ambient sound environment

Environmental value	Description of environmental value
Sleep during the night	An ambient sound environment that supports sleep during the night
Domestic and 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 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.

The ERS land use categories and their descriptions are provided in Table 17.

Table 17: Land use categories for the ambient sound environment

Land use category	General description	Planning zones
Category I	An urban form with distinctive features or characteristics of taller buildings, high commercial and residential intensity and high site coverage.	Industrial Zone 1 (IN1Z) Industrial Zone 2 (IN2Z) Port Zone (PZ) Road 1 Zone (RDZ1) Capital City Zone (CCZ) Docklands Zone (DZ)
Category II	Medium rise building form with a strong urban or commercial character. Typically contains mixed land uses including activity centres and larger consolidated sites, and an active public realm.	Industrial Zone 3 (IN3Z) Commercial 1 Zone (C1Z) Commercial 2 Zone (C2Z) Commercial 3 Zone (C3Z) Activity Centre Zone (ACZ) Mixed Use Zone (MUZ) Road 2 Zone (RDZ2)
Category III	Lower rise building form including lower density residential development and detached housing typical of suburban residential settings or in towns of district or regional significance.	Residential Growth Zone (RGZ) General Residential Zone (GRZ) Neighbourhood Residential Zone (NRZ) Urban Floodway Zone (UFZ) Public Park and Recreation Zone (PPRZ) Urban Growth Zone (UGZ) [1]
Category IV	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.	Low Density Residential Zone (LDRZ) Township Zone (TZ) Rural Living Zone (RLZ) Green Wedge A Zone (GWAZ) Rural Conservation Zone (RCZ) Public Conservation and Resource Zone (PCRZ) Green Wedge Zone (GWZ) Farming Zone (FZ) Rural Activity Zone (RAZ)

Land use category	General description	Planning zones
Category V	Unique combinations of landscape, biodiversity and geodiversity. These natural areas typically provide undisturbed species habitat and enable people to see and interact with native vegetation and wildlife.	Natural areas are classified as land within Category V irrespective of the planning zones that apply to that land.
Category I, II, III or IV depending on surrounding land uses and the intent of the specific planning zone (which may have a diversity of uses) as specified in a schedule to the planning zone		Comprehensive Development Zone (CDZ) Priority Development Zone (PDZ) Special Use Zone (SUZ) Public Use Zone (PUZ)

1 Urban Growth Zone (UGZ) is a Category III land use until the relevant precinct structure plan is adopted, at which time the approved land uses will determine the land use category.

The ERS indicators and objectives relevant to each land use category are described in Table 18.

Table 18: Indicators and objectives for the ambient sound environment

Land use category	Indicators	Objectives
Category I	Outdoor $L_{Aeq,8h}$ from 2200 hrs to 0600 hrs	55 dB L_{Aeq}
	Outdoor $L_{Aeq,16hr}$ from 0600 hrs to 2200 hrs	60 dB L_{Aeq}
Category II	Outdoor $L_{Aeq,8h}$ from 2200 hrs to 0600 hrs	50 dB L_{Aeq}
	Outdoor $L_{Aeq,16hr}$ from 0600 hrs to 2200 hrs	55 dB L_{Aeq}
Category III	Outdoor $L_{Aeq,8h}$ from 2200 hrs to 0600 hrs	40 dB L_{Aeq}
	Outdoor $L_{Aeq,16hr}$ from 0600 hrs to 2200 hrs	50 dB L_{Aeq}
Category IV	Outdoor $L_{Aeq,8h}$ from 2200 hrs to 0600 hrs	35 dB L_{Aeq}
	Outdoor $L_{Aeq,16hr}$ from 0600 hrs to 2200 hrs	40 dB L_{Aeq}
Category V	Qualitative	A sound quality that is conducive to human tranquillity and enjoyment having regard to the ambient natural soundscape

Natural areas are a land-use category for which the ERS details desired outcomes in terms of noise level to be achieved or maintained in Victoria. 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*.

C4 Victorian Wind Energy Guidelines

The Victorian Department of Transport and Planning publication *Planning Guidelines for Development of Wind Energy Facilities* dated September 2023 (Victorian Wind Energy Guidelines) provide advice to responsible authorities, proponents and the community about suitable sites to locate wind energy facilities and to inform planning decisions about a wind energy facility proposal.

The Victorian Wind Energy Guidelines set out:

- *a framework to provide a consistent and balanced approach to the assessment of wind energy projects across the state*
- *a set of consistent operational performance standards to inform the assessment and operation of a wind energy facility project*
- *guidance as to how planning permit application requirements might be met*
- *a framework for the regulation of wind turbine noise.*

Section 4.3.2 of the Victorian Wind Energy Guidelines outlines the application requirements for a wind energy facility. Specifically, to following written reports are required to be submitted to address potential noise impacts:

- *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 New Zealand Standard NZS6808:2010, Acoustics – Wind Farm Noise*
  - *provides an assessment of whether the proposed wind energy facility will comply with the noise limit for that facility*
  - *where the proposed wind energy facility will be the subject of a wind turbine noise agreement under the Environment Protection Regulations 2021, specifies the premises of the relevant 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 the New Zealand Standard NZS6808:2010, Acoustics – Wind Farm Noise and includes an assessment of whether a high amenity noise limit is applicable under Section 5.3 of the standard.*
- *A report prepared by an environmental auditor appointed under Part 8.3 of the Environment Protection Act 2017 that verifies whether or not the pre-construction (predictive) noise assessment was conducted under New Zealand Standard NZS6808:2010, Acoustics – Wind Farm Noise*

Section 5 of the Victorian Wind Energy Guidelines outlines the key criteria for evaluating the planning merits of a wind energy facility. The following guidance is provided for the assessment of noise levels from proposed new wind farm developments:

> *A wind energy facility must comply with the noise limits in the New Zealand Standard NZS 6808:2010 Acoustics – Wind Farm Noise (the Standard).* […]
>
> *The Standard specifies a general 40 decibel limit (40 dB $L_{A90(10min)}$) for wind energy facility sound levels outdoors at noise sensitive locations, or that the sound level should not exceed the background sound level by more than five decibels (referred to as 'background sound level +5 dB'), whichever is the greater.* […]

Noise sensitive locations are defined in the Standard as, "The location of a noise sensitive activity, associated with a habitable space or education space in a building not on a wind farm site", and include:

- *any part of land zoned predominantly for residential use*
- *residential land uses included in the accommodation group at clause 73.03, Land use terms of the VPP and all planning schemes*
- *education and child care uses included in the child care centre group and education centre group at clause 73.03 of the of the VPP and all planning schemes.*

A 45-decibel limit is recommended for stakeholder dwellings. A stakeholder dwelling is a dwelling located on the same land as the wind energy facility, or one that has an agreement with the wind energy facility to exceed the noise limit. […]

Under Section 5.3 of the Standard, a 'high amenity noise limit' of 35 decibels may be justified in special circumstances. All wind energy facility applications must be assessed using Section 5.3 of the Standard to determine whether a high amenity noise limit is justified for specific locations, following procedures outlined in 5.3.1 of the Standard. Guidance can be found on this issue in the VCAT determination for the Cherry Tree Wind Farm[23].

Measurement and compliance assessment methods are set out in the Standard. The assessment must be made without relying on noise reduction operation modes to achieve compliance.

It is noted that although the Victorian Wind Energy Guidelines specifically refer to receivers within the Project boundary and/or with a noise agreement in place as 'stakeholder dwellings', they have been referred to as *involved receivers* within this report. This has been done at the request of the proponent to minimise the potential for misinterpretation of terminology by the reader. Similarly, receivers outside of the Project boundary and without a noise agreement have been referred to as *non-involved receivers.*

Clause 73.03 of the Victoria Planning Provisions (VPP) defines *Accommodation* as *land used to accommodate persons* and lists the following uses:

• *Camping and caravan park*	• *Host farm*
• *Corrective institution*	• *Residential aged care facility*
• *Dependent person's unit*	• *Residential building*
• *Dwelling*	• *Residential village*
• *Group accommodation*	• *Retirement village*

Consideration must also be given to whether a high amenity noise limit is warranted to reflect special circumstances at specific locations.

23 *Cherry Tree Wind Farm v Mitchell Shire Council* (2013)

C5 NZS 6808

NZS 6808 provides methods for the prediction, measurement, and assessment of sound from wind turbines. The following sections provide an overview of the objectives of NZS 6808 and the key elements of the standard's assessment procedures.

C5.1 Objectives

The foreword of NZS 6808 provides guidance about the objectives of the noise limits outlined within the standard:

> *Wind farm sound may be audible at times at noise sensitive locations, and this Standard does not set limits that provide absolute protection for residents from audible wind farm sound. Guidance is provided on noise limits that are considered reasonable for protecting sleep and amenity from wind farm sound received at noise sensitive locations.*

The *Outcome Statement* of NZS 6808 then goes on to provide information about the objective of the standard in a planning context:

> *This Standard provides suitable methods for the prediction, measurement, and assessment of sound from wind turbines. In the context of the* [New Zealand] *Resource Management Act, application of this Standard will provide reasonable protection of health and amenity at noise sensitive locations.*

Section C1.1 of the standard provides further information about the intent of the standard, which is:

> [...] *to avoid adverse noise effects on people caused by the operation of wind farms while enabling sustainable management of natural wind resources.*

Based on the objectives outlined above, NZS 6808 addresses health and amenity considerations at noise sensitive locations by specifying noise limits which are to be used to assess wind farm noise.

