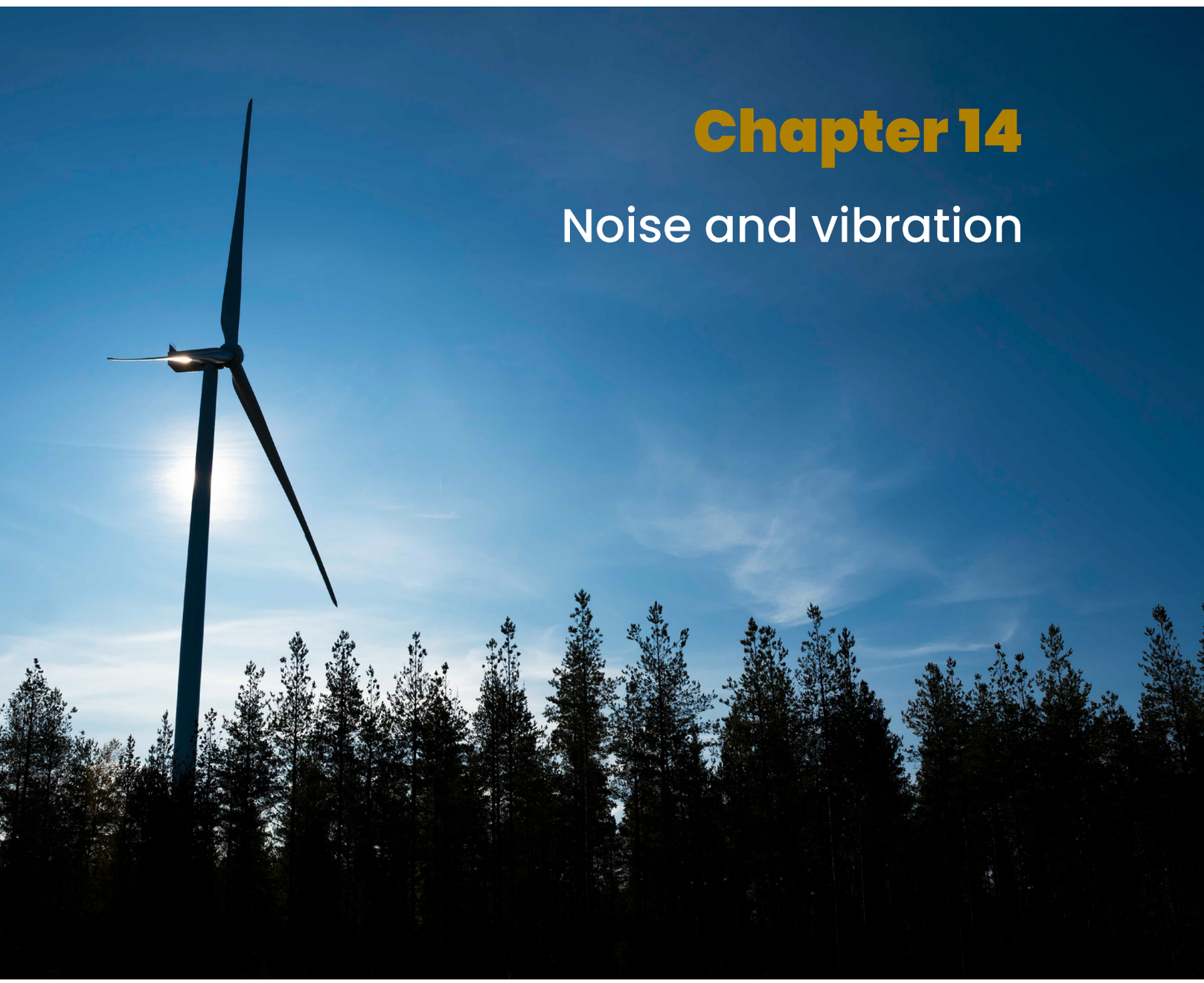


Chapter 14

Noise and vibration

Acknowledgement of Country

Neoen Australia acknowledges the traditional custodians of the land in which we live, and pays its respects to their elders, past and present. The Gunditjmara are the original custodians of the Country on which the Project is located and we acknowledge them as the original custodians. We are committed to Aboriginal engagement and reconciliation and aim to bring Aboriginal and Torres Strait Islander people, local communities and the councils along for the journey to strengthen relationships and enhance local community outcomes.

Disclaimer

14 Noise and vibration

This chapter describes the potential noise and vibration impacts from construction, operation and decommissioning activities associated with the Project, as well as the mitigation measures proposed to avoid, minimise, and manage potential adverse impacts.

This chapter summarises the outcomes of the **Environmental Noise Assessment (Appendix O).**

14.1 Overview

The noise and vibration impact assessment has determined potential noise and vibration levels that may be experienced at noise sensitive receiver locations surrounding the Project Area during construction, operation, and decommissioning of the Project. A total of 40 receivers were identified within five km of the proposed turbine locations, including:

- 34 non-involved receivers (15 residential dwellings and 19 campsites)
- six involved receivers (residential dwellings associated with the Project).

The construction noise and vibration assessment considered 57 receivers identified by Neoen Australia Pty Ltd (the Proponent) within two km of construction activities, including nine involved receivers and two non- involved receivers (camping grounds). The location of receivers are shown on **Figure 14.1**

Noise levels associated with key construction activities have been predicted at the nearest receivers and are within the typical noise range that would be expected for construction of a wind farm. Works associated with these construction activities and levels progress relatively quickly and therefore predicted noise levels would only be expected to be reached for a short period of time, typically significantly less than three to four weeks and less than one week for the highest noise level associated with cable trench digging. The predicted noise levels for operation of the quarry during construction are lower than the most stringent EPA Victoria (Environment Protection Authority Victoria) Publication 1826.4 *Noise limit and assessment protocol for the control of noise from commercial, industrial and trade premises and entertainment venues* (Noise Protocol) limit of 36 decibels (dB) applicable to the night period, by at least 5 dB, at all three non-involved receivers (campgrounds) located within 5 km of the quarry.

Construction vibration at one non-involved receiver may be perceptible and potentially disruptive for a brief period when cable trench digging activities are occurring at the nearest point to the dwelling. Perceptible vibration at this receiver due to cable trench digging activities are expected to be manageable via resident consultations, appropriate work scheduling, and prioritising efficient work times to minimise the duration of trench digging nearest to the dwelling.

A Construction Noise and Vibration Management Plan (CNVMP) would be prepared prior to construction commencing. The plan will provide a clear overview of the proposed construction program and include details of all reasonably practicable mitigation measures to be implemented to reduce the risk of harm from construction activity noise and vibration and to fulfil the general environmental duty under the *Environment Protection Act 2017* (Vic) (EP Act).

Predicted noise levels for operation of the wind farm have been determined using the sound power levels for four candidate turbine models. The results demonstrate that wind turbine noise levels associated with the Project are predicted to comply with the noise limits as defined by the New Zealand Standard *NZS 6808:2010 Acoustics – Wind Farm Noise* (NZS 6808) for all receivers and candidate wind turbines. Specifically, the predicted operational noise levels for all turbine models are:

- Below the applicable base noise limit of 40 dB L_{A90} by at least 2.0 dB at all non-involved receivers.
- Below the applicable base noise limit of 45 dB L_{A90} by at least 2.0 dB at all involved receivers outside of the Project Area.
- Below the reference base noise level of 45 dB L_{A90} by at least 4.4 dB at all involved receivers within the Project Area.

