



Noise Impact Assessment

Tragowel BESS

Green Switch Australia and Potentia Energy

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SLR Project No.: 640.031589.00001

20 April 2026

Revision: 2.6

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Revision Record

Revision	Date	Prepared By	Checked By	Authorised By
2.6	20 April 2026	Benjamin French	Benjamin French	Gustaf Reutersward
2.5	27 January 2026	Jenq Sim & Benjamin French	Benjamin French	Gustaf Reutersward
2.4	15 January 2026	Jenq Sim & Benjamin French	Benjamin French	Gustaf Reutersward
2.3	12 January 2026	Jenq Sim & Benjamin French	Benjamin French	Gustaf Reutersward
2.2	17 December 2025	Jenq Sim & Benjamin French	Benjamin French	Gustaf Reutersward
2.1	5 December 2025	Jenq Sim & Benjamin French	Benjamin French	Gustaf Reutersward
2.0	7 November 2025	Jenq Sim	Benjamin French	Gustaf Reutersward
1.0	4 February 2025	Jenq Sim Benjamin French	Gustaf Reutersward	Gustaf Reutersward
0.1	11 December 2024	Jenq Sim Benjamin French	Gustaf Reutersward	Gustaf Reutersward

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 Green Switch Australia and Potentia Energy (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 Tragowel BESS planning permit application submission on behalf of Green Switch Australia and Potentia Energy.

SLR Consulting Pty Ltd (SLR) was engaged by Green Switch Australia to provide a noise impact assessment of a proposed 200MW/800MWh Battery Energy Storage System (BESS), located at Loddon Valley Highway, Tragowel.

The proposed site is located within farmland approximately 6 km south of Kerang township.

The predicted noise levels were assessed against the various requirements of EPA Victoria (EP Act, EP Regulations, Noise Protocol, Environment Reference Standard (ERS), Low Frequency Noise Guidelines and General Environmental Duty).

Construction noise impacts are controlled by limiting works to day periods and a combination of training/equipment maintenance and community engagement.

Compliance with the Noise Protocol is expected at all sensitive receivers for all time periods for the proposed BESS. Cumulative noise of Project combined with the existing Kerang Solar Plant and the proposed Kerang BESS and Solar Farm Hybrid and Kerang BESS was also assessed, with compliance demonstrated at all sensitive receivers.

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 existing sound quality within the Tragowel Swamp Conservation Reserve was qualitatively assessed with reference to the ERS. It is expected that the Project will be inaudible from the southern part of the Reserve and not expected to noticeably alter the existing noise environment in the northern part of the Reserve.

Accordingly, the Project meets the relevant Regulations and is not expected to have an unreasonable acoustic impact on the surrounding area. Due to the anticipated lack of impacts on sensitive receivers, no noise mitigation measures are required for the modelled BESS equipment.

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Table of Contents

Basis of Report	i
Executive Summary	ii
1.0 Introduction	5
2.0 Project Area	5
2.1 Noise Sensitive Receivers	5
3.0 Victorian Regulations – Project Criteria	9
3.1 General Environmental Duty.....	9
3.2 Noise Criteria	9
3.2.1 EP Act 2017	9
3.2.2 EP Regulations and Noise Protocol 2021	10
3.2.3 Environment Reference Standard	11
3.2.4 Low Frequency Noise Guidelines	14
3.3 Construction Noise Criteria.....	15
4.0 Noise Assessment	16
4.1 General Modelling Assumptions	16
4.2 Construction Noise Assessment.....	17
4.2.1 Construction Activities	17
4.3 Operational Noise Assessment	17
4.3.1 Noise Sources.....	18
4.3.2 Noise Characteristics	18
4.4 Construction Noise Assessment Results	19
4.5 Operational Noise Assessment Results.....	20
4.5.1 Cumulative Noise	23
4.5.2 Low Frequency Noise.....	26
4.5.3 Environment Reference Standard – Natural Areas	26
5.0 Conclusions.....	27

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Tables

Table 1	Noise Sensitive Receiver	6
Table 2	Definitions of Day, Evening and Night (Environmental Protection Regulations 2021)	11
Table 3	ERS environmental values relating to the ambient sound environment.....	12
Table 4	Land use categories for the ambient sound environment.....	13
Table 5	Indicators and objectives for the ambient sound environment.....	14



Table 6	Outdoor Low Frequency Noise Threshold Levels	15
Table 7	EPA Publication 1834 November 2020 Construction Noise Guidelines.....	15
Table 8	Construction Scenarios and Equipment.....	17
Table 9	Equipment and Sound Power Levels	18
Table 10	Construction Assessment Results	19
Table 11	Noise Assessment Results Scenario 1: Day and Evening 45 °C.....	20
Table 12	Noise Assessment Results Scenario 2: Night 35 °C	20
Table 13	Cumulative Noise Assessment: Source Levels	24
Table 14	Predicted Cumulative Noise Level from the Project, and Surrounding Industry – Day and Evening	24
Table 15	Predicted Cumulative Noise Level from the Project, and Surrounding Industry - Night.....	24
Table 16	Predicted Low Frequency Noise Levels 25 Hz to 160 Hz.....	26

Figures

Figure 1	Proposed Site Layout	7
Figure 2	Project Area and Assessment Locations.....	8
Figure 3	Operational Noise Assessment Scenario 1: Noise Contours.....	21
Figure 4	Operational Noise Assessment Scenario 2: Noise Contours.....	22
Figure 5	Regional Context	25

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1.0 Introduction

Green Switch Australia and Potentia Energy is proposing to develop a 200MW/800MWh Battery Energy Storage System (BESS), located at Loddon Valley Highway, Tragowel (the Project).

SLR Consulting Pty Ltd (SLR) has been engaged by Green Switch and Potentia Energy to undertake a noise impact assessment to support a planning permit application.

2.0 Project Area

The proposed BESS site is located on Farming Zone (FZ) land approximately 6 km south of the town of Kerang. The southern boundary of the Kerang Solar Plant is to the north of the proposed BESS site.

The site is on agricultural land primarily used for animal grazing and growing fodder crops. In the northwest corner of the site, there is a small farming dam and an informal irrigation channel constructed by the owner. The land is flat with few trees, providing clear views of the highway and across the surrounding landscape. Existing tree coverage provides vegetative screening along the southern boundary of the site.

The proposed BESS will have a power rating of 200 MW at the point of connection and storage capacity of 800 MWh (4 hour duration) and includes:

- 172 containerised batteries¹
- 43 Power Conversion Systems² (PCS or Power Conversion Unit PCU) (each containing two inverters, a MV transformer and MV switchgear)
- 1 x 220 MVA HV Transformer

The proposed BESS layout is shown in **Figure 1**.

2.1 Noise Sensitive Receivers

There are four identified sensitive receivers surrounding the site, most of which are beyond 1 km from the proposed site boundary, and are all within Farming Zones (FZ). The closest dwelling is located approximately 860 m east of the site. Approximately 820 m south of the proposed site is the northern most point of the Tragowel Swamp Nature Conservation Reserve.

