Elaine BESS

Noise Impact Assessment

Akaysha Energy Pty Ltd c/o Cogency Australia

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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 Akaysha Energy Pty Ltd c/o Cogency Australia (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 Elaine Battery Energy Storage System (BESS) Planning Permit Application submission on the behalf of Akaysha Energy Pty Ltd.

SLR consulting Pty Ltd (SLR) was engaged by Akaysha Energy Pty Ltd c/o Cogency Australia to provide a noise impact assessment of a proposed 311 MW / 1,244 MWh BESS (the Project), to support a Planning Permit Application submission under the Planning and Environment Act 1987.

The Project is located at 225 Elaine-Bluebridge Road, Elaine, Victoria, on rural farmland 5.3 km north of Elaine and approximately 22.5 km south-east of Ballarat.

The predicted noise levels were assessed against the various requirements of the EPA (EP Act, EP Regulations and Noise Protocol limits and GED).

The key project findings in relation to noise are as follows:

- Noise from **construction activities**: Scheduling construction activities to the EPA normal working hours (e.g. day period 7.00 am to 6.00 pm), community engagement and best practice noise management controls, regular maintenance, broadband reversing beepers etc. will minimise residual risk of impact or harm to nearby receivers.
- Noise from **operational activities**: Noise modelling with a conservative 'worst case' assumption of 100% operating load for all time periods during conditions favourable to noise propagation results in compliance with the Noise Protocol at the closest sensitive receivers for the day and evening periods. The nighttime noise limit is predicted to be achieved if the BESS operates at 80% battery and 30% power electronics (inverter) fan duty, with no further mitigation.

It is recommended to confirm compliance by post commissioning noise measurements.

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1.0 Introduction

Akaysha Energy Pty Ltd is proposing to develop a 311 MW / 1,244 MWh battery energy storage system (BESS), located at 225 Elaine-Bluebridge Road, Elaine, Victoria.

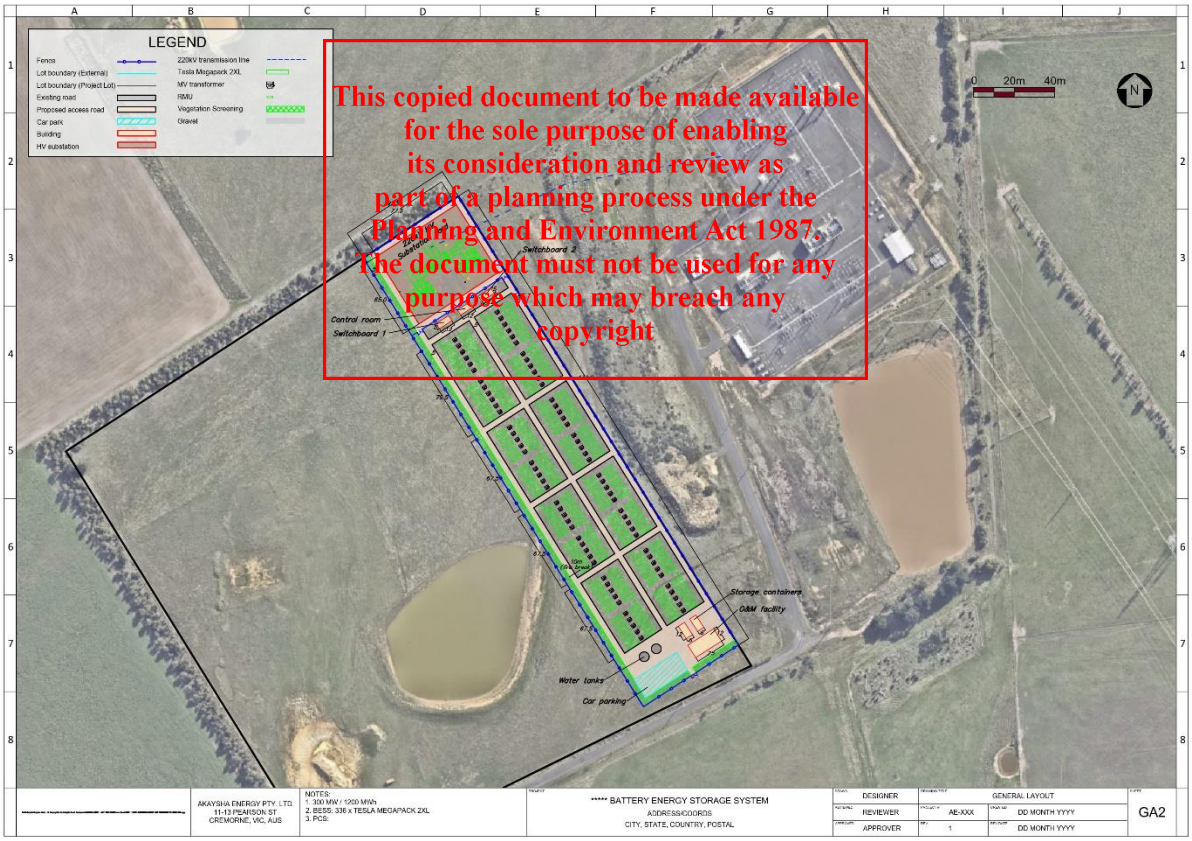
SLR Consulting Pty Ltd (SLR) has been engaged by Akaysha Energy c/o Cogency Australia to conduct a noise assessment to support the Planning Permit Application of the proposed Elaine BESS.

2.0 Project Area

The proposed site is on rural farmland 5.3 km north of Elaine and approximately 22.5 km south east of Ballarat. The site located immediately east of the Elaine Terminal Station, between the Elaine and Yendon wind farms that make up the Lal Lal Wind Farm.

The BESS will also include a 220 V – 33 kV High Voltage substation on the northern side and will feed into the existing Elaine substation via an approximately 300 m long aboveground transmission line or buried cable. **Figure 1** shows the project layout plan.

Figure 1 Concept Layout Plan



Twenty noise sensitive receivers were identified within a 2 km radius of the site boundary. **Figure 2** shows the identified receivers with respect to the project area and **Table 1** summarises the receiver locations (UTM coordinates in GDA 2020 Zone 54) and the distance to the centroid of the project site.

