Preliminary Noise Assessment

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Capricorn BESS Project

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Preliminary Noise Assessment

Capricorn BESS Project

0729714

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ACRONYMS AND ABBREVIATIONS

Acronyms	Description
Acoustic environment	The part of the environment of an area or place characterised by the total amount of noise that may be experienced there.
Acoustic quality objective	The maximum level of noise that should be experienced in the acoustic environment of the sensitive receptor
Background Creep	Noise progressively increasing or creeping higher over time with the establishment of new developments in a locality
BESS	Battery Energy Storage System
dB	Decibel, a derived unit used to express values on a logarithmic scale. In acoustics, the dB scale is used to measure sound pressure and sound power levels, each of which are related to a standard reference point to allow comparison between measurements.
dB(A)	dB(A) denotes a single number sound pressure level that includes a frequency weighting ("A-weighting") to reflect the subjective loudness of the sound level. The frequency of a sound affects its perceived loudness. Human hearing is less sensitive at low and high frequencies, and so the A-weighting is used to account for this effect. An A-weighted decibel level is written as dB(A).
EP Act	*Environmental Protection Act 1994.*
EP Regulations	Environmental Protection (Noise) Regulation 2019
EPP (Noise)	Environmental Protection (Noise) Policy 2019
Hz	Hertz – the measure of frequency of sound wave oscillations per second. 1 oscillation per second equals 1 hertz
$L_{A1,adj,1hr}$	A-weighted sound pressure level, adjusted for tonal character or impulsiveness, that is exceeded for 1% of a 1-hour period when measured using a fast standardised response time
$L_{A10,adj,1hr}$	A-weighted sound pressure level, adjusted for tonal character or impulsiveness, that is exceeded for 10% of a 1-hour period when measured using a fast standardised response time
$L_{Aeq,adj,1hr}$	A-weighted sound pressure level of a continuous steady sound, adjusted for tonal character, that within a 1-hour period has the same mean square sound pressure of a sound that varies with time
Residence	Includes a building, or part of building, capable of being used as a dwelling
Sensitive Receptor	An area or place where noise is measured
SPL	Sound Pressure Level – the level of sound pressure; as measured at a distance by a standard sound level meter with a microphone. This differs from SWL in that this is the received sound as opposed to the sound intrinsic at the source

Acronyms	Description
SWL	Sound Power Level – this is a measure of the total power radiated by a source. The Sound Power of a source is a fundamental property of the source and is independent of the surrounding environment

EXECUTIVE SUMMARY

Environmental Resources Management Australia Pty Ltd (ERM) has undertaken a Noise Assessment on behalf of Enel Green Power Australia Pty Ltd (EGPA), in support of a Development Application for the Capricorn Battery Energy Storage System (BESS) Project (the Project or the Site) for a Material Change of Use, Reconfiguring a Lot under the *Planning Act 2016* (Planning Act) and an approval for access from a State-controlled Road under the *Transport Infrastructure Act 1994*.

The nearest Sensitive Receptors are at 1 Childs Avenue and 2 Childs Avenue, Bouldercombe which is 612m and 625m respectively from the Project site boundary. To understand the existing noise environment at this location with respect to the noise influence from the existing Bouldercombe Substation and the existing Bouldercombe BESS, short-term noise monitoring was conducted.

The Project criteria applicable to the Sensitive Receptors are the Acoustic Quality Objectives and the Background Creep criteria from the Environmental Protection (Noise) Policy 2019 (EPP(Noise)). The Background Creep criteria was derived from the noise monitoring results.

Noise modelling using the environmental noise modelling software, SoundPLAN v9 was conducted utilising representative and realistic noise data for the proposed Project equipment.

The predicted Project noise levels are within the EPP (Noise) Acoustic Quality Objectives and Background Creep criteria, and no Project-specific noise mitigation measures are proposed as part of the development application, based on this assessment.

The BESS technology to be implemented for the Project has not been finalised and realistic assumptions on the equipment have been made in the noise modelling conducted. Recommendations to avoid Project criteria exceedances have also been provided in this report.

1. INTRODUCTION

Environmental Resources Management Australia Pty Ltd (ERM) has undertaken a Noise Assessment on behalf of Enel Green Power Australia Pty Ltd (EGPA), in support of a Development Application for the Capricorn Battery Energy Storage System (BESS) Project (the Project or the Site) for a Material Change of Use, Reconfiguring a Lot under the *Planning Act 2016* (Planning Act) and an approval for access from a State-controlled Road under the *Transport Infrastructure Act 1994*.

The proposed development is located approximately 2.5 km north of Bouldercombe and 16 km south of Rockhampton, Queensland. The proposed development is within the Rockhampton Regional Council Local Government Area, with the assessment manager for the Development Application being Rockhampton Regional Council.