C5.2 Noise sensitive locations

The provisions of NZS 6808 are intended to protect noise sensitive locations (also generally referred to as *receivers* herein) that existed before the development of a wind farm. Noise sensitive locations are defined by the Standard as:

> *The location of a noise sensitive activity, associated with a habitable space or education space in a building not on the wind farm site. Noise sensitive locations include:*
>
> *(a) Any part of land zoned predominantly for residential use in a district plan;*
>
> *(b) Any point within the notional boundary of buildings containing spaces defined in (c) to (f);*
>
> *(c) Any habitable space in a residential building including rest homes or groups of buildings for the elderly or people with disabilities …*
>
> *(d) Teaching areas and sleeping rooms in educational institutions …*
>
> *(e) Teaching areas and sleeping rooms in buildings for licensed kindergartens, childcare, and day-care centres; and*
>
> *(f) Temporary accommodation including in hotels, motels, hostels, halls of residence, boarding houses, and guest houses.*
>
> *In some instances holiday cabins and camping grounds might be considered as noise sensitive locations. Matters to be considered include whether it is an established activity with existing rights.*

For the purposes of an assessment according to the Standard, the notional boundary is defined as:

> *A line 20 metres from any side of a dwelling or other building used for a noise sensitive activity or the legal boundary where this is closer to such a building.*

NZS 6808 was prepared to provide methods of assessment in the statutory context of New Zealand. Specifically, NZS 6808 notes that in the context of the New Zealand Resource Management Act, application of the Standard will provide reasonable protection of health and amenity at noise sensitive locations. This is an important point of context, as the New Zealand Resource Act states:

> *(3)(a)(ii): A consent authority must not, when considering an application, have regard to any effect on a person who has given written approval to the application.*

Based on the above definitions and statutory context, noise predictions are normally prepared for involved receivers irrespective of whether they are inside or outside of the Project boundary. However, the noise limits specified in the Standard are not applied to these locations on account of their participation with the Project.

C5.3 Noise limit

Section 5.2 *Noise limit* of NZS 6808 defines acceptable noise limits as follows:

> *As a guide to the limits of acceptability at a noise sensitive location, at any wind speed wind farm sound levels ($L_{A90(10\,min)}$) should not exceed the background sound level by more than 5 dB, or a level of 40 dB $L_{A90(10\,min)}$, whichever is the greater.*

This arrangement of limits requires the noise associated with a wind farm to be restricted to a permissible margin above background noise, except in instances when both the background and source noise levels are low. In this respect, the criteria indicate that it is not necessary to continue to adhere to a margin above background when the background noise levels are below the range of 30–35 dB.

The criteria specified in NZS 6808 apply to the combined noise level of all wind farms influencing the environment at a receiver. Specifically, section 5.6.1 states:

> *The noise limits … should apply to the cumulative sound level of all wind farms affecting any noise sensitive location.*

C5.4 High amenity

Section 5.3.1 of NZS 6808 states that the base noise limit of 40 dB L_{A90} is *appropriate for protection of sleep, health, and amenity of residents at most noise sensitive locations*. It goes on to note that the application of a high amenity noise limit may require additional consideration:

> […] *In special circumstances at some noise sensitive locations a more stringent noise limit may be justified to afford a greater degree of protection of amenity during evening and night-time. A high amenity noise limit should be considered where a plan promotes a higher degree of protection of amenity related to the sound environment of a particular area, for example where evening and night-time noise limits in the plan for general sound sources are more stringent than 40 dB $L_{Aeq(15\,min)}$ or 40 dBA L_{10}. A high amenity noise limit should not be applied in any location where background sound levels, assessed in accordance with section 7, are already affected by other specific sources, such as road traffic sound.*

The definition of the high amenity noise limit provided in NZS 6808 is specific to New Zealand planning legislation and guidelines. A degree of interpretation is therefore required when determining how to apply the concept of high amenity in Victoria, as informed by the Victorian Wind Energy Guidelines and EPA-DTP Publication 3011 *Wind Energy Facility Turbine Noise – Technical Guideline* dated 20 December 2024.

In accordance with Section 5.3 of NZS 6808, if a high amenity noise limit is justified, wind farm noise levels (L_{A90}) during evening and nigh-time periods should not exceed the background noise level (L_{A90}) by more than 5 dB or 35 dB L_{A90}, whichever is the greater. The standard recommends that this reduced noise limit would typically apply for wind speeds below 6 m/s at hub height. A high amenity noise limit is not applicable during the daytime period.

The method for assessing the applicability of the high amenity noise limit, detailed in NZS 6808, is a two-step approach as follows:

1. Determination of whether the planning guidance for the area warrants consideration of a high amenity noise limit

   First and foremost, for a high amenity noise limit to be considered, the land zoning of a receiver must promote a higher degree of acoustic amenity.

2. Evaluation of whether a high amenity noise limit is justified

   Following the guidance presented in C5.3.1, if the planning guidance for the area warrants consideration of a high amenity noise limit, and the receiver is located within the predicted 35 dB L_{A90} noise contour, then a calculation should be undertaken to determine whether background noise levels are sufficiently low.

C5.5 Special audible characteristics

Section 5.4.2 of NZS 6808 requires the following:

> *Wind turbine sound levels with special audible characteristics (such as tonality, impulsiveness and amplitude modulation) shall be adjusted by arithmetically adding up to +6dB to the measured level at the noise sensitive location.*

Notwithstanding this, the standard requires that wind farms be designed with no special audible characteristics at nearby residential properties while concurrently noting in Section 5.4.1 that:

> […] *as special audible characteristics cannot always be predicted, consideration shall be given to whether there are any special audible characteristics of the wind farm sound when comparing measured levels with noise limits.*

NZS 6808 emphasises assessment of special audible characteristics during the post-construction measurement phase of a project. An indication of the potential for tonality to be a characteristic of the noise emission from the assessed turbine model is sometimes available from tonality audibility assessments conducted as part of manufacturer turbine noise emission testing. However, this data is frequently not available at the planning stage of an assessment.

C6 EPA Publication 1826.5 (Noise Protocol)

EPA Publication 1826.5 *Noise limit and assessment protocol for the control of noise from commercial, industrial and trade premises and entertainment venues* (Noise Protocol) sets noise limits that apply to commercial, industrial and trade premises and entertainment venues in Victoria. Compliance with the noise limits is mandatory under the EP Act.

The proposed on-site substation and BESS are considered a *commercial, industrial and trade premises* under the EP Act.

The Noise Protocol prescribes noise limits that are used to assess whether a noise is prescribed to be unreasonable in accordance with the EP Regulations. The noise limits apply at a noise sensitive area, which is defined in Section 4 of the EP Regulations as being *within 10 metres of the outside of the external walls* of buildings including dwellings, hotels, schools. In rural areas only, noise sensitive areas also include land within the boundaries of tourist establishments, campgrounds, and caravan parks.

The procedures for setting noise limits are defined separately for urban and rural areas. However, in both cases, the noise limits are defined by considering the land zoning in the area and the noise environment of the receiver. The noise limits are defined separately for day, evening and night periods.

In contrast to NZS 6808 and Part 5.3 Division 5 of the EP Regulations, the Noise Protocol does not differentiate between involved and non-involved receivers.

The measurement and analysis procedures outlined in the Noise Protocol include adjustments which are to be applied to noise that is characterised by audible tones, impulses or intermittency.

APPENDIX D NOISE PREDICTION MODEL

D1 Key operational noise prediction elements

Key elements of the method used for predicting operational wind turbine noise from the Project are summarised in Table 19.

Table 19: Operational noise prediction elements

Detail	Description
Software	Proprietary noise modelling software SoundPLANnoise version 9.1
Method	ISO 9613-2: 1996 *Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation* (ISO 9613-2:1996) Specific to wind turbine noise predictions, adjustments to the ISO 9613-2:1996 method are applied on the basis of the guidance contained in the UK Institute of Acoustics publication *A good practice guide to the application of ETSU-R-97 for the assessment and rating of wind turbine noise* (UK Institute of Acoustics guidance). The adjustments are applied within the SoundPLANnoise modelling software and relate to the influence of terrain screening and ground effects on sound propagation. Specific details of adjustments are noted below and are discussed below.
Source characterisation	Each source of operational noise is modelled as a point source of sound. The total sound of the component of the wind farm being modelled (e.g. wind turbines, transformers) is then calculated on the basis of simultaneous operation of all elements (e.g. all wind turbines, all equipment associated with quarrying activities) and summing the contribution of each. To model the wind turbine noise, the following specific procedures are noted: • Calculations of wind turbine to receiver distances and average sound propagation heights are made on the basis of the point source being located at the position of the hub of the wind turbine. • Calculations of terrain related screening are made on the basis of the point source being located at the maximum tip height of each wind turbine. Further discussion of terrain screening effects is provided below.
Terrain data	10 m resolution within the site and surrounds, obtained from ELVIS - Elevation and Depth - Foundation Spatial Data.
Terrain effects (turbine-specific procedures)	Adjustments for the effects of terrain are determined and applied on the basis of the UK Institute of Acoustics guidance and research outlined below. • Valley effects: +3 dB is applied to the calculated noise level of a wind turbine when a significant valley exists between the wind turbine and calculation point. A significant valley is determined to exist when the actual mean sound propagation height between the turbine and calculation point is 50 % greater than would occur if the ground were flat. • Terrain screening effects: only calculated if the terrain blocks line of sight between the maximum tip height of the turbine and the calculation point. The value of the screening effect is limited to a maximum value of -2 dB. The Project is located in a relatively flat area characterised by little variations in ground elevation between the wind turbines and surrounding receivers. Based on comparison of predicted noise levels with and without terrain elevation data included, terrain effects ranging between -1.5 dB and +1.1 dB were calculated for receivers within 5 km of the proposed wind turbines. For reference purposes, the ground elevations at the turbines and receivers are tabled in Appendix B and Appendix F, respectively. The topography of the site is depicted in the elevation map provided in Appendix H.