Figure 2 Project Area and Sensitive Receivers within 2 km

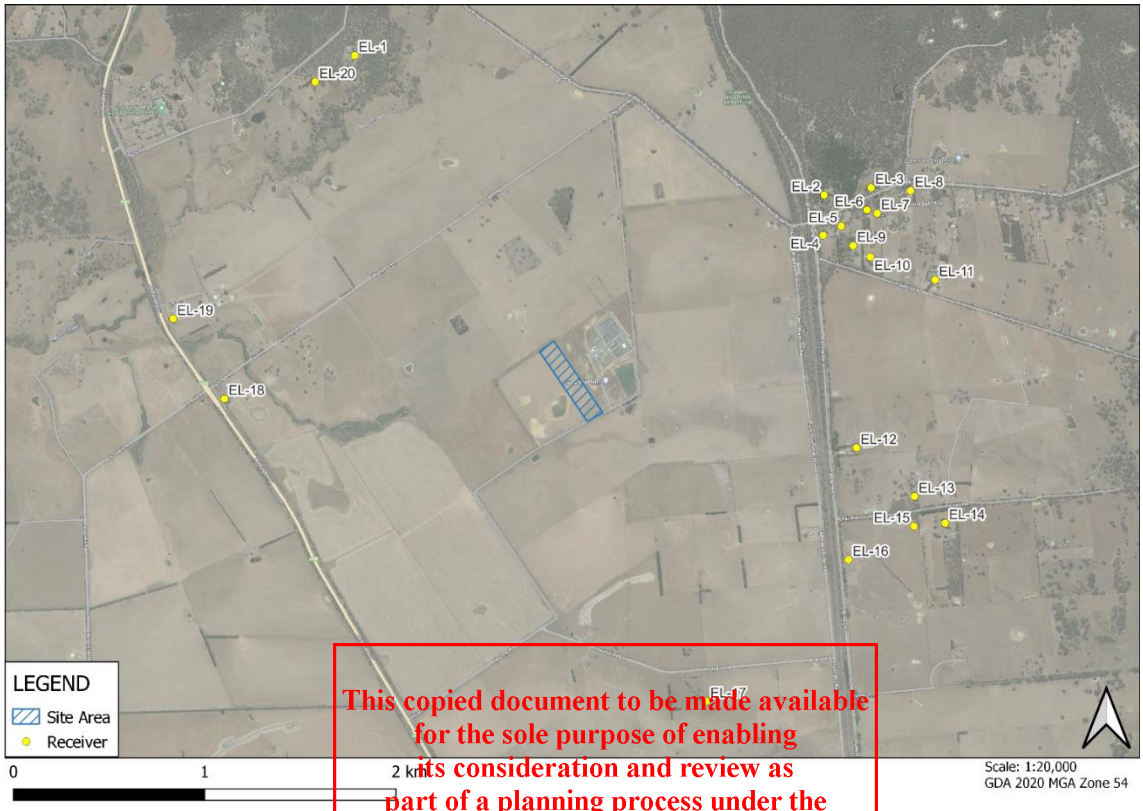


Table 1 Noise Sensitive Receivers

Receptor	Easting	Northing	Distance to project centroid (m)
EL-1	764194	5821355	2040
EL-2	766597	5820469	1640
EL-3	766845	5820493	1870
EL-4	766578	5820260	1520
EL-5	766676	5820302	1630
EL-6	766816	5820378	1790
EL-7	766868	5820357	1830
EL-8	767050	5820464	2040
EL-9	766731	5820196	1640
EL-10	766817	5820132	1700
EL-11	767148	5819990	1980
EL-12	766682	5819141	1530
EL-13	766968	5818868	1890
EL-14	767119	5818718	2090
EL-15	766955	5818713	1950
EL-16	766602	5818560	1720

Receptor	Easting	Northing	Distance to project centroid (m)
EL-17	765813	5817869	1810
EL-18	763399	5819609	1810
EL-19	763158	5820043	2100
EL-20	763979	5821231	2060

3.0 Existing Noise Environment

Background noise monitoring was conducted by SLR to characterise and quantify the existing noise environment at the site and surrounding land. Continuous unattended noise logging was conducted at 33 Betsons Rd, Mount Doran (receiver EL-10), which is indicative of the noise environment of the closest sensitive receivers.

Monitoring commenced on 7 March 2023 and concluded on 25 March 2023. The objective of the unattended noise monitoring was to quantify the existing ambient and background noise levels at the nearest noise sensitive receivers to the subject site, and to assist in determining the appropriateness of nominated noise criteria for the proposed development.

The unattended noise monitoring was carried out using an ARL -316 noise logger (serial number: 16-207-045). The logger was configured to record A-weighted fast statistical noise levels over consecutive hourly periods. It was checked for calibration before and after the monitoring period, using an ARL NDB Sound Level Calibrator (serial number 3011372) and no significant drift in calibration was detected. The noise logger was located in the acoustic free field with a microphone height of 1.5 m above the existing ground level.

The noise monitoring was conducted consistent with guidelines provided in Australian Standard 1055 *Acoustics – Description and Measurement of Environmental Noise* and the EPA Publication 1826.4 *(Noise limit and assessment protocol for the control of noise from commercial, industrial and trade premises and entertainment venues*) (Noise Protocol). The acoustic instrumentation was designed to comply with Australian Standard IEC 61672.1-2004 *Electroacoustics – Sound level meters – Specifications* and carry current manufacturer calibration certificates.

Weather data for the monitoring period was obtained from the Bureau of Meteorology's Ballarat Aerodrome weather station (Station ID: 089002), located approximately 31 km from the project site. Any periods of precipitation (rainfall) or wind speeds greater than 5 m/s were excluded from the analysis of existing noise levels.

The complete measurement results of the unattended noise surveys are presented graphically in **Appendix A** along with photos of the installed monitoring equipment. **Table 2** contains the measured background noise levels.

Table 2 Monitored Noise Levels – Existing Noise Environment

Location	Measured Background Noise Level, L_{90} dBA		
	Day	Evening	Night
33 Betsons Rd, (EL-10)	33	29	24

4.0 Victorian Regulations

4.1 General Environmental Duty

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

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 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.

4.2 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.

4.2.1 EP Act 2017

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

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

Unreasonable noise means noise that—

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

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

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

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

4.2.2 EP Regulations and Noise Protocol 2021

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

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 3 presents the assessment periods prescribed by the Regulations**.**

Table 3 Definitions of Day, Evening and Night (Environmental Protection Regulations 2021)

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

Rural Method – Noise Limits

The Noise Protocol noise limits for receivers in a rural environment take into consideration both influence of the zoning map categories (and changes in zoning categories), the background noise, 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 BESS facility.

Paragraph (31) states that if the utility is located in a Farming Zone 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

Project Specific Noise Limits

The BESS and all receivers within 2 km are located within a Farming Zone, and the receivers are deemed to be not located in background relevant areas, therefore the project specific noise limits are the distance-adjusted levels for utilities and are shown in **Table 4**:

Table 4 Project Specific Noise Limits

Receiver	Day	Evening	Night
All receivers	45 dBA	39 dBA	34 dBA

Protocol Assessment

The effective noise level is determined for noise from commercial, industrial and trade premises, as a 30-minute equivalent sound pressure level ($L_{Aeq, 30min}$) adjusted for character, including tonality, intermittency, and duration, where relevant.

The adjusted noise level is compared with the noise limit to determine whether or not the premises complies with the Noise Protocol.

As the proposed BESS facility is potentially able to operate 24-hours per day, the most stringent night-time noise limits have been applied to this assessment.