This report contains the methodology and findings of the Noise Assessment, including the listing of proposed Project infrastructure and their noise emissions, identification of potentially affected sensitive receptors, applicable noise criteria and the predicted noise levels at Sensitive Receptors.

2. PROJECT AND SITE DESCRIPTION

2.1 OVERVIEW

The proposed development includes a 300MW / 1200MWh BESS. The BESS will be located adjacent to the approved Bouldercombe Solar Farm and would form an integral component of operations.

The BESS will include battery containers, inverters (which convert Direct Current to grid compliant Alternating Current), power conversion units and substation including two main transformers. The substation will be connected to the Bouldercombe (Powerlink) sub-station via underground or overhead cables.

2.2 PROJECT SITE

The Project site is located within a rural area and is surrounded by characteristic rural uses including cattle grazing. The site is adjacent to and accessed via the Burnett Highway.

The Project site comprises a smaller area of approximately 16 ha within the land parcel of 108 ha. The Project site is characterized by the following features:

- Currently utilised for rural purposes including stock grazing;
- Adjacent to a State-controlled Road, being the Burnett Highway;
- Adjacent to an existing Bouldercombe (Powerlink) substation south of the Site and
- Adjacent to the existing Bouldercombe BESS south of the Site and
- Adjacent to the approved Bouldercombe Solar Farm northeast of the Project site.

2.3 SENSITIVE RECEPTORS

For this Noise Assessment, the nearest Sensitive Receptors considered are summarized in **Table 2-1** and are shown in **Appendix A.** These locations are representative of locations that will potentially experience the highest operational noise impacts associated with the Project. Project criteria compliance at these locations indicate compliance at all sensitive receptors surrounding the Project site.

TABLE 2-1 SENSITIVE RECEPTORS

Sensitive Receptor ID	UTM Coordinates (GDA94 Zone 56)		Address	Type	Distance From Site Boundary, m
	X, m	Y, m			
1	243792	7394452	1 Childs Avenue	Residential	612
2	243702	7394430	2 Childs Avenue	Residential	625
3	245529	7396093	‘Glenlands’ Residence	Residential	1887

2.4 EXISTING NOISE ENVIRONMENT

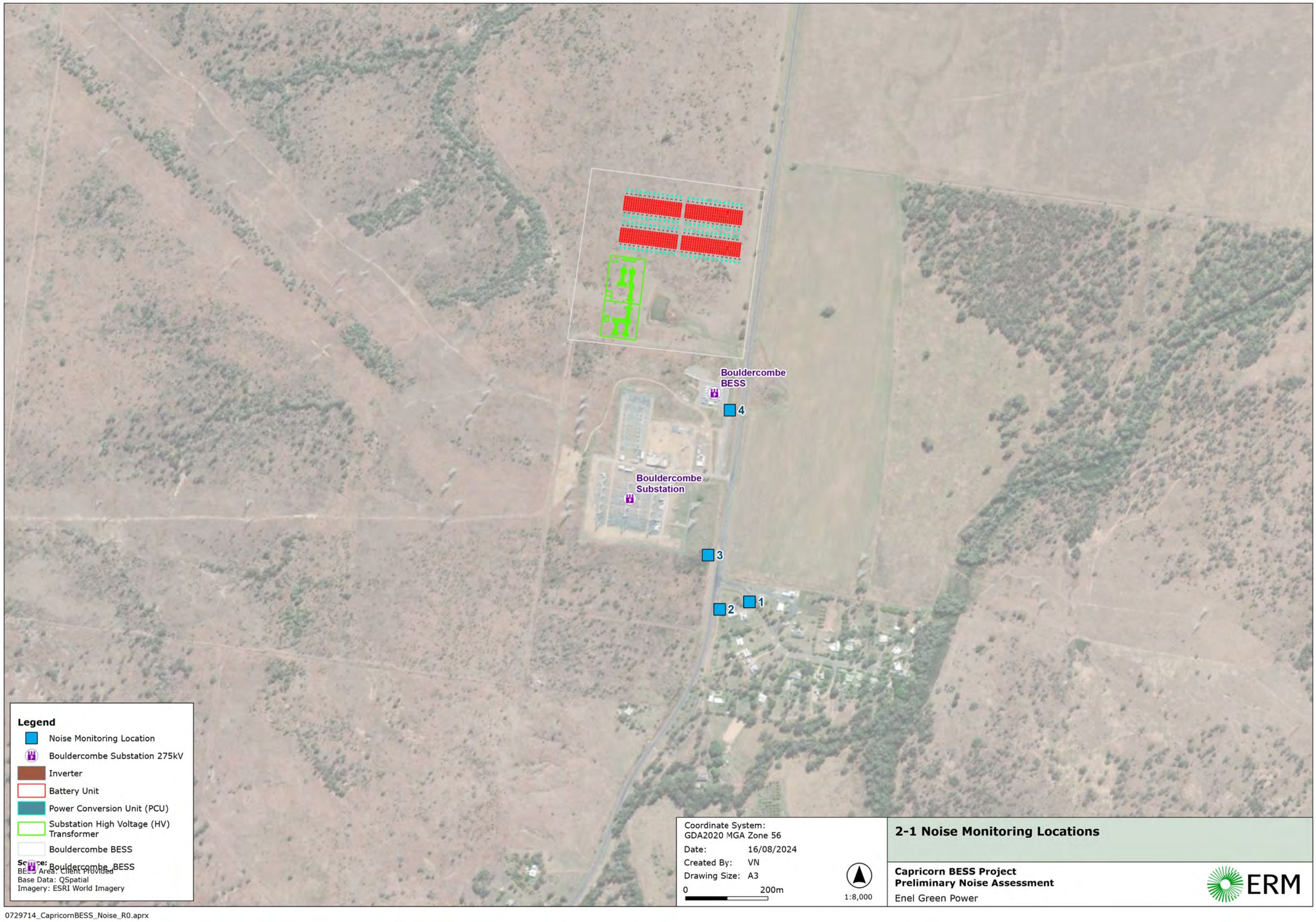
The existing noise environment at the Sensitive Receptors is best described as 'rural' or an area with an acoustical environment that is dominated by natural sounds, generally characterised by low background noise levels with intermittent influence from local road traffic. However, there is noise influence from the existing Bouldercombe Substation and the existing Bouldercombe BESS. To understand the existing noise environment, ERM was engaged by EGPA to undertake noise monitoring at the nearest residential Sensitive Receptors which are 1 Childs Avenue and 2 Childs Avenue (as shown in **Figure 2-1**). Both these Sensitive Receptors have the highest potential to be affected to by noise impacts from the Project and experience different background noise environments due to their proximity to the Burnett Highway.