Detail	Description
Ground conditions	Ground factor of G = 0.5 based on the UK Institute of Acoustics guidance and research outlined below. The ground around the site corresponds to acoustically soft conditions (G = 1) according to ISO 9613-2:1996. The adopted value of G = 0.5 assumes that 50% of the ground cover is acoustically hard (G = 0) to account for variations in ground porosity and provide a cautious representation of ground effects.
Atmospheric conditions	Temperature: 10°C, relative humidity 70%, and atmospheric pressure 101.325 kPa These represent conditions which result in relatively low levels of atmospheric sound absorption. The calculations are based on sound speed profiles which increase the propagation of sound from each turbine to each receiver, whether as a result of thermal inversions or wind directed toward each calculation point. [24]
Receiver heights	1.5 m above ground level Specific to wind turbine noise predictions, the UK Institute of Acoustics guidance refers to receiver heights of 4 m, and this guidance has subsequently been documented in international standards and, most recently, the EPA Publication 3011 *Wind Energy Facility Turbine Noise – Technical Guideline* dated 20 December 2024 (Technical Guideline). The UK Institute of Acoustics guidance was written as a complete approach to the prediction of wind turbine noise in the context of the regulatory requirements in the UK. Specifically, the method is for the prediction of the L_{A90} wind turbine noise levels for short-term downwind conditions. Conceptually, this is directly relevant to a planning stage assessment of a wind farm under NZS 6808:2010 *Acoustics – Wind farm noise* (NZS 6808), as the assessment is intended to represent typical worst case L_{A90} noise levels of a wind farm. However, an important technical detail is that application of the complete method is incompatible with NZS 6808. This is because the UK Institute of Acoustics guidance specifies that the calculation should include subtraction of 2 dB to account for the difference between the equivalent noise level that the sound power level of the turbines is determined from, and the L_{A90} noise measurement metric. However, NZS 6808 specifically states that predictions based on the sound power levels, without adjustment between L_{Aeq} and L_{A90} noise levels, shall be taken as representative of the L_{A90} noise levels. As a result, adoption of a 4 m receiver height in the context of an NZS 6808 assessment would result in a significantly more conservative assessment than an assessment based on the complete prediction method outlined in the UK Institute of Acoustics guidance. For this reason, noise predictions in Australia have generally been based on a lower prediction height of 1.5 m, but without any adjustment between L_{Aeq} and L_{A90} noise levels. The difference between predicted noise levels at 1.5 m and 4 m varies between sites but is generally comparable to the 2 dB value factored in the UK Institute of Acoustics guidance. As a result, the effect of a lower receiver height is balanced out by not applying an L_{Aeq} to L_{A90} correction, resulting in similar predicted noise levels.

[24] The sound speed profile defines the rate of change in the speed of sound with increasing height above ground

D2 Operational wind turbine noise prediction overview

In Australia, noise predictions are typically calculated using ISO 9613-2:1996 *Acoustics – Attenuation of sound during propagation outdoors - Part 2: General method of calculation* (ISO 9613-2:1996) with a set of conservative assumptions tailored to wind turbine noise assessment, as detailed in UK Institute of Acoustics publication *A good practice guide to the application of ETSU-R-97 for the assessment and rating of wind turbine noise* (UK Institute of Acoustics guidance).

A revised version of the standard, ISO 9613-2:2024, was published earlier in 2024 based on broadly equivalent procedures to ISO 9613-2:1996, subject to refinements, clarifications, and supplementary advice for different types of sources.[25] Notably, ISO 9613-2:2024 introduces an informative annex on wind turbine noise modelling to reflect the recommendations of the UK Institute of Acoustics guidance.

ISO 9613-2:1996 has been used for this assessment for consistency with previous iterations of the noise model for this project.

The use of this standard is supported by international research publications, measurement studies conducted by Marshall Day Acoustics and direct reference to the standard in NZS 6808, the South Australian EPA *Wind farms environmental noise guidelines* and the Queensland *Planning Guideline - State code 23: Wind farm development*.

The standard specifies an engineering method for calculating noise at a known distance from a variety of sources under meteorological conditions favourable to sound propagation. The standard defines favourable conditions as downwind propagation where the source blows from the source to the receiver within an angle of ±45 degrees from a line connecting the source to the receiver, at wind speeds between approximately 1 m/s and 5 m/s, measured at a height of 3 m to 11 m above the ground. Equivalently, the method accounts for average propagation under a well-developed moderate ground based thermal inversion. In this respect, it is noted that at the wind speeds relevant to noise emissions from wind turbines, atmospheric conditions do not favour the development of thermal inversions throughout the propagation path from the source to the receiver.

To calculate far-field noise levels according to the ISO 9613-2, the noise emissions of each wind turbine are firstly characterised in the form of octave band frequency levels. A series of octave band attenuation factors are then calculated for a range of effects including:

- geometric divergence
- air absorption
- reflecting obstacles
- screening
- vegetation
- ground reflections.

The octave band attenuation factors are then applied to the noise emission data to determine the corresponding octave band and total calculated noise level at receivers.

Calculating the attenuation factors for each effect requires a relevant description of the environment into which the sound propagation such as the physical dimensions of the environment, atmospheric conditions and the characteristics of the ground between the source and the receiver.

[25] ISO 9613-2:2024 *Acoustics — Attenuation of sound during propagation outdoors Part 2: Engineering method for the prediction of sound pressure levels outdoors*

Wind farm noise propagation has been the subject of considerable research in recent years. These studies have provided support for the reliability of engineering methods such as ISO 9613-2:1996 when a certain set of input parameters are chosen in combination. Specifically, the studies to date tend to support that the assignment of a ground absorption factor of G = 0.5 for the source, middle and receiver ground regions between a wind farm and a calculation point tends to provide a reliable representation of the upper noise levels expected in practice, when modelled in combination with other key assumptions; specifically all wind turbines operating at identical wind speeds, emitting sound levels equal to the test measured levels plus a margin for uncertainty (or guaranteed values), at a temperature of 10ºC and relative humidity of 70% to 80%, with specific adjustments for screening and ground effects as a result of the ground terrain profile.

In support of the use of ISO 9613-2:1996 and the choice of G = 0.5 as an appropriate ground characterisation, the following references are noted:

- A factor of G = 0.5 is frequently applied in Australia for general environmental noise modelling purposes as a way of accounting for the potential mix of ground porosity which may occur in regions of dry/compacted soils or in regions where persistent damp conditions may be relevant
- NZS 6808 refers to ISO 9613-2:1996 as an appropriate prediction method for wind farm noise, and notes that soft ground conditions should be characterised by a ground factor of G = 0.5
- In 1998, a comprehensive study (commonly cited as the Joule Report), part funded by the European Commission found that the ISO 9613-2:1996 model provided a robust representation of upper noise levels which may occur in practice and provided a closer agreement between predicted and measured noise levels than alternative methods such as CONCAWE and ENM. Specifically, the report indicated the ISO 9613-2:1996 method generally tends to marginally over predict noise levels expected in practice
- The UK Institute of Acoustics journal dated March/April 2009 published a joint agreement between practitioners in the field of wind farm noise assessment (UK IOA 2009 joint agreement), including consultants routinely employed on behalf of both developers and community opposition groups, and indicated the ISO 9613-2:1996 method as the appropriate standard and specifically designated G = 0.5 as the appropriate ground characterisation. This agreement was subsequently reflected in the recommendations detailed in the UK Institute of Acoustics guidance.

A range of measurement and prediction studies for wind farms in which Marshall Day Acoustics' staff have been involved in have provided further support for the use of ISO 9613-2:1996 and G = 0.5 as an appropriate representation of typical upper noise levels expected to occur in practice. [26, 27, 28]

The findings of these studies demonstrate the suitability of the ISO 9613-2:1996 method to predict the propagation of wind turbine noise for:

- the types of noise source heights associated with a modern wind farm, extending the scope of application of the method beyond the 30 m maximum source heights considered in ISO 9613-2:1996
- the types of environments in which wind farms are typically developed, and the range of atmospheric conditions and wind speeds typically observed around wind farm sites.

  Importantly, this supports the extended scope of application to wind speeds in excess of 5 m/s.

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[26] Bullmore, Adcock, Jiggins & Cand – *Wind Farm Noise Predictions: The Risks of Conservatism*; Presented at the Second International Meeting on Wind turbine Noise in Lyon, France September 2007.

