



Noise Impact Assessment

Macedon BESS

Macedon BESS Development Pty Ltd

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Revision Record

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1.0	18 November 2025	JS	AD	AD

Basis of Report

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

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Executive Summary

This technical report is an attachment to the Macedon BESS Planning Application submission on behalf of Macedon BESS Development.

SLR Consulting has been engaged by Macedon BESS Development to provide a noise and vibration impact assessment of a proposed 188.6 MW / 501 MWh battery energy storage system (BESS) located at Lot 2 Black Forest Drive, Macedon, Victoria.

The proposed site is located in Rural Conservation Zone (RCZ). The closest sensitive receivers are approximately 140 m north east from the project boundary.

Construction noise from the site is managed by scheduling construction activities to the EPA normal working hours (e.g. day period 7.00 am to 6.00 pm). Community engagement and best practice noise management controls including regular maintenance, broadband reversing beepers etc. will be implemented to minimise residual risk of impact or harm to nearby receivers.

Noise emission data of batteries and silenced inverter units provided by original equipment manufacturers (OEM) were used as a basis for the operational noise assessment. The predicted noise levels were assessed against the various requirements of EPA Victoria (EP Act, EP Regulations and Noise Protocol limits and GED).

The operational noise assessment indicates that with feasible and reasonable mitigation measures being implemented, compliance can be demonstrated with the Noise Protocol. The recommended measures include a 4 m noise wall at the boundary of the BESS. Cumulative noise from Powercor substation was factored in the noise model.

Low frequency noise was assessed in accordance with the Low Frequency Guidelines and demonstrated that the risk of problematic low frequency noise at the closest receivers is low.

Accordingly, the Project meets the relevant Regulations and is not expected to have an unreasonable acoustic impact on the surrounding area.

All plant, equipment and design layout will be reviewed during the detailed design stage to ensure that compliance with the noise criteria, including cumulative noise, is maintained as OEMs are selected and the acoustic performance of the plant and layout is refined.

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Table of Contents

Basis of Report	i
Executive Summary	ii
1.0 Introduction	1
2.0 Project Site & Surrounding Area	1
3.0 Background Noise Monitoring	4
3.1 Methodology.....	4
3.2 Monitoring Results.....	5
4.0 Victorian Regulations – Project Criteria	5
4.1 General Environmental Duty.....	5
4.2 Noise Criteria	6
4.2.1 EP Act 2017	6
4.2.2 EP Regulations and Noise Protocol 2021	6
4.2.3 Low Frequency Noise Guidelines	8
4.3 Construction Noise Criteria.....	9
4.4 Construction Vibration Criteria.....	10
5.0 Noise Assessment	10
5.1 General Modelling Assumptions	10
5.2 Construction Noise Assessment.....	11
5.2.1 Construction Activities	11
5.3 Operational Noise Assessment	11
5.3.1 Noise Sources	11
5.3.2 Noise Characteristics	12
6.0 Assessment Results	13
6.1 Construction Noise Assessment.....	13
6.2 Qualitative Construction Vibration Assessment	14
6.3 Operational Noise Assessment	15
6.4 Low Frequency Noise.....	16
7.0 Conclusions.....	17

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Tables

Table 1	Noise Sensitive Receivers	2
Table 2	Noise Monitoring Results Summary	5
Table 3	Definitions of Day, Evening and Night Periods.....	7
Table 4	Noise Protocol Limits	8



Table 5	Outdoor Low Frequency Noise Threshold Levels	8
Table 6	EPA Publication 1834 November 2020 Construction Noise Guidelines.....	9
Table 7	Vibration Velocity Damage Risk and Annoyance Risk Criteria (mm/s Peak)	10
Table 8	Construction Scenarios and Equipment.....	11
Table 9	Equipment Sound Power Levels – BESS & HV Transformer	12
Table 10	Equipment Sound Power Levels - Powercor Substation	12
Table 11	Construction Assessment Results	13
Table 12	CVNG Recommended Minimum Working Distances from Vibration Intensive Equipment	14
Table 13	EPA Noise Protocol Assessment – Night Period.....	15
Table 14	Predicted Low Frequency Noise at Receivers.....	16

Figures

Figure 1	Map of project site & surroundings.....	1
Figure 2	Sensitive receiver and noise monitoring locations.....	2
Figure 3	Proposed Site Layout	3
Figure 4	Photo of Installed Monitoring Equipment.....	4
Figure 5	Recommended Noise Barrier.....	15
Figure 6	Predicted Noise Contours	16

Appendices

Appendix A	Noise Monitoring Results
Appendix B	Construction Noise Sources
Appendix C	BESS Equipment Data

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1.0 Introduction

Macedon BESS Development Pty Ltd is proposing to develop a 188.6 MW / 501 MWh battery energy storage system (BESS) located at Lot 2 Black Forest Drive, Macedon ('the Project').

SLR Consulting Pty Ltd (SLR) has been engaged by Macedon BESS Development Pty Ltd to undertake a noise impact assessment in relation to the planning application for the project.

2.0 Project Site & Surrounding Area

The site is located in a low-density rural area with farming and residential properties, as shown in **Figure 1** below.

Figure 1 Map of project site & surroundings



The area surrounding the site includes;

- Macedon-Woodend Road and residential properties to the east.
- An electrical substation (operated by Powercor) to the south.
- Calder Freeway and Rural Conservation Zone (RCZ) to the west.

The nearest sensitive receivers are presented in **Table 1** and **Figure 2**.

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Table 1 Noise Sensitive Receivers

Receiver ID	Address	Distance to project site
R1	121 Lawson Road	620 metres
R2	2 Allison Lane	440 metres
R3	2 Allison Lane	520 metres
R4	96 Black Forest Drive	300 metres
R5	62 Black Forest Drive	140 metres
R6	48 Black Forest Drive	140 metres
R7	11 Mount Macedon Road	400 metres