Table 1 summarizes the sensitive receiver locations and the distance to the centroid of the Project site.

The proposed site and closest sensitive receivers are presented in **Figure 2**.

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¹ The 5.365 MWh BYD MC10C-B5365-E-R4M04 model was used for this assessment. Noting that the proponent has not selected an original equipment manufacturer (OEM) at this stage, BYD is indicative of typical BESS OEMs.

² The Sungrow SC6900UD PCS is modelled in this assessment. The proponent has not selected an OEM at this stage.



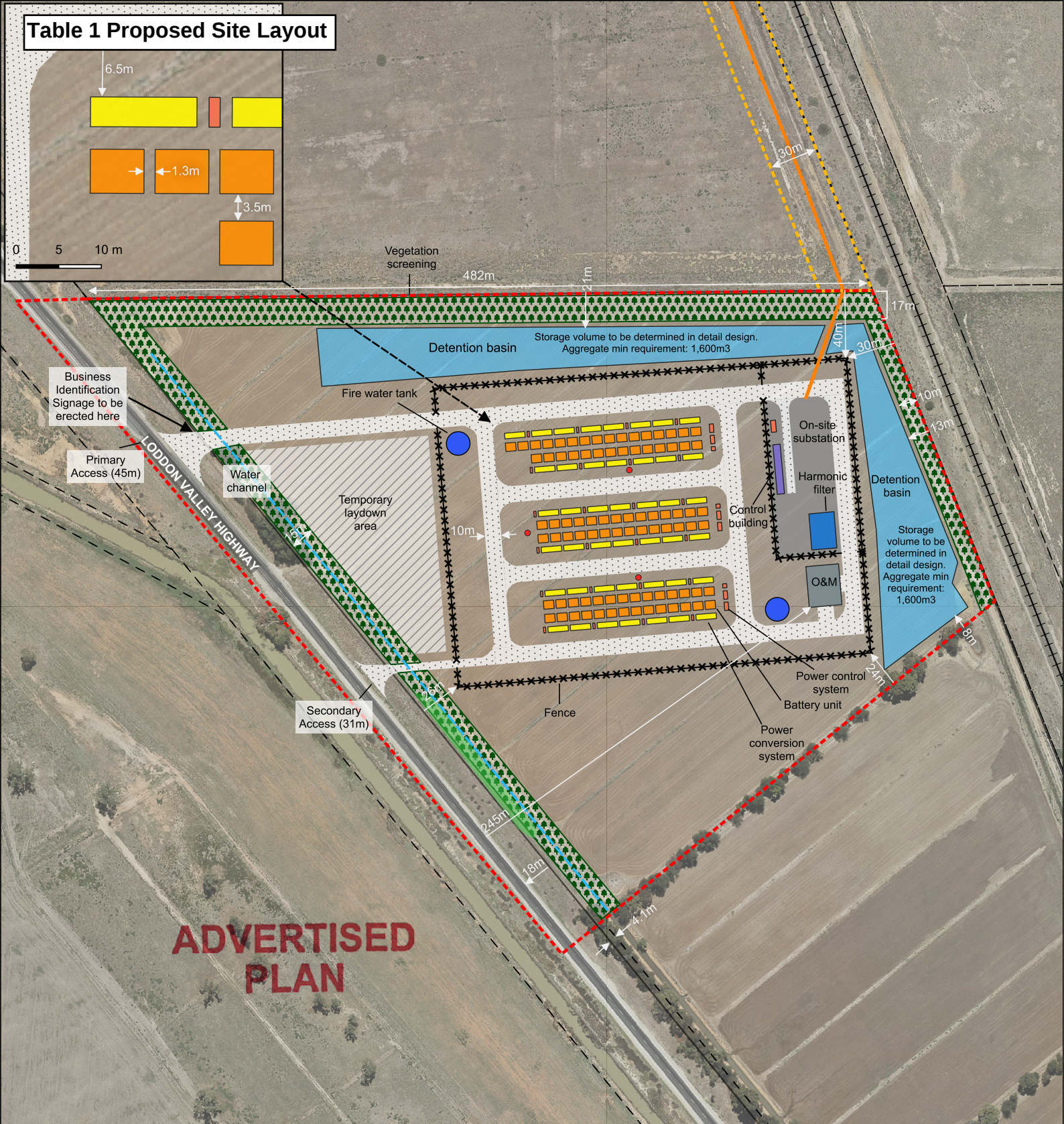
Table 1 Noise Sensitive Receiver

Receiver ID	Address	Distance to Project Boundary, m
R1	258 Old Echuca Rd, Kerang East	860
R2	3987 Loddon Valley Hwy, Tragowel	1000
R3	3739 Loddon Valley Hwy, Tragowel	1080
R4	13 McPhail Rd, Tragowel	1050

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Table 1 Proposed Site Layout



BESS Concept Layout Plan

2405 - Tragowel BESS

LEGEND

Project Site

-  BESS Development Area
-  Transmission Development Area

Proposed Infrastructure

-  Underground transmission line
-  Battery unit
-  Power conversion system
-  Power control systems

-  Harmonic filter
-  Control building
-  Operations and maintenance
-  On site substation
-  Water tanks
-  Vegetation screening
-  Fire Hydrants
-  Fence

- /// Temporary laydown area
- Access roads

Existing Features

-  Impacted native vegetation
 Roads
 Rail line
 Water channel
 Surveyor title boundary
 VicPlan title boundary