4.2.3 Low frequency noise guidelines

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

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

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

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

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

Table 5 details the outdoor noise threshold criterion to be used for outdoor measurements. The noise threshold level for outdoor low frequency is based on the assumed façade noise reductions given in Downey and Parnell (2017).

Table 5 Outdoor One-third Octave Low Frequency Noise Threshold Levels from 10 Hz to 160 Hz

Outdoor one-third octave low frequency noise threshold levels													
One-third Octave (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

4.3 Construction Noise – Victoria

The *Civil construction, building and demolition guide*, (EPA Publication 1834) of November 2020 replaced earlier documents EPA Publication 480 and the relevant section of EPA Publication 1254.

EPA Publication 1834 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 does not establish objective noise goals or limits for works conducted during Normal Working Hours, it states that construction noise should be minimised as far as possible in any situation and that a noise impact assessment may be used to inform the risk assessment process for construction works and to inform plans for the management of noise generated during construction.

Table 6 presents the EPA construction noise guidelines.

Table 6 EPA Publication 1834 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 details that whilst projects should aim to constrain works to normal working hours, where necessary, works or activities outside normal working hours may occur for:

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

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

5.0 Noise Modelling

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 9613-2[1] 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.

5.1 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 within 5 km of the proposed site was sourced from publicly available 50 centimetre digital elevation data from Victorian State Government Department of Environment, Land, Water and Planning (DELWP).
- Ground absorption is modelled by a single number parameter between 0 (hard – reflective) and 1 (soft – absorptive). Elaine Terminal Station and the Project area were modelled as hard ground, all other ground surfaces were modelled with a ground absorption parameter of 0.6, suitable for rural farmland.

5.2 Construction Noise Assessment

Construction activities are proposed to be undertaken during daytime hours only. Two construction scenarios were evaluated:

1. Clear and grade the entire site, including compaction and drainage and construction of hardstand pads for the BESS infrastructure.
2. BESS infrastructure deliveries and installation, installation of transformers and construction of onsite buildings.

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

5.2.1 Sound Power Levels

Sound power levels of typical mobile plant and equipment, taken from SLR's noise database of field measurements and BS 5228-1:2009[2] are summarised in **Table 7**. For a worst-case assessment it is assumed that all equipment is operating continuously over the assessment period, due to sequencing of equipment usage that often occurs on site, this is expected to represent a conservative approach.

The construction scenarios were modelled as area sources covering the infrastructure study area.

Table 7 Construction Equipment Sound Power Levels

Scenario	Equipment	Quantity	SWL, per item, $L_{Aeq,\ 15\ min}$
Clear and Grade	Excavator CAT 330 – 30T	2	107
	Dozer CAT D8	1	113
	Grader	2	103
	Dump Truck	2	105
	Vibratory Roller	1	105
	Water cart	1	106
Infrastructure Delivery and Construction	Trucks	2	102
	Powered Hand Tools	4	102
	Forklift or Telehandler	1	102
	20 t Franna crane	1	98
	Diesel Generator	4	94
	Diesel Pumps	2	97
	Elevated Working Platform (EWP)	3	95

5.3 Operational Noise Assessment

5.3.1 Sound Power Levels

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 being generated by the equipment.

Sound power levels were supplied by the OEM for cooling fan duty cycles ranging from 0% to 100% in 10% increments. Each BESS unit consists of 5 cooling units (for the 4-hour charge/discharge cycle configuration), two fans cool the battery modules, and three fans cool the power electronics (inverter). These fans can operate at different duty cycles, depending on the cooling requirements of the battery and inverter. When charging and discharging, the two battery fans typically operate between 40% to 100% load, depending on the ambient temperature, whilst the inverter fans generally do not exceed 30%.

Considering the previous discussion, two scenarios were developed:

[2] *Code of Practice for Noise and Vibration Control on Construction and Open Sites – Part 1: Noise*

Scenario 1: 100% Fan Duty – Day/Evening Period Assessment

This is considered the absolute worst-case day-time scenario, all fans are operating at 100% duty for the duration of the assessment. Noise levels at the receiver are assessed against the daytime criterion of 45 dBA.

Scenario 2: 80% Battery Fan Duty, 30% Power Electronics Duty – Night Period Assessment

Depending on market conditions, the BESS may occasionally discharge during the night period. This scenario models a typical night period discharge. An 80% battery fan duty is deemed a reasonable assumption for night operations considering that ambient temperatures are lower than the day time.

Table 8 summaries sound power levels for the key operational equipment.

Noise emissions from Elaine Terminal Station were modelled to account for cumulative noise impacts from existing industry to assess against the Noise Protocol. It should be noted that noise emissions from the Elaine Wind Farm turbines were not modelled as they are assessed under separate legislation.

The spectrum for the Elaine Terminal Station transformer was adopted from reference data by Bies and Hanson (11.16).

Table 8 Equipment Sound Power Levels – BESS & HV Transformer

Qty	Item	Scenario	Sound Power Level (SWL), per unit $L_{eq\ 15\ min}$, dBA
	Battery and inverter	Scenario 1: 100% battery fan duty & 100% inverter fan duty	98
		Scenario 2: 80% battery fan duty & 30% inverter fan duty	93
	Medium voltage transformers	1 & 2	68 to 70[1]
1	200 MW HV Transformer	1 & 2	86[2]

Notes:

1: The medium voltage transformers (MVT) are at least 10 dB quieter than the battery units, and there are twice as many battery sources as MVTs, therefore the source contribution of the MVT to noise levels at the closest sensitive receiver are negligible.

2: from supplier measurements

Table 9 Equipment Sound Power Levels – Elaine Terminal Station

Qty	Item	Scenario	Sound Power Level (SWL), per unit $L_{eq\ 15\ min}$, dBA
1	84 MW HV Transformer	1 & 2	93[1]

Notes:

1: derived from AS60076.1

6.0 Assessment Results

6.1 Construction Nosie Results

Table 10 presents the construction noise results for the clear and grade and infrastructure construction scenarios. It is anticipated that construction works would occur during the EPA normal working hours (day) only. Predicted levels are of the order of 31 to 35 dBA at the closest receivers. This compares with the measured existing background level at EL-10 (33 dBA, L_{90}). It is expected that construction noise may be audible on occasions at the receivers, however it is unlikely to be intrusive.

Noise contour maps for the construction scenarios are presented in **Appendix B**.

Table 10 Construction Assessment Results

Receiver ID	Clear and Grade, dBA	BESS & HV Substation construction, dBA
EL-1	32	25
EL-2	33	26
EL-3	32	25
EL-4	34	27
EL-5	33	27
EL-6	32	26
EL-7	32	25
EL-8	31	24
EL-9	33	27
EL-10	33	26
EL-11	32	25
EL-12	35	28
EL-13	32	25
EL-14	30	24
EL-15	31	25
EL-16	33	26
EL-17	37	30
EL-18	32	25
EL-19	30	23
EL-20	31	24

6.2 Operational Noise Results

6.2.1 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 battery fans do have tonal characteristics. Tonality is judged (subjectively) at the receiver in context with the ambient environment.

