



Appendix I:

Noise Impact Assessment

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Noise Impact Assessment

Camperdown BESS

Camperdown BESS Pty Ltd

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Prepared by:

SLR Consulting Australia Pty Ltd

SLR Project No.: 620.041535.00001

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Revision Record

Revision	Date	Prepared By	Checked By	Authorised By
001	22 May 2026	Jenq Sim	Arvind Deivasigamani	Arvind Deivasigamani

Basis of Report

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

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Executive Summary

This technical report is an attachment to the Camperdown BESS Planning Permit application submission on behalf of Camperdown BESS Pty Ltd.

SLR Consulting Pty Ltd (SLR) was engaged by Camperdown BESS Pty Ltd (Camperdown BESS) to provide a Noise Impact Assessment for a Battery Energy Storage System (BESS) of 60 megawatt (MW) / approximately 240 megawatt hours (MWh) at the point of connection, located at Wire Lane, Camperdown, Victoria (the 'Subject Site'). The Subject Site is identified as Lot 2 of LP34716 and Lot 2 of PS817143.

Noise emission data of inverter units provided by original equipment manufacturers (OEM) were used as a basis for the assessment. As for the battery units, no OEM has been selected at this stage, so conservative sound power level assumptions were used to represent Day, Evening and Night operations. Although the battery OEM is not confirmed at this stage, this assessment demonstrates the feasibility of the BESS in the planned site and layout.

Predicted noise levels at the closest sensitive receivers were assessed against the various requirements of the Environment Protection Authority (EPA) Victoria (EP Act, EP Regulations, and Noise Protocol limits and General Environmental Duty):

- Compliance with the Noise Protocol is expected at all sensitive receivers for all time periods for the modelled scenarios.
- Cumulative noise impacts of the Project and the industries to the west and south of the Project were also assessed, with compliance expected at all noise sensitive receivers.
- Low frequency noise was assessed in accordance with the Low Frequency Guidelines and demonstrated that the risk of problematic low frequency noise is low.

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 finalised OEMs are selected and the acoustic performance of the plant and layout is refined. When selecting the battery OEM, it is also important to assess any potential tonal characteristics in accordance with the EPA requirements.

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Table of Contents

Basis of Report	i
Executive Summary	ii
Acronyms and Abbreviations	iv
1.0 Introduction	1
1.1 Terminology	1
2.0 Project Area and Sensitive Receivers.....	2
3.0 Victorian Regulations – Project Criteria	4
3.1 General Environmental Duty.....	4
3.2 Regulated Noise Criteria	4
3.2.1 EP Act 2017	4
3.2.2 EP Regulations and Noise Protocol 2021	5
3.2.3 Cumulative Noise Impacts	7
3.2.4 Low Frequency Noise Guidelines	8
4.0 Noise Assessment	10
4.1 General Modelling Assumptions	10
4.2 Noise Sources and Scenarios of Modelling	10
4.2.1 Noise Characteristics	11
4.2.2 Low Frequency Noise	11
4.3 Operational Noise Assessment Results	12
5.0 Conclusion.....	13

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Tables

Table 1 Sensitive Receivers	2
Table 2 Definitions of Day, Evening and Night (Environmental Protection Regulations 2021)	6
Table 3 Noise Limits	7
Table 4 Cumulative Industry Adjustment	8
Table 5 Outdoor Low Frequency Noise Threshold Levels	9
Table 6 Equipment and Sound Power Levels	10
Table 7 Operational Noise Results	12

Figures

Figure 1 BESS Layout and Sensitive Receivers	3
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Acronyms and Abbreviations

BESS	Battery Energy Storage System
dB	Decibel
dBA	A-weighted decibel
EPA	Environment Protection Authority
EP Act	Environment Protection Act 2017
EP Regulations	Environmental Protection Regulations 2021
FZ	Farming Zone
GED	General Environmental Duty
GRZ	General Residential Zone
Hz	Hertz
kHz	Kilohertz
LDRZ	Low Density Residential Zone
LFNG	EPA Publication 1996 "Noise guidelines: Assessing low frequency noise"
MVA	Megavolt-Ampere
MW	Megawatt
MWh	Megawatt Hour
OEM	Original Equipment Manufacturer
SLR	SLR Consulting Australia Pty Ltd
SWL	Sound Power Level

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1.0 Introduction

SLR Consulting Pty Ltd (SLR) has been engaged by Camperdown BESS (the Proponent) to undertake a Noise Impact Assessment to support a Planning Permit application in relation to the development of a utility-scale Battery Energy Storage System (BESS) located at Wiridgil Road, Camperdown, VIC 3260 (Lot 2 LP34716 and Lot 2 PS817143) (the Project).