[27] Bullmore, Adcock, Jiggins & Cand – *Wind Farm Noise Predictions and Comparisons with Measurements*; Presented at the Third International Meeting on Wind turbine Noise in Aalborg, Denmark June 2009.

[28] Delaire, Griffin, & Walsh – *Comparison of predicted wind farm noise emission and measured post-construction noise levels at the Portland Wind Energy Project in Victoria, Australia*; Presented at the Fourth International Meeting on Wind turbine Noise in Rome, April 2011.

In addition to the choice of ground factor referred to above, adjustments to ISO 9613-2:1996 for screening and valleys effects are applied based on recommendations of the Joule Report, UK IOA 2009 joint agreement and the UK Institute of Acoustics guidance. The following adjustments are applied to the calculations:

- screening effects as a result of terrain are limited to 2 dB
- screening effects are assessed based on each wind turbine being represented by a single noise source located at the maximum tip height of the wind turbine rotor
- an adjustment of 3 dB is added to the predicted noise contribution of a wind turbine if the terrain between the wind turbine and receiver in question is characterised by a significant valley.

  A significant valley is defined as a situation where the mean sound propagation height is at least 50 % greater than it would be otherwise over flat ground.

The adjustments detailed above are implemented in the wind turbine calculation procedure of the SoundPLANnoise 9.1 software used to conduct the noise modelling. The software uses these definitions in conjunction with the digital terrain model of the site to evaluate the path between each wind turbine and receiver pairing, and then subsequently applies the adjustments to each wind turbine's predicted noise contribution where appropriate.

D3 Operational wind turbine noise uncertainty

Guidance on uncertainty in wind farm noise assessment is provided in Appendix C of NZS 6808.

The guidance in Appendix C is designated as *informative*, meaning that the content is only for information and its provisions do not form part of the mandatory requirements of the standard. Notwithstanding this, Appendix C notes that it is good practice to state the uncertainty and confidence level for all sound levels.

Uncertainty in environmental noise modelling is typically addressed in one of two ways:

1. Mean predicted noise levels: selection of mean input values and modelling parameters to calculate a mean predicted noise level. The combined uncertainty relating to the inputs and prediction method is then assessed and used to consider how noise levels in practice could differ from the predicted noise levels.
2. Upper predicted noise levels: selection of conservative input values and modelling parameters to calculate the upper predicted noise levels, inherently accounting for uncertainty in the modelling. Noise levels in practice are then expected to be lower than predicted by the modelling.

NZS 6808 Appendix C notes that uncertainty should be determined in accordance with the procedures outlined in Craven and Kerry[29]. However, the procedures referenced in Craven and Kerry are primarily applicable to measurements rather than noise modelling. The procedures are also based on the calculation of uncertainty values which are more relevant when considering mean assessment values.

The approach to uncertainty adopted for this assessment is based on calculation of upper predicted noise levels. This approach is consistent with the UK Institute of Acoustics guidance on wind turbine noise modelling which addresses uncertainty by describing procedures for the calculation of upper predicted noise levels based on conservative input selections. With this approach, it is not necessary to apply uncertainty margins to the predicted noise levels. Noise levels associated with operation of the wind farm when measured and assessed in accordance with NZS 6808 are expected to be lower than the predictions. This finding is supported by extensive post-construction noise compliance monitoring undertaken at wind farm sites across Australia. Further, Appendix C notes that when comparing a sound level with an applicable noise limit, the sound level should be deemed to comply if it is equal to or less than the noise limit and does not specify the addition or subtraction of uncertainties.

Notwithstanding the above, the elements of the modelling which may give rise to uncertainty can be considered in the context of the framework outlined in Craven and Kerry. Specifically, the procedures in Craven and Kerry suggest considering uncertainty in sections related to source, transmission and receiver. The source and transmission considerations are directly relevant to noise modelling and are discussed further below. The section related to receiver uncertainty in Craven and Kerry is solely concerned with measurement related uncertainties (e.g. instrumentation uncertainty and background noise influences) and is therefore not relevant to the noise modelling.

[29] Craven, N J, and Kerry, G. *A good practice guide on the sources and magnitude of uncertainty arising in the practical measurement of environmental noise*. University of Salford. 2001

Source uncertainties (sound power levels)

The source levels of each wind turbine are characterised in terms of the sound power levels determined in accordance with IEC 61400-11. The results of sound power testing in accordance with this standard are typically characterised by an uncertainty margin of approximately ±1 dB. To reflect this, the sound power data sourced from the manufacturer's documentation has been factored in the noise modelling as follows:

- The manufacturer data has been adjusted by the addition of +1 dB at all wind speeds.
- All turbines are assumed to simultaneously emit sound power levels at the uncertainty adjusted values.

Uncertainty relating to the frequency characteristics of the wind turbine's noise emissions was also addressed by identifying the wind speed with the most unfavourable spectrum profile (i.e. the spectrum profile which would result in the highest predicted noise levels) and then applying the same profile to every wind speed.

Transmission uncertainties (prediction method)

The ISO 9613-2:1996 prediction method indicates an uncertainty margin of the order of ±3 dB in relation to calculated noise levels at distances between 100 m and 1,000 m for situations with an average propagation height between 5 m and 30 m (noting the information provided earlier in this appendix regarding the validation work undertaken to support the application of ISO 9613-2:1996 to greater propagation heights). However, the uncertainty margins are noted for a prediction in accordance with the inputs described in ISO 9613-2:1996. A strict application of ISO 9613-2:1996 would involve designating a ground factor of G = 1 (instead of the more conservative G = 0.5 ground factor used in the calculations) to represent the porous ground conditions around the site which ISO 9613-2:1996 defines as follows:

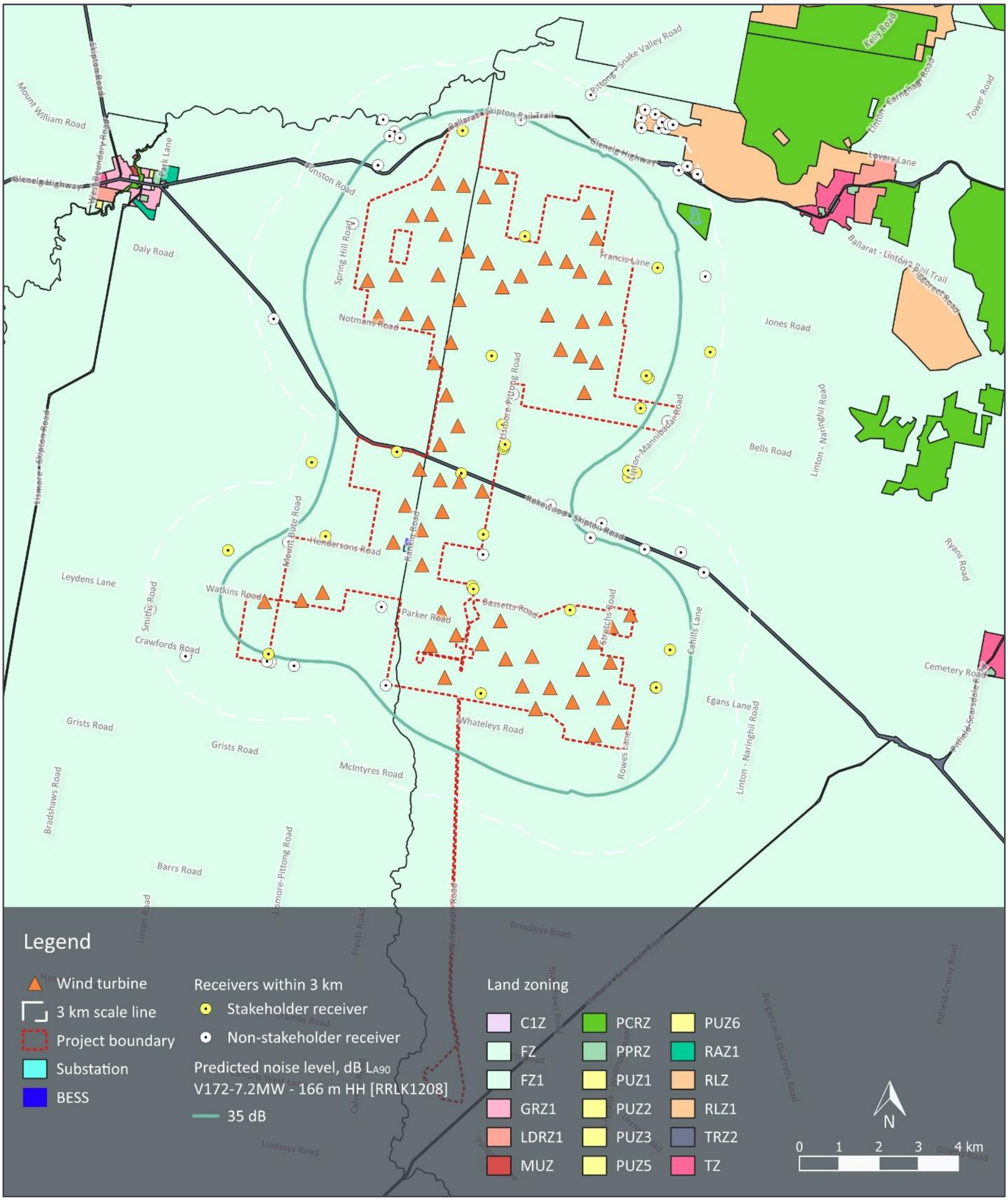
> ***Porous ground****, which includes ground covered by grass, trees or other vegetation, and all other ground surfaces suitable for the growth of vegetation, such as farming land. For porous ground G = 1.*

A prediction based on a ground factor of G = 1, instead of G = 0.5 used in the modelling, would typically result in predicted noise levels approximately 3 dB lower, thus effectively offsetting the quoted uncertainty margin. This also does not account for the other conservative aspects of the model, such as the assumption that each receiver is simultaneously downwind of every wind turbine at all times and consistent atmospheric conditions which result in minimal atmospheric absorption.