Given the propagation distances to the receivers (of the order of 1.5 to 2 km) 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 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.

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.

6.2.2 Low Frequency Noise

Low frequency noise contains significant acoustic energy in one-third octave bands ranging from 10 Hz to 160 Hz. The OEM provided noise spectra for their units between 100 Hz to 10 kHz. Depending on the duty cycle, the cooling fans of the battery units 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 100, 125 and 160 Hz frequency bands were not identified at any receivers in the modelling.

6.2.3 Scenario 1: 100% Fan Duty – Day/Evening Period Assessment

The predicted noise levels at the identified receivers within 2 km of the project site are presented in **Table 11**. Noise contour plots for Scenario 1 can be found in **Appendix B**.

Compliance with the day and evening time criteria can be achieved at all receivers when all batteries are operating at 100% fan duty.

Table 11 Scenario 1 Results: 100% Fan Duty – Day and Evening Period Assessment

Receiver	100% Fan Duty, LAeq, 30 min	Noise Limits LAeq, 30 min		Margin of Compliance, dBA	
		Day	Evening	Day	Evening
EL-1	37	45	39	8	2
EL-2	38	45	39	7	1
EL-3	37	45	39	8	2
EL-4	39	45	39	6	0
EL-5	38	45	39	7	1
EL-6	37	45	39	8	2
EL-7	37	45	39	8	2
EL-8	36	45	39	9	3
EL-9	38	45	39	7	1
EL-10	38	45	39	7	1
EL-11	36	45	39	9	3
EL-12	39	45	39	6	0
EL-13	37	45	39	8	2
EL-14	35	45	39	10	4
EL-15	36	45	39	9	3
EL-16	38	45	39	7	1
EL-17	39	45	39	6	0
EL-18	37	45	39	8	2
EL-19	35	45	39	10	4
EL-20	37	45	39	8	2

6.2.4 Scenario 2: 80% Battery Fan Duty, 30% Power Electronics Duty – Night Period Assessment

The predicted noise levels at the closest identified receivers shown in **Table 12**. Noise contour plots for Scenario 2 can be found in **Appendix B**.

Compliance with the night-time criteria can be achieved at all receivers when all batteries are operating at 80% battery fan and 30% power electronics fan duty.

Table 12 Scenario 1 Results: 80% Battery Fan Duty, 30% PE Duty – Night Period Assessment

Receiver	80% Battery, 30% PE Duty. LAeq, 30 min	Night Time Criterion, LAeq, 30 min	Margin of Compliance, dBA
EL-1	30	34	4
EL-2	32	34	2
EL-3	31	34	3
EL-4	33	34	1
EL-5	32	34	2
EL-6	31	34	3
EL-7	31	34	3
EL-8	30	34	4
EL-9	32	34	2
EL-10	32	34	2
EL-11	30	34	4
EL-12	33	34	1
EL-13	31	34	3
EL-14	29	34	5
EL-15	30	34	4
EL-16	32	34	2
EL-17	33	34	1
EL-18	31	34	3
EL-19	29	34	5
EL-20	30	34	4

7.0 Discussion

7.1 Construction Noise

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.

7.2 Operational Noise

Scenario 1 showed that the Rural Utilities noise criteria can be met during the day and evening period with the battery and power electronics cooling fans operating at 100% and under atmospheric conditions favourable to noise propagation. This is the absolute worst-case scenario; OEM data showed that the power electronics fan are generally not required to operate at 100%, even on hot days (circa 40 degree Celsius).

Data from the OEM suggests that the batteries (each including 5 cooling fans, 2 fans cool the battery modules, and 3 cool the power electronics) may operate at lower duties during night operations, as ambient temperatures are lower. The battery modules may operate between 40% to 80% duty cycle and the power electronics cooling fan generally operates no greater than 30% duty cycle. Compliance with the night-time noise criteria can be achieved at these fan loads.

8.0 Conclusions

This noise assessment report was prepared to support a Planning Permit Application for the Elaine BESS development. This report presents applicable noise criteria, background noise measurements, assessment methodology and results that show compliance with the day, evening and night-time noise goals.

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

Compliance with the day and evening criteria are demonstrated for the worst case 100% operating load under conditions favourable to noise propagation. Compliance with the night-time noise goal can be achieved if the batteries operate at 80% battery fan duty and 30% power electronics fan duty. Further review by the proponent with the OEM is recommended to ensure this is achievable at all times.

All plant, equipment and the design layout will be reviewed during the detailed design stage to ensure that compliance with the noise limits is achieved as the acoustic performance of plant and site layout is refined, followed by post commissioning noise measurements to confirm compliance.

Appendix A Background Noise Measurments

Elaine BESS

Noise Impact Assessment

Akaysha Energy Pty Ltd c/o Cogency Australia

SLR Project No.: 640.30616.00001

13 May 2024

SLR

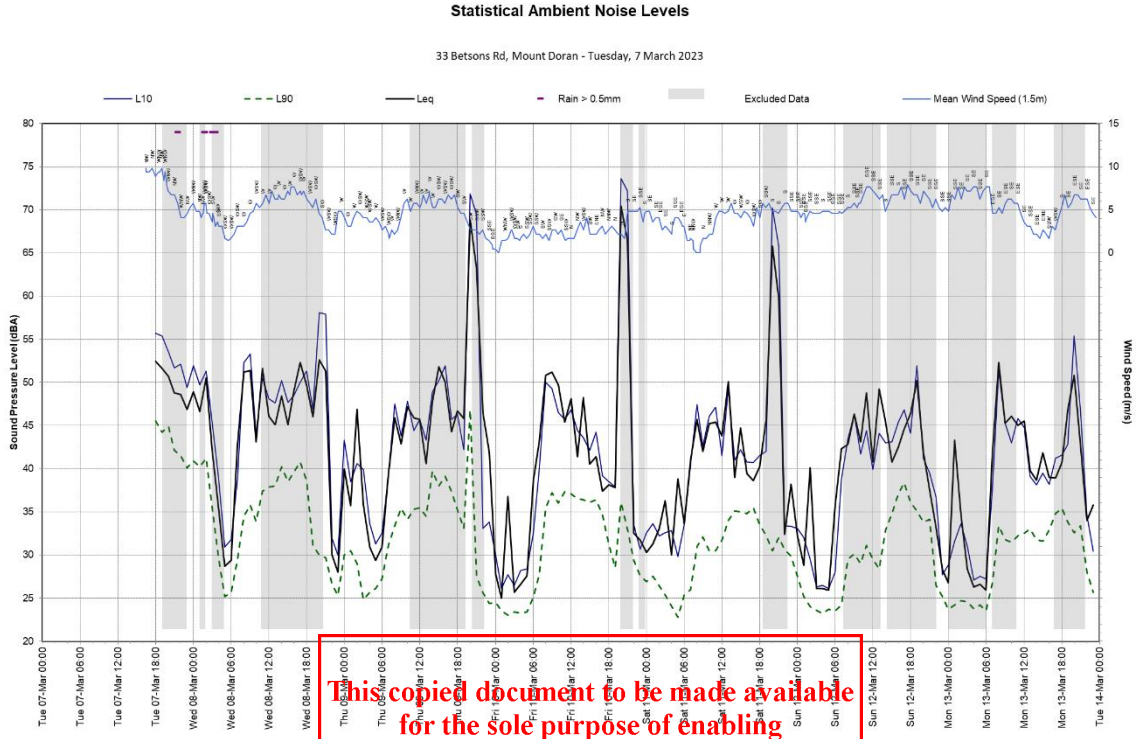
Figure A1: Location EL10 background noise measurement location