2.4.1 NOISE MEASUREMENT LOCATIONS

Noise measurements were conducted at the nearest Sensitive Receptors and at intermediate locations (dominated by noise from the existing Bouldercombe Substation and the existing Bouldercombe BESS) as shown in **Table 2-2** and displayed in **Figure 2-1.**

TABLE 2-2 NOISE MONITORING LOCATIONS

Noise Monitoring Location	UTM Coordinates (GDA94 Zone 56)		Description
	X, m	Y, m	
1	243715	7394463	Background noise at 1 Childs Ave; 85m from Burnett Highway
2	243642	7394445	Background noise at 2 Childs Ave; 17m from Burnett Highway
3	243614	7394576	Bouldercombe Substation noise
4	243667	7394926	Bouldercombe BESS noise



2-1 Noise Monitoring Locations

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0729714_CapricornBESS_Noise_R0.aprx

2.4.2 METHODOLOGY

Ten-minute operator-attended noise measurements were undertaken at Noise Monitoring Locations 1, 2, 3 and 4 during the day, evening, and night periods on 24 July 2024 in accordance with the Queensland Noise Measurement Manual (Queensland Government DES, 2020).

The sound level meter NTi XL2 was set to show instantaneous noise levels throughout each measurement, with noise events noted by ERM. Overall A-weighted 10-minute acoustic statistical parameters (L_{max}, L_{min}, L_{eq}, L_1, L_{10} and L_{90}) were recorded by the device.

The measurement instrumentation used to complete the assessment complied with the requirements of AS 61672.1 and AS/IEC 60942 with current National Association of Testing Authorities calibration certificates, with certification at intervals not exceeding two years at the time of use.

Instrument calibration was checked before monitoring and again at its conclusion, with no difference noted between the two results.

2.4.3 MEASUREMENT EQUIPMENT

The measurement instrumentation are as follows:

- Sound Level Meter: NTi XL2 Type 1, Serial Number A2A-06905-E0, FW3.03; and
- Acoustic Calibrator: Brüel & Kjær Type 4231, Serial Number 2205468.

Meteorological conditions were observed during attended noise monitoring. Wind and temperature conditions were measured with a handheld anemometer. Noise monitoring was conducted in the absence of rainfall and windspeeds above 5 m/s.

2.4.4 MEASUREMENT RESULTS

The results of the attended noise measurements are summarised in **Table 2-3**.