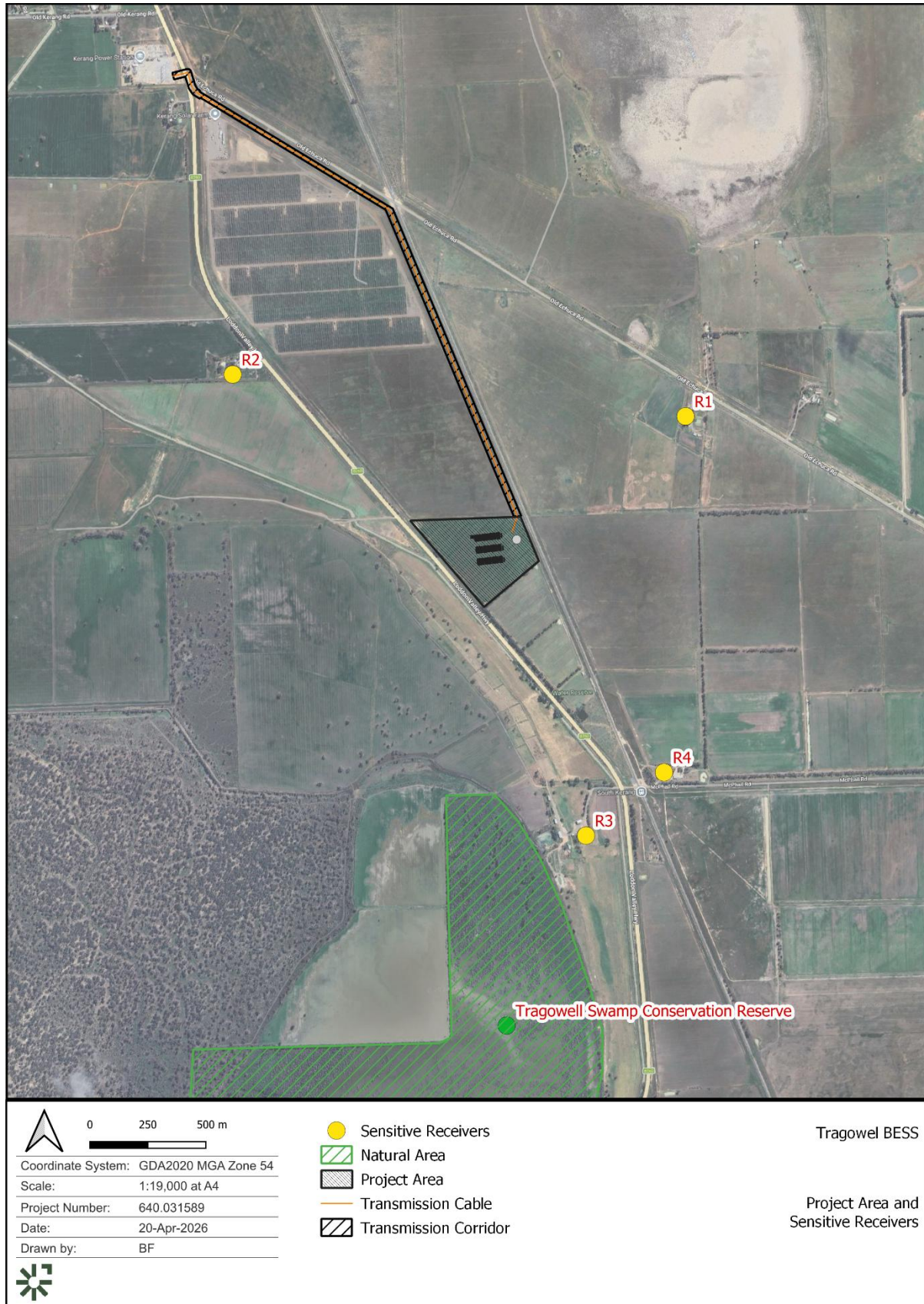
Version: 1.3

Date: 15/04/2026

Disclaimer: This plan is preliminary and subject to detailed studies and approval.

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Figure 2 Project Area and Assessment Locations



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.

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.

3.2 Noise Criteria

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

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

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- 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 at the noise sensitive area 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 at the noise sensitive area 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 at the noise sensitive area 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 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.

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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

With regard to the Tragowel BESS site, all noise sensitive receivers are located outside of the Major Urban Area, therefore the determination of noise criteria follows the Rural Method.

The Noise Protocol noise limits for receivers in a rural environment normally takes into consideration the influence of zoning map categories (and changes in zoning categories), the distance between the zoning boundary and receiver (where different zones apply) as well as the background noise. However, a special consideration applies for utilities.

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 BESS facility.

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

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

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Since all sensitive receivers and the proposed site are in a Farming Zone (FZ) (i.e. the distance adjustment is 0 dB), the above levels are therefore the noise limits applicable for this project.

3.2.3 Environment Reference Standard

The Environment Reference Standard (ERS) tool is defined in the EP Act. The ERS:

- identifies environmental values that the Victorian community want to achieve and maintain.
- provides a way to assess those environmental values in locations across Victoria.

The ERS is made up of four main components in relation to ambient sound:

- Environmental values: These are the central parts of the ERS. An environmental value is a statement about a desired outcome for human health and the environment. For example, an ambient sound environment that supports child development and learning. Environmental values are the uses, attributes, or functions of the environment that the Victorian community wants to achieve and maintain.



- **Areas of application:** The ERS defines the area or areas to which the environmental values, or specific indicators and objectives, apply. For example, most ambient sound indicators and objectives relate to specified land use planning zones.
- **Indicators:** These are usually defined in relation to each environmental value. The indicators are the parameters or markers used to assess whether environmental values are being achieved or maintained, or if they are threatened. For example 'outdoor LAeq' ('outdoor LAeq,16h from 6 am to 10 pm' or 'outdoor LAeq,8h from 10 pm to 6 am'), which is a key indicator used for ambient sound (ERS Table 3.3).
- **Objectives:** These are the evaluation benchmarks. An objective is the character, level, load, concentration, or amount of an indicator used to assess whether an environmental value (or several environmental values) is being achieved, maintained or threatened. Most objectives are scientifically derived quantitative assessment levels. However, some are more qualitative, for example, the ambient sound objective for 'natural areas' is 'a sound quality that is conducive to human tranquillity and enjoyment having regard to the ambient natural soundscape' (ERS Table 3.3).

Table 3 presents the ERS environmental values relating to the ambient sound environment.

Table 3 ERS environmental values relating to the ambient sound environment

Environmental value	Description of environmental value
Sleep during the night	An ambient sound environment that supports sleep at night
Domestic and recreational activities	An ambient sound environment that supports recreational and domestic activities in a residential setting
Normal conversation	An ambient sound environment that allows for a normal conversation indoors without the need to raise voices
Child learning and development	An ambient sound environment that supports cognitive development and learning in children
Human tranquillity and enjoyment outdoors in natural areas	An ambient sound environment that allows for the appreciation and enjoyment of the environment for its natural condition and the restorative benefits of tranquil soundscapes in natural areas
Musical entertainment	An ambient sound environment that recognises the community's demand for a wide range of musical entertainment

For the purposes of 'areas of application' the ERS outlines a framework for assessing the ambient sound environment over a period of time based on the land use category of the area of assessment. **Table 4** presents the land use categories relating to the ambient sound environment. The categories relevant to this assessment are Category IV for the dwellings in Farming Zones and Category V for the Tragowel Swamp Conservation Zone.