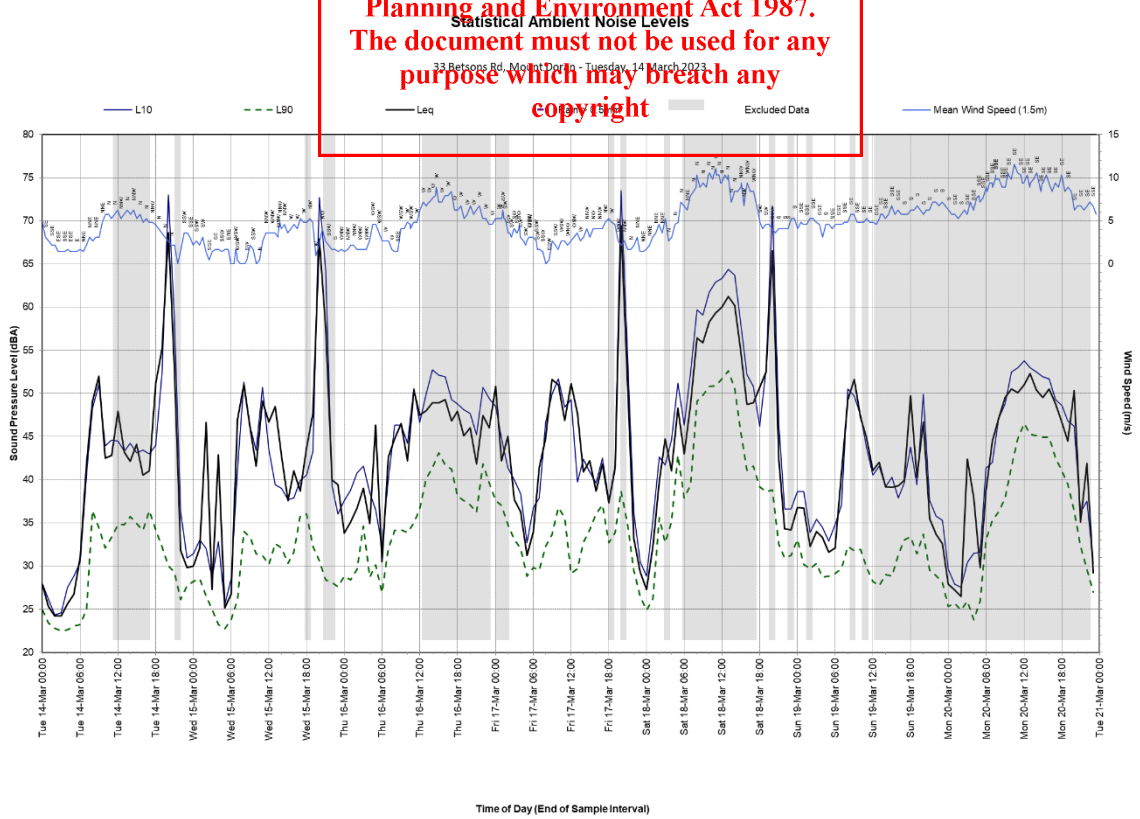
LOOKING NORTH

LOOKING EAST

LOOKING SOUTH

LOOKING WEST





Appendix B Noise Contour Maps

Elaine BESS

