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Grahamvale BESS

305 Verney Rd & 221 Grahamvale Rd, Grahamvale

Acoustic Report – Environmental Noise Emission Assessment

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1. Introduction

The proposal includes the construction and operation of a battery energy storage system (BESS) at the sites described as 305 Verney Rd and 221 Grahamvale Rd, Grahamvale.

The new facility will include electrical infrastructure which will generate noise emissions with the potential to impact on the acoustic amenity of the surrounding environment including at residential receptors.

In consideration of the above, Watson Moss Growcott Acoustics (WMG) has been engaged to undertake an assessment of noise emissions from the proposal and consider the outcomes relative to Victorian legislative requirements.

This report presents the findings of the assessment and includes indicative noise mitigation strategies to ensure that calculated noise emissions achieve compliance with relevant criteria at sensitive receptors in proximity to the site.

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2. Noise Assessment Objectives

When addressing potential noise emissions from the proposal, the assessment must consider the requirements of the Environmental Protection Act 2017, as well as relevant referral documentation including:

- Environment Protection Regulations 2021.
- EPA Publication 1826.4 'Noise limit and assessment protocol for the control of noise from commercial, industrial and trade premises and entertainment venues'.
- Environmental Reference Standard.
- EPA Publication 1996 Noise Guideline – assessing low frequency noise.
- Greater Shepparton Planning Scheme (Clause 13.05-1S – Noise Management).

In consideration of the above, the primary objective of the assessment is to determine whether the proposal satisfies the minimum requirements of the Environment Protection Act 2017, and whether noise emissions comply with the requirements of the above Regulations and guideline documentation.

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3. Noise Assessment Terminology

Noise assessment terminology used within this report is defined within Table 1 below.

Table 1: Noise Assessment Terminology

Terminology	Definition
dB(A)	Decibels recorded on a sound level meter, which has had its frequency response modified electronically to an international standard, to quantify the average human loudness response to sounds of different character
L_{eq}	The equivalent continuous level that would have the same total acoustic energy over the measurement period as the actual varying noise level under consideration. It is the noise measure defined by the EPA as the measure of the noise to use in assessing compliance with noise limits.
L_{90}	The level exceeded for 90% of the measurement period, which is representative of the typical lower levels in a varying noise environment. It is the noise measure defined by the EPA as the measure of the background noise level to use in determining noise limits.
Sound Power Level (L_w)	The sound power level of a source is a measure of the amount of energy in the form of sound emitted from the source. The sound power level of a source is an inherent characteristic of that source and does not vary with distance from the source or with a different acoustic environment. The sound power level equals the sound pressure level at a distance from the source plus 10 times the logarithm (to base 10) of the measurement surface area (m^2), and is relative to a reference sound power of 1pW, (10-12 Watts).
Sound Pressure Level (L_p)	Sound that we can hear with our ears or measure with a sound level meter is actually small variations in the pressure of the air around us. The magnitude of the pressure fluctuations vary over a very wide range from the very lowest levels we can just hear to the very high levels we need to be protected from, and for that reason sound is measured on a logarithmic scale. The sound pressure level equals 10 times the logarithm (to base 10) of the sound pressure divided by a reference pressure, which is 20 μPa . The sound pressure level reduces with increasing distance from a source and is influenced by the surroundings.

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4. Measurement Equipment

As part of the assessment works, WMG has used the equipment described in Table 2 below

Table 2: Measurement Equipment List

Equipment Designation	Use of Equipment
Rion NA27 Precision Sound Level Meter	Handheld Noise Measurements
Ngara Real Time Sound Acquisition System	Fixed Position Unattended Noise Monitoring

Field calibration of the measurement equipment was checked with a Bruel & Kjaer Type 4230 Sound Level Calibrator at commencement and completion of the noise measurements and found to be within the correct calibration range.

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5. Site and Surrounding Environment

The land under consideration is located to the north of Shepparton town centre and is generally surrounded by Farm Zone (FZ) land occupied by commercial and residential use. The site abuts Grahamvale Road to the east, Public Use Zone (PUZ1) land associated with a local water channel to the west, and FZ land to the north and south.

For the purposes of this assessment, the closest and therefore most critical sensitive uses located within proximity to the site are understood to include:

- R01 – 265 Grahamvale Rd.
- R02 – 227 Grahamvale Rd.
- R03 – 221 Grahamvale Rd.
- R04 – 205 Grahamvale Rd.
- R05 – 215 Grahamvale Rd.
- R06 – 197 Ford Road.
- R07 – 195 Ford Road.
- R08 – 145-185 Ford Road.
- R09 – 255 Verney Road.
- R10 – 307 Verney Road.
- R11 – 315 Verney Road.
- R12 – 335 Verney Road.
- R13 – 345 Verney Road.
- R14 – 337 Grahamvale Road.
- R15 – 305 Grahamvale Road

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Figure 1 below provides an aerial image of the subject site boundary, the proposed BESS location and the surrounding environment including the sensitive receptors which have been considered as part of the noise emission assessment.