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Table 4 Land use categories for the ambient sound environment

Land use category	General description	Planning zones
Category I	An urban form with distinctive features or characteristics of taller buildings, high commercial and residential intensity, and high site coverage.	Industrial Zone 1 (IN1Z) Industrial Zone 2 (IN2Z) Port Zone (PZ) Road 1 Zone (RDZ1) Capital City Zone (CCZ) Docklands Zone (DZ)
Category II	Medium rise building form with a strong urban or commercial character. Typically contains mixed land uses including activity centres and larger consolidated sites, and an active public realm.	Industrial Zone 3 (IN3Z) Commercial 1 Zone (C1Z) Commercial 2 Zone (C2Z) Commercial 3 Zone (C3Z) Activity Centre Zone (ACZ) Mixed Use Zone (MUZ) Road 2 Zone (RDZ2)
Category III	Lower rise building form including lower density residential development and detached housing typical of suburban residential settings or in towns of district or regional significance.	Residential Growth Zone (RGZ) General Residential Zone (GRZ) Neighbourhood Residential Zone (NRZ) Urban Floodway Zone (UFZ) Public Park and Recreation Zone (PPRZ) Urban Growth Zone (UGZ)
Category IV	Lower density or sparse populations with settlements that include smaller hamlets, villages and small towns that are generally unsuited for further expansion. Land uses include primary industry and farming.	Low Density Residential Zone (LDRZ) Township Zone (TZ) Rural Living Zone (RLZ) Green Wedge A Zone (GWAZ) Rural Conservation Zone (RCZ) Public Conservation and Resource Zone (PCRZ) Green Wedge Zone (GWZ) Farming Zone (FZ) Rural Activity Zone (RAZ)
Category V	Unique combinations of landscape, biodiversity, and geodiversity. These natural areas typically provide undisturbed species habitat and enable people to see and interact with native vegetation and wildlife	Natural areas are classified as land within Category V irrespective of the planning zones that apply to that land.
Category I, II, III or IV depending on surrounding land uses and the intent of the specific planning zone (which may have a diversity of uses) as specified in a schedule to the planning zone		Comprehensive Development Zone (CDZ) Priority Development Zone (PDZ) Special Use Zone (SUZ) Public Use Zone (PUZ)



For the ambient sound environment, for each land use category, the ERS sets out indicators and objectives. The objectives for each land use category are typical ambient sound level values and are neither noise limits nor noise design criteria. **Table 5** presents the indicators and objectives relating to the ambient sound environment.

Table 5 Indicators and objectives for the ambient sound environment

Land use category	Indicators	Objectives
Category I	Outdoor LAeq,8h from 10pm to 6am	55 dBA
	Outdoor LAeq,16h from 6am to 10pm	60 dBA
Category II	Outdoor LAeq,8h from 10pm to 6am	50 dBA
	Outdoor LAeq,16h from 6am to 10pm	55 dBA
Category III	Outdoor LAeq,8h from 10pm to 6am	40 dBA
	Outdoor LAeq,16h from 6am to 10pm	50 dBA
Category IV	Outdoor LAeq,8h from 10pm to 6am	35 dBA
	Outdoor LAeq,16h from 6am to 10pm	40 dBA
Category V	Qualitative	A sound quality that is conducive to human tranquillity and enjoyment having regard to the ambient natural soundscape

Where non-regulated noise is generated as part of the Project, it will be evaluated against the ERS in accordance with the guidance provided in EPA Publication 1992: "Guide to the Environment Reference Standard".

The applicable noise objective for the natural area of Tragowel Swamp Nature Conservation Reserve is Category V (See **Table 5**).

Note that noise from industry is regulated by the Noise Protocol and the Noise Protocol limits are more stringent than the ERS objectives. Compliance with the Noise Protocol at the Category IV land uses will also comply with the ERS.

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, and
- baseline noise levels in the absence of the noise of concern.

Table 6 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 6 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

3.3 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 7 presents the EPA construction noise guidelines.

Table 7 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:

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- **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.

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 algorithms of ISO 9613-2³, 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.

4.1 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).
- Source height were set according to the source item.
- Receivers are in the acoustic free field, 1.5 m above ground level.
- The BESS containers and PCUs are elevated 1.8 m above the existing ground level a built-up earth pad and concrete piers.
- All equipment is assumed to be in operation for the entire 30 minute assessment period.

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³ ISO 9613-2:1996 *Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation*



- Ground topography within 2 km of the proposed site was sourced from publicly available 10 metre digital elevation data from Geoscience Australia.
- 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, which is suitable for rural farmland.

4.2 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.

4.2.1 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 A**.

Table 8 Construction Scenarios and Equipment

Scenario	Works Activity	Equipment
W.01	Earthworks	Dozer, excavator, front end loader, vibratory roller, dump truck, water truck
W.02	Construction of piers and hardstands	Concrete pump, concrete truck/agitator, concrete vibrator
W.03	Equipment installation	Elevated working platform, flatbed truck, hand tools, mobile crane

4.3 Operational Noise Assessment

The following two scenarios were developed to assess the operations of the proposed BESS.

Scenario 1: Day and Evening Period 45 °C

This scenario is representative of operations during the summer peak, where ambient temperatures are highest. This operational load is only expected to occur for a small percentage of the year. As such, it is considered a very conservative scenario.

Since Sunday day periods are assessed against the evening noise criteria, Scenario 1 is also assessed against the evening criterion of 39 dBA.

Scenario 2: Night Period 35 °C

Scenario 2 corresponds with typical, summer day time operations and peak night time operations. Since the night period has the more stringent criteria, Scenario 2 is assessed against the night criterion of 34 dBA.



4.3.1 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 is typically dominated by cooling noise sources, 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**.

Table 9 Equipment and Sound Power Levels

Qty	Item	Sound Power Level (SWL), per unit L _{eq} 15 min, dBA
172	Battery Container ¹	Scenario 1: 86 Scenario 2: 83
86	Inverter ²	83
1	High Voltage Transformer	92
43	Medium Voltage Transformers	60
Notes: 1: Battery container sound power levels are based on BYD MC10C-B5365-E-R4M04 operating in an ambient temperature environment of 45 °C for Scenario 1 and 35 °C for Scenario 2. 2: Inverter sound power levels for both scenarios are based on 43 Sungrow SC3450UD PCUs @ 85% load (two inverters per PCU), the maximum output specified in the datasheet.		

4.3.2 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 contain tonal characteristics close to the source. Given the propagation distances to the receivers (of approximately 1 km) combined with anticipated local ambient noise, such as frogs, insects, Loddon Valley Highway traffic and occasional trains on the Piangil railway line, it is expected that tonal characteristics of the BESS will not be distinguishable 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.

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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 PCSs. However the duty cycle period exceeds 30 minutes and is not considered intermittent. Therefore, no characteristic adjustments have been applied to the following results.

4.4 Construction Noise Assessment Results

Table 10 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 10 Construction Assessment Results

Receiver	W.01 Earthworks, dBA	W.02 Construction of Pads, Hardstands & Ramps, dBA	W.03 Equipment Installation, dBA
R1	44	38	37
R2	42	36	35
R3	42	36	35
R4	42	36	35

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.

4.5 Operational Noise Assessment Results

The predicted noise levels at the identified representative sensitive receivers, were assessed against the day, evening and night time noise criteria. **Table 11** and **Table 12** shows the predicted noise levels and margin of compliance with the relevant noise criteria for Scenarios 1 and 2 respectively. Noise contour plots corresponding to the assessment scenarios are presented in **Figure 3** and **Figure 4**.