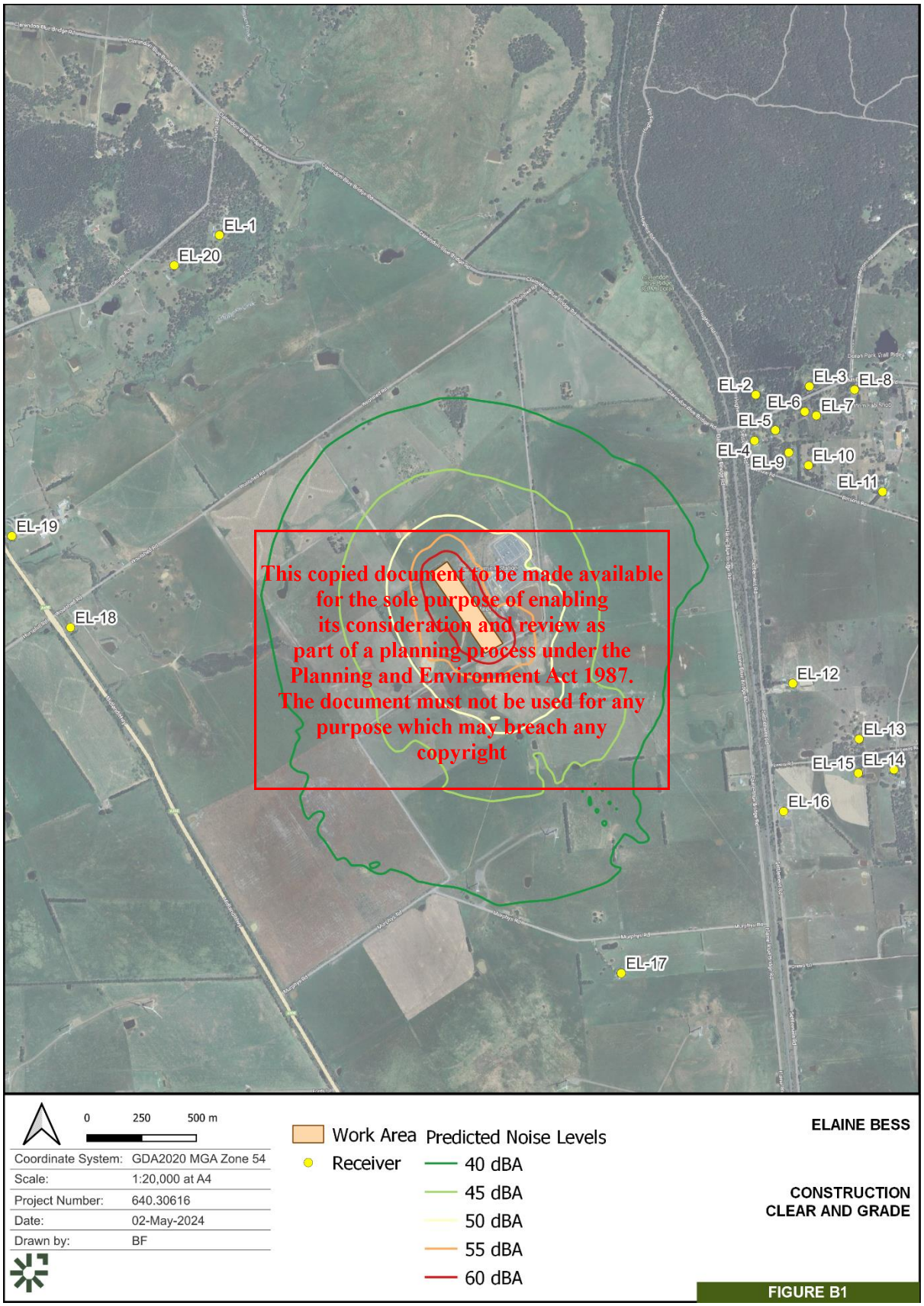
Noise Impact Assessment

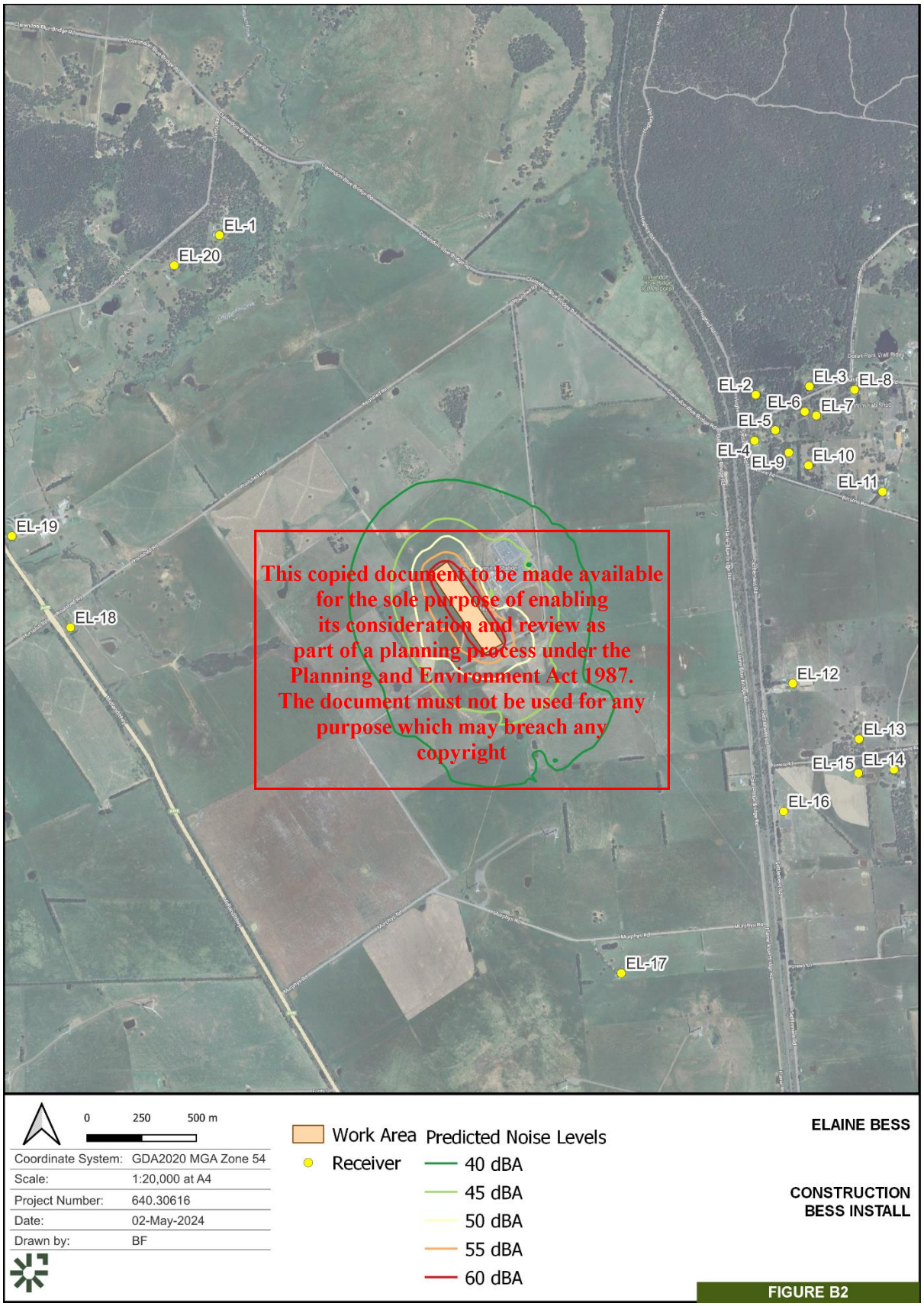
Akaysha Energy Pty Ltd c/o Cogency Australia