Figure 2 Sensitive receiver and noise monitoring locations

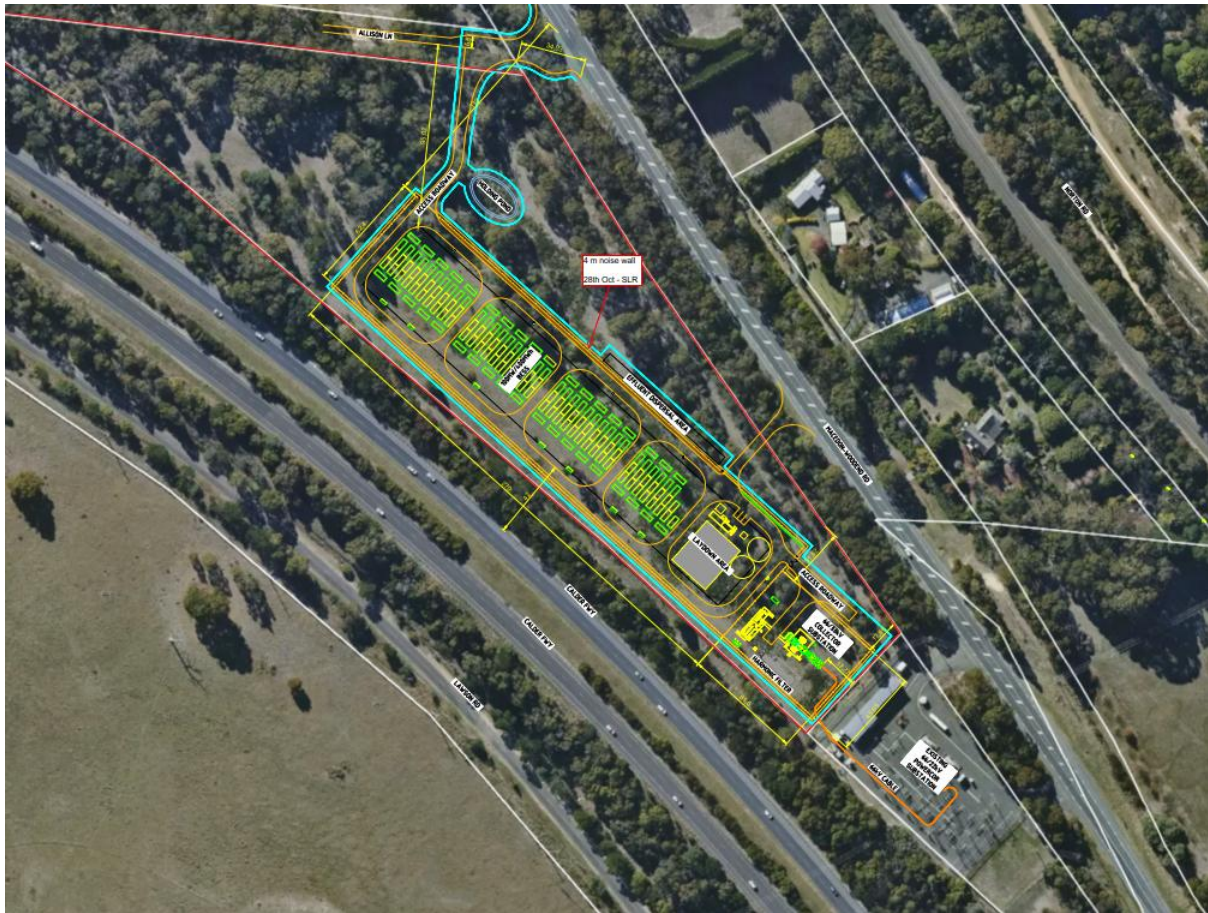


The project site layout (dated 27/10/2025) is shown in **Figure 3** and includes the following:

- 123 containerised batteries
- 41 inverters
- 1 high-voltage transformers in the south-east corner of the site
- 7 auxiliary transformers
- 1 harmonic filter located to the south-east
- a connection to the existing substation located to the south-east

- access roads around the site

Figure 3 Proposed Site Layout



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3.0 Background Noise Monitoring

3.1 Methodology

Noise monitoring was conducted to determine background noise levels for the EPA Noise Protocol 'noise limits based on background noise level assessment'. The monitoring was conducted from Friday 28th February 2025 for a period of one week.

The monitoring location was near the eastern boundary of the project site, as shown in **Figure 2** (NM1). A photo of the installed monitoring equipment is shown in **Figure 4** below.

Figure 4 Photo of Installed Monitoring Equipment



Noise monitoring was conducted in accordance with *AS 1055:2018 Acoustics- Description and measurement of environmental noise*. The monitoring equipment consisted of an *NTi XL2 Acoustic Analyser*, serial number A2A-18552-E0. This monitoring equipment has current NATA calibration, and field checks of the calibration were conducted at the start and end of the monitoring, and no drift in noise level was observed.

The average background noise level was determined in accordance with EPA Victoria Environmental Protection Regulations 2021. Monitoring data potentially affected by rain or wind was excluded from the analysis.

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3.2 Monitoring Results

Table 2 below presents the monitoring results summary. Detailed monitoring results are presented in **Appendix A**.

Table 2 Noise Monitoring Results Summary

Date	L90, 1h, dBA		
	Day	Eve	Night
Friday, 28 February 2025	55	54	35
Saturday, 1 March 2025	53	53	37
Sunday, 2 March 2025	-	58	41
Monday, 3 March 2025	58	54	42
Tuesday, 4 March 2025	52	51	37
Wednesday, 5 March 2025	53	55	42
Thursday, 6 March 2025	58	55	40
<i>Minimum within measurement period</i>	<i>52</i>	<i>51</i>	<i>35</i>

4.0 Victorian Regulations – Project Criteria

4.1 General Environmental Duty

The general environmental duty (GED) is at the centre of the Environment Protection Act 2017 (EP Act), and it applies to all Victorians. GED states that a person who is engaging in an activity that may give rise to risks of harm to human health or the environment from pollution or waste must minimise those risks, so far as reasonably practicable.

Under the Act, harm, in relation to human health or the environment, means an adverse effect on human health or the environment (of whatever degree or duration) and includes:

- an adverse effect on the amenity of a place or premises that unreasonably interferes with or is likely to unreasonably interfere with enjoyment of the place or premises; or
- a change to the condition of the environment to make it offensive to the senses of human beings; or
- anything prescribed to be harm for the purposes of the Act or the regulations; and
- Should consider potential cumulative effect of harm arising from an activity combined with harm arising from other activities or factors.

To determine what is (or was at a particular time) reasonably practicable in relation to the minimisation of risks of harm to human health and the environment, regard must be had to the following matters:

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



In the assessment of noise impacts with reference to GED, consideration must first be given to eliminating risks so far as reasonably practicable, and then to reducing those risks so far as reasonably practicable.

4.2 Noise Criteria

Certain types of noise within Victoria are regulated. The following sections provide an overview of how regulated noise is assessed in Victoria.