14.2 EES evaluation objective

The specific environmental matters to be investigated and documented in the this EES are set out in the *Scoping Requirements for Kentbruck Green Power Hub Environment Effects Statement* (Scoping Requirements). The Scoping Requirements provide evaluation objectives that describe the desired outcomes to be achieved for each of the matters being addressed in this EES.

The following draft evaluation objective is relevant for the noise and vibration impact assessment:

> ***Community amenity, safety, roads and transport*** *– To avoid and minimise adverse effects for community amenity and safety, with regard to construction noise, vibration, dust, traffic and transport, operational turbine noise and fire risk management.*

This chapter and the **Environmental Noise Assessment (Appendix O)** address the Project's amenity matters relating to noise and vibration emissions, in response to the Scoping Requirements.

14.3 Assessment methodology

The following approach was undertaken for the noise and vibration impact assessment:

- Established the study area and characterise the existing noise conditions across the study area as follows:
    - Identify the potential noise sensitive locations in proximity to the Project.
    - Determine background noise levels at identified receivers.
    - Identify the land zoning of the Project Area and surrounds.
- Established suitable noise criteria against which to assess the Project based on the background noise levels and applicable land zoning.
- Predicted the level of noise expected to occur during operation of the Project using noise emission data for the wind turbines and related infrastructure, a 3D digital model of the Project Area and surrounding environment, and international standards used for the calculation of environment sound propagation.
- Determined predicted noise levels during construction based on expected construction equipment and activities.
- Assessment of predicted noise levels against the associated criteria to identify any exceedances.
- Assessment of potential noise and vibration impacts due to construction and operation of the Project.
- Identification of measures to avoid, minimise, and manage potential impacts.
- Assessment of the residual noise and vibration impacts with the implementation of mitigation measures.

14.4 Existing conditions

14.4.1 Study area

The study area for the noise and vibration impact assessment considered all noise sensitive locations identified by the Proponent within 5 km of the wind farm site and within 2 km of any construction activity (comprising residential dwellings and campsites) (see **Figure 14.1** and **Figure 14.2**). The noise and vibration impact assessment also considered receivers located along local traffic routes which may be used by construction traffic associated with the Project.

14.4.2 Noise sensitive locations

In accordance with NZS 6808, noise sensitive locations considered in the noise and vibration impact assessment included residential dwellings and campsites located outside the wind farm site. The definition of noise sensitive locations under NZS 6808 excludes dwellings located within a wind farm site boundary. However, consistent with the *Planning Guidelines for Development of Wind Energy Facilities* (DTP, 2023) (Policy and Planning Guidelines), Regulation 131B of the Environment Protection Regulations 2021 (EP Regulations) specifies a noise limit for involved receivers and has therefore been considered in the noise and vibration impact assessment.

A total of 40 receivers were identified by the Proponent within 5 km of turbines, comprising:

- 34 non-involved receivers on properties that are not associated with the Project, including:
    - 15 residential dwellings
    - 19 campsites.
- Six residential dwellings on properties associated with the wind farm (involved receivers), including:
    - two receivers within the Project Area
    - two receivers outside of the Project Area where a noise agreement is being negotiated between the landowner and the Proponent
    - two receivers outside of the Project Area which have been identified as hosts for Project infrastructure.

The locations of these 40 receivers are shown on **Figure 14.1** and **Figure 14.2.**

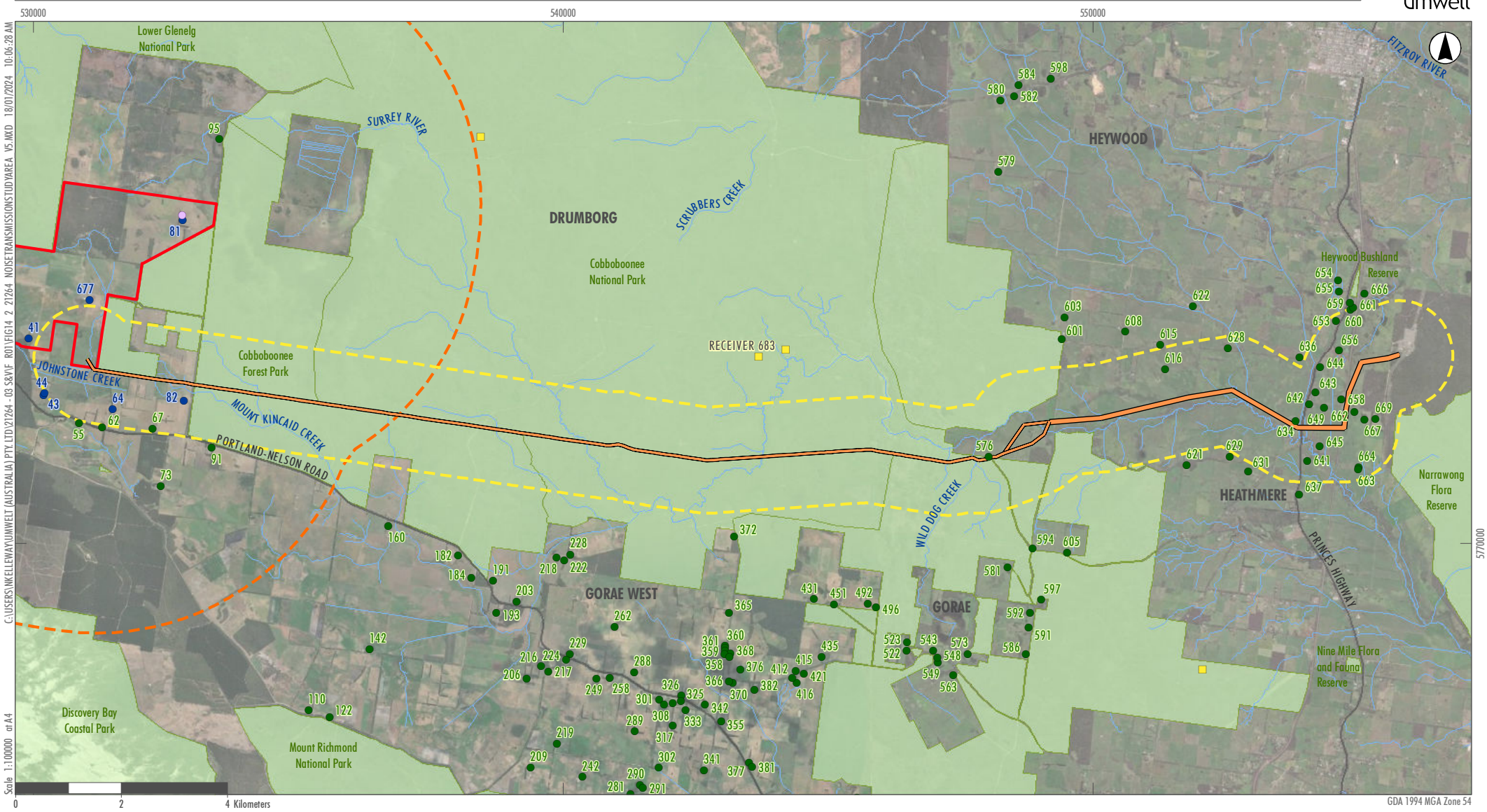
Legend

- Wind Farm Site
- Noise and Vibration Study Area - Wind Farm Operation
- Noise and Vibration Study Area - Transmission Line Construction
- Underground Transmission Line
- Campground
- Involved Noise Sensitive Locations
- Non-involved Noise Sensitive Locations
- Background Noise Monitor Location
- Parks and Reserves
- Roads
- Watercourses