TABLE 2-3 ATTENDED NOISE MONITORING RESULTS ON 24 JULY 2024

Start Time	Period	Noise Monitoring Location	L_{Aeq}, dB(A)	L_{AF90}, dB(A)	Observations
14:09	Day	1	57	43	Noise dominated by bird calls, traffic on Burnett Highway and wind-induced tree noise.. Ambient noise is 43-46 dB(A). Car passby noise is 52-55dB(A) every 10-20 seconds.
14:30	Day	2	64	42	Noise dominated by bird calls, traffic on Burnett Highway and wind-induced tree noise. Ambient noise is 46-48 dB(A). Car pass-by noise was 65-72dB(A) every 10-20 seconds.
14:46	Day	3	66	46	Noise dominated by traffic on Burnett Highway and wind in tree noise. Car passby noise is 70-75dB(A). Ambient noise was approximately 48 dB(A).
14:59	Day	4	74	56	Noise was dominated by traffic on Burnett Highway and wind-induced tree noise. Noise from the existing Bouldercombe BESS was present in the absence of car passbys.
20:05	Evening	1	40	33	Noise was dominated by traffic on Burnett Highway. Noise from the existing Bouldercombe substation was present in the absence of car passbys.
20:20	Evening	2	57	35	Noise was dominated by traffic on Burnett Highway. Noise from the existing Bouldercombe substation was present in the absence of car passbys.
20:36	Evening	3	64	39	Noise was dominated by traffic on Burnett Highway. . Noise from the existing Bouldercombe substation was present in the absence of car passbys.
20:58	Evening	4	64	36	Noise was dominated by traffic on the Burnett Highway. There was also wind-induced tree noise and mild insect noise. Noise from the existing Bouldercombe BESS was present in the absence of car passbys.

Start Time	Period	Noise Monitoring Location	L_{Aeq}, dB(A)	L_{AF90}, dB(A)	Observations
22:18	Night	1	38	34	Noise was dominated by wind and occasional traffic on the Burnett Highway (every 40 seconds – 1 minute). Noise from the existing Bouldercombe substation was present in the absence of car passbys.
22:33	Night	2	59	39	Noise was dominated by wind and occasional traffic on the Burnett Highway (every 40 seconds – 1 minute). Noise from the existing Bouldercombe substation was present in the absence of car passbys.
22:47	Night	3	56	39	Noise was dominated by wind and occasional traffic on the Burnett Highway (every 40 seconds – 1 minute).. There was also wind induced tree noise and bird noise. Noise from the existing Bouldercombe substation was present in the absence of car passbys
22:02	Night	4	65	32	Noise was dominated by wind and occasional traffic on the Burnett Highway (every 40 seconds – 1 minute).. There was also wind-induced tree noise and bird noise. Noise from the existing BESS was present in the absence of car passbys

3. LEGISLATIVE CONTEXT AND CRITERIA

3.1 ENVIRONMENTAL PROTECTION (NOISE) POLICY 2019

In Queensland, noise is regulated under the *Environmental Protection Act 1994* (Queensland Government, 1994) and subordinate regulation and policy including the Environmental Protection Regulation 2019 (EP Regulation) (Queensland Government, 2019), and the EPP(Noise) (Queensland Government, 2019).

Section 9 of EPP (Noise) provides the management intent for noise as follows:

> *(2)To the extent it is reasonable to do so, noise must be dealt with in a way that ensures—*
>
> *(a) the noise does not have any adverse effect, or potential adverse effect, on an environmental value under this policy; and*
>
> *(b)* ***background creep*** *in an area or place is prevented or minimised.*
>
> *(3) Despite subsection (2)(b), if the* ***acoustic quality objectives*** *for an area or place are not being achieved or maintained, the noise experienced in the area or place must, to the extent it is reasonable to do so, be dealt with in a way that progressively improves the acoustic environment of the area or place.*
>
> *(4) In this section—background creep, for noise in an area or place, means a gradual increase in the total amount of background noise in the area or place as measured under the document called the 'Noise measurement manual' published on the department's website.*

3.2 BACKGROUND CREEP

Assessment of background creep forms part of EPP(Noise). The criteria is designed to prevent background noise from progressively increasing or creeping higher over time with the establishment of new developments in a locality. EPP(Noise) does not provide the methodology to assess background creep. Background creep assessment methodology is taken from its previous iteration, EPP(Noise) 2008 (Queensland Government, 2008) which states that:

2) To the extent that it is reasonable to do so, noise from an activity must not be

for noise that is continuous noise measured by $L_{A90,T}$ more than nil dB(A) greater than the existing acoustic environment measured by $L_{A90,T}$; or

- for noise that varies over time measured by $L_{Aeq,adj,T}$ more than 5dB(A) greater than the existing acoustic environment measured by $L_{A90,T}$.

The noise from the Project is expected to be variable due to the nature of the Project. Although Project noise emissions are expected to be constant over a 1-hr period, the equipment may operate intermittently and at different intensity over the 12-hour day period, 4-hour evening period and the 8-hour night period. The background creep criteria presented in **Table 3-1** is applicable to Project noise contribution at the two worst-affected noise sensitive receptors and are based on the noise measurements of the existing noise environment obtained in **Section 2.4**.