4.2.1 EP Act 2017

The EP Act prescribes that a person must not, from a place or premises that are not residential premises—

- emit an unreasonable noise; or
- permit an unreasonable noise to be emitted

Unreasonable noise means noise that—

- is unreasonable having regard to the following—
 - its volume, intensity, or duration
 - its character
 - the time, place, and other circumstances in which it is emitted
 - how often it is emitted
 - any prescribed factors, or
- is prescribed to be unreasonable noise

For the purposes of the above definition, ‘frequency spectrum’ is a prescribed factor.

The EP Act prescribes that, noise emitted from commercial, industrial and trade premises is prescribed to be aggravated noise if:

- in the case of noise emitted during the day period, the effective noise level exceeds the lower of the following:
 - 75 dBA
 - the noise limit plus 15 dB, and
- in the case of noise emitted during the evening period, the effective noise level exceeds the lower of the following:
 - 70 dBA
 - the noise limit plus 15 dB, and
- in the case of noise emitted during the night period, the effective noise level exceeds the lower of the following—
 - 65 dBA
 - the noise limit plus 15 dB.

4.2.2 EP Regulations and Noise Protocol 2021

The Environmental Protection Regulations 2021 (EP Regulations) support the EP Act by providing clarity and further detail for duty holders on how to fulfil their obligations. Regulations are used to deal with matters in detail and may contain their own penalties for breaches.

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In Victoria, noise emissions from commercial, industrial and trade premises are not permitted to be unreasonable or aggravated, and are subject to the provisions of the Regulations, and the *“Noise limit and assessment protocol for the control of noise from commercial, industrial and trade premises and entertainment venues”*, EPA Publication 1826.4 May 2021 (the Noise Protocol).

The Noise Protocol presents the methodology for determining the noise limit (maximum allowable level of noise emitted from a premise) when measured in a noise sensitive area. Noise sensitive areas are defined in the Regulations as that part of the land within the boundary of a parcel of land that is within 10 m of the outside of the external walls of a place where people generally sleep (homes, dormitories, hotels, hospitals, correctional facilities etc.), schools (including childcare centres) and tourist establishments in rural areas (campgrounds, caravan parks, etc.).

Table 3 presents the assessment periods prescribed by the Regulations.

Table 3 Definitions of Day, Evening and Night Periods

Period	Day	Time
Day	Monday to Saturday (except public holidays)	7:00 am – 6:00 pm
Evening	Monday to Saturday Sunday and public holidays	6:00 pm – 10:00 pm 7:00 am – 10:00 pm
Night	Monday to Sunday	10:00 pm – 7:00 am

Rural Method – Noise Limits

With regard to the Macedon BESS site, all noise sensitive receivers are located outside of the Major Urban Area, therefore the determination of noise criteria follows the Rural Method. Due to significant levels of background noise in the area, the noise limits have been determined using the ‘noise limits based on background level’ section of the Rural Method.

The calculation of noise limits based on the background level assessment is as follows:

- a. For the day period, the noise limit is the greater of:
 - i. The distance adjusted level or base noise level, or
 - ii. The day background level plus 8 dB
- b. For the evening period, the noise limit is the greater of:
 - i. The distance adjusted level or base noise level, or
 - ii. The evening background level plus 5 dB
- c. For the night period, the noise limit
 - i. Is the greater of –
 1. The distance adjusted or base noise level, or
 2. The night background plus 5 dB
 - ii. Must not be greater than 55 dBA.

Based on the results of the background noise monitoring, the calculated EPA Noise Protocol limits are shown in **Table 4** below.

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Table 4 Noise Protocol Limits

Period	Noise Limit, dBA Leq
Day	60 (52+8)
Evening	56 (51+5)
Night	40 (35+5)

Cumulative Noise Impacts

Regulation 119 of the EP Regulations states that the noise contributions from all commercial, industrial and trade premises must not exceed the noise limit for a noise sensitive area. Therefore noise from all commercial and industrial operations are required to cumulatively comply with the identified noise limits.

In order to assess the cumulative impact from all industrial premises near the subject site, noise from the existing Powercor substation has been included in the acoustic modelling. No other surrounding industries are expected to have any meaningful contribution to the sensitive receivers identified.

4.2.3 Low Frequency Noise Guidelines

EPA Publication 1996 “Noise guidelines: Assessing low frequency noise” (LFNG) provides guidance for acoustic consultants and other qualified professionals who assess low frequency noise (10Hz – 160Hz).

Frequency spectrum is a prescribed factor under the EP Act and subordinate legislation. The assessment of frequency spectrum applies to noise from commercial, industrial and trade premises only.

Low frequency noise emitted from commercial, industrial and trade premises should be assessed by comparing its frequency spectrum to the relevant threshold levels. Specifically, Z-frequency weighted (unweighted or linear) measurements in one-third octave bands from 10 Hz to 160 Hz are compared with low frequency threshold levels.

The threshold levels are not set limits. Rather, they are levels that indicate a potential risk of problematic low frequency noise. The disturbance from low frequency noise depends on the:

- noise level,
- characteristics that can increase annoyance with the noise, for example, tonality, frequency modulation,
- baseline noise levels in the absence of the noise of concern.

Table 5 details the outdoor low frequency noise threshold levels, which would apply for levels measured outdoors and based on the assumed façade noise reductions given in Downey and Parnell (2017).

Table 5 Outdoor Low Frequency Noise Threshold Levels

Outdoor 1/3 Octave Low Frequency Noise Threshold Levels													
Freq, Hz	10	12.5	16	20	25	31.5	40	50	63	80	100	125	160
Leq, dB	92	89	86	77	69	61	54	50	50	48	48	46	44

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4.3 Construction Noise Criteria

The *Civil construction, building and demolition guide* (EPA Publication 1834 November 2020) adopts a primary mechanism of reducing noise and vibration impacts through limiting the times of operation of noisy equipment, vehicles and operations. Whilst EPA Publication 1834 November 2020 does not establish objective noise goals or limits for works conducted during Normal Working Hours, it states that construction noise should be minimised as far as possible in any situation and that a noise impact assessment may be used to inform the risk assessment process for construction works and to inform plans for the management of noise generated during construction.

Table 6 presents the EPA construction noise guidelines.