It is not possible to specify exact uncertainty margins for the conservative prediction approach adopted for the assessment. However, based on experience and the published studies referenced earlier in this appendix, the uncertainty in short term measured noise levels under downwind conditions is typically of the order of ±2 dB. This reduces to reduces to ±1 dB or less when comparing predictions with measured noise levels determined in accordance with NZS 6808 which are based on the analysis of aggregated data for a range of atmospheric conditions.

APPENDIX E ZONING MAP

Figure 9: Zoning map for the Project and surrounding area



APPENDIX F RECEIVER COORDINATES

The following table sets out the assessed receivers considered in the environmental noise assessment. (Reference *20250331*, supplied by the proponent on 3 April 2025).

Table 20: Receivers within 3 km of the proposed wind turbines – MGA94 Zone 54

Receiver	Easting, m	Northing, m	Terrain elevation, m	Distance to the nearest wind turbine, m	Nearest wind turbine	Land zoning
Non-stakeholder receiver						
17	719,844	5,828,616	365	2,960	T5	FZ
21	721,206	5,828,238	400	2,949	T5	RLZ1
23	721,465	5,828,124	392	2,988	T5	RLZ1
26	721,111	5,828,039	368	2,729	T5	RLZ1
27	714,610	5,827,991	310	2,125	T2	FZ
28	718,076	5,827,983	350	1,521	T1	FZ
31	721,637	5,827,925	402	2,932	T5	RLZ1
35	721,114	5,827,783	360	2,511	T5	RLZ1
36	721,549	5,827,775	400	2,760	T5	RLZ1
37	721,728	5,827,767	413	2,872	T5	RLZ1
40	714,900	5,827,690	321	1,709	T2	FZ1
43	714,773	5,827,576	320	1,712	T2	FZ1
45	715,032	5,827,527	326	1,500	T2	FZ1
59	714,478	5,826,842	330	1,543	T7	FZ1
60	722,274	5,826,816	408	2,752	T5	FZ
63	722,057	5,826,715	384	2,513	T5	FZ
64	722,530	5,826,618	435	2,915	T5	RLZ1
82	713,854	5,825,375	368	1,486	T19	FZ1
95	711,851	5,822,972	314	2,563	T19	FZ1
99	717,891	5,821,072	276	1,618	T35	FZ
101	721,769	5,820,394	276	2,221	T33	FZ
113	718,827	5,818,286	265	1,768	T40	FZ
114	720,111	5,817,823	271	2,424	T50	FZ
119	719,831	5,817,458	270	2,195	T50	FZ
120	712,214	5,817,344	295	1,508	T47	FZ1
121	721,196	5,817,167	279	1,693	T50	FZ
123	722,110	5,817,090	291	2,024	T50	FZ
124	717,124	5,817,035	280	1,509	T42	FZ

Receiver	Easting, m	Northing, m	Terrain elevation, m	Distance to the nearest wind turbine, m	Nearest wind turbine	Land zoning
125	722,687	5,816,586	292	2,135	T50	FZ
130	708,745	5,815,662	289	2,887	T48	FZ1
131	714,565	5,815,715	280	1,481	T45	FZ1
136	709,668	5,814,572	267	2,343	T48	FZ1
138	711,683	5,814,345	260	1,521	T48	FZ1
139	711,778	5,814,327	260	1,546	T48	FZ1
140	712,363	5,814,232	261	1,669	T47	FZ1
141	714,676	5,813,739	263	1,507	T62	FZ1
171	722,725	5,824,039	368	2,536	T17	FZ
175	709,631	5,814,475	266	2,428	T48	FZ1
Stakeholder receiver outside the Project boundary						
84 (S)	718,182	5,825,051	303	768	T11	FZ
88 (S)	721,525	5,824,258	303	1,362	T17	FZ
96 (S)	722,848	5,822,136	310	2,774	T25	FZ
98 (S)	721,296	5,821,482	284	1,382	T32	FZ
104 (S)	717,682	5,819,809	276	1,290	T35	FZ
105 (S)	717,665	5,819,766	277	1,272	T40	FZ
106 (S)	717,643	5,819,703	279	1,206	T40	FZ
108 (S)	712,809	5,819,357	306	2,600	T41	FZ1
109 (S)	720,785	5,819,149	271	2,268	T33	FZ
110 (S)	720,983	5,819,096	273	2,414	T33	FZ
112 (S)	720,780	5,818,984	272	2,409	T33	FZ
118 (S)	713,158	5,817,494	303	1,421	T46	FZ1
122 (S)	710,701	5,817,142	276	1,589	T48	FZ1
135 (S)	721,836	5,814,636	267	1,338	T50	FZ
142 (S)	721,466	5,813,689	262	1,280	T67	FZ
281 (S)	721,489	5,813,684	261	1,293	T67	FZ
1148 (S)	721,239	5,821,540	290	1,313	T32	FZ

Receiver	Easting, m	Northing, m	Terrain elevation, m	Distance to the nearest wind turbine, m	Nearest wind turbine	Land zoning
Stakeholder receiver within the Project boundary						
39 (S)	716,611	5,827,715	345	1,387	T3	FZ1
97 (S)	717,343	5,822,040	285	1,097	T28	FZ
100 (S)	721,095	5,820,721	273	1,483	T33	FZ
102 (S)	717,608	5,820,305	274	1,129	T35	FZ
107 (S)	714,955	5,819,624	326	738	T37	FZ1
111 (S)	716,578	5,819,082	292	269	T39	FZ
117 (S)	717,133	5,817,543	282	1,108	T40	FZ
128 (S)	716,848	5,816,242	276	1,035	T49	FZ
129 (S)	716,882	5,816,167	274	1,015	T49	FZ
132 (S)	719,318	5,815,638	263	1,023	T52	FZ
137 (S)	711,720	5,814,529	261	1,340	T48	FZ1
143 (S)	717,070	5,813,538	270	1,009	T62	FZ

(S) Stakeholder

APPENDIX G TABULATED PREDICTED NOISE LEVEL DATA

Table 21: Predicted noise levels, dB L_{A90} – V162-6.8MW

Receiver	Hub-height wind speed, m/s											
	4	5	6	7	8	9	10	11	12	13	14	15
Non-stakeholder receivers												
17	18.0	18.0	19.0	22.3	25.5	27.3	27.3	27.4	27.8	28.1	28.3	28.5
21	18.2	18.2	19.2	22.5	25.7	27.5	27.5	27.6	28.0	28.3	28.5	28.7
23	17.9	17.9	18.9	22.2	25.4	27.2	27.2	27.3	27.7	28.0	28.2	28.4
26	18.3	18.3	19.3	22.6	25.8	27.6	27.6	27.7	28.1	28.4	28.6	28.8
27	20.6	20.6	21.6	24.9	28.1	29.9	29.9	30.0	30.4	30.7	30.9	31.1
28	22.6	22.6	23.6	26.9	30.1	31.9	31.9	32.0	32.4	32.7	32.9	33.1
31	18.2	18.2	19.2	22.5	25.7	27.5	27.5	27.6	28.0	28.3	28.5	28.7
35	18.8	18.8	19.8	23.1	26.3	28.1	28.1	28.2	28.6	28.9	29.1	29.3
36	18.6	18.6	19.6	22.9	26.1	27.9	27.9	28.0	28.4	28.7	28.9	29.1
37	18.5	18.5	19.5	22.8	26.0	27.8	27.8	27.9	28.3	28.6	28.8	29.0
40	22.2	22.2	23.2	26.5	29.7	31.5	31.5	31.6	32.0	32.3	32.5	32.7
43	22.3	22.3	23.3	26.6	29.8	31.6	31.6	31.7	32.1	32.4	32.6	32.8
45	23.2	23.2	24.2	27.5	30.7	32.5	32.5	32.6	33.0	33.3	33.5	33.7
59	23.8	23.8	24.8	28.1	31.3	33.1	33.1	33.2	33.6	33.9	34.1	34.3
60	19.0	19.0	20.0	23.3	26.5	28.3	28.3	28.4	28.8	29.1	29.3	29.5
63	19.0	19.0	20.0	23.3	26.5	28.3	28.3	28.4	28.8	29.1	29.3	29.5
64	19.3	19.3	20.3	23.6	26.8	28.6	28.6	28.7	29.1	29.4	29.6	29.8
82	24.9	24.9	25.9	29.2	32.4	34.2	34.2	34.3	34.7	35.0	35.2	35.4
95	19.6	19.6	20.6	23.9	27.1	28.9	28.9	29.0	29.4	29.7	29.9	30.1
99	26.6	26.6	27.6	30.9	34.1	35.9	35.9	36.0	36.4	36.7	36.9	37.1
101	20.9	20.9	21.9	25.2	28.4	30.2	30.2	30.3	30.7	31.0	31.2	31.4
113	23.4	23.4	24.4	27.7	30.9	32.7	32.7	32.8	33.2	33.5	33.7	33.9
114	21.7	21.7	22.7	26.0	29.2	31.0	31.0	31.1	31.5	31.8	32.0	32.2
119	22.5	22.5	23.5	26.8	30.0	31.8	31.8	31.9	32.3	32.6	32.8	33.0
120	23.4	23.4	24.4	27.7	30.9	32.7	32.7	32.8	33.2	33.5	33.7	33.9
121	21.9	21.9	22.9	26.2	29.4	31.2	31.2	31.3	31.7	32.0	32.2	32.4
123	20.3	20.3	21.3	24.6	27.8	29.6	29.6	29.7	30.1	30.4	30.6	30.8
124	26.8	26.8	27.8	31.1	34.3	36.1	36.1	36.2	36.6	36.9	37.1	37.3
125	19.7	19.7	20.7	24.0	27.2	29.0	29.0	29.1	29.5	29.8	30.0	30.2