TABLE 3-1 BACKGROUND CREEP CRITERIA

Sensitive Receptor ID	Address	Background Noise, $L_{A90,T}$ dB(A) [1, 2]			Background Creep Variable Noise Criteria, $L_{Aeq,T}$ dB(A) [2]		
		Day	Evening	Night	Day	Evening	Night
1	1 Childs Ave, Bouldercombe	43	33	34	48	38	39
2	2 Childs Ave, Bouldercombe	42	35	39	47	40	44

Note:

1. Based on short-term noise measurements detailed in **Table 2-3.**

2. Day – 7am to 6pm, Evening -6pm to 10pm, Night – 10pm to 7am

3.3 ACOUSTIC QUALITY OBJECTIVES

Schedule 1 of the EPP(Noise) 2019 lists the acoustic quality objectives for residential sensitive receptors and are provided in **Table 3-2.**

TABLE 3-2 ACOUSTIC QUALITY OBJECTIVES

Sensitive Receptor	Time of Day	Acoustic Quality Objectives [1] (measured at the receptor) dB(A)			Environmental Value
		$L_{Aeq,adj,1hr}$	$L_{A10,adj,1hr}$	$L_{A1,adj,1hr}$	
residence (for outdoors)	daytime and evening	50	55	65	health and wellbeing
residence (for indoors)	daytime and evening	35	40	45	health and wellbeing
	night-time	30	35	40	health and wellbeing, in relation to the ability to sleep

Notes:

1. $L_{A1,adj,1hr}$ means the A-weighted sound pressure level, adjusted for tonal character or impulsiveness, that is exceeded for 1% of a 1-hour period when measured using a fast standardised response time.

2. $L_{A10,adj,1hr}$ means the A-weighted sound pressure level, adjusted for tonal character or impulsiveness, that is exceeded for 10% of a 1-hour period when measured using a fast standardised response time.

3. $L_{Aeq,adj,1hr}$ means an A-weighted sound pressure level of a continuous steady sound, adjusted for tonal character, that within a 1-hour period has the same mean square sound pressure of a sound that varies with time.
4. The adjustment, 'adj' for tonal character, impulsiveness

Both the indoor and outdoor objectives in **Table 3-2** must be met as per EPP (Noise). Accounting for an outdoor-to-indoor reduction of 7 dB for typical Queensland buildings with open windows as per the Noise and Vibration – EIS Information Guideline by the Department of Environment and Science (Queensland Government DES, 2022), the acoustic quality objectives for operational noise for residences are as follows:

- **$L_{Aeq,adj,1hr}$ 42 dB during the daytime and evening periods and**
- **$L_{Aeq,adj,1hr}$ 37 dB during the night-time period.**

These criteria are cumulative and consider existing and Project noise.

4. OPERATIONAL NOISE ASSESSMENT

4.1 ASSESSMENT METHODOLOGY

Noise modelling has been undertaken using SoundPLAN v9, which is a software package for the calculation, presentation, assessment, and prediction of environmental noise. The noise prediction algorithms in ISO 9613 *Acoustics – Attenuation of sound during propagation outdoors* (Standards Australia, 1996) have been implemented into this software package.

The noise modelling considered the sound power level of the Project's operational equipment, and applies adjustments for attenuation from geometric spreading, acoustic shielding from intervening ground topography, ground effects, meteorological effects and atmospheric absorption.

The ground absorption and meteorological parameters summarised in **Table 4-1** were used and are considered conservative.

TABLE 4-1 MODELLED GROUND AND METEOROLOGICAL CONDITIONS

Ground Factor	Relative Humidity	Temperature
0.5	70%	10°C

Interval topographical contours of 10m were incorporated into the noise model, and the propagation of site noise emissions was significantly influenced by topography.

All predicted operational noise levels consider adjustments to the predicted noise levels for tonality.

4.2 MODELLED OPERATIONAL NOISE SOURCES

The modelled operational noise sources are summarised in **Table 4-2**. The assumed locations of the noise sources are shown in the noise contour figures in **Appendix A**.

The BESS technology to be implemented for the Project has not been finalised. Realistic assumptions on equipment sound power levels have been made in **Table 4-2**.

TABLE 4-2 MODELLED NOISE SOURCES

Plant Item	Sound Power Level per Plant Item, L_{eq} dB(A)	Quantity	Notes
Battery Unit	79.7	525	• Make and Model: CSI Solbank – S-2967-2h-H-A/E-0 • Based on supplier noise assessment at factory • Maximum cooling power operation • Equipment noise data sheet provided in **Appendix B**
Inverter	85.8	105	• Make and Model: SMA SCS 3950UP-XT • Sound Power Level provided manufacturer • Fitted with silencer • Equipment noise data sheet provided in **Appendix B**
Power Conversion Unit (PCU)	63.9	105	• Medium Voltage (MV) Transformer (1 per Inverter) • Client advice and noise measurements • Equipment noise data sheet provided in **Appendix B**
Substation High Voltage (HV) Transformer	97.6	2	• 180 MVA Transformer • Sound Power Level based on IEC 60076-10:2001 (AS/NZS 600076.10:2009) – Standard Maximum Sound Level

4.3 PREDICTED OPERATIONAL NOISE LEVELS

Based on the noise modelling methodology described in **Section 4.1** of this report and the operational noise sources presented in **Table 4-2**, noise levels have been predicted and assessed against the outdoor Project criteria in **Table 3-1** and **Table 3-2** at the nearest Sensitive Receptors. Noise contours are provided in **Appendix A**.