Table 6 EPA Publication 1834 November 2020 Construction Noise Guidelines

Time of day	Construction noise guidelines
Normal working hours: 7 am – 6 pm Monday to Friday 7 am – 1 pm Saturday	Minimise as far as possible in any situation
Weekend/evening work hours: 6 pm – 10 pm Monday to Friday 1 pm – 10 pm Saturday 7 am – 10 pm Sunday and Public Holidays	Noise level at any residential premises not to exceed background noise (L ₉₀) by: • 10 dBA or more for up to 18 months • 5 dBA or more after 18 months
Night period: 10 pm – 7 am Monday to Sunday	Noise inaudible within a habitable room of any residential premises

EPA Publication 1834 November 2020 details that whilst projects should aim to constrain works to normal working hours, where necessary, works or activities outside normal working hours may occur for:

- **Low-noise impact works** – these are inherently quiet or unobtrusive, for example, manual painting, internal fitouts, and cabling. Low-noise works do not have intrusive characteristics such as impulsive noise or tonal movement alarms.
- **Managed-impact works** – works where the noise emissions are managed through actions specified in a noise and vibration management plan (may be part of a broader environmental management plan), to minimise impacts on sensitive receivers. Managed-impact works do not have intrusive characteristics such as impulsive noise or tonal movement alarms.
- **Unavoidable works** – are works which pose an unacceptable risk to life or property or a major traffic hazard and can be justified. Includes an activity which has commenced but cannot be stopped. A project would need to demonstrate that planned unavoidable works cannot be reasonably moved to normal work hours. This requires additional consideration of potential noise and vibration generating activities and controls to minimise noise and vibration. These can be recorded within the noise and vibration management plan (may be part of a broader environmental management plan).

It is anticipated that most construction activities related to the Project will be able to be completed during EPA normal working hours, with the exception of unavoidable works (if required) and low-noise impact works.

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4.4 Construction Vibration Criteria

The effects of vibration in buildings can be divided into three main categories (in increasing levels of vibration exposure);

- Annoyance or disturbance of occupants
- Disturbance of objects within the structure and cosmetic damage
- Structural damage

Vibration limits are commonly designed to minimise the risk of cosmetic damage and are set well below the levels that have potential to cause structural damage. The British Standard BS 7385 Part 2-1993 *Evaluation and measurement for vibration in buildings Part 2*, provides frequency-dependent vibration limits related to cosmetic damage risk.

The German Standard DIN 4150-3: 1999 *Structural Vibration Part 3: Effects of vibration in structures* provides guideline values for evaluating the effect of vibration on sensitive structures, such as buried pipework.

The EPA publication *Assessing Vibration: a technical guide (DEC 2006)* provides preferred values for continuous and impulsive vibration levels associated with a low probability of annoyance from occupants. The applicable damage risk and annoyance risk vibration velocity criteria are summarised in **Table 7**.

Table 7 Vibration Velocity Damage Risk and Annoyance Risk Criteria (mm/s Peak)

Receiver Area	Damage Risk (mm/s)		Annoyance Risk (mm/s)	
	Horizontal	Vertical	Horizontal	Vertical
Residential/Dwellings	7.5	7.5	1.2	0.45
Commercial/Offices	25	25	1.6	0.6
Industrial/Workshops			3.2	1.2
Reinforced structures (ie concrete buildings)			-	-

5.0 Noise Assessment

A 3D noise model was constructed within the modelling software SoundPLAN 9.1 to predict noise levels at the nearby sensitive receivers.

Noise modelling was conducted using the algorithms of ISO 9613-2¹, which predicts the A-weighted sound pressure levels under meteorological conditions favourable to propagation from sources of known sound power levels. This enhanced propagation is equivalent to downwind propagation or a moderate ground-based temperature inversion. The model also includes attenuation due to air absorption, ground attenuation and shielding.

5.1 General Modelling Assumptions

The following general assumptions are made based on best-practice modelling methods to suit the project:

- A reflection-order of three (3).

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¹ ISO 9613-2:1996 *Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation*



- Source height were set according to the source item.
- Receivers are in the acoustic free field, 1.5 m above ground level.
- All equipment is assumed to be in operation for the entire 30 minute assessment period.
- Ground topography was sourced from publicly available 5 meters digital elevation data from VIC Government.
- Ground absorption is modelled by a single number parameter between 0 (hard – reflective) and 1 (soft – absorptive). The existing Powercor substation, Macedon BESS substation and BESS infrastructure were modelled as hard ground, all other ground surfaces were modelled with a ground absorption parameter of 0.6.

5.2 Construction Noise Assessment

The following standard construction hours are proposed for the Project:

- Monday to Friday - 7 am to 6 pm.
- Saturday – 7 am to 1 pm.
- Sunday and Public Holidays - No works to be undertaken.

No works are proposed to be undertaken outside of the standard construction hours.

5.2.1 Construction Activities

Representative scenarios have been developed to assess the likely impact from the various construction phases of the proposal. These scenarios are shown in **Table 8**.

The sound power levels for the construction equipment used in each scenario are presented in **Appendix B**.

Table 8 Construction Scenarios and Equipment

Scenario	Works Activity	Equipment
W.01	Vegetation Clearing	Chainsaw, chipper, excavator, front end loader, dump truck, water truck
W.02	Earthworks	Dozer, excavator, front end loader, vibratory roller, dump truck, water truck, rockbreaker
W.03	Construction of pads and hardstands	Concrete pump, concrete truck/agitator, concrete vibrator
W.04	Equipment installation	Elevated working platform, flatbed truck, hand tools, mobile crane
W.05	Noise walls installation	Bored piling rig, hand tools, dump truck

5.3 Operational Noise Assessment

5.3.1 Noise Sources

All equipment items are assumed to be in operation for the entirety of a 30-minute assessment period. Noise emissions of the BESS equipment are typically dominated by cooling equipment, which can be variable depending on the percentage of maximum power



(charge/discharge) and the subsequent temperatures, both ambient and that being generated by the equipment.

Sound power levels (SWL) and quantities of noise producing equipment are shown in **Table 9**. The sound power levels are based on the performance of currently available containerised battery and inverter models including OEM developed attenuation packages. The spectral noise data for the modelled battery and inverter are provided in **Appendix C**.

It is noted that the noise contribution from the auxiliary transformers and harmonic filter at the closest sensitive receiver is negligible, as their SWL are significantly lower (>10 dB) than those of the battery and inverter units.

The SWL for the Powercor substation transformers shown in **Table 10** were adopted from AS 60076.10:2009 reduced maximum (33 MVA rating).

Table 9 Equipment Sound Power Levels – BESS & HV Transformer

Qty	Item	Sound Power Level (SWL), per unit $L_{eq\ 30\ min, dBA}$
123	Battery Container	76 ¹
41	Inverter	85 ²
1	High Voltage Transformer	86 ³
Notes: 1: SWL and spectrum based on battery container operating at 100% fan setting with silencer kit. 2: SWL and spectrum based on a charging Inverter operating at 100% fan speed with noise reduction kit. 3: Based on AS 60076.10:2009 reduced maximum (100 MVA rating).		