FIGURE 14.1

Wind Farm Operation Noise Impact Assessment Study Area

Image Source: ESRI Basemap (2021) Data source: Geoscience Australia; DELWP (2021)



Legend

- Wind Farm Site
- Noise and Vibration Study Area - Wind Farm Operation
- Noise and Vibration Study Area - Transmission Line Construction
- Underground Transmission Line
- Campground
- Involved Noise Sensitive Locations
- Non-involved Noise Sensitive Locations
- Background Noise Monitor Location
- Parks and Reserves
- Roads
- Watercourses

FIGURE 14.2

Transmission Line Construction Noise and Vibration Impact Assessment Study Area

Image Source: ESRI Basemap (2021) Data source: Geoscience Australia; DELWP (2021)

14.4.3 Background noise monitoring

Background noise level levels are used to inform the setting of noise limits for both the wind turbine components and related infrastructure of a wind farm project. However, due to the rural locality of the Project, background noise level data are most relevant to the assessment of the wind turbines, which enables changes in background noise levels and wind turbine noise levels to be assessed under different wind conditions.

In accordance with the Policy and Planning Guidelines, background noise level information is used for setting noise limits for the wind turbine component of a wind farm project. The procedures for determining background noise levels are defined in NZS 6808. Background noise monitoring was undertaken at five receivers in the vicinity of the wind farm site between 19 May 2021 and 13 July 2021. The location of these background monitoring sites is shown in **Figure 14.1.**

Consistent with common practice for wind farm noise assessments in Victoria, the background noise levels have been separately analysed for the all-time (day and night combined) and night period. **Table 14.1** and **Table 14.2** summarise the background noise levels determined in accordance with NZS 6808 for the all-time- and night periods, respectively. Wind speed is taken at hub height, which is the distance from the ground to the turbine rotor, as per NZS 6808 and wind speeds below 3 m/s are not reported as the wind farm would not be operational below this wind speed.

Table 14.1: Background noise levels, dB L_{A90} – all-time period

Receiver	Hub height wind speed (m/s)												
	3	4	5	6	7	8	9	10	11	12	13	14	15
10 proxy[1]	26.4	27.5	28.4	29.1	29.5	29.8	30.0	30.1	30.1	30.3	30.4	30.7	31.2
21	26.8	27.9	28.8	29.5	30.1	30.5	30.9	31.2	31.6	32.0	32.5	33.2	34.0
31	30.5	30.5	30.7	31.1	31.7	32.4	33.3	34.2	35.1	36.0	36.9	37.6	38.3
81	26.5	27.3	28.1	29.0	29.8	30.6	31.4	32.1	32.8	33.5	34.1	34.7	35.1

Table 14.2: Background noise levels (dB L_{A90}) – night period

Receiver	Hub height wind speed (m/s)												
	3	4	5	6	7	8	9	10	11	12	13	14	15
10 proxy[1]	-	-	-	-	-	-	-	-	28.1	28.3	28.7	29.1	29.7
21	-	-	-	-	-	31.4	31.4	31.4	31.6	32.0	32.4	33.1	33.8
31	-	-	-	30.2	30.2	30.5	31.1	31.9	33.0	34.1	35.3	36.4	37.4
81	24.7	25.3	26.0	26.7	27.4	28.2	28.9	29.7	30.5	31.2	31.9	32.6	33.2

14.4.4 Applicable noise limits

14.4.4.1 Wind farm operation

The applicable noise limit for wind farms in Victoria is dependent on factors relating to land zoning, background noise levels and whether the receiver is involved with the Project. NZS 6808 specifies that any sound levels associated with a wind energy facility should not exceed a 40 dB noise limit at sensitive receivers (outdoors), or that the noise levels should not exceed the background sound level by more than 5 dB (referred to as 'background sound level +5 dB'), whichever is greater.

[1] Consent to undertake background noise monitoring was not granted at this receiver, therefore an alternative location was selected at a similar distance to the nearest proposed turbine.

NZS 6808 also defines a reduced noise limit of 35 dB for special circumstances in 'high amenity areas' (areas where a higher degree of amenity protection for the sound environment is required). A land zoning review was undertaken in accordance with NZS 6808 to determine whether consideration of a high amenity noise limit is warranted for the Project. Receivers that fall within the predicted 35 dB L_{A90} contour of the Project are zoned as Farming Zone (FZ) and Public Park and Recreation Zone (PPRZ).

Guidance concerning the FZ is provided in the *Wind Energy Facility Turbine Noise Regulation Guidelines* (EPA Victoria, 2021) (Noise Regulation Guidelines) which indicates that the high amenity noise limit should not be applied to the FZ. In addition, guidance from the Victorian Civil Administrative Tribunal (VCAT) determination for the Cherry Tree Wind Farm (Cherry Tree Wind Farm Pty Ltd v Mitchell Shire Council, 2013) found that receivers within the FZ do not warrant consideration of the high amenity noise limit. This determination was supported in the planning panel report for Golden Plains Wind Farm.

Campsites within the study area are mostly located within the PPRZ. The Noise Regulation Guidelines do not comment on the application of the high amenity noise limit to PPRZ. The following factors were considered when considering if the high amenity noise limit is warranted for receivers within the PPRZ:

- The PPRZ does not specifically promote higher degree of amenity protection with respect to the sound environment.
- The PPRZ includes provisions for land uses that are not inherently low noise.
- Precedents for the application of high amenity noise limits of the PPRZ were not able to be identified.
- The PPRZ is not included in the list of zone types that the EPA web guideline recommends the high amenity noise limits should apply to.

Based on the above factors there is no clear precedent, indication or justification for application of a high amenity limit to receivers within the PPRZ and therefore the high amenity limit is not justified for the Project.

It is noted that the Environment Reference Standard (ERS) defines natural areas where the environmental value of human tranquillity and enjoyment outdoors in natural areas applies. However, the ERS is not considered relevant for the assessment of wind turbine noise at receivers, as noise is regulated under the EP Regulations which set out a specific regulatory framework for wind farm noise and refers to the NZ Standard. EPA Guide, 1992: *Guide to the Environment Reference Standard* specifies that direct regulation (in this case EP Regulations) takes precedence over the ERS. The NZ Standard outlines the appropriate limits based on an analysis of the relevant zoning rather than by reference to the environmental values in the ERS.

The Policy and Planning Guidelines and Regulation 131B of the EP Regulations specify a noise limit for involved receivers of 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 01 November 2021.

The applicable noise limits that have been adopted for the Project are provided in **Table 14.3**.