1.1 Terminology

The areas of investigation and assessment discussed within this report for the Project include:

- *the Project* – the proposed Camperdown BESS;
- *Subject Site* – consisting of Lot 2 LP34716 and Lot 2 PS817143;
- *Project Area* – the area associated with the Project within the Subject Site. This consists of all compounds and equipment within the Project boundary fence including the BESS compound, Substation compound, O&M Buildings, Control Room, Switch Room and internal roads.

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2.0 Project Area and Sensitive Receivers

The Project is in the Farming Zone (FZ) located at Wire Lane, Camperdown VIC 3260 (Lot 2 of LP34716 and Lot 2 of PS817143).

The Project layout and sensitive receivers' location are shown in **Figure 1**.

All representative sensitive receivers, associated plan zone, and their approximate distance to the BESS centroid are listed in **Table 1**. The receiver IDs used in this report are specific to this assessment and do not correspond to receiver IDs referenced in other technical reports submitted as part of this application.

Rather than identifying each sensitive receiver individually, a selection of representative receivers has been identified encompassing locations in all directions around the Subject Site, such that demonstrating compliance at these receivers would indicate compliance at all other receivers.

Note that there are farm buildings approximately 130 m south-east of R2 that are not considered sensitive receivers. This parcel of land is agricultural and is unlikely to have any residential use in the future.

Table 1 Sensitive Receivers

Receiver ID	Zone Type	Approximate Distance to BESS Centroid
R1	FZ	440 m
R2	FZ	440 m
R3	FZ	560 m
R4	FZ	650 m
R5	FZ	790 m
R6	FZ	810 m
R6b	FZ	950 m
R7	LDRZ	1100 m
R8	LDRZ	1050 m
R9	GRZ	1300 m
R10	GRZ	1250 m
R11	GRZ	1270 m
R12	GRZ	1280 m
R13	GRZ	1130 m
R14	LDRZ	1050 m
R15	FZ	950 m
R16	FZ	520 m

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Figure 1 BESS Layout and Sensitive Receivers



FIGURE 1

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3.0 Victorian Regulations – Project Criteria

3.1 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.

The concept of minimising risks of harm to human health and the environment, so far as reasonably practicable, requires the person:

- to eliminate risks of harm to human health and the environment so far as reasonably practicable; and
- if it is not reasonably practicable to eliminate risks of harm to human health and the environment, to reduce those risks so far as reasonably practicable.

Under the EP 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.

Harm may arise due to the 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.

3.2 Regulated Noise Criteria

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

3.2.1 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.

3.2.2 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.

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 (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

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etc.), schools (including childcare centres) and tourist establishments in rural areas (campgrounds, caravan parks, etc.).

Table 2 presents the assessment periods prescribed by the Regulations.

Table 2 Definitions of Day, Evening and Night (Environmental Protection Regulations 2021)

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

The Noise Protocol noise limits for receivers in a rural environment takes into consideration both influence of the zoning map categories (and changes in zoning categories), the background noise (for background noise-relevant areas), and the distance between the zoning boundary and receiver (where different zones apply).

Noise Limits in Rural Areas for Utilities

Section 2.6 of the Protocol defines the method for determining noise limits in rural areas for utilities, which include electricity infrastructure, which is an appropriate classification for the Project.

Paragraph (31) states that if the utility is located in a Farming Zone (FZ) and the distance adjustment is 0 dB then the distance-adjusted level for each period is:

- Day: 45 dBA
- Evening: 39 dBA
- Night: 34 dBA

Given the location of the Subject Site and receivers, the area is not expected to be influenced by high background noise. In this regard, the base utility noise limits above will be used for the purpose of this preliminary assessment. Note that this noise limits are applicable only to receivers located within the same zone type as the noise source, which will be the FZ for the Project.

As for receivers that are not within the FZ, distance adjustment of 1dB for every 100 metres of receiver distance is applied to their respective base noise limits. However, according to the EP Regulations – Reg 118 (2)(b), for noise emitted in a rural area the lowest noise limits applicable to surrounding sensitive receivers are:

- Day: 45 dBA
- Evening: 37 dBA
- Night: 32 dBA

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As such, in the case where the distance-adjusted levels are below the lowest noise limit applicable, the latter will be used as the final noise limits.



Table 3 shows the plan zone and final noise limits applicable for each sensitive receiver.

Table 3 Noise Limits

Receiver ID	Zone Type	Noise Limits, dBA		
		Day	Evening	Night
R1	FZ	45	39	34
R2	FZ	45	39	34
R3	FZ	45	39	34
R4	FZ	45	39	34
R5	FZ	45	39	34
R6	FZ	45	39	34
R6b	FZ	45	39	34
R7	LDRZ	45	37	32
R8	LDRZ	45	37	32
R9	GRZ	45	37	32
R10	GRZ	45	37	32
R11	GRZ	45	37	32
R12	GRZ	45	37	32
R13	GRZ	45	37	32
R14	LDRZ	45	37	32
R15	FZ	45	39	34
R16	FZ	45	39	34

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3.2.3 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.