Receiver	Hub-height wind speed, m/s											
	4	5	6	7	8	9	10	11	12	13	14	15
130	15.3	15.3	16.3	19.6	22.8	24.6	24.6	24.7	25.1	25.4	25.6	25.8
131	26.1	26.1	27.1	30.4	33.6	35.4	35.4	35.5	35.9	36.2	36.4	36.6
136	16.8	16.8	17.8	21.1	24.3	26.1	26.1	26.2	26.6	26.9	27.1	27.3
138	21.4	21.4	22.4	25.7	28.9	30.7	30.7	30.8	31.2	31.5	31.7	31.9
139	21.5	21.5	22.5	25.8	29.0	30.8	30.8	30.9	31.3	31.6	31.8	32.0
140	21.7	21.7	22.7	26.0	29.2	31.0	31.0	31.1	31.5	31.8	32.0	32.2
141	23.8	23.8	24.8	28.1	31.3	33.1	33.1	33.2	33.6	33.9	34.1	34.3
171	20.7	20.7	21.7	25.0	28.2	30.0	30.0	30.1	30.5	30.8	31.0	31.2
175	16.6	16.6	17.6	20.9	24.1	25.9	25.9	26.0	26.4	26.7	26.9	27.1
Stakeholder receivers outside the Project boundary												
84 (S)	30.4	30.4	31.4	34.7	37.9	39.7	39.7	39.8	40.2	40.5	40.7	40.9
88 (S)	24.6	24.6	25.6	28.9	32.1	33.9	33.9	34.0	34.4	34.7	34.9	35.1
96 (S)	19.7	19.7	20.7	24.0	27.2	29.0	29.0	29.1	29.5	29.8	30.0	30.2
98 (S)	24.1	24.1	25.1	28.4	31.6	33.4	33.4	33.5	33.9	34.2	34.4	34.6
104 (S)	26.8	26.8	27.8	31.1	34.3	36.1	36.1	36.2	36.6	36.9	37.1	37.3
105 (S)	26.9	26.9	27.9	31.2	34.4	36.2	36.2	36.3	36.7	37.0	37.2	37.4
106 (S)	27.1	27.1	28.1	31.4	34.6	36.4	36.4	36.5	36.9	37.2	37.4	37.6
108 (S)	21.3	21.3	22.3	25.6	28.8	30.6	30.6	30.7	31.1	31.4	31.6	31.8
109 (S)	21.0	21.0	22.0	25.3	28.5	30.3	30.3	30.4	30.8	31.1	31.3	31.5
110 (S)	20.7	20.7	21.7	25.0	28.2	30.0	30.0	30.1	30.5	30.8	31.0	31.2
112 (S)	20.9	20.9	21.9	25.2	28.4	30.2	30.2	30.3	30.7	31.0	31.2	31.4
118 (S)	24.4	24.4	25.4	28.7	31.9	33.7	33.7	33.8	34.2	34.5	34.7	34.9
122 (S)	20.4	20.4	21.4	24.7	27.9	29.7	29.7	29.8	30.2	30.5	30.7	30.9
135 (S)	24.8	24.8	25.8	29.1	32.3	34.1	34.1	34.2	34.6	34.9	35.1	35.3
142 (S)	26.2	26.2	27.2	30.5	33.7	35.5	35.5	35.6	36.0	36.3	36.5	36.7
281 (S)	26.1	26.1	27.1	30.4	33.6	35.4	35.4	35.5	35.9	36.2	36.4	36.6
1148 (S)	24.4	24.4	25.4	28.7	31.9	33.7	33.7	33.8	34.2	34.5	34.7	34.9

Receiver	Hub-height wind speed, m/s											
	4	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
Stakeholder receivers within the Project boundary												
39 (S)	24.7	24.7	25.7	29.0	32.2	34.0	34.0	34.1	34.5	34.8	35.0	35.2
97 (S)	28.2	28.2	29.2	32.5	35.7	37.5	37.5	37.6	38.0	38.3	38.5	38.7
100 (S)	23.5	23.5	24.5	27.8	31.0	32.8	32.8	32.9	33.3	33.6	33.8	34.0
102 (S)	26.9	26.9	27.9	31.2	34.4	36.2	36.2	36.3	36.7	37.0	37.2	37.4
107 (S)	29.1	29.1	30.1	33.4	36.6	38.4	38.4	38.5	38.9	39.2	39.4	39.6
111 (S)	36.5	36.5	37.5	40.8	44.0	45.8	45.8	45.9	46.3	46.6	46.8	47.0
117 (S)	27.6	27.6	28.6	31.9	35.1	36.9	36.9	37.0	37.4	37.7	37.9	38.1
128 (S)	28.4	28.4	29.4	32.7	35.9	37.7	37.7	37.8	38.2	38.5	38.7	38.9
129 (S)	28.6	28.6	29.6	32.9	36.1	37.9	37.9	38.0	38.4	38.7	38.9	39.1
132 (S)	28.0	28.0	29.0	32.3	35.5	37.3	37.3	37.4	37.8	38.1	38.3	38.5
137 (S)	22.4	22.4	23.4	26.7	29.9	31.7	31.7	31.8	32.2	32.5	32.7	32.9
143 (S)	28.9	28.9	29.9	33.2	36.4	38.2	38.2	38.3	38.7	39.0	39.2	39.4

(S) Stakeholder

Table 22: Predicted noise levels, dB L_{A90} – V172-7.2MW

Receiver	Hub-height wind speed, m/s											
	4	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
Non-stakeholder receivers												
17	20.3	20.4	22.2	24.9	27.7	29.8	30.5	30.5	30.5	30.5	30.5	30.5
21	20.6	20.7	22.5	25.2	28.0	30.1	30.8	30.8	30.8	30.8	30.8	30.8
23	20.2	20.3	22.1	24.8	27.6	29.7	30.4	30.4	30.4	30.4	30.4	30.4
26	20.6	20.7	22.5	25.2	28.0	30.1	30.8	30.8	30.8	30.8	30.8	30.8
27	23.0	23.1	24.9	27.6	30.4	32.5	33.2	33.2	33.2	33.2	33.2	33.2
28	25.1	25.2	27.0	29.7	32.5	34.6	35.3	35.3	35.3	35.3	35.3	35.3
31	20.5	20.6	22.4	25.1	27.9	30.0	30.7	30.7	30.7	30.7	30.7	30.7
35	21.2	21.3	23.1	25.8	28.6	30.7	31.4	31.4	31.4	31.4	31.4	31.4
36	21.0	21.1	22.9	25.6	28.4	30.5	31.2	31.2	31.2	31.2	31.2	31.2
37	20.9	21.0	22.8	25.5	28.3	30.4	31.1	31.1	31.1	31.1	31.1	31.1
40	24.6	24.7	26.5	29.2	32.0	34.1	34.8	34.8	34.8	34.8	34.8	34.8
43	24.7	24.8	26.6	29.3	32.1	34.2	34.9	34.9	34.9	34.9	34.9	34.9
45	25.6	25.7	27.5	30.2	33.0	35.1	35.8	35.8	35.8	35.8	35.8	35.8
59	26.3	26.4	28.2	30.9	33.7	35.8	36.5	36.5	36.5	36.5	36.5	36.5