Table 14.3: Noise limits adopted for the Project

Receiver status	Noise limit
Non-involved	40 dB or background L_{A90} + 5 dB, whichever is the greater
Involved	45 dB or background L_{A90} + 5 dB, whichever is the greater
Involved (within the Project Area)	Not applicable Recommended that noise levels do not exceed a reference level of 45 dB or background L_{A90} + 5 dB, whichever is the greater

14.4.4.2 Substation operation

Transformers and any associated cooling equipment would be the main sources of noise within the main substation and collector substations required for the Project. Specific details of the transformer make and model are yet to be determined, however, to provide a basis for assessing the substations, each transformer has been assumed to have a rating 375 MVA. In lieu of manufacturer sound power level data for a specific transformer model, reference has been made to Australian Standard *AS 60076-10:2009 Power transformers – Part 10: Determination of sound levels* (AS 60076-10) which provides a method for estimating transformer sound power levels.

Noise limits for the operation of the main substation and collector substations have been determined based on the Noise Protocol (EPA Victoria, 2021). Noise limits have been defined for day, evening, and night time periods, as outlined in **Table 14.4**. The lowest noise limit is for night-time noise at 34 dB L_{eff}. As the substations would operate 24 hours a day and seven days a week, meeting the applicable night-time noise limit of 34 dB L_{eff} infers meeting the noise limits during all other time periods.

Table 14.4: Noise Protocol time periods and noise limits

Period	Day of week	Start time	End time	Noise limit (dB L_{eff})
Day	Monday-Saturday	7 am	6 pm	45
Evening	Monday-Saturday	6 pm	10 pm	39
	Sunday, public holidays	7 am	10 pm	
Night	Monday-Sunday	10 pm	7 am	34

14.4.4.3 Quarry operation

Noise limits for the quarry operation has been determined in accordance with the Noise Protocol. It is noted that these noise limits do not differentiate between temporary and permanent operations.

The recommended noise levels for earth resources are determined based on land zoning where the receiver is located and, where applicable, the background noise in the area.

There are three receivers located within 5 km of the proposed quarry location, with the closest located 4.3 km from the quarry, and they are located within land designated as FZ or PPRZ. The applicable noise limits are detailed in **Table** 14.5

Table 14.5: Noise limits applicable to quarry operations

Period	Day of week	Start time	End time	Noise limit (dB L_{eff})
Day	Monday-Saturday	7 am	6 pm	46
Evening	Monday-Saturday	6 pm	10 pm	41
	Sunday, public holidays	7 am	10 pm	
Night	Monday-Sunday	10 pm	7 am	36

14.5 Construction impacts

14.5.1 Predicted construction noise levels

Noise levels associated with each of the main construction activities have been predicted at the nearest receivers (accounting for all identified noise sensitive locations including campsites) to provide an indication of the upper range of potential noise levels.

Given that the precise equipment selections and methods of working would be determined during the development of a construction plan, and that the noise associated with construction plant and activity varies significantly, the predicted noise levels provided in **Table 14.6** are an indicative range of levels which may occur in practice.

Table 14.6 provides the predicted noise levels for each of the main construction activities for non-involved receivers (including campsites) and involved receivers. Refer to **Figure 14.1** for reference to the nearest receivers.

Table 14.6: Indicative range of construction noise predictions for non-involved and involved receivers

Construction activity	Non-involved receivers			Campsites			Involved receivers		
	Nearest receiver	Distance to nearest receiver (m)	Predicted level range (dB L_{Aeq})	Nearest receiver	Distance to nearest receiver (m)	Predicted level range (dB L_{Aeq})	Nearest receiver	Distance to nearest receiver (m)	Predicted level range (dB L_{Aeq})
Access road and tracks construction	674	1,010	45-50	673	1,921	40-45	677	276	60-65
Cable trench digging	576	30	75-80	709	1,884	35-40	677	271	55-60
HDD	576	780	40-45	709	1,853	30-35	82	6,761	15-20
Met mast installation	27	6,488	20-25	700	7,088	20-25	676	2,659	30-35
Power pole installation	27	3,413	25-30	721	2,975	30-35	676	332	50-55
Powerline stringing	27	3,413	25-30	721	2,975	25-30	676	332	50-55
Site compound construction	27	3,237	30-35	673	3,695	30-35	676	1,064	40-45
Substation installation	55	1,274	40-45	702	4,949	25-30	44	1,012	40-45
Collector substation installation	18	4,541	25-30	721	3,043	30-35	675	2,659	30-35
Turbine assembly	674	1,038	40-45	673	2,105	35-40	675	615	45-50
Turbine foundations construction	674	1,038	40-45	673	2,105	35-40	675	615	45-50

The predicted noise levels presented in **Table 14.6** are a typical range expected for the construction of a wind farm. The highest noise levels are predicted to occur during cable trench digging near a non-involved receiver, followed by the construction of access roads. However, the works associated with these construction activities progress relatively quickly and therefore these levels would only be expected to be reached for a short period of time, typically less than three to four weeks and less than one week for the highest noise level associated with cable trench digging.

EPA Publication 1834.1 *Civil construction, building and demolition guide* does not apply receiver noise limits during normal working hours. However, the magnitude of the predicted noise levels is sufficient to warrant the works being restricted to normal working hours. Further, the predicted levels, combined with the scale of the Project, are sufficient to warrant the implementation of the requirements in EPA Publication 1834.1 with respect to both noise emissions and managerial controls.

Potential out of hours work would need to be limited to low noise works (such as maintenance activities) or unavoidable works which must occur during the evening and night periods for safety and reducing traffic disruption. This approach is consistent with EPA Publication 1834.1 (see mitigation measure MM-NV01).

A CNVMP will be prepared prior to construction of the Project to confirm all reasonably practicable measures that will be implemented to reduce the risk of harm from construction activity noise. The plan will include provisions to notify receivers of the timing of the nearest construction activities (see mitigation measure MM-NV01).

14.5.2 Predicted construction traffic noise levels

Based on the peak hour construction traffic volume estimates provided in the traffic impact assessment (see **Chapter 15 *Transport***), hourly construction traffic noise levels of up to 60 dB $L_{Aeq,1hr}$ have been predicted at dwellings located within 20 m of a road. Considering that receivers in the vicinity of the Project are typically located more than 20 m from roads, construction traffic noise levels are expected to be lower than 60 dB L_{Aeq}. An increase of 2 dB in hourly traffic noise levels is predicted to occur due to the Project's construction activities. Such a minimal increase in noise levels is not considered to be perceptible.

14.5.3 Predicted construction vibration levels

The nearest receiver to construction activities is a non-involved receiver (576) located approximately 30 m from the underground transmission line route. There is no Victorian guidance for construction vibration, however, the NSW Roads and Maritime Service's 2016 publication *Construction Noise and Vibration Guideline* identifies minimum working distances for cosmetic damage for typical items of vibration intensive plant, all of which are less than 25 m. This non-involved receiver is located at a greater distance than the identified minimum working distances, and therefore cosmetic damage as a result of construction related vibration is considered unlikely.