Table 10 Equipment Sound Power Levels - Powercor Substation

Qty	Item	Sound Power Level (SWL), per unit $L_{eq\ 30\ min, dBA}$
2	Substation Transformer	79

5.3.2 Noise Characteristics

The Noise Protocol contains provisions for adjustments for undesirable noise characteristics such as tonality, impulsiveness and intermittency. If one or more of these characteristics are present at the receiver, then an adjustment is applied to the overall level.

The following outlines the noise characteristics and discusses whether the adjustments are relevant to this assessment.

Tonality

BESS sources may exhibit tonal characteristics. The tonal penalty will be determined by examining the predicted noise level spectrum at sensitive receivers in accordance with the Noise Protocol Section 3.4 and Annex C.

Impulsiveness

The impulsiveness characteristic refers to a dominant sudden pressure peak, or series of peaks, or a single burst with multiple pressure peaks whose amplitude decays with time or a sequence of bursts. Noise due to cooling the BESS is not impulsive in nature.

Intermittency

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Intermittency is present when the noise increases in level rapidly, and by at least 5 dB, on at least two occasions during a 30 minute period and maintains the higher level for at least one-minute.

The cooling fans are expected to cycle up and down as required to cool the batteries and power electronics. However the duty cycle period exceeds 30 minutes and is not considered intermittent. Therefore, no characteristic adjustments have been applied to the following results.

6.0 Assessment Results

6.1 Construction Noise Assessment

Table 11 presents the construction noise results for the modelled scenarios. It is anticipated that construction works would occur during the EPA normal working hours (day) only.

Table 11 Construction Assessment Results

Receiver	W.01 Vegetation Clearing	W.02 Earthworks	W.03 Construction of pads, hardstands & ramps	W.04 Equipment installation	W.05 Noise Wall Installation
R1	56	55	47	48	47
R2	60	59	51	52	51
R3	58	57	49	50	49
R4	62	61	53	54	52
R5	70	69	61	62	62
R6	71	69	61	62	64
R7	61	60	52	53	50

Construction of the BESS facility may be audible from several receivers from time to time, however noise impacts are minimised due to the distance to receivers and works being temporary and conducted during EPA normal working hours (day period) only.

The Australian Standard AS2436-2010 *Guide to Noise Control on Construction, Maintenance and Demolition Sites* sets out numerous practical recommendations to assist in taking all reasonable and practicable measures to prevent or minimise noise impacts.

Noise control strategies to be considered are listed below:

- Ensure construction works to occur during normal working hours:
 - Weekdays: 7 am to 6 pm,
 - Saturday: 7 am to 1 pm.
- Incorporate clear signage at the site including relevant contact numbers for community enquiries.
- The lowest noise emitting plant and equipment that can economically and efficiently undertake the work should be selected where possible.
- Maintain regular maintenance of equipment to keep it in good working order and operating at the lowest feasible noise level.



- Use less intrusive broadband reversing beepers on mobile plant where possible.
- Equipment operators are to be made aware of noise impacts and techniques to minimise emissions through training/instruction, examples include:
 - Avoid dropping materials from height into bins, trucks and receptacles.
 - Operate mobile plant and power tools in a quiet, efficient manner where possible.
 - Switch plant off when not in use.
- Machines/tools found to produce excessing noise compared with industry best practice should be removed from service until repairs or modification can be made, or the machine/tool is replaced.
- Where possible avoid tonal reversing/movement alarms on machinery and replace with broadband (non-tonal) alarms or ambient noise-sensing alarms.
- Use dampened bits on impulsive tools (e.g. ratchet drivers) to avoid 'ringing' noise.

6.2 Qualitative Construction Vibration Assessment

Minimum working distances for typical vibration intensive construction equipment are provided in the NSW Roads and maritime *Construction Noise and Vibration* Guideline (CNVG) and shown in **Table 12**.

The minimum working distances are for cosmetic damage (from BS 7385) and human comfort (from the EPA *Assessing Vibration: A Technical Guide*). Works that occur further from receivers the minimum distances are unlikely to result in vibration impacts.

Table 12 CVNG Recommended Minimum Working Distances from Vibration Intensive Equipment

Plant Item	Rating/Description	Minimum Working Distance	
		Cosmetic Damage	Human Comfort
Vibratory Roller	1-2 tonne	5 m	15 m to 20 m
	2-4 tonne	6 m	20 m
	4-6 tonne	12 m	40 m
	7-13 tonne	15 m	100 m
	13-18 tonne	20 m	100 m
	>18 tonne	25 m	100 m
Small Hydraulic Hammer	300 kg (5 to 12 t excavator)	2 m	7 m
Medium Hydraulic Hammer	900 kg (12 to 18 t excavator)	7 m	23 m
Large Hydraulic Hammer	1,600 kg (18 to 34 t excavator)	22 m	73 m
Piling Rig – Bored	≤ 800 mm	2 m (nominal)	4 m
Jackhammer	Hand held	1 m (nominal)	2 m
Note: More stringent conditions may apply to heritage or other sensitive structures			

Based on the equipment and activities identified for the proposed construction, potential sources of vibration are limited and would likely only occur during site preparation, bulk earthworks and road works.

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The closest two sensitive receivers to the project site are R5 and R6 with distances to the project site boundary of approximately 125 m and 110 m respectively. In this regard, these distances are outside of the minimum working distances as shown in **Table 12**.

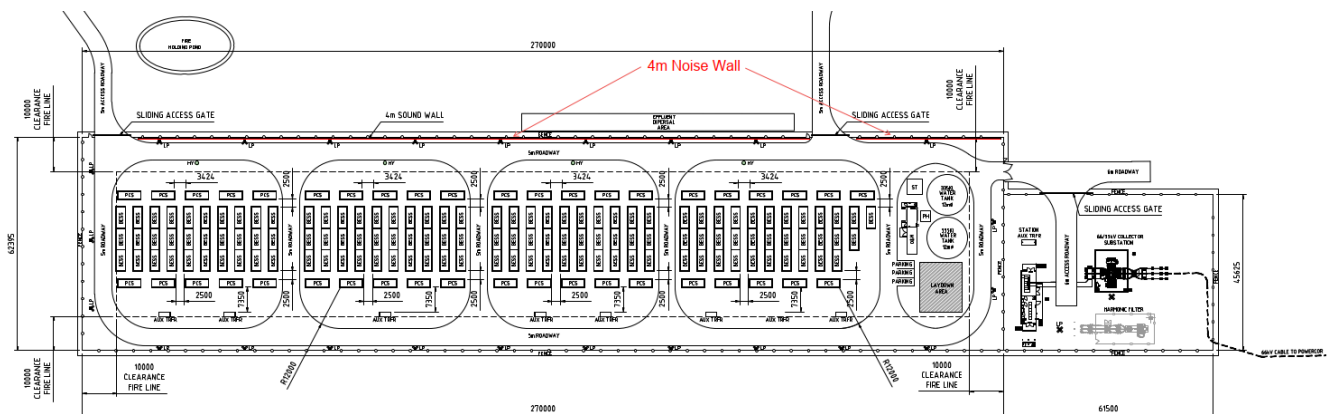
It is therefore expected that vibration generated by the construction works will comply with the requirements of the human comfort and cosmetic damage criteria.