Table 11 Noise Assessment Results Scenario 1: Day and Evening 45 °C

Receiver	Predicted Noise Level, dBA	Characteristic Adjustment	Effective Noise Level, dBA	Day/Evening Criterion, dBA	Margin of Compliance (Day/Evening) dBA
R1	34	0	34	45/39	11/5
R2	31	0	31	45/39	14/8
R3	32	0	32	45/39	13/7
R4	32	0	32	45/39	13/7

Table 12 Noise Assessment Results Scenario 2: Night 35 °C

Receiver	Predicted Noise Level, dBA	Characteristic Adjustment	Effective Noise Level, dBA	Night Criterion, dBA	Margin of Compliance (Night) dBA
R1	32	0	32	34	2
R2	29	0	29	34	5
R3	29	0	29	34	5
R4	30	0	30	34	4

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Figure 3 Operational Noise Assessment Scenario 1: Noise Contours

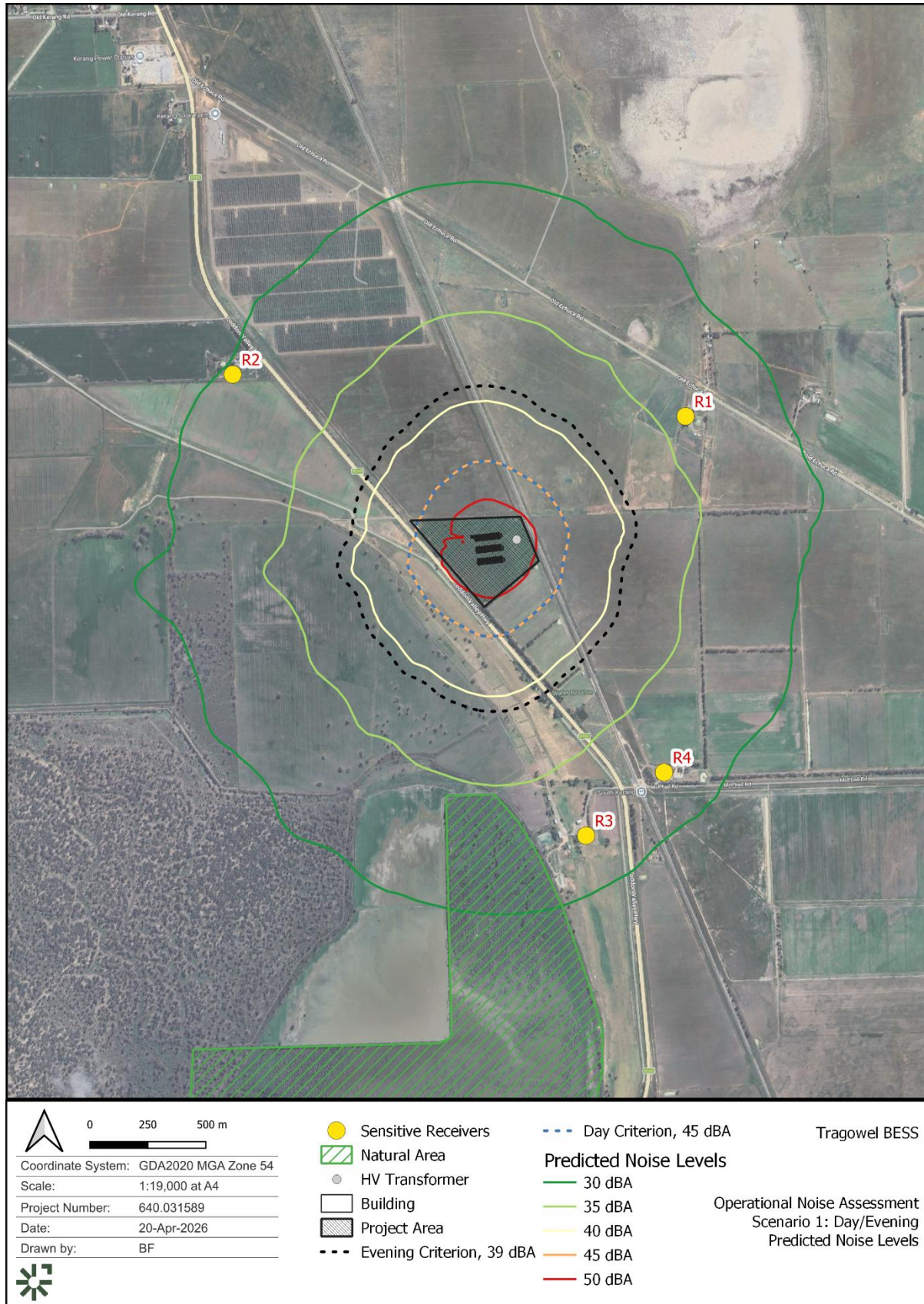
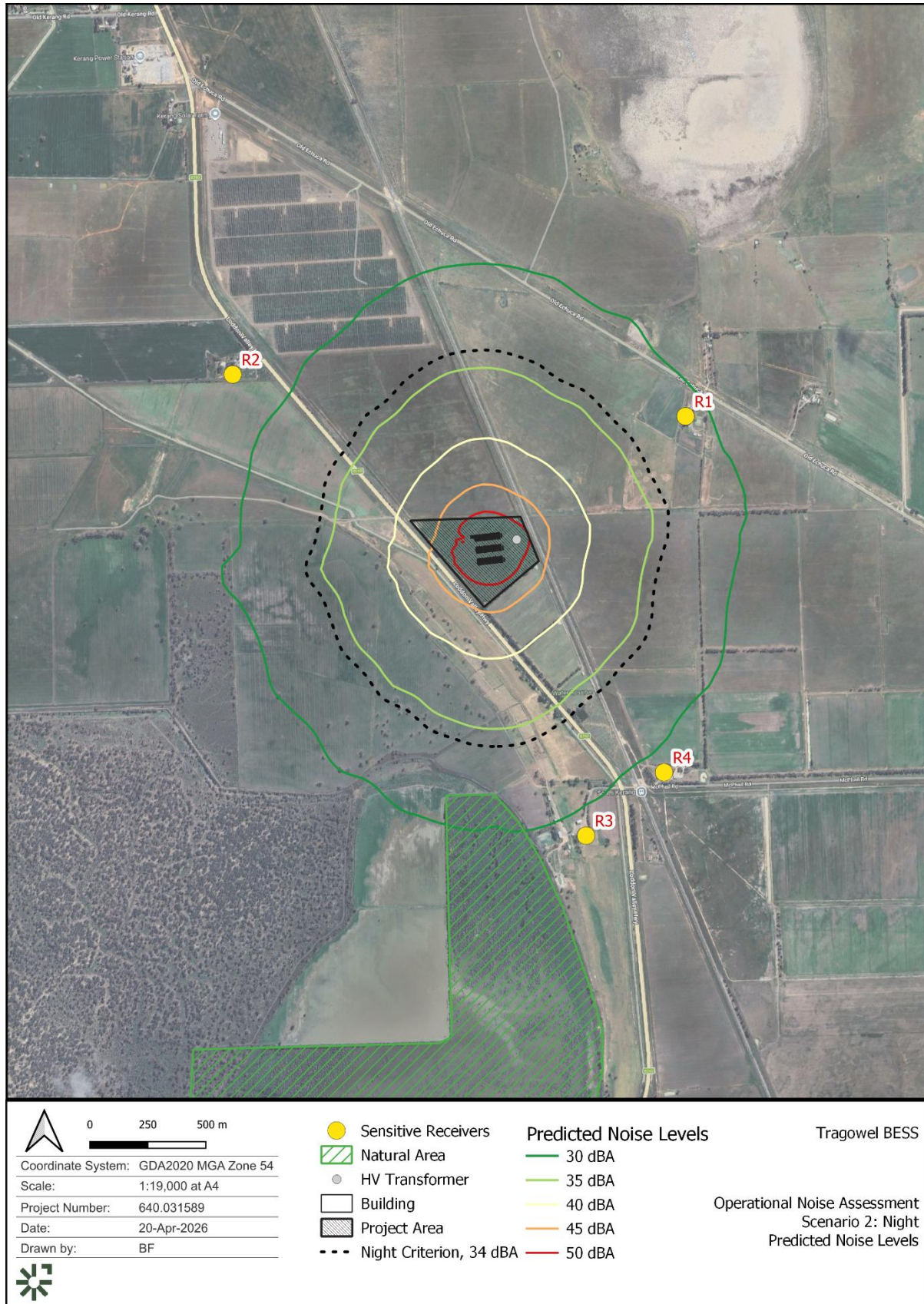