Receiver (576) is located within the range of distances identified in the *Construction Noise and Vibration Guideline* (RMS, 2016) for human comfort, and therefore vibration could be perceptible and potentially disruptive for the brief period while cable trench digging activities are occurring at the nearest point to the dwelling. It is noted that the minimum working distances relate to continuous vibration, however for most construction activities, vibration emissions are intermittent in nature. Perceptible vibration at this receiver due to cable trench digging activities is therefore expected to be manageable via resident consultations, appropriate scheduling, and prioritising efficient work times to minimum the duration of trench digging nearest to the dwelling. Receiver 576 is located more than 17 km from the longer term areas of working (i.e. in the wind farm site), and so vibration considerations are solely related to the brief period of cable trench digging.

All other receivers around the Project are located more than 100 m from vibration generating construction activities and are therefore beyond the safe working distances for both cosmetic damage and human response.

A CNVMP will be prepared to manage potential effects of construction noise from on-site activities and off-site traffic movements, and construction vibration associated with any activities expected to occur at less than 100 m from a receiver (see mitigation measure MM-NV01).

14.5.4 Predicted quarry and concrete batching plant noise levels

The quarry and concrete batching plants would operate during various periods of construction of the Project, with the quarry also available during the Project's operation. While these activities are temporary operations associated with construction, due to the size of the Project, they may be required to operate over a period of two years. The quarry has been assessed against the noise limits identified in **Section 14.4.4.3**, and the concrete batching plants have been assessed against the noise limits identified in **Section 14.4.4.2.**

The quarry pit design, schedule of equipment and the intensity of operations would be developed in greater detail during subsequent stages of the Project. However, preliminary information has been modelled to develop estimated indicative noise level predictions based on the example schedule of plant and noise emissions.

The predicted noise levels for the temporary quarry are conservatively based on all plant continuously operating simultaneously within any given 30-minute assessment period. In practice, variations in the duration and intensity of operation of each item of plant are likely to result in lower noise levels. These variations in operating characteristics would need to be accounted for in the detailed design assessment for the quarry.

The predicted noise levels for the three receivers located within 5 km of the quarry were determined using the calculation methodology in *ISO 9613-2:1996 Acoustics – Attenuation of sound during propagation outdoors*. The results indicate that the predicted noise levels are lower than the most stringent Noise Protocol limit of 36 dB ENL applicable to the night period, by at least 5 dB.

The predicted noise levels for the ten receivers within 5 km of the concrete batching plants are lower than the most stringent Noise Protocol noise limit of 32 dB applicable to the night period by at least 10 dB at nine of the ten assessed receivers.

Operational noise levels from the eastern concrete batching plant are estimated to be above the night base noise limit by 1 dB at receiver 676, which is an abandoned dwelling owned by an involved landowner involved. A noise agreement is in place between the Proponent and the landowner covering both the construction and operation of the Project.

The Quarry Work Plan will include details of all reasonably practicable mitigation measures to be implemented to fulfil the general environmental duty under the EP Act and achieve the noise limits determined in accordance with the Noise

Protocol (see mitigation measure MM-NV03). In addition, all temporary concrete batching plants will be designed and operated in accordance with the general management measures in EPA Publication 1806 *Reducing risk in the premixed concrete industry* to minimise industrial noise emissions and not emit unreasonable noise (see mitigation measure MM-NV02).

14.6 Operation impacts

14.6.1 Predicted operational noise levels

Noise levels predicted for operation of the wind farm have been determined using the sound power levels for candidate turbine models. The purpose of a candidate turbine model 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 turbines being considered for the Project.

The wind turbine model to be used in the Project would be selected after a tender process to procure the supply of turbines. The final selection would be based on a range of design requirements, including achieving compliance with the relevant statutory approval conditions at surrounding receivers.

The following four candidate turbine models were considered in the operational noise assessment:

- General Electrics GE 6.0-164
- Vestas V162-6.2MW
- Siemens Gamesa SG 6.2-170
- Nordex N163/5.7.

Information on sound power levels for each model can be found in the **Environmental Noise Assessment (Appendix O**).

The locations of the predicted 30, 35, 40 and 45 dB L_{A90} noise contours are illustrated in **Figure 14.3,** for the wind speed which results in the highest predicted noise levels for the Nordex N163/5.7 candidate turbine model. The predicted noise levels for this model are considered the 'worst-case' scenario of the four candidate turbine models. However, the difference in predicted noise levels is minimal between the candidate turbine models.

The results demonstrate that wind turbine noise levels associated with the Project are predicted to comply with the noise limits for all receivers and candidate wind turbines. Specifically, the predicted operational noise levels for all turbine models are:

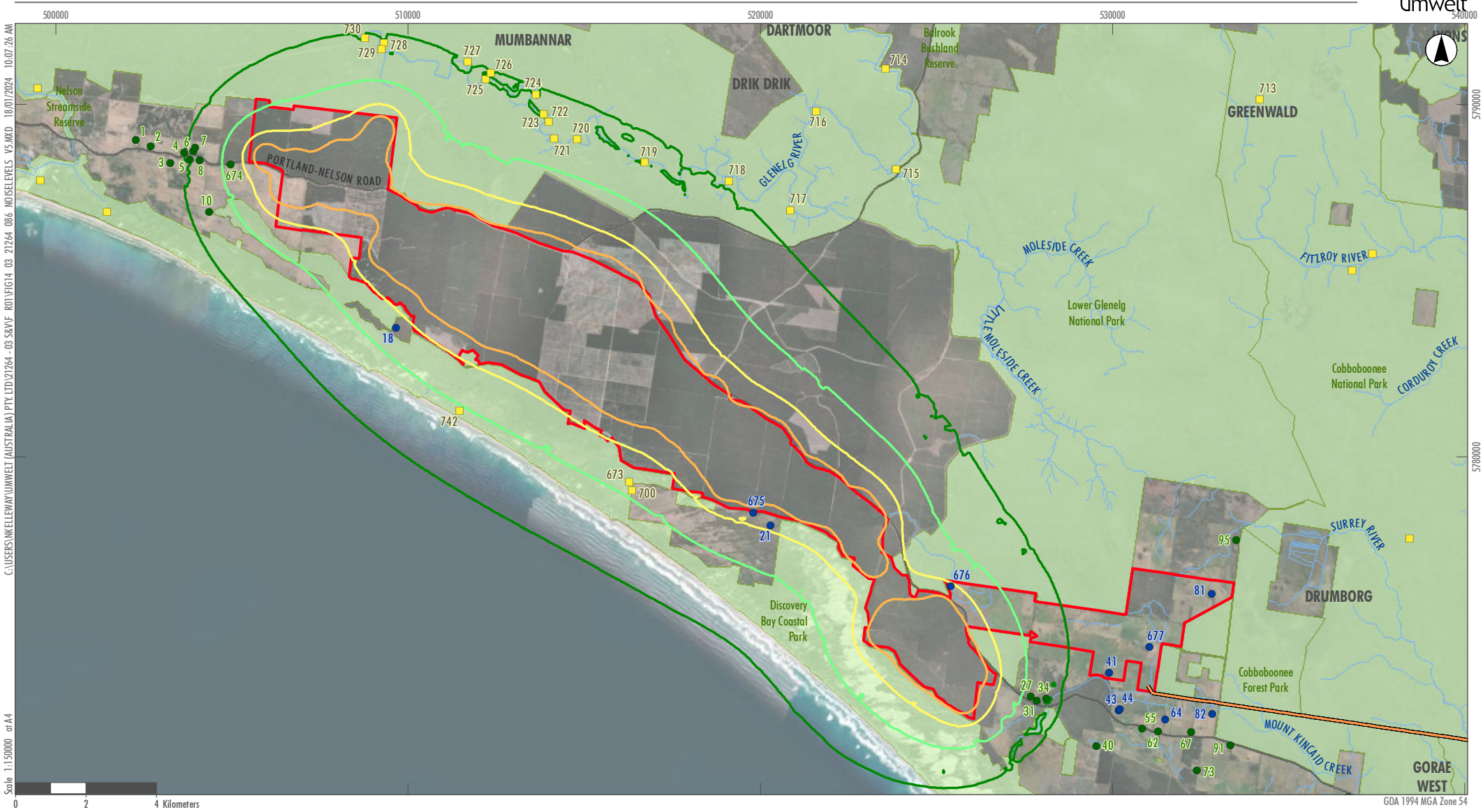
- Below the applicable base noise limit of 40 dB L_{A90} by at least 2.0 dB at all non-involved receivers.
- Below the applicable base noise limit of 45 dB L_{A90} by at least 2.0 dB at all involved receivers outside of the Project Area.
- Below the reference base noise level of 45 dB L_{A90} by at least 4.4 dB at all involved receivers within the Project Area.