6.3 Operational Noise Assessment

The predicted noise levels at the sensitive receivers were assessed against the noise criteria. Due to the site operating 24 hours a day, the assessment is based on the worst-case night period, therefore the applicable noise limit is 40 dBA Leq.

Initial modelling results for an unmitigated scenario (i.e. without noise barriers) indicated exceedances with the noise limits, therefore a 4 m high noise barrier was designed in order to achieve compliance. The location of the noise barrier is shown in **Figure 5** below.

Figure 5 Recommended Noise Barrier



The night period assessment – inclusive of the proposed noise barrier – is shown in **Table 13** below. These results indicate that compliance with the EPA Noise Protocol night period limit is expected to be achieved, based on the presented noise barrier design.

Noise contours are presented in **Figure 6** below.

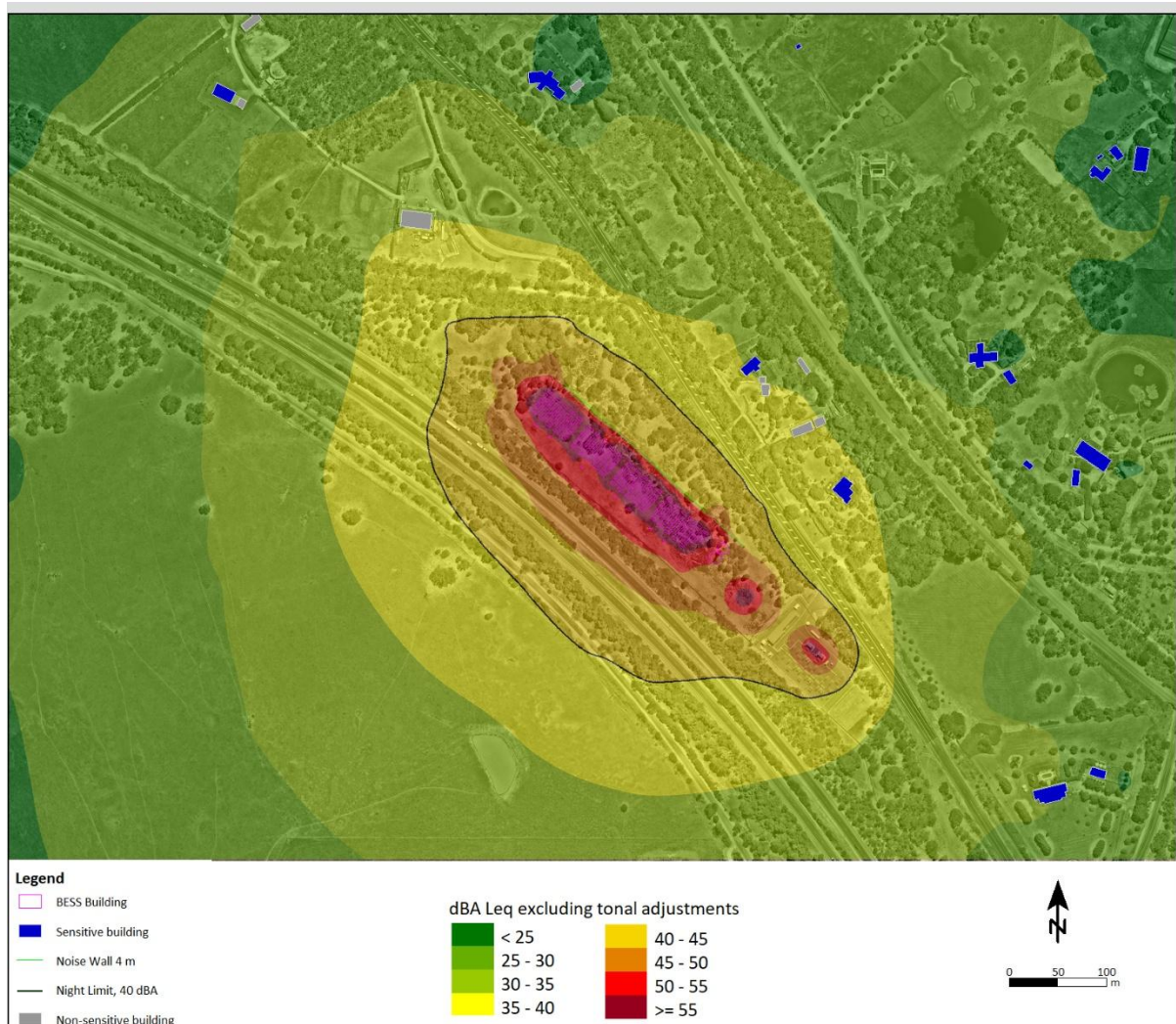
Table 13 EPA Noise Protocol Assessment – Night Period

Receiver	Predicted noise level, dBA	Tonality adjustment	Effective noise level, dBA	Compliance
R1	23	0	23	Y
R2	30	0	30	Y
R3	27	0	27	Y
R4	31	0	31	Y
R5	38	+2	40	Y
R6	38	+2	40	Y
R7	31	0	31	Y

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Figure 6 Predicted Noise Contours



6.4 Low Frequency Noise

The Noise Guidelines: *Assessing Low Frequency Noise* (Publication 1996 June 2021) adopts a low frequency threshold level as a screening tool to identify the potential risk of problematic low frequency noise. Notwithstanding the incomplete supplier data, where the available battery spectral data begins at 50 Hz, and the limitations of modelling low frequency noise with ISO9613 algorithm, exceedances of the frequency bands between 25 and 160 Hz were **not observed** at any assessed receiver.

Table 14 shows the predicted 1/3 octave noise levels between 25 and 160 Hz, for all assessed receivers. The low frequency noise threshold, shown in the final row of **Table 14** is not exceeded.