Figure 4 Operational Noise Assessment Scenario 2: Noise Contours



4.5.1 Cumulative Noise

It was noted in **Section 2.0** that there are existing industries in the surrounding project area:

- Kerang Terminal Station, 1.3 km north of R2 and
- Kerang Solar Plant, less than 200 m northeast of R2.

Additionally, the Kerang Solar Farm and BESS Hybrid development is proposed for construction with sites directly east of the Project and west of the existing Kerang Solar Plant. The Kerang Solar Farm and BESS Hybrid is planned to have a power output of 161 MW with an integrated AC coupled 55 MW (2 hour) BESS. The northern Solar Farm and BESS Hybrid development will include a standalone Kerang BESS development as well. This BESS will have a capacity of 103 MW / 206 MWh.

Wind farm developments are proposed near Macorna, 15 km south east of the Project. Due to the distance to the project, and wind farm noise is assessed under different legislation, cumulative impacts from wind farm noise is not included in this assessment.

Figure 5 shows the locations of the current and planned industry in relation to Tragowel BESS.

Noise contributions from the Kerang Terminal Station to R2 and the other receivers further away, are likely to be negligible given propagation distance exceeds 1 km.

It is noted that the solar farms will operate a minimal load during the night-time period (10pm to 7am) at reduced power during the evening period (6pm to 10pm). Expected power output from interstate solar farm projects undertaken by SLR predicted less than 10% inverter power prior to 6am and 40% between 6 and 7 am.

The BESS components of the developments are likely to charge during the day and night periods and discharge during the morning and evening peaks.

In order to quantify the cumulative impacts from the existing and proposed industry, the surrounding industry were assumed to have similar acoustic performances as the Tragowel BESS plant (i.e. each inverter was modelled as 92 dBA sound power level), which is considered to be a conservative assumption. The Kerang Solar Plant inverter locations were identified from Google Earth imagery and modelled as point sources. The proposed developments were modelled as area sources with an overall sound power level based on the published capacity of the solar farm/BESS.

Two scenarios were modelled to quantify potential cumulative impacts due to the existing and planned developments:

- **Day and Evening:** all BESS and Solar Farm noise sources are active and are assumed to be operating at 100% between 7 am and 10 pm.
- **Night:** BESS noise sources are active, solar farm noise sources are operating at <10% power prior to 6am and at 40% between 6 am and 7 am.

Table 13 shows the estimated sound power levels for nearby industry during day, evening and night.

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Table 13 Cumulative Noise Assessment: Source Levels

Industry	Overall Sound Power Level (SWL), dBA	
	Day & Evening	Night
Kerang Solar Plant	101	88
Kerang Solar Farm and BESS Hybrid (east)	103	100
Kerang Solar Farm and BESS Hybrid (west)	103	100
Kerang BESS	105	105

Table 14 and **Table 15** shows the predicted individual from the BESS operations as well as the noise emission from the solar plant for the day/evening and night scenarios respectively.

Table 14 Predicted Cumulative Noise Level from the Project, and Surrounding Industry – Day and Evening

Receiver	Predicted Noise Contribution from Individual Projects, dBA				Cumulative Predicted Noise Level, dBA	Noise Criteria, dBA Day / Evening	Margin of Compliance, dB
	Tragowel BESS	Kerang Solar Plant	Kerang Solar Farm and BESS Hybrid	Kerang BESS			
R1	34	<20	30	<20	36	45/39	9/3
R2	31	31	36	26	38	45/39	7/1
R3	32	<20	25	<20	32	45/39	13/7
R4	32	<20	31	<20	35	45/39	10/4

Table 15 Predicted Cumulative Noise Level from the Project, and Surrounding Industry - Night