TABLE 4-3 PREDICTED OPERATIONAL NOISE LEVELS

Sensitive Receptor	**Distance from Nearest Project Noise Source, m**	**Predicted Project Noise Levels, Leq dB(A)** [1]	**Acoustic Quality Objectives, L_{eq} dB(A)**	**Variable Background Creep Criteria, L_{eq} dB(A)**
1 Childs Avenue	612	29.5	42 (Day and Evening) 37 (Night)	48 (Day) 38 (Evening) 39 (Night)
2 Childs Avenue	625	31.6	42 (Day and Evening) 37 (Night)	47 (Day) 40 (Evening) 44 (Night)
'Glenlands' Residence	1887	19.7	42 (Day and Evening) 37 (Night)	N/A

Note:

1. Day – 7am to 6pm, Evening -6pm to 10pm, Night – 10pm to 7am

This assessment has conservatively assumed that all operations will remain the same for each assessment period (i.e., day, evening, and night). The predicted Project noise levels are within the EPP (Noise) Acoustic Quality Objectives and Background Creep criteria.

5. RECOMMENDATIONS AND CONCLUSION

The predicted Project noise levels are within the EPP (Noise) Acoustic Quality Objectives and Background Creep criteria, and no Project-specific noise mitigation measures are proposed based on this assessment.

As the BESS technology to be implemented for the Project has not been finalised, realistic assumptions on equipment noise data have been made. Notwithstanding, the following noise mitigation measures to prevent potential noise impacts to sensitive receptors are recommended:

- Re-assessment using final equipment selections and relevant manufacturers' noise data should be conducted at the detailed design stage of the Project.
- A review of the applicable fan duty cycle for the final battery unit selection should be conducted for any re-assessment using final equipment selections. Higher fan duty cycles for battery units may result in the prediction of higher noise levels.
- The diurnal variation in battery unit fan duty cycles which may involve a lower fan duty cycle during night-time should be considered for any re-assessment using final equipment selections. This may result in lower noise level predictions.
- Programming control of the selected battery unit's fan cycles may be required to reduce battery unit noise emissions to meet Project criteria.
- Use of proprietary noise control treatment provided by equipment manufacturers should be considered after final equipment selections if the Project criteria is not met. In this assessment, silencers have been implemented for the assessed Inverters as shown in **Appendix B**.
- Design and implementation of noise barriers to provide noise attenuation shall be considered after final equipment selections if the Project criteria is not met. Noise barriers, if required, are recommended to be installed close to the noise sources. The separation distance between any barriers and equipment shall be provided by the equipment supplier based on equipment ventilation requirements. Based on the typical heights of the noise sources assessed, any noise barrier enclosing the battery units and transformers shall exceed 4 m in height in order to be effective.

6. STATEMENT OF LIMITATIONS

1. This report is based solely on the scope of work described in the submitted proposal performed by ERM for EGPA. The Scope of Work was governed by a contract between ERM and EGPA.
2. No limitation, qualification or caveat set out below is intended to derogate from the rights and obligations of ERM and EGPA.
3. The findings of this report are solely based on, and the information provided in this report is strictly limited to that required by the Scope of Work. Except to the extent stated otherwise, in preparing this report ERM has not considered any question, nor provides any information, beyond that required by the Scope of Work.
4. This report was prepared between July 2023 and April 2024 and is based on conditions encountered and information reviewed at the time of preparation. The report does not, and cannot, take into account changes in law, factual circumstances, applicable regulatory instruments or any other future matter. ERM does not, and will not, provide any on-going advice on the impact of any future matters unless it has agreed with the Client to amend the Scope of Work or has entered into a new engagement to provide a further report.
5. Unless this report expressly states to the contrary, ERM's Scope of Work was limited strictly to identifying typical environmental conditions associated with the Project site and does not evaluate the condition of any structure on the subject site nor any other issues.
6. This report is based on one or more site inspections conducted by ERM personnel, the noise monitoring described in the report, and information provided by the Client or third parties (including regulatory agencies). All conclusions and recommendations made in the report are the professional opinions of the ERM personnel involved. Whilst normal checking of data accuracy was undertaken, except to the extent expressly set out in this report ERM:
    a. did not, nor was able to, make further enquiries to assess the reliability of the information or independently verify information provided by EGPA;
    b. assumes no responsibility or liability for errors in data obtained from, the Client, any third parties or external sources (including regulatory agencies).
    c. Although the data that has been used in compiling this report is generally based on actual circumstances, if the report refers to hypothetical examples those examples may, or may not, represent actual existing circumstances.
7. Only the environmental conditions referred to in this report have been considered. To the extent permitted by law and except as is specifically stated in this report, ERM makes no warranty or representation about:
    - the suitability of the site(s) for any purpose or the permissibility of any use;
    - the presence, absence or otherwise of any environmental conditions or contaminants at the site(s) or elsewhere; or
8. Use of the site for any purpose may require planning and other approvals and, in some cases, environmental regulator and accredited site auditor approvals. ERM offers no opinion as to the likelihood of obtaining any such approvals, or the