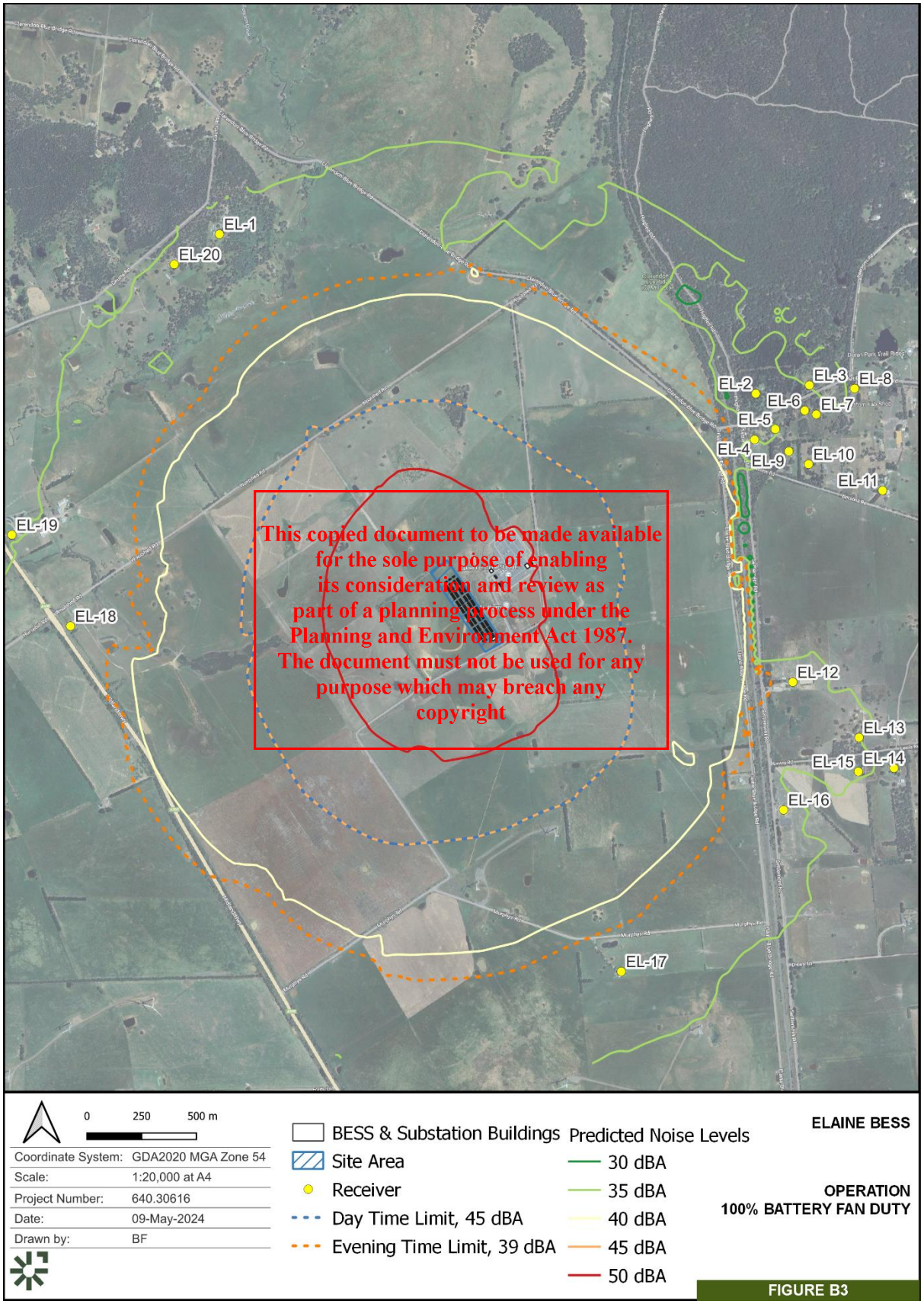
SLR Project No.: 640.30616.00001

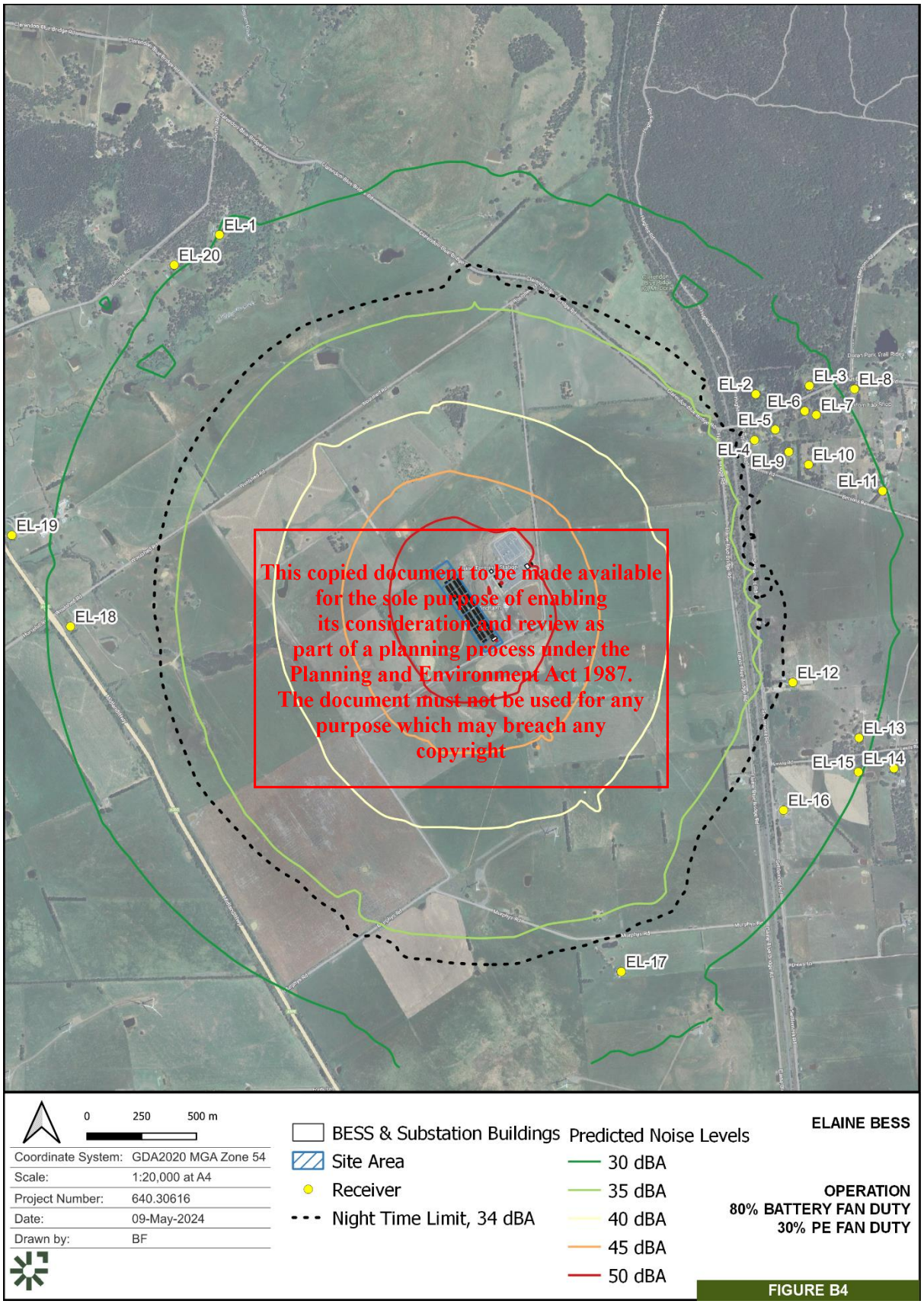
13 May 2024

SLR









Making Sustainability Happen

Technical Memorandum

To:	Hannah Scott	**From:**	Gustaf Reutersward
Company:	Department of Transport and Planning		**SLR Consulting Australia**
cc:		**Date:**	1 July 2024
		Project No.	640.30616.00001

RE: Elaine BESS Addendum
Response to DTP cumulative noise request

Dear Hannah,

I have reviewed the letter prepared by the Department of Transport and Planning (DTP) dated 26/06/2024 and provide the following.

The letter requests that the Elaine BESS project amendment application provide further information regarding the potential for cumulative noise impacts as per the extract below.

> The further information required is:
>
> 1. An updated Noise Impact Assessment (or a follow up addendum/letter) prepared by a suitably qualified consultant that takes into consideration:
>   - The cumulative noise impacts of the proposed facility, the Elaine Terminal Station and Lal Lal Wind Farm (i.e. the current noise environment).
>   - The cumulative noise impacts of the proposed facility, the Elaine Terminal Station, Lal Lal Wind Farm and the recently approved Elaine Solar Farm and BESS (PA2302521) (i.e. the future noise environment).