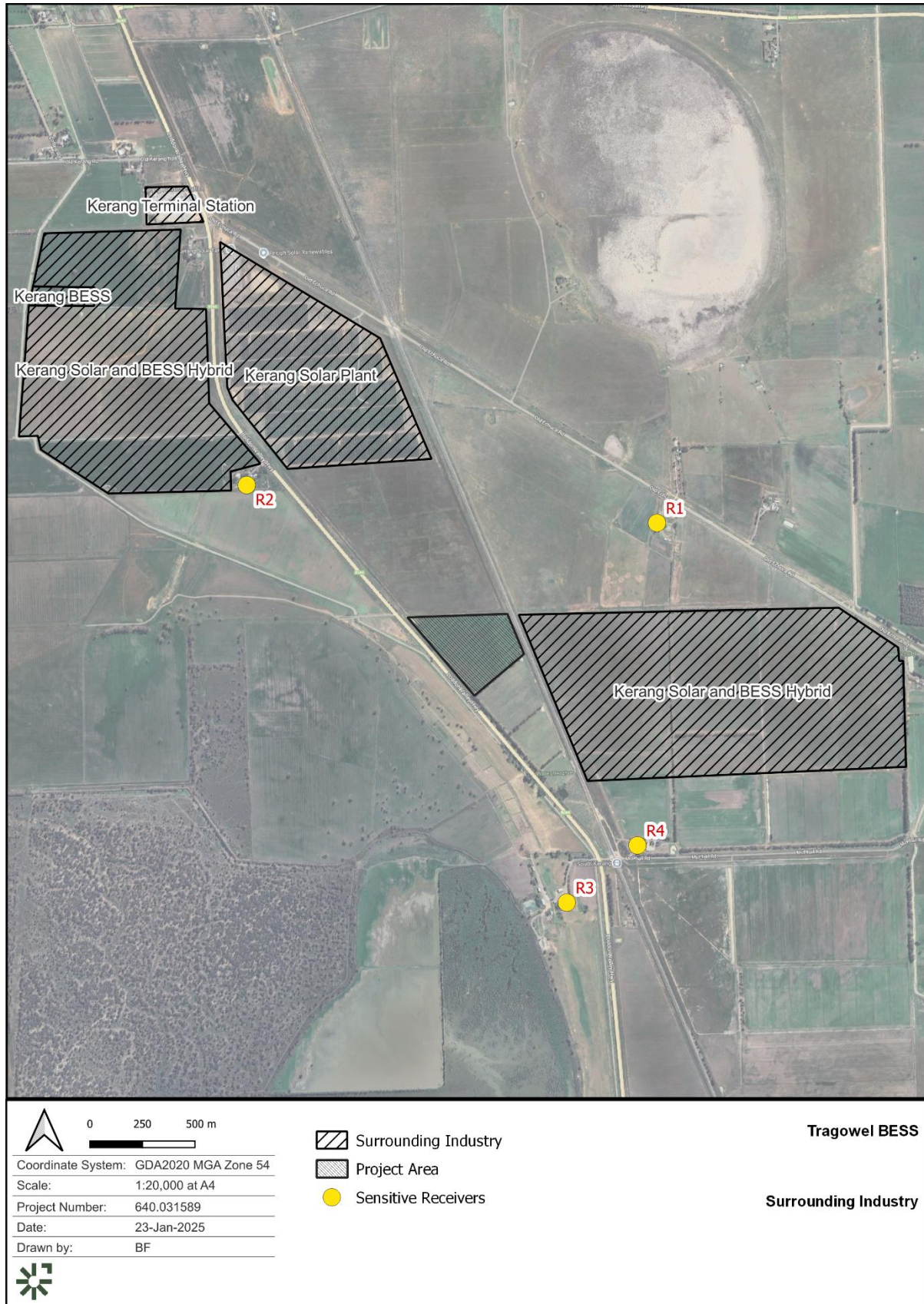
Receiver	Predicted Noise Contribution from Individual Projects, dBA				Cumulative Predicted Noise Level, dBA	Noise Criteria, dBA Night	Margin of Compliance, dB
	Tragowel BESS	Kerang Solar Plant	Kerang Solar Farm and BESS Hybrid	Kerang BESS			
R1	32	<20	26	<20	33	34	1
R2	29	<20	32	26	34	34	0
R3	29	<20	21	<20	30	34	4
R4	30	<20	27	<20	32	34	2

Compliance with the day and evening period is demonstrated at all receivers when all BESS projects and solar farms are operating.

Compliance with the night period limit is demonstrated at all receivers when Tragowel BESS is operating in conjunction with the AC coupled Kerang Solar Farm BESS component and the Kerang BESS.



Figure 5 Regional Context



4.5.2 Low Frequency Noise

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 (LFN).

Potential problematic low frequency noise contains significant acoustic energy in one-third octave bands ranging from 10 Hz to 160 Hz. The available noise data for the assessed BESS units provided one third spectra between 25 Hz to 20 kHz for both the inverters and battery containers.

Although this is incomplete data for a formal low frequency assessment, from our experience, the 63 Hz to 125 Hz bands are still likely to be the most critical in the assessment of low frequency noise.

The low frequency noise threshold levels between 25 Hz and 160 Hz have been reproduced in **Table 16** for comparison with the predicted low frequency noise levels at each receiver.

Table 16 Predicted Low Frequency Noise Levels 25 Hz to 160 Hz

Receiver	Outdoor 1/3 Octave Low Frequency Noise (Hz)								
	25	31.5	40	50	63	80	100	125	160
R1	42	40	39	38	35	35	40	36	29
R2	40	38	37	36	33	33	38	34	26
R3	40	38	37	36	33	32	37	33	26
R4	41	39	38	37	34	33	38	34	27
LFN Threshold	69	61	54	50	50	48	48	46	44

The above shows that the predicted 1/3 octave band levels do not exceed the low frequency thresholds at between 25 and 160 Hz. Therefore, the risk of problematic low frequency noise at the closest receivers due to the Project is low.

4.5.3 Environment Reference Standard – Natural Areas

Potential noise intrusion to natural areas is not assessed under the Noise Protocol, they instead have a qualitative indicator through the Environment Reference Standard (ERS), with an objective to achieve a sound quality that is *'conductive to human tranquillity and enjoyment having regard to the ambient natural soundscape'* (Land Use Category V).

The closest part of Tragowel Swamp Nature Conservation Reserve is approximately 820 m to the south of the Project, extending to almost 4 km at its furthest point. The Reserve is home to a diverse range of wildlife including wallabies, waterbirds, frogs and reptiles.

Public access to the swamp is via a parking bay which is adjacent to the Loddon Valley Highway, located approximately 2.5km south of the project, as well as what appears to be a local Council or VicRoads road-base storage facility. During periods when the swamp is inundated with water, public access to the swamp is likely limited to swamp foreshore area adjacent to the parking area, however, when the swamp is not waterlogged, the central and southern portion of the Reserve is likely to be more open to recreational hikers, birdwatchers, and 4WDers. The northern portion of the Reserve has limited public access due to farming operation adjacent to Reserve.

The soundscape across the Reserve is likely to be a combination of natural noise sources (e.g. birds, insects, frogs, wind in foliage etc.) combined with anthropogenic (human-



generated) noise sources (e.g. Loddon Valley Highway traffic, trains, farming activity, overhead aircraft etc.).

It is anticipated that the soundscape in the more accessible area of the Reserve adjacent the parking area would frequently be dominated by the sound of passing traffic on the nearby (approximately 70-100m away) Loddon Valley Highway which carries an annual average daily traffic (AADT) volume of approximately 2000 and 30% heavy vehicles. Further to the north in the Reserve in the less accessible locations, it is anticipated that along with traffic noise, farming activity noise and the noise from V/Line and freight trains on the Piangil line, which will sound their horn as they approach the Mcphail Road level crossing (500 m north east of the Reserve) will be more prevalent.

The predicted 'worst case' noise from the BESS at the northern boundary of the Tragowel Swamp Nature Conservation Reserve is approximately 35 dBA and less than 20 dBA at the southern boundary.

It is anticipated that the BESS may be occasionally audible at times at the northern parts of the Reserve (which is unlikely to be often accessed by public) during charging and discharging cycles, depending on prevailing weather conditions and other existing noise sources, natural and anthropogenic. However, further to the south in the more accessible area of the Reserve and parking lot area it is likely the BESS would be inaudible.

Given the likely existing prominence of traffic noise from the Loddon Highway and occasional train horns, the addition of the Project to the north of the Reserve is not expected to negatively impact on wildlife inhabiting the Tragowel Swamp Conservation Reserve, nor have any noticeable detrimental impact on the sound quality hikers and birdwatchers enjoy while visiting the Conservation Reserve.