conditions and obligations which such approvals may impose, which may include the requirement for additional environment works.

9. This report should be read in full and no excerpts are to be taken as representative of the whole report. To ensure its contextual integrity, the report is not to be copied, distributed or referred to in part only. No responsibility or liability is accepted by ERM for use of any part of this report in any other context.
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    - has been prepared and is intended only for the exclusive use of the Client
    - has not been prepared nor is intended for the purpose of advertising, sales, promoting or endorsing any Client interests including raising investment capital, recommending investment decisions, or other publicity purposes
    - does not purport to recommend or induce a decision to make (or not make) any purchase, disposal, investment, divestment, financial commitment or otherwise in or in relation to the site(s); and
    - does not purport to provide, nor should be construed as, legal advice.

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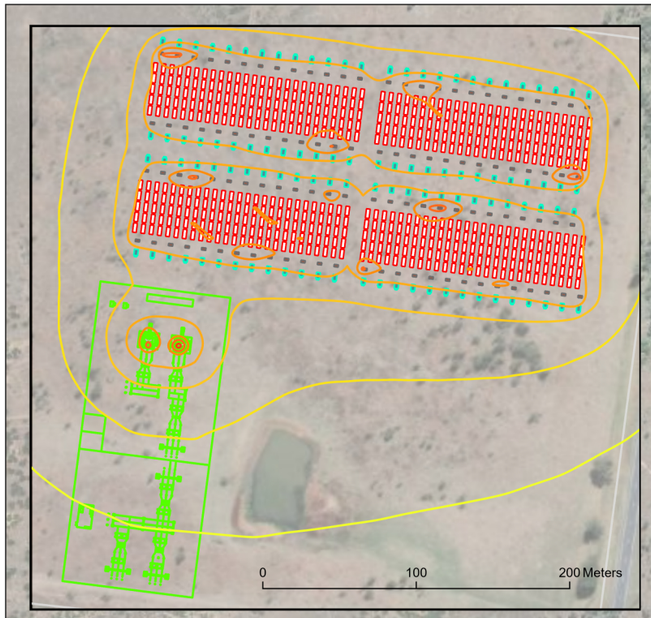
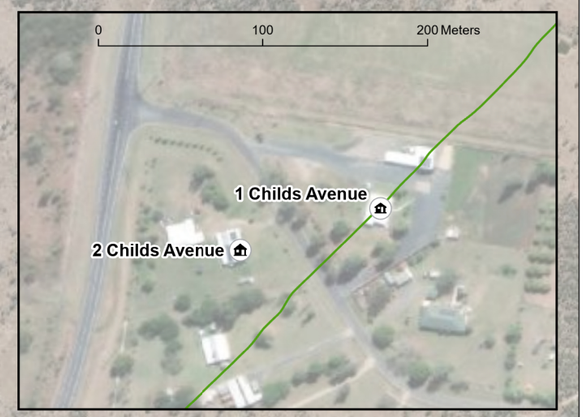
APPENDIX A PREDICTED OPERATIONAL NOISE CONTOURS



‘Glenlands’ Residence

Bouldercombe Substation

1 Childs Avenue
2 Childs Avenue



Legend

- Battery Unit
- Power Conversion Unit (PCU)
- Inverter
- Substation High Voltage (HV) Transformer
- Bouldercombe BESS
- Bouldercombe Substation 275kV
- Sensitive Receptor

Noise Contours

- 20 Leq dB(A)
- 25 Leq dB(A)
- 30 Leq dB(A)
- 35 Leq dB(A)
- 40 Leq dB(A)
- 45 Leq dB(A)
- 50 Leq dB(A)
- 55 Leq dB(A)
- 60 Leq dB(A)
- 65 Leq dB(A)
- 70 Leq dB(A)
- 75 Leq dB(A)
- 80 Leq dB(A)

Source:
BESS Area: Client Provided
Base Data: QSpatial
Imagery: ESRI World Imagery