1.0 Current noise environment - Elaine Terminal Station and Lal Lal Wind Farm

The Elaine BESS Noise Impact Assessment report (ref: 640.30616-R02-v1.2-20240513) already does include the noise contribution from the existing Elaine Terminal Station.

The assumed noise emission levels are detailed in Table 9 of the report and are based on AS60076.1, which is likely to provide a conservative estimate for the Terminal Station HV transformers.

Wind farm noise from wind turbine generators in Victoria is regulated under *Environment Protection Amendment (Wind Turbine Noise) Regulations 2022* and is evaluated using New Zealand Standard NZS6808:2010 *Acoustics - Wind farm noise (*NZS6808).

Fixed plant associated with a wind farm, such as the electrical terminal transformer substation (e.g. Elaine Terminal Station), is assessed separately under EPA Publication 1826: *Noise limit and assessment protocol for the control of noise from commercial,*

industrial and trade premises and entertainment venues (Noise Protocol). The two assessments are separate, as the two assessment methodologies are largely incompatible.

NZS6808 noise limits are based on a statistical regression of wind speed and pre-existing baseline background noise levels and a wind farm noise emission that varies with wind speed. A result of this is that during higher wind speeds when wind farm noise is greater, the noise limit is higher as background noise levels are generally greater.

Noise protocol noise limits are typically based on base noise limits with adjustment for zoning and minimum background noise levels, where they are high.

It should be noted that the minimum NZS6808 noise limit of 40 dBA is generally higher than the relevant night-time Noise Protocol derived noise limit of 34 dBA.

In summary, wind farm noise emissions are considered separately from other industrial noise sources under the regulatory regime in Victoria.

2.0 Future noise environment - Lal Lal Wind Farm and the recently approved Elaine Solar Farm

I have briefly reviewed the WSP *Elaine Solar Farm Noise Impact Assessment* report (Elaine Solar Farm NIA), dated October 2023, and make the following observations:

- The assessment considers noise emissions from the subject project (Elaine Solar Farm) only, with no consideration of other existing or proposed projects.
- The assessment appears to be a worst case impact evaluation, based on the "conservative assumption that all plant has is required to operate at 100 % at all times (24-hour operation)".
- There are inconsistencies between the approved BESS size, project description in the NIA and the modelled BESS in the NIA, making it difficult to accurately model the cumulative noise impacts.).
- The report does not evaluate the likelihood of night-time (10pm to 7am) BESS discharge or noise emission, nor does it provide any indication of a more realistic operating scenario for noise emission during the night-time, considering lower ambient temperatures associated with night-time and the resulting lower cooling fan loads during night-time.
- The predictions utilise ISO9613 prediction algorithms that are "designed to assume conditions that favour the propagation of noise from meteorological effects, described as a slight wind (1 to 5 m/s) blowing from source to receiver, or a well-developed moderate ground-based temperature inversion".
- The predicted noise levels in the report include the following adjustments:
    - +2dB for overall modelling uncertainty. We note that by including such a penalty for uncertainty, skews the risk profile of the impact assessment.
    - Up to +5dB tonal correction at some receptors, noting that this is based on a 1/3 octave spectrum of a singular unit, whereas the Solar Farm BESS facility may have 40-100+ BESS units operating at different capacities and therefore uniquely different spectra. Further the tonality assessment takes no consideration of the absolute level compared to ambient background levels and hence no consideration of masking. The tonal assessment therefore likely overstates the risk of tonality being a feature.

In my opinion, on the basis of the above, the Elaine Solar Farm NIA provides an overly conservative evaluation of likely noise levels emitted during the night-time.

Notwithstanding the above, the Elaine Solar Farm NIA provides predicted levels to receptors that are common to that evaluated by SLR for Akaysha's Elaine BESS project.

Examining the documented predicted noise levels for both projects (noting that they are rounded to the nearest integer) we get the following, showing the potential cumulative noise of both Elaine BESS & Terminal Station together with the Elaine Solar Farm.

Table 1 Cumulative noise consideration

Receptors		Predicted Noise Level			
SLR NIA	WSP NIA	Elaine BESS + Terminal Station dBA	Elaine Solar Farm dBA	Cumulative dBA	Potential exceedance night limit dB
EL1	146 Courts Rd	30	32	34	
EL4	544 Settlement Rd	29	31	33	
EL10	51 Betsons Rd	32	31	35	+1
EL12	430 Settlement Rd	33	31	35	+1
EL16	Elaine Blue Bridge Rd	32	31	35	+1
EL17	154 Murphys Rd	33	31	35	+1
EL18	5876 Midland Hwy	31	33	35	+1

The above indicates that the addition of the predicted Elaine Solar Farm noise levels to the cumulative Elaine BESS & Terminal station predicted noise levels would result in an increase of approximately 2 to 4 dB to receptors critical to both projects and the potential cumulative noise may exceed the night-time noise limit by approximately 1 dB. In practice a 1 dB difference in noise level would be imperceptible.

However, as discussed above, the predictions from the Elaine Solar Farm NIA report may likely include a number of overly conservative assumptions (100% operation at night, uncertainty margin and tonality penalty), which overstate the predicted night-time noise from the facility.

3.0 Closure

Cumulative noise from the Elaine BESS and Elaine Terminal Station have already been considered in the Elaine BESS Noise Impact Assessment report.

Wind Farm noise emissions are considered separately from other industrial noise sources under the regulatory regime in Victoria and the Noise Protocol and NZS6808 assessment methodologies are largely incompatible.

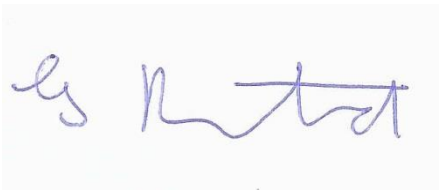
We have evaluated the potential cumulative noise from Elaine BESS, Elaine Terminal Station and the Elaine Solar Farm in Table 1. The result indicates that the predicted cumulative noise may marginally exceed the most stringent nighttime noise limit at the closest receptors, however, due to a number of conservative input assumptions, the result likely overstates the potential noise impact. Accordingly, the predicted marginal exceedance should be evaluated together with the following considerations;

- What is the likelihood all BESS batteries operating at 100% cooling load during the night-time (10pm-7am)? Considering that morning and evening peak electricity demand is typically outside of the night time period, and night-time ambient temperatures are significantly lower than peak daytime temperature.
- Whilst an individual battery unit may have a frequency spectrum that shows tonality (at a frequency directly related to fan speed) when measured in its proximity, what is the likelihood of the overall received sound having tonal character when considering that it is comprised of the cumulative contribution of up to 200-400 individual battery modules that operate somewhat independently of each other (and likely at different fan speeds).

In consideration of the above it is my opinion that cumulative noise impact at night-time is unlikely to be an issue.

Regards,

SLR Consulting Australia



GUSTAF REUTERSWARD M.A.A.S. BE (MECH) HONS
TECHNICAL DIRECTOR ACOUSTICS