Guidance is provided in the EPA 2021 Publication 1997 June 2021 *Technical Guide – Measuring and analysing Industry noise and music noise*. The guidance provided in Section 3.3.1 is as follows:

Proposed new industry or extension of existing premises in rural areas

In rural areas, new industry plant or operations should be designed so that their emissions are less than the noise limits. Circumstances for which the equal sharing principle applies for new industry developments include:

- *Where there is existing industry impacting on noise sensitive areas*
- *Sites where there are multiple small commercial, industrial or trade premises.*

The contribution of the proposed development should then be abated to meet, for each period of the day, a level set below the relevant noise limit by $10 \times \log(10)$ decibels, where N is the total number of existing and likely contribution industrial plant installations.



Applicable commercial industrial and trade premises to the west include Camperdown Salesyard which does not operate during the evening and night period, and the Camperdown Substation which is expected to emit noise throughout the day and night period.

The quarry to the south (Gent Quarries) also operates during day period only (based on publicly available information).

Given the information above, the cumulative industry adjustment has been based on the closest industries to each receiver for day/evening and night operations.

Table 4 shows the number of industries near each receiver during day, evening and night (including this Project) and the adjusted project specific noise target.

Table 4 Cumulative Industry Adjustment

Receiver	Number of Contributing Industries (D/E/N)*	Cumulative Industry Adjustment, dB (D/E/N)	Adjusted Project Specific Noise Target, dBA (D/E/N)
R1	1/1/1	0/0/0	45/39/34
R2	1/1/1	0/0/0	45/39/34
R3	1/1/1	0/0/0	45/39/34
R4	1/1/1	0/0/0	45/39/34
R5	1/1/1	0/0/0	45/39/34
R6	1/1/1	0/0/0	45/39/34
R6b	1/1/1	0/0/0	45/39/34
R7	3/2/2	5/3/3	40/34/29
R8	3/2/2	5/3/3	40/34/29
R9	3/2/2	5/3/3	40/34/29
R10	1/1/1	0/0/0	45/37/32
R11	1/1/1	0/0/0	45/37/32
R12	1/1/1	0/0/0	45/37/32
R13	2/1/1	3/0/0	42/37/32
R14	2/1/1	3/0/0	42/37/32
R15	2/1/1	3/0/0	42/39/34
R16	1/1/1	0/0/0	45/39/34

*Including Camperdown BESS

3.2.4 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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4.0 Noise Assessment

A 3D noise model was constructed within the modelling software SoundPLAN 8.2 to predict noise levels at the nearby sensitive receivers.

Noise modelling was conducted using the ISO 9613-2¹ algorithms incorporated in the noise modelling software. The ISO 9613-2 algorithm 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.

4.1 General Modelling Assumptions

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

- The reflection-order of other buildings was set to three (3), indicating that the noise model allowed for three (3) reflections off façades.
- Source heights were set according to the source item.
- Receivers were set 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 10 metre digital elevation data from Geoscience Australia along with elevation data provided by the client.
- Ground absorption is modelled by a single number parameter between 0 (hard – reflective) and 1 (soft – absorptive). The substation and BESS infrastructure was modelled as hard ground, all other ground surfaces were modelled with a ground absorption parameter of 0.6, suitable for rural farmland.

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4.2 Noise Sources and Scenarios Modelled

Sound power levels of noise producing equipment are shown in **Table 6**. The Project is assumed to operate 24 hours, 7 days a week.

Regarding the Sound Power Level (SWL) for the transformer shown in **Table 6**, the overall SWL has been derived based on the rated MVA for this Project and reference to Australian Standard 60076.1:2014 *Power transformers: General* (AS60076.1).

Table 6 Equipment and Sound Power Levels

Item	Quantity	Sound Power Level per Unit, dBA
Generic Battery	54	85 (Day and Evening) 80 (Night)

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



Item	Quantity	Sound Power Level per Unit, dBA
SMA SCS 4600 UPS with Noise Reduction Kit	18	85
High Voltage Transformer (60 MW rating)	1	91

Two scenarios were modelled as follows:

Scenario 1: Day and Evening Operation – 100% Battery Fan Duty (85 dBA)

Scenario 2: Night Operation – Reduced Battery Fan Duty (80 dBA)

Alternatively, a BESS OEM should be selected with a maximum sound power level of up to 80 dBA, removing the need to reduce battery fan duty at night.