Table 14 Predicted Low Frequency Noise at Receivers

Receiver	Outdoor 1/3 Octave Low Frequency Noise (Hz)								
	25	31.5	40	50	63	80	100	125	160
R1	26	23	28	34	34	31	27	22	20
R2	34	30	36	39	39	37	31	27	24
R3	28	25	30	35	35	32	29	24	22

Receiver	Outdoor 1/3 Octave Low Frequency Noise (Hz)								
	25	31.5	40	50	63	80	100	125	160
R4	33	29	35	39	39	36	33	28	26
R5	38	34	40	45	45	42	40	36	34
R6	37	33	39	44	44	42	39	36	34
R7	30	26	32	37	37	35	31	28	26
LFN Threshold	69	61	54	50	50	48	48	46	44

7.0 Conclusions

This Noise Impact Assessment was prepared to support a Planning Application for the Macedon BESS. This report presents applicable noise criteria, assessment methodology and results to demonstrate the compliance with the noise limits as proscribed by the Noise Protocol.

Construction noise impacts are controlled by limiting works to day periods and a combination of training/equipment maintenance and community engagement. Construction vibration impacts are unlikely to result in cosmetic damage and human discomfort at the nearest receivers.

Cumulative noise was considered from the project together with the existing Powercor substation in the vicinity of the Project. The operational noise assessment indicates that feasible and reasonable mitigation measures are required to control the impacts from the proposal. The recommended measures include 4 m noise walls as shown in **Figure 5**. With the inclusion of the proposed noise wall, operational noise levels are expected to comply with the noise limits at all receivers throughout the day, evening and night period.

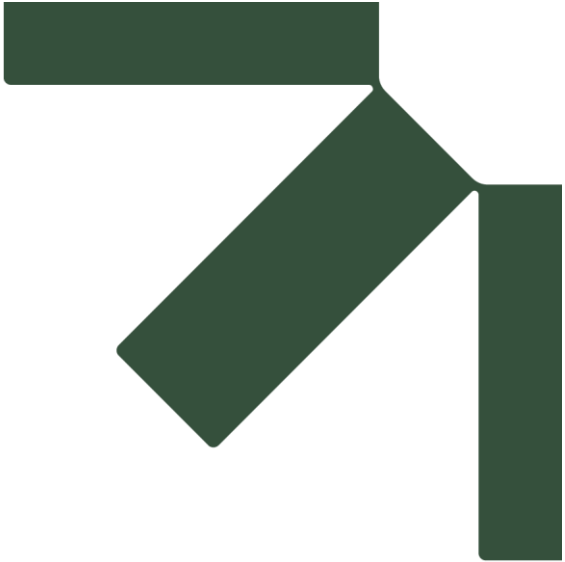
Low frequency noise was assessed in accordance with the Low Frequency Guidelines and demonstrated that the risk of problematic low frequency noise at the closest receivers is low.

The Project is predicted to meet the relevant noise criteria and legislation at all times with the modelled battery and inverter units along with the recommended mitigation measures. The Project is not expected to negatively impact the surrounding areas.

All plant, equipment and design layout will be reviewed during the detailed design stage to ensure that compliance with the noise criteria, including cumulative noise, is maintained as the acoustic performance of the plant and layout is refined.

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Appendix A Noise Monitoring Results

Noise Impact Assessment

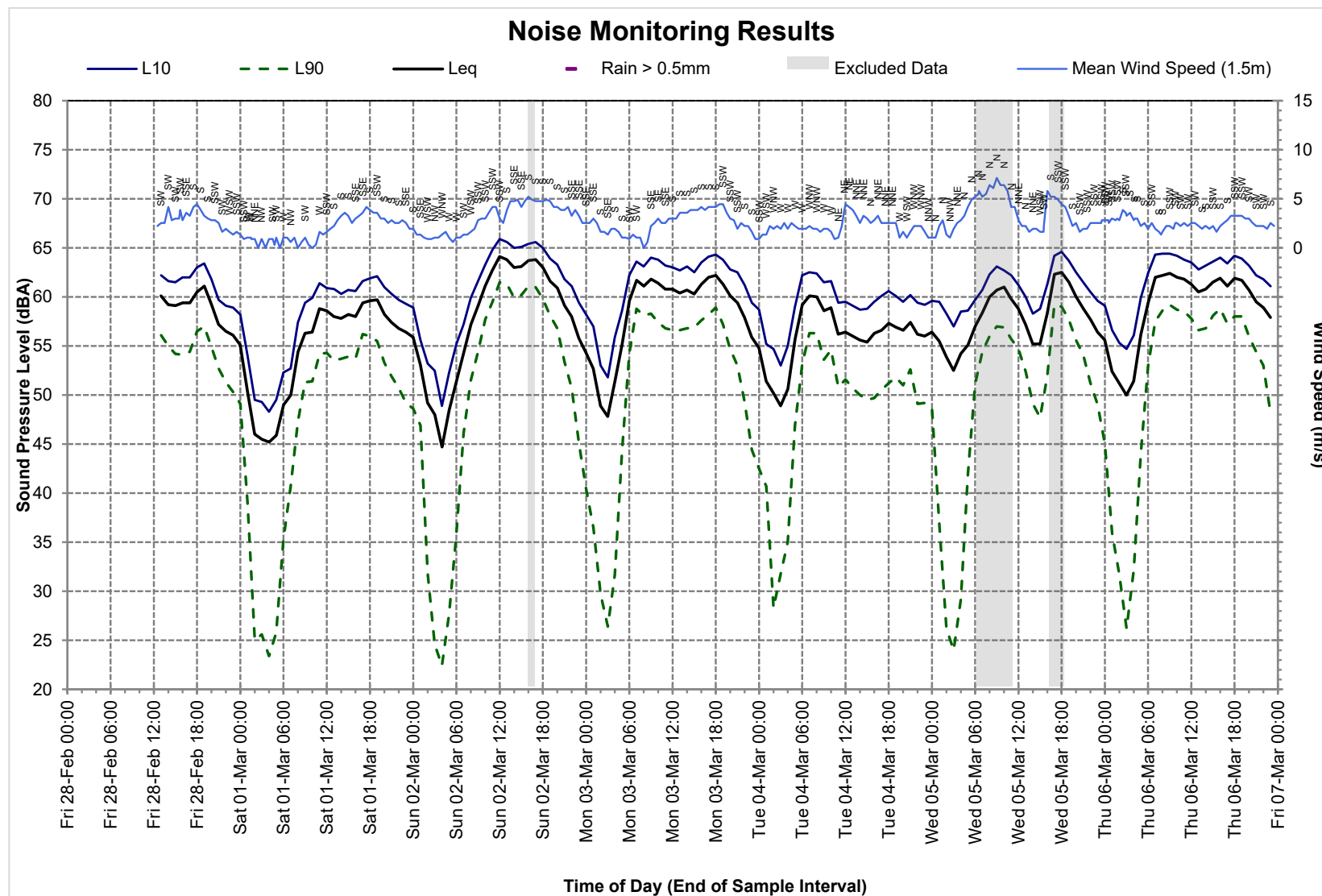
Macedon BESS

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Appendix B Construction Noise Sources