5.0 Conclusions

This Noise Impact Assessment was prepared to support a Planning Application for the Tragowel BESS at Loddon Valley Highway, Tragowel. 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.

Cumulative noise was considered from the project together with the existing Kerang Solar Farm and proposed future developments. Compliance with the FZ Utilities noise limits is predicted at all receivers during day and evening with all BESS and solar developments operating and during the night when BESS components are operating.

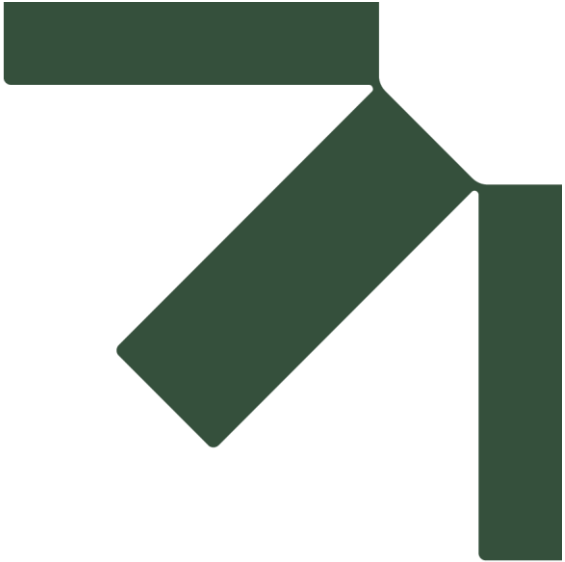
Low frequency noise was assessed in accordance with the Low Frequency Guidelines and demonstrated that the risk of problematic low frequency noise at the closest receivers is low.

The anticipated soundscape within the Tragowel Swamp Conservation Reserve was qualitatively evaluated. With the addition of the Project it is expected that the BESS will be inaudible from the more accessible southern parts of the Reserve and it is not expected to noticeably alter or negatively impact the existing soundscape in other parts of the Reserve.

The Project is predicted to meet the relevant noise criteria and legislation at all times without the need for noise mitigation with the modelled BESS equipment.

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Appendix A Construction Noise Sources

Noise Impact Assessment

Tragowel BESS

Green Switch Australia and Potentia Energy

SLR Project No.: 640.031589.00001

20 April 2026

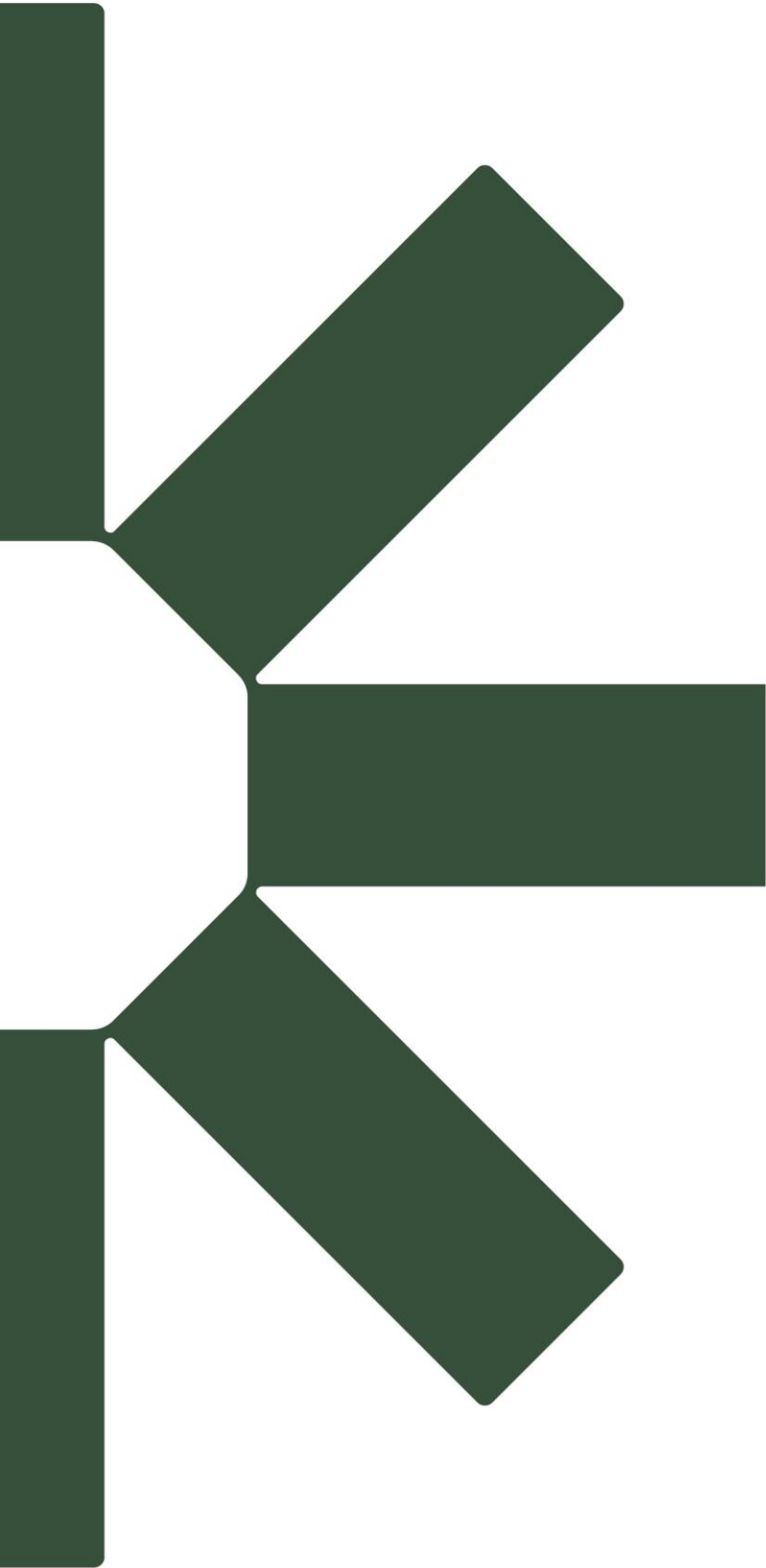
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Equipment	Total SWL	Concrete Pump	Concrete Truck	Concrete Vibrator	Crane - Mobile (100t)	Dozer	Elevated Working Platform	Excavator (20t)	Front End Loader	Hand Tools	Roller - Vibratory	Truck - Dump	Truck - Flatbed	Water Truck
Sound Power Level¹, dBA		109	109	113	113	116	97	105	112	104	114	110	103	107
Estimated on-time in any 30 minutes		20	30	10	30	20	30	20	20	30	30	20	20	20
<u>Scenario</u>														
W.01 Earthworks	119					X		X	X		X	X		X
W.02 Construction of pads, hardstands & ramps	113	X	X	X										
W.03 Equipment installation	114				X		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*

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