While the high amenity limit is not applicable to the Project (see **Section 14.4.4.1**), for reference purposes the modelling indicates that the predicted noise levels are below the high amenity limit for all candidate wind turbines. Specifically, the predicted noise levels for all candidate turbine noise levels are below 35 dB L_{A90} for wind speeds up to 6 m/s inclusive (the Noise Regulation Guideline*s* specifies this is the highest wind speed for applying high amenity limits).

A pre-development noise assessment will be prepared and submitted to the EPA Victoria as the responsible authority, demonstrating that the wind farm is expected to achieve compliance with the operational noise requirements established in accordance with NZS 6808. The pre-development noise assessment will be based on the final wind turbine layout, representative noise emission data for the final selected turbine model and the location of all receivers around the wind farm (see mitigation measure MM-NV05).

Following construction, a post-construction noise assessment will be undertaken by a suitably qualified and experienced acoustic consultant to demonstrate operation of the Project is compliant with applicable noise limits. This will be undertaken in accordance with the EP Regulations, and an EPA Victoria appointed environmental auditor would be engaged to prepare a report verifying the assessment (see mitigation measure MM-NV06).

A Noise Management Plan (NMP) will be prepared and implemented during operation to ensure compliance with operational noise requirements as per the pre-development noise assessment (see MM-NV07). The NMP will outline measure for regular wind turbine noise monitoring and preparation of annual statements (see mitigation measures MM-NV08 and MM-NV09).



Legend

- Campground
- Involved Noise Sensitive Locations
- Non-involved Noise Sensitive Locations
- Underground Transmission Line
- Wind Farm Site
- Parks and Reserves
- Roads
- Watercourses

Noise Levels dB(A)

- 30
- 35
- 40
- 45

FIGURE 14.3

Highest Predicted Noise Levels

Image Source: ESRI Basemap (2021) Data source: Geoscience Australia; DELWP (2021)

14.6.2 Predicted substation noise levels

Predicted noise levels have been determined for the main substation and collector substations, as shown in **Table 14.7**. Nearest receivers are shown on **Figure 14.1.** Location of source items can be found on Figure 3.2 **in Chapter 3** ***Project description.***

Table 14.7: Predicted substation noise levels at the nearest receivers

Source item	Nearest receiver	Distance to the nearest receiver (m)	Predicted noise level (dB L_{eff})
Collector substation #1 (western substation)	721 (Campground)	3,043	15
Collector substation #2 (middle substation)	675 (Involved)	2,659	18
Collector substation #3 (eastern substation)	676 (Involved)	2,758	17
Main substation	44 (Involved)	1,012	27

The predicted noise levels are below the noise limits applicable to the day, evening, and night periods by a reasonable margin. The following conclusions have been made:

- The predicted effective noise levels are at least 7 dB below the night-time noise limit.
- The predicted effective noise levels are very low and would be comparable to or less than background noise levels in most instances. The adjustment for tonality is therefore not expected to be applicable at most, if not all, locations.

Noise levels from the main substation and collector substations are unlikely to result in noise impacts on nearby receivers. However, noise levels would be reviewed at the time when equipment selections are finalised, accounting for manufacturer noise emission data.

The low predicted noise levels indicate that noise from the transformer station (within the main substation) is unlikely to represent a risk of harm to the environment as a result of noise. The general environmental duty under the EP Act is therefore expected to be addressed by selecting transformers with noise emissions equivalent to, or lower than, the Australian Standard *AS 60076-10:2009 Power transformers – Part 10: Determination of sound levels* empirical values. Actual noise emission values for contemporary transformer designs are usually lower than the empirical values.

Before development starts, a pre-development noise assessment is to be submitted to the Responsible Authority demonstrating that the related infrastructure associated with the wind farm (including substations) is expected to achieve the noise limits determined in accordance with the Noise Protocol (see mitigation measure MM-NV04).

14.6.3 Cumulative impacts

The nearest approved and/or operating wind farm is Cape Bridgewater Wind Farm, approximately 20 km to the south-east of the Project. Due to the significant distance, cumulative noise impacts are not anticipated to occur.

14.7 Environmental Reference Standard

14.7.1 Natural areas

The ERS sets out the environmental values for the ambient sound environment that are to be achieved or maintained in Victoria. The ERS also sets out the indicators and objectives to support those values. The environmental value relevant to natural areas is “human tranquillity and enjoyment outdoors in natural areas,” which is described as “an ambient sound environment that allows for the appreciation and enjoyment of the environment for its natural condition and the restorative benefits of tranquil landscapes in natural areas.”

The ERS defines natural areas as national parks, state parks, state forests, nature conservation reserves and wildlife reserves. The following natural areas have been considered in the assessment:

- Lower Glenelg National Park

- Cobboboonee National Park
- Cobboboonee Forest Park
- Mount Richmond National Park
- Discovery Bay Coastal Park
- Various reserves

In addition to identified natural areas, the Great South West Walk runs around the Project.

The assessment found that the natural areas identified extend over relatively large areas and encompass a broad range of sound environments. As a result of these factors, and the extent of the natural areas, background noise levels are likely to vary significantly. At locations immediately adjacent to the coast, the background noise levels would be elevated by the effect of coastal influences and wind. At other locations where wind disturbance of vegetation is a key influence, the background noise would vary significantly according to factors such as ground elevation (in turn affecting exposure to the wind) and the type and density of vegetation in the surrounding area.

Noise from construction and operation of the Project would be audible in sections of the natural areas around the Project and has the potential to impact the environmental value of human tranquillity and enjoyment outdoors in these locations. Importantly, given than the environmental value relates to subjective impression of the soundscape's characteristics, impacts can occur at very low levels of audible noise from the Project; particularly if the character and pattern of the noise is significantly different from the existing environment.