Noise Impact Assessment

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Equipment	Total SWL	Chainsaw	Chipper	Concrete Pump	Concrete Truck	Concrete Vibrator	Crane - Mobile (100t)	Dozer	Elevated Working Platform	Excavator (20t)	Front End Loader	Hand Tools	Roller - Vibratory	Rockbreaker	Truck - Dump	Truck - Flatbed	Water Truck	Bored Piling Rig
Sound Power Level²		119	120	109	109	113	113	116	97	105	112	104	114	117	110	103	107	116
Estimated on-time in any 15 minutes		5	15	10	15	5	15	10	15	10	10	15	15	10	10	10	10	15
<u>Scenario</u>																		
W.01 Vegetation clearing	122	X	X							X	X				X		X	
W.02 Earthworks	121							X		X	X		X	X	X		X	
W.03 Construction of pads, hardstands & ramps	113			X	X	X												
W.04 Equipment installation	114						X		X			X				X		
W.05 Noise walls installation	117											X			X			X

Note 1: Sound power level data is taken from the DEFRA Noise Database, TfNSW Construction and Vibration Guideline and TfNSW Construction Noise and Vibration Strategy

Appendix C BESS Equipment Data

Noise Impact Assessment

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Battery

Frequency (Hz)	A-weighted Sound Power Level (dB)
	100% Fan Duty with Silencer
50	79
63	78
80	76
100	78
125	72
160	71
200	74
250	71
315	69
400	75
500	69
630	68
800	66
1000	65
1250	63
1600	63
2000	60
2500	58
3150	54
4000	53
5000	55
6300	54
8000	49
10000	48
Total (dBA)	76

Note: Original noise report from the OEM can be supplied by the Project upon request.

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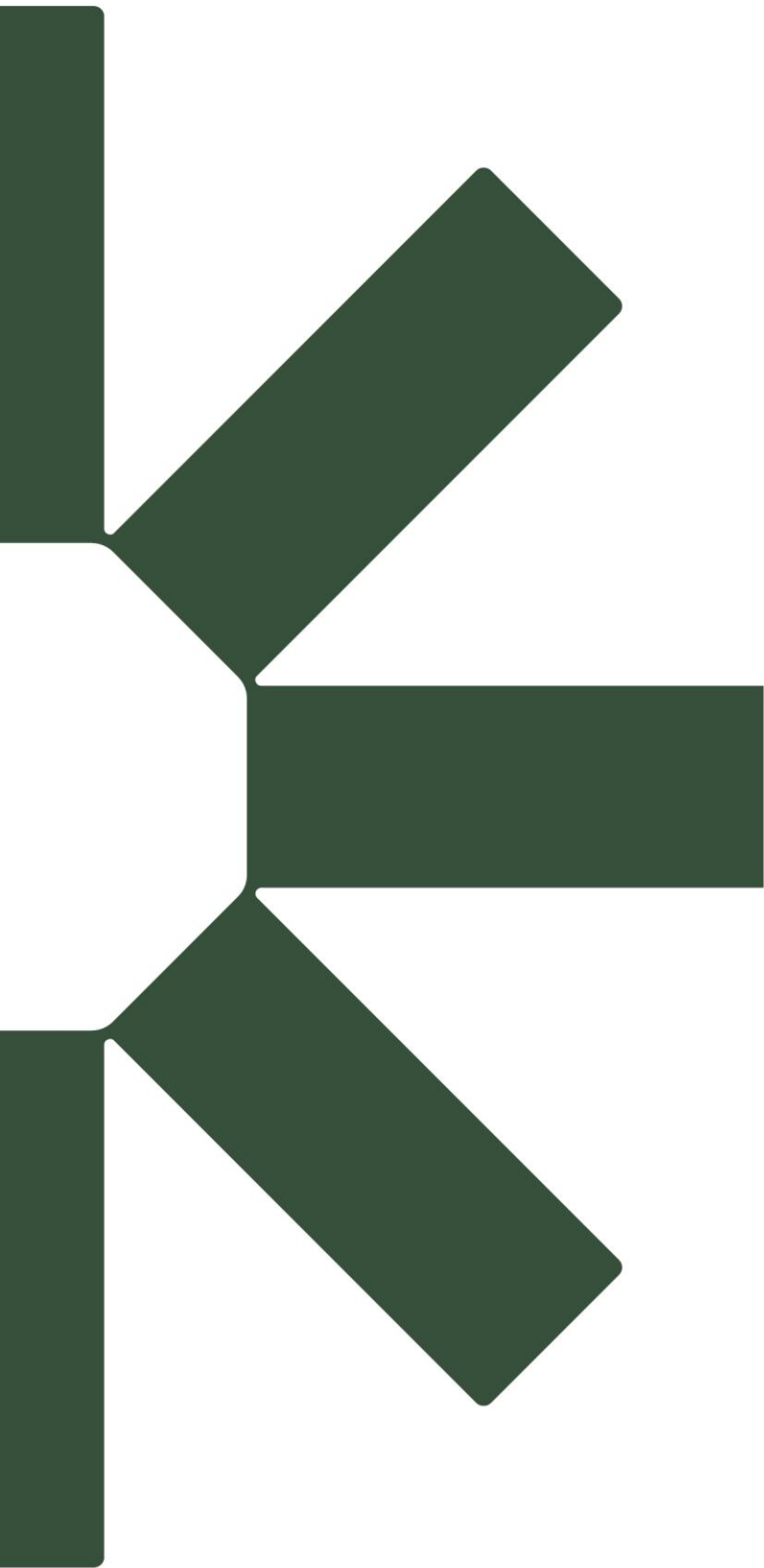
Inverter

Frequency (Hz)	A-weighted Sound Power Level (dB)
	100% Fan Duty with Attenuation
25	79
31	75
40	81
50	80
63	82
80	79
100	78
125	77
160	72
200	73
250	69
315	72
400	72
500	72
630	68
800	70
1000	67
1250	64
1600	62
2000	61
2500	74
3150	79
4000	61
5000	67
6300	79
8000	69
10000	69
Total (dBA)	85

Note: Original noise report from the OEM can be supplied by the Project upon request.

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