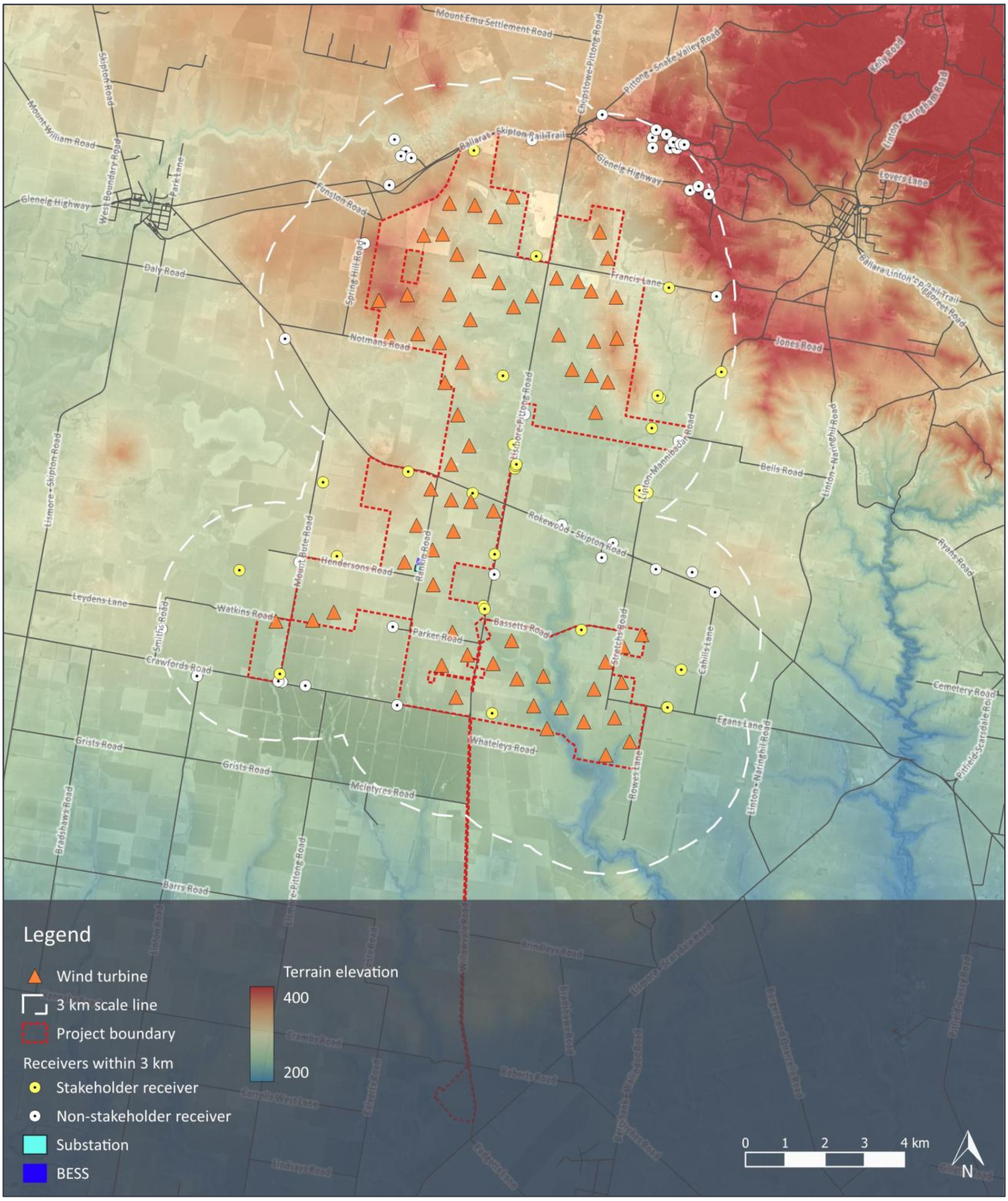
Receiver	Hub-height wind speed, m/s											
	4	5	6	7	8	9	10	11	12	13	14	15
60	21.4	21.5	23.3	26.0	28.8	30.9	31.6	31.6	31.6	31.6	31.6	31.6
63	21.3	21.4	23.2	25.9	28.7	30.8	31.5	31.5	31.5	31.5	31.5	31.5
64	21.6	21.7	23.5	26.2	29.0	31.1	31.8	31.8	31.8	31.8	31.8	31.8
82	27.3	27.4	29.2	31.9	34.7	36.8	37.5	37.5	37.5	37.5	37.5	37.5
95	22.0	22.1	23.9	26.6	29.4	31.5	32.2	32.2	32.2	32.2	32.2	32.2
99	29.0	29.1	30.9	33.6	36.4	38.5	39.2	39.2	39.2	39.2	39.2	39.2
101	23.3	23.4	25.2	27.9	30.7	32.8	33.5	33.5	33.5	33.5	33.5	33.5
113	25.8	25.9	27.7	30.4	33.2	35.3	36.0	36.0	36.0	36.0	36.0	36.0
114	24.1	24.2	26.0	28.7	31.5	33.6	34.3	34.3	34.3	34.3	34.3	34.3
119	24.9	25.0	26.8	29.5	32.3	34.4	35.1	35.1	35.1	35.1	35.1	35.1
120	25.9	26.0	27.8	30.5	33.3	35.4	36.1	36.1	36.1	36.1	36.1	36.1
121	24.3	24.4	26.2	28.9	31.7	33.8	34.5	34.5	34.5	34.5	34.5	34.5
123	22.7	22.8	24.6	27.3	30.1	32.2	32.9	32.9	32.9	32.9	32.9	32.9
124	29.3	29.4	31.2	33.9	36.7	38.8	39.5	39.5	39.5	39.5	39.5	39.5
125	22.1	22.2	24.0	26.7	29.5	31.6	32.3	32.3	32.3	32.3	32.3	32.3
130	17.7	17.8	19.6	22.3	25.1	27.2	27.9	27.9	27.9	27.9	27.9	27.9
131	28.6	28.7	30.5	33.2	36.0	38.1	38.8	38.8	38.8	38.8	38.8	38.8
136	19.2	19.3	21.1	23.8	26.6	28.7	29.4	29.4	29.4	29.4	29.4	29.4
138	23.9	24.0	25.8	28.5	31.3	33.4	34.1	34.1	34.1	34.1	34.1	34.1
139	23.9	24.0	25.8	28.5	31.3	33.4	34.1	34.1	34.1	34.1	34.1	34.1
140	24.1	24.2	26.0	28.7	31.5	33.6	34.3	34.3	34.3	34.3	34.3	34.3
141	26.2	26.3	28.1	30.8	33.6	35.7	36.4	36.4	36.4	36.4	36.4	36.4
171	23.1	23.2	25.0	27.7	30.5	32.6	33.3	33.3	33.3	33.3	33.3	33.3
175	18.9	19.0	20.8	23.5	26.3	28.4	29.1	29.1	29.1	29.1	29.1	29.1
Stakeholder receivers outside the Project boundary												
84 (S)	33.1	33.2	35.0	37.7	40.5	42.6	43.3	43.3	43.3	43.3	43.3	43.3
88 (S)	27.1	27.2	29.0	31.7	34.5	36.6	37.3	37.3	37.3	37.3	37.3	37.3
96 (S)	22.0	22.1	23.9	26.6	29.4	31.5	32.2	32.2	32.2	32.2	32.2	32.2
98 (S)	26.5	26.6	28.4	31.1	33.9	36.0	36.7	36.7	36.7	36.7	36.7	36.7
104 (S)	29.3	29.4	31.2	33.9	36.7	38.8	39.5	39.5	39.5	39.5	39.5	39.5
105 (S)	29.4	29.5	31.3	34.0	36.8	38.9	39.6	39.6	39.6	39.6	39.6	39.6
106 (S)	29.6	29.7	31.5	34.2	37.0	39.1	39.8	39.8	39.8	39.8	39.8	39.8

Receiver	Hub-height wind speed, m/s											
	4	5	6	7	8	9	10	11	12	13	14	15
108 (S)	23.7	23.8	25.6	28.3	31.1	33.2	33.9	33.9	33.9	33.9	33.9	33.9
109 (S)	23.4	23.5	25.3	28.0	30.8	32.9	33.6	33.6	33.6	33.6	33.6	33.6
110 (S)	23.0	23.1	24.9	27.6	30.4	32.5	33.2	33.2	33.2	33.2	33.2	33.2
112 (S)	23.2	23.3	25.1	27.8	30.6	32.7	33.4	33.4	33.4	33.4	33.4	33.4
118 (S)	26.8	26.9	28.7	31.4	34.2	36.3	37.0	37.0	37.0	37.0	37.0	37.0
122 (S)	22.9	23.0	24.8	27.5	30.3	32.4	33.1	33.1	33.1	33.1	33.1	33.1
135 (S)	27.3	27.4	29.2	31.9	34.7	36.8	37.5	37.5	37.5	37.5	37.5	37.5
142 (S)	28.7	28.8	30.6	33.3	36.1	38.2	38.9	38.9	38.9	38.9	38.9	38.9
281 (S)	28.6	28.7	30.5	33.2	36.0	38.1	38.8	38.8	38.8	38.8	38.8	38.8
1148 (S)	26.9	27.0	28.8	31.5	34.3	36.4	37.1	37.1	37.1	37.1	37.1	37.1
Stakeholder receivers within the Project boundary												
39 (S)	27.2	27.3	29.1	31.8	34.6	36.7	37.4	37.4	37.4	37.4	37.4	37.4
97 (S)	30.7	30.8	32.6	35.3	38.1	40.2	40.9	40.9	40.9	40.9	40.9	40.9
100 (S)	25.9	26.0	27.8	30.5	33.3	35.4	36.1	36.1	36.1	36.1	36.1	36.1
102 (S)	29.4	29.5	31.3	34.0	36.8	38.9	39.6	39.6	39.6	39.6	39.6	39.6
107 (S)	31.7	31.8	33.6	36.3	39.1	41.2	41.9	41.9	41.9	41.9	41.9	41.9
111 (S)	39.5	39.6	41.4	44.1	46.9	49.0	49.7	49.7	49.7	49.7	49.7	49.7
117 (S)	30.1	30.2	32.0	34.7	37.5	39.6	40.3	40.3	40.3	40.3	40.3	40.3
128 (S)	30.9	31.0	32.8	35.5	38.3	40.4	41.1	41.1	41.1	41.1	41.1	41.1
129 (S)	31.2	31.3	33.1	35.8	38.6	40.7	41.4	41.4	41.4	41.4	41.4	41.4
132 (S)	30.6	30.7	32.5	35.2	38.0	40.1	40.8	40.8	40.8	40.8	40.8	40.8
137 (S)	24.9	25.0	26.8	29.5	32.3	34.4	35.1	35.1	35.1	35.1	35.1	35.1
143 (S)	31.5	31.6	33.4	36.1	38.9	41.0	41.7	41.7	41.7	41.7	41.7	41.7