Audibility of the Project in the identified natural areas is dependent on several factors:

- Proximity and scale of the Project
- Proximity and scale of activities associated with construction of the Project
- The level and character of the noise associated with construction of the Project
- Timing and duration of activities associated with construction of the Project
- Operating conditions of the Project
- The level and character of the noise associated with operation of the Project
- Extent of the identified natural areas that are reasonably accessible to the public
- Natural background noise sources (e.g. ocean, vegetation, fauna, etc.)
- Anthropogenic background noise sources (e.g. road traffic, farming and forestry activities, etc.)
- Wind conditions (e.g. wind speed and wind direction).

The proximity of the identified natural areas to the Project is such that there will be parts of these areas where activities associated with both construction and operation of the Project will contribute to the soundscape.

14.7.2 Potential effects on natural areas from construction noise

Construction activities represent a temporary source of undesirable noise in sections of the natural areas around the Project.

The construction period for the Project is about two to 2.5 years, from enabling works through to commissioning. Within this period, the location of the works would change as the work front for each construction stage progress through the Project area. As a result, at a given location within the neighbouring natural areas, construction noise would only be experienced for a portion of the overall construction period. As the construction activities move further away from a given location within the natural area, the intermittent noise of construction would progressively reduce, with construction noise approaching a level equivalent to distant/intermittent agricultural activity in the surrounding area.

Operation of the temporary quarry and batching plants is a relevant consideration for natural areas during the construction period. These elements of the Project would operate for a greater portion of the construction period than other types of construction activity. Operation of the quarry and concrete batching plants may be audible in some parts of the surrounding natural areas during construction, mainly within a section of the Glenelg River National Park directly to the north of the quarry.

While construction noise impacts on environmental values would be temporary, the effects of construction noise on human tranquillity and enjoyment outdoors will be accounted for in the preparation and implementation of the CNVMP for the Project. Specifically, the effects of noise on natural areas where people reside will be factored in to the development of reasonable and practical measures to fulfil the general environmental duty (GED) (see mitigation measure MM-NV01).

14.7.3 Potential effects on natural areas from operational noise

With respect to operational noise of the Project in natural areas, the primary consideration is noise from wind turbines. The Project would most likely be audible on some occasions at the locations where wind turbine noise levels are above 30 dB LA90. Below that level, wind turbine noise may still be audible at times, but it would be much dependent on wind conditions and the specific characteristics of the background environment, and any audible wind turbine noise would be increasingly difficult to distinguish from the ambient sound environment.

As an indication, wind turbine noise levels above 30 dB LA90 are predicted to occur in areas within approximately two km of the Project's wind turbines. Conversely, where predicted wind turbine noise levels are higher than 40 dB LA90, the Project is expected to be regularly audible. The distribution of predicted wind turbine noise levels in the identified natural areas is shown in **Figure 14.4** (sourced from the Environmental Noise Assessment at Appendix O of the EES).

Figure 14.4: Natural areas in the vicinity of the Project with predicted operational wind turbine noise levels

(Source: Environmental Noise Assessment at Appendix O of the EES)

14.8 Mitigation measures

Table 14.8 outlines the mitigation measures developed to avoid, minimise, and manage noise and vibration impacts on receivers from construction and operation of the Project.

Table 14.8: Noise and vibration mitigation measures

ID	Mitigation measure	Relevant work area	Project phase
MM-NV01	**Construction Noise and Vibration Management Plan (CNVMP)** Before commencement of development, a Construction Noise and Vibration Management Plan (CNVMP) will be prepared to address the effects of construction noise related to on-site activities and off-site traffic movements, and construction vibration associated with any activities expected to occur at less than 100 metres from a receiver. The CNVMP will include: • A clear overview of the proposed construction program and demonstrate all reasonably practicable measures proposed to fulfil the general environmental duty under the EP Act, accounting for guidance under EPA Publication 1834.1 *Civil construction, building and demolition guide.* • A schedule of noise emission data for the major plant items to be used for construction of the Project, and a comparison of the data with the noise emission ranges set out in AS 2436 *Guide to Noise and Vibration Control on Construction, Demolition and Maintenance Sites (Reconfirmed 2016)*. • Define all unavoidable work and low-noise managed-impact works which may occur outside of normal working hours, such as out of hours deliveries or turbine installation activities that are subject to weather constraints. • Details relating to proposed routing and timing of construction traffic, including protocols to minimise noise along local roads to the extent reasonably practicable. • Details of the measures to be implemented to address noise characteristics such as tonality, impulsive noise and low frequency noise, including consideration of residential receivers and noise levels in natural areas. • The proposed scheduling of any out of hours works, and provide evidence to support that low managed-impact works meet the criteria defined in EPA Publication 1834. • Identify specific activities which warrant notification of neighbouring residents in advance of the work occurring, such as unavoidable works outside of normal working hours and activities with potential to cause perceptible vibration. • Identify specific activities and construction stages which warrant notification of Parks Victoria of noise impacts to natural areas of state and national parks. The CNVMP will be prepared in consultation with Environment Protection Authority Victoria and Parks Victoria. An EPA appointed independent environmental auditor (IEA) would be engaged to prepare a report verifying the CNVMP. Both the CNVMP and the IEA's verification report must be made available to EPA Victoria on request. Prior to decommissioning, a decommissioning noise and vibration management plan (DNVMP) would be prepared and submitted to the responsible authority for endorsement. This plan would include: • An assessment of the potential impacts of decommissioning noise and vibration from Project activities. • Outline the proposed decommissioning program and how the proposed management controls are compliant with the requirements defined by EPA Victoria Publication 1834: *Civil construction, building and demolition guide.*	All works	Pre-Construction