4.2.1 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

Data provided by the OEM suggests that the SMA inverters do have tonal characteristics. However, tonality is judged (subjectively) at the receiver in context with the ambient environment.

The modelled inverters exhibit a high frequency tone at 3.15 kHz and 6.3 kHz. As for the battery units, no OEM has been selected at this stage. However, given the propagation distances to the receivers (of the order of 400 m) and the fact that the cooling plant of the batteries and inverters operate independently with varying speeds and noise spectra at any given moment, combined with local ambient noise, it is expected that tonal characteristics of the BESS is not expected to be audible at the closest noise sensitive receivers.

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

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.

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4.2.2 Low Frequency Noise

Low frequency noise contains significant acoustic energy in one-third octave bands ranging from 10 Hz to 160 Hz. The Inverter OEM provided noise spectra for their units between 25 Hz to 10 kHz.

Depending on the duty cycle, the cooling fans of the battery units typically contain significant acoustic energy in the mid-frequencies; 250 Hz to 400 Hz.

The Noise Guidelines: *Assessing Low Frequency Noise* (Publication 1996) adopts a low frequency threshold level as a screening tool to identify the potential risk of problematic low frequency noise. Given the incomplete supplier data and limitations of modelling low frequency noise with ISO9613 algorithm, exceedances of the 25 to 160 Hz frequency bands were not identified at any receivers in the modelling and since the acoustic energy of the sources are most dominant around the mid-frequencies, low frequency noise is not expected to be problematic for the Project.

The low frequency noise assessment should be revisited if the inverter OEM is changed or once the battery units OEM have been selected.

4.3 Operational Noise Assessment Results

The predicted noise levels at the identified sensitive receivers for both scenarios are detailed in **Table 7**.

The predicted noise levels indicate that compliance can be achieved at all receivers throughout all periods with the modelled scenarios. Nevertheless, when selecting the battery OEM, ensure that the battery does not contain tonal characteristics.

Table 7 Operational Noise Results

Receiver	D/E/N Noise Limits (dBA)	D/E/N Noise Adjusted Project Specific Noise Target (dBA)	Scenario 1: Day and Evening		Scenario 2: Night	
			Predicted Noise Level (dBA)	Compliance?	Predicted Noise Level (dBA)	Compliance?
R1	45/39/34	45/39/34	36	Yes	33	Yes
R2	45/39/34	45/39/34	34	Yes	31	Yes
R3	45/39/34	45/39/34	32	Yes	28	Yes
R4	45/39/34	45/39/34	30	Yes	27	Yes
R5	45/39/34	45/39/34	29	Yes	26	Yes
R6	45/39/34	45/39/34	29	Yes	25	Yes
R6b	45/39/34	45/39/34	26	Yes	22	Yes
R7	45/37/32	40/34/29	25	Yes	21	Yes
R8	45/37/32	40/34/29	25	Yes	22	Yes
R9	45/37/32	40/34/29	23	Yes	19	Yes
R10	45/37/32	45/37/32	24	Yes	20	Yes
R11	45/37/32	45/37/32	23	Yes	19	Yes
R12	45/37/32	45/37/32	23	Yes	20	Yes
R13	45/37/32	42/37/32	25	Yes	21	Yes



Receiver	D/E/N Noise Limits (dBA)	D/E/N Adjusted Project Specific Noise Target (dBA)	Scenario 1: Day and Evening		Scenario 2: Night	
			Predicted Noise Level (dBA)	Compliance?	Predicted Noise Level (dBA)	Compliance?
R14	45/37/32	42/37/32	26	Yes	22	Yes
R15	45/39/34	42/39/34	26	Yes	22	Yes
R16	45/39/34	45/39/34	34	Yes	31	Yes

5.0 Conclusion

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

Cumulative noise from the surrounding industries was factored when determining project specific noise limits. Compliance with the Noise Protocol is expected at all sensitive receivers for all time periods for the proposed BESS with the modelled battery sound power level for day and evening, and night operations. Alternatively, a BESS OEM should be selected with a maximum sound power level of up to 80 dBA, removing the need to reduce battery fan duty at night.

Exceedances of the 25 to 160 Hz frequency bands were not identified at any receivers in the modelling and since the acoustic energy of the sources are most dominant around the mid-frequencies, low frequency noise is not expected to be problematic for this Project. However, Considering the incomplete supplier data and limitations of modelling low frequency noise with ISO9613 algorithm, low frequency noise assessment should be revisited once the battery units OEM have been selected.

The Project is predicted to meet the relevant noise criteria and legislation at all times with the modelled battery and inverter units.

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, including any updated OEM selection. When selecting the battery OEM, it is important to assess the noise emissions for any tonal characteristics as per the EPA requirements.

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