(S) Stakeholder

APPENDIX H SITE TOPOGRAPHY

Figure 10: Terrain elevation map for the Project and surrounding area



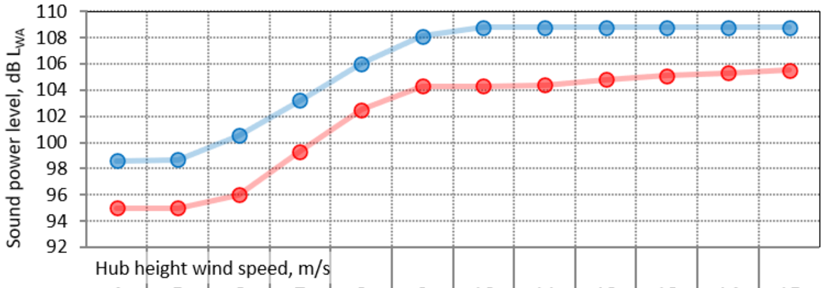
APPENDIX I NZS 6808 DOCUMENTATION

(a) Map of the site showing topography, turbines and residential properties: See Appendix H

(b) Noise sensitive locations: See Section 5.1 and Appendix F

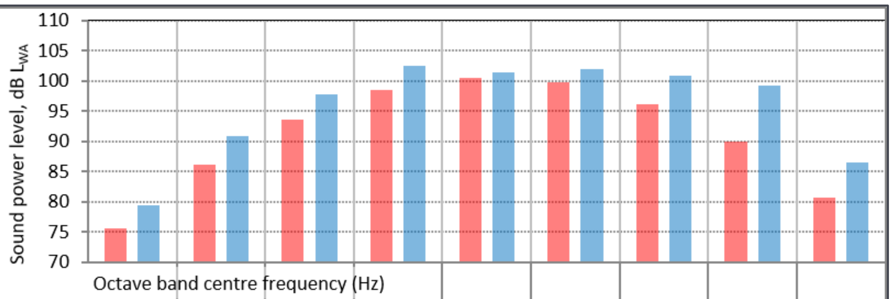
(c) Wind turbine sound power levels, dB L_{WA} (refer to Section 7.3.1)

Sound power levels (manufacturer specification +1 dB margin for uncertainty), dB L_{WA}



Hub height wind speed, m/s	4	5	6	7	8	9	10	11	12	13	14	15
V162-6.8MW	95.0	95.0	96.0	99.3	102.5	104.3	104.3	104.4	104.8	105.1	105.3	105.5
V172-7.2MW	98.6	98.7	100.5	103.2	106.0	108.1	108.8	108.8	108.8	108.8	108.8	108.8

Reference octave band spectra adjusted to the highest sound power level detailed above, dB L_{WA}



Octave band centre frequency (Hz)	31.5	63	125	250	500	1000	2000	4000	8000
V162-6.8MW	75.6	86.0	93.6	98.4	100.5	99.7	96.2	89.8	80.7
V172-7.2MW	79.3	90.8	97.8	102.4	101.4	102.0	100.9	99.3	86.5

(d) Wind turbine model: See Table 4 of Section 7.3

(e) Turbine hub height: See Table 4 of Section 7.3

(f) Distance of noise sensitive locations from the wind turbines: See Appendix F

(g) Calculation procedure used: ISO 9613-2 prediction algorithm as implemented in SoundPLANnoise v9.1 (See Section 4.3 and Appendix D)

(h) Meteorological conditions assumed: See Appendix D

(i) Air absorption parameters:

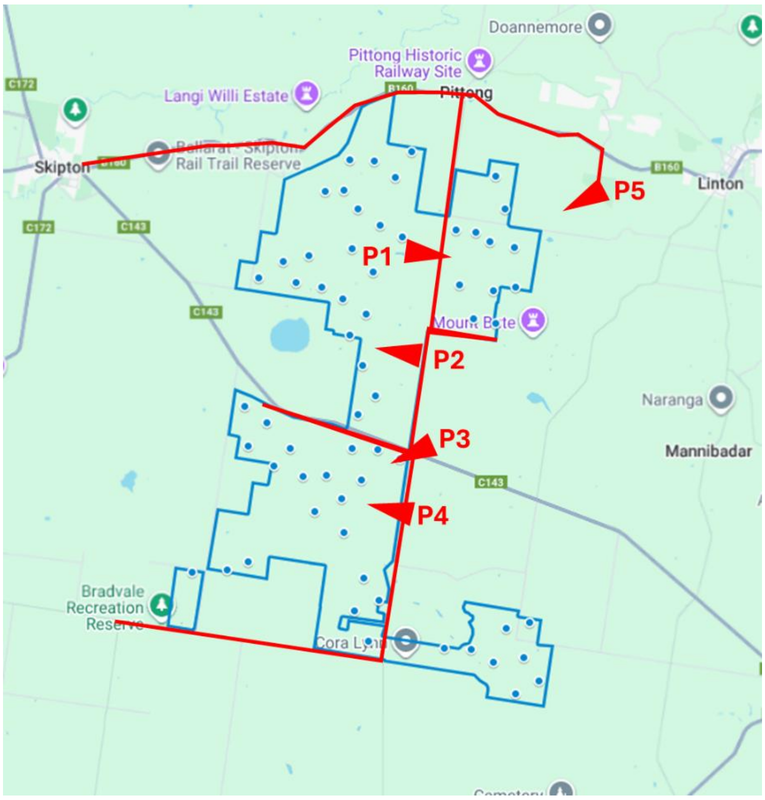
	Octave band mid frequency, Hz							
Description	**63**	**125**	**250**	**500**	**1,000**	**2,000**	**4,000**	**8,000**
Atmospheric attenuation, dB/km	0.12	0.41	1.04	1.93	3.66	9.66	32.8	116.9

(j) Topography/screening: 10 m resolution elevation contours – See Appendix H

(k) Predicted far-field wind farm sound levels: See Section 7.4 and Appendix G.

Appendix C Site visit photos

Route driven



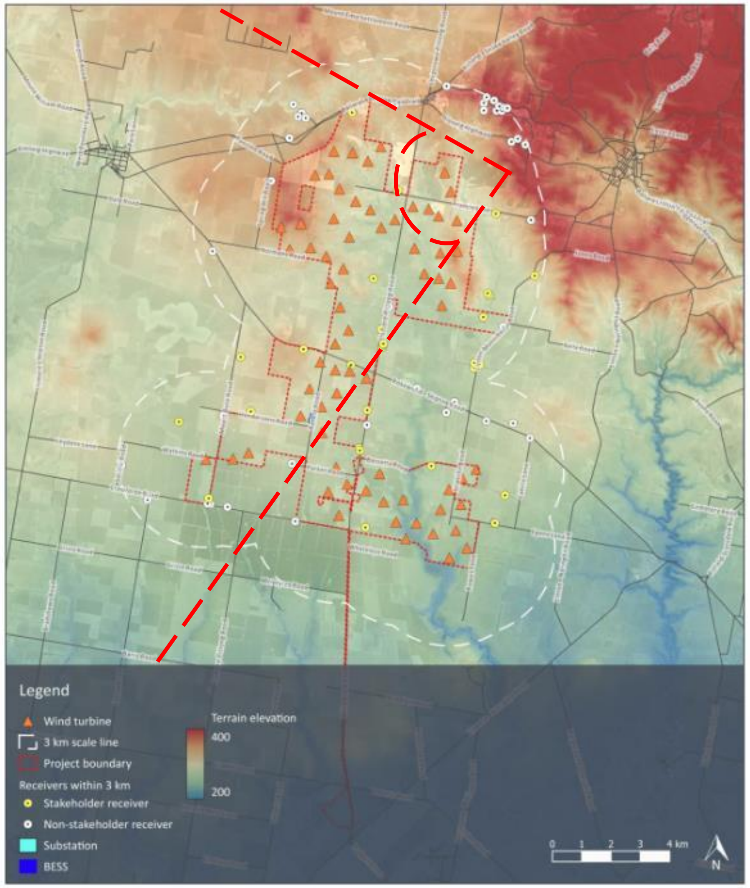
Photograph Appendix C.1: View to east from the Pittong-Lismore Rd in northeastern project area showing open farmland project area and plantation forestry.

Photograph Appendix C.2: View to west from the Pittong-Lismore Rd in northwestern project area showing open farmland, homestead and project area beyond.

Photograph Appendix C.3: View to southwest from near the Pittong-Lismore Rd/C143 intersection showing project area.

Photograph Appendix C.4: View to west from near the Pittong-Lismore Rd/C143 intersection showing project area.

Photograph Appendix C.5: ***Panoramic view from Flagstaff Hill Lookout.***



umwelt