	• Outline all unavoidable works, low-noise impact and managed-impact works that may occur outside normal working hours. • Outline the proposed scheduling of any out of hours works to minimise noise and vibration impacts. An EPA appointed IEA would be engaged to prepare a report verifying the DNVMP. Both the DNVMP and the IEA's verification report must be made available to EPA Victoria on request. The CNVMP must be submitted and approved by the Victorian Minister for Planning prior to development commencing.		
MM-NV02	**Concrete batching plant** All temporary concrete batching plants will be designed and operated in accordance with the general management measures in EPA Publication 1806 *Reducing risk in the premixed concrete industry* to minimise industrial noise emissions and not emit unreasonable noise. This includes not exceeding the noise limits set under the Part 5.3 Division 3 of Environment Protection Regulations 2021 (Vic) and the incorporated Noise Protocol (EPA publication 1826). Operations will minimise the risk of harm from noise emissions so far as reasonably practicable, consistent with the General Environmental Duty; and unreasonable noise, is not emitted having regard to the factors in part (a) of the definition of unreasonable noise in section 3(1) of the *Environment Protection Act 2017* (Vic) – this includes considering the risk associated with low frequency noise as assessed in the Noise guidelines: assessing low frequency noise (EPA publication 1997) (as amended or replaced from time to time)..	Wind farm	Construction
MM-NV03	**Quarry Work Plan** Before commencement of development, a Quarry Work Plan will be prepared in consultation with relevant authorities and endorsed as part of the Work Authority. The Quarry Work Plan will be generally consistent with the Quarry Work Plan Requirements Report (**Appendix X)** and will document all reasonable practical mitigation measures to be implemented for the purpose of fulfilling the general environmental duty under the Environment Protection Act 2017 (Vic) (EP Act)and achieving the noise limits determined in accordance with the Noise Protocol. This will include: • Working hours, equipment noise controls and details of any perimeter screening if/where relevant. • Not exceeding the noise limits set under the Part 5.3 Division 3 of Environment Protection Regulations 2021 and the incorporated Noise Protocol (EPA publication 1826); minimise the risk of harm from noise emissions so far as reasonably practicable, consistent with the GED; and unreasonable noise, is not emitted having regard to the factors in part (a) of the definition of unreasonable noise in section 3(1) of the EP Act 2017 – this includes considering the risk associated with low frequency noise as assessed in the Noise guidelines: assessing low frequency noise (EPA publication 1997) (as amended or replaced from time to time).	Quarry	Pre-Construction Operation
MM-NV04	**Pre-development noise assessment of ancillary infrastructure** Before development starts, a pre-development noise assessment is to be submitted to the Responsible Authority demonstrating that the related infrastructure associated with the wind farm is expected to achieve the noise limits determined in accordance with *EPA publication 1826.4 'Noise limit and assessment protocol for the control of noise from commercial, industrial and trade premises and entertainment venues*, and it complies with the *Environment Protection Regulations 2021*. The assessment will take account of reasonably practicable measures to fulfil the general environmental duty under the *Environment Protection Act 2017* (Vic)	Wind farm	Pre-construction

MM - NV05	**Pre-construction wind turbine noise assessment** Prior to the commencement of construction, a pre-construction noise assessment would be completed and approved by the responsible authority. This assessment would be undertaken to assess the final project layout and equipment selection to ensure that the noise criteria are achieved at all non-stakeholder dwellings under all wind speeds prior to construction commencing. The pre-development noise assessment will be based on the final wind turbine layout, representative noise emission data for the final selected turbine model and the location of all receivers around the wind farm (existing or approved noise sensitive receivers at the date of the wind farm's approval). The pre-development noise assessment will identify all involved receivers where noise agreements have been established. The pre-development noise assessment will be prepared in accordance with the assessment and documentation requirements of NZS 6808. The pre-development noise assessment will be accompanied by a report prepared by an environmental auditor appointed under Part 8.3 the *Environment Protection Act 2017* (Vic) that verifies if the acoustic assessment undertaken for the purpose of the pre-development noise assessment has been conducted in accordance with the NZS 6808 Standard.	Wind farm	Pre-construction
MM-NV06	**Post-construction Noise Assessment** A post-construction noise assessment will be undertaken by a suitably qualified and experienced acoustic consultant to demonstrate operation of the Project is compliant with applicable noise limits. The assessment will be undertaken in accordance with the Environment Protection Regulations 2021, and an Environment Protection Authority Victoria (EPA) appointed environmental auditor would be engaged to prepare a report verifying the assessment. Both the post-construction noise assessment and the auditor's verification report will be provided to the EPA within 10 days of the completion of the auditor's verification report.	Wind farm	Operation
MM-NV07	**Noise Management Plan** Before development starts, a Noise Management Plan (NMP) will be prepared as by regulation 131E the Environment Protection Regulations 2021. In addition to the requirements of regulation 131E, the NMP will also document: • a procedure for the preparation of annual statements in accordance with regulation 131F • a procedure for undertaking wind turbine noise monitoring in accordance with regulation 131G • a procedure for complaints management in accordance with regulation 131E(2(a)). • a schedule of sound power level testing which will be undertaken to verify that the emissions of the installed turbines are consistent with the findings presented in the pre-development noise assessment.	Wind farm	Pre-construction Operation
MM-NV08	**Noise Monitoring** Regular wind turbine noise monitoring would be undertaken in accordance with regulation 131G of the Environment Protection Regulations 2021 and as detailed in the Noise Management Plan.	Wind farm	Operation
MM-NV09	**Annual Statement** Annual statements would be prepared annually in accordance with regulation 131F of the Environment Protection Regulations 2021 and as detailed in the Noise Management Plan.	Wind farm	Operation

14.9 Conclusion

The Project is anticipated to generate noise during both construction and operation. A total of 40 receivers were identified within 5 km of the proposed turbines, comprising 34 non-involved receivers on properties that are not associated with the Project (15 dwellings and 19 campsites), and six residential dwellings on properties associated with the Project (involved receivers).

Noise levels associated with each of the main construction activities have been predicted at the nearest receivers and are considered typical for the construction of a wind farm. The highest noise levels are predicted to occur during cable trench digging near a non-involved receiver, followed by the construction of powerlines (overhead and underground) and access roads. However, the works associated with these construction activities would progress relatively quickly and these levels would therefore only be expected to be reached for a short period of time, typically less than three to four weeks and less than one week for the highest noise level associated with cable trench digging. The predicted noise levels for use of the quarry during construction are lower than the most stringent Noise Protocol limit of 36 dB applicable to the night period, by at least 5 dB, at all three receivers located within 5 km of the quarry. The predicted noise levels for the ten receivers within 5 km of the concrete batching plants are lower than the most stringent Noise Protocol noise limit of 32 dB applicable to the night period by at least 10 dB at nine of the 10 assessed receivers. Operational noise levels from the proposed eastern concrete batching plant are estimated to be above the night base noise limit by 1 dB at receiver 676. However, this is an abandoned dwelling owned by an involved landowner involved, and a noise agreement is in place between the Proponent and the landowner covering both the construction and operation of the Project.

One non-involved receiver (576) is located within the range of distances where vibration could be perceptible and potentially disruptive for the brief period while cable trench digging activities are occurring at the nearest point to the dwelling. Perceptible vibration at this receiver due to cable trench digging activities is expected to be manageable via resident consultations, appropriate scheduling, and prioritising efficient work times to minimum the duration of trench digging nearest to the dwelling, with significant residual impacts unlikely to occur.

A construction Noise and Vibration Management Plan and measures within the Quarry Work Plan will detail all reasonably practicable mitigation measures to be implemented to reduce the risk of harm from construction activity noise and vibration and to fulfil the general environmental duty under the EP Act and achieve the noise limits determined in accordance with the Noise Protocol.

Predicted noise levels for operation of the wind farm have been determined using the sound power levels for the four candidate turbine models. The results demonstrate that wind turbine noise levels associated with the Project are predicted to comply with the noise limits for all receivers and candidate wind turbines.

A pre-development noise assessment will be prepared and submitted to the responsible authority demonstrating that the wind farm is expected to achieve compliance with the operational noise requirements established in accordance with NZS 6808. The pre-development noise assessment will be based on the final wind turbine layout, representative noise emission data for the final selected turbine model and the location of all receivers around the wind farm. A NMP will be prepared and implemented during operation to ensure compliance with operational noise requirements as per the pre-development noise assessment and that there would be no significant adverse impacts.

It is therefore considered that the Project satisfies the relevant noise and vibration evaluation objective specified in the Scoping Requirements, to avoid and minimise adverse effects for community amenity.

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