Coordinate System:
GDA2020 MGA Zone 56
Date: 26/08/2024
Created By: IY
Drawing Size: A3
0 500Meters
1:16,500

Appendix A Predicted Operational Noise Contours

Capricorn BESS Project
Preliminary Noise Assessment
Enel Green Power

ERM

0729714_CapricornBESS_Noise_R0.aprx

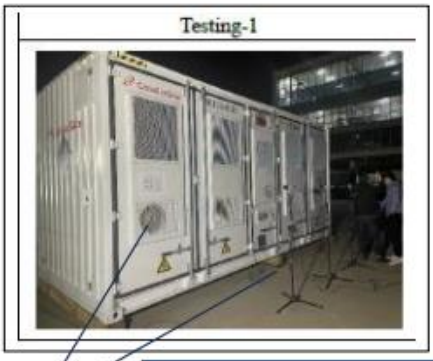
APPENDIX B EQUIPMENT NOISE SPECIFICATIONS

Battery Unit

SOLBANK TESTING REPORT

CSI Solbank – S-2967-2h-H-A/E-0 battery
(noise assessment at the factory)

1m	
頻率（Hz）	101
50	29.1
63	31.0
80	34.0
100	52.3
125	40.5
160	42.1
200	46.5
250	46.5
315	47.7
400	55.9
500	54.9
630	51.2
800	53.6
1000	54.7
1250	55.7
1600	57.2
2000	55.9
2500	58.4
3150	60.9
4000	56.5
5000	54.7
6300	54.4
8000	51.1
10000	49.2
12500	54.3
16000	39.7
20000	35.4



Sound level meter on a tripod used during noise measurement

HVAC exhaust – approximately 1m from ground level

1/3 octave band frequency at 1m distance from the battery unit –

CSI Solbank battery sound power (dB) 1/1 octave band frequency level used for predictive noise calculations

Frequency	31.5	63	125	250	500	1k	2k	4k	8k	16k	Hz
Level		46.6	63	61.7	61.2	69.5	72.1	72.9	76.9	54.5	dB
Total					79.9						

Inverter

Measurement No. 25 at 3933 kVA with Silencer Kit

Sound Power Levels of the Third Octave Band Frequencies according to EN ISO 9614-2

231019 002	Meas 25
Frequency	Tot.Pwr,A
25 Hz	27,42
31,5 Hz	39,38
40 Hz	43,79
50 Hz	52,16
63 Hz	55,07
80 Hz	57,2
100 Hz	62,39
125 Hz	58,94
160 Hz	58,73
200 Hz	62,45
250 Hz	65,46
315 Hz	70,66
400 Hz	64,11
500 Hz	64,34
630 Hz	65,52
800 Hz	64,36
1 kHz	63,94
1,25 kHz	61,02
1,6 kHz	59,51
2 kHz	58,53
2,5 kHz	75,35
3,15 kHz	84,38
4 kHz	61,75
5 kHz	64,8
6,3 kHz	74,85
8 kHz	65,59
10 kHz	66,03
A	85,82
Z	89,93

1/3 octave band frequency used for predictive noise calculation

Inverter with Silencer Kit

Silencer's exhaust approximately 1m from the ground

MV Transformer

A-weighted sound pressure levels $LpA0$					
Plan Position	Heght 1	Heght 2	Plan Position	Heght 1	Heght 2
1	51,5		11	49,6	
2	48,1		12	53,6	
3	51,7		13		
4	52,2		14		
5	48,4		15		
6	52		16		
7	50,2		17		
8	50		18		
9	52,5		19		
10	51,1		20		

The uncorrected average A-weighted sound pressure level is $LpA0=10\log(1/N\ \sum(i=1)^N\ (10^{(0.1*LpAi)}))$ = 51,19 dB(A)

The average A-weighted background noise pressure level (before) is $LbgA=10\log(1/N\ \sum(j=1)^N (10^{(0.1*LbgAj)}))$ = 47,09 dB(A)

The average A-weighted background noise pressure level (after) is $LbgA=10\log(1/N\ \sum(j=1)^N (10^{(0.1*LbgAj)}))$ = 46,79 dB(A)

The test is accepted if one of the following conditions is verified:
1) if LpA0 - the major of LbgA is ≥ 8dB
2) if LpA0 - the major of LbgA is < 8dB and LbgA(before) - LbgA(after) is < 3 dB

The corrected average A-weighted sound pressure level is: $LpA=10\log([10]^{(0.1*LpA0)} - [10]^{(0.1*LbgA)}) - k$ = 49,23 dB(A)

where Lbga is the lower of the two A-weighted background noise sound pressure levels.

Calculation of sound power level:

The A-weighted sound power level: $LwA=LpA+10\ log\ S/S0$ = **63,86 dB(A)**

where So is equal to the reference area $(1\ m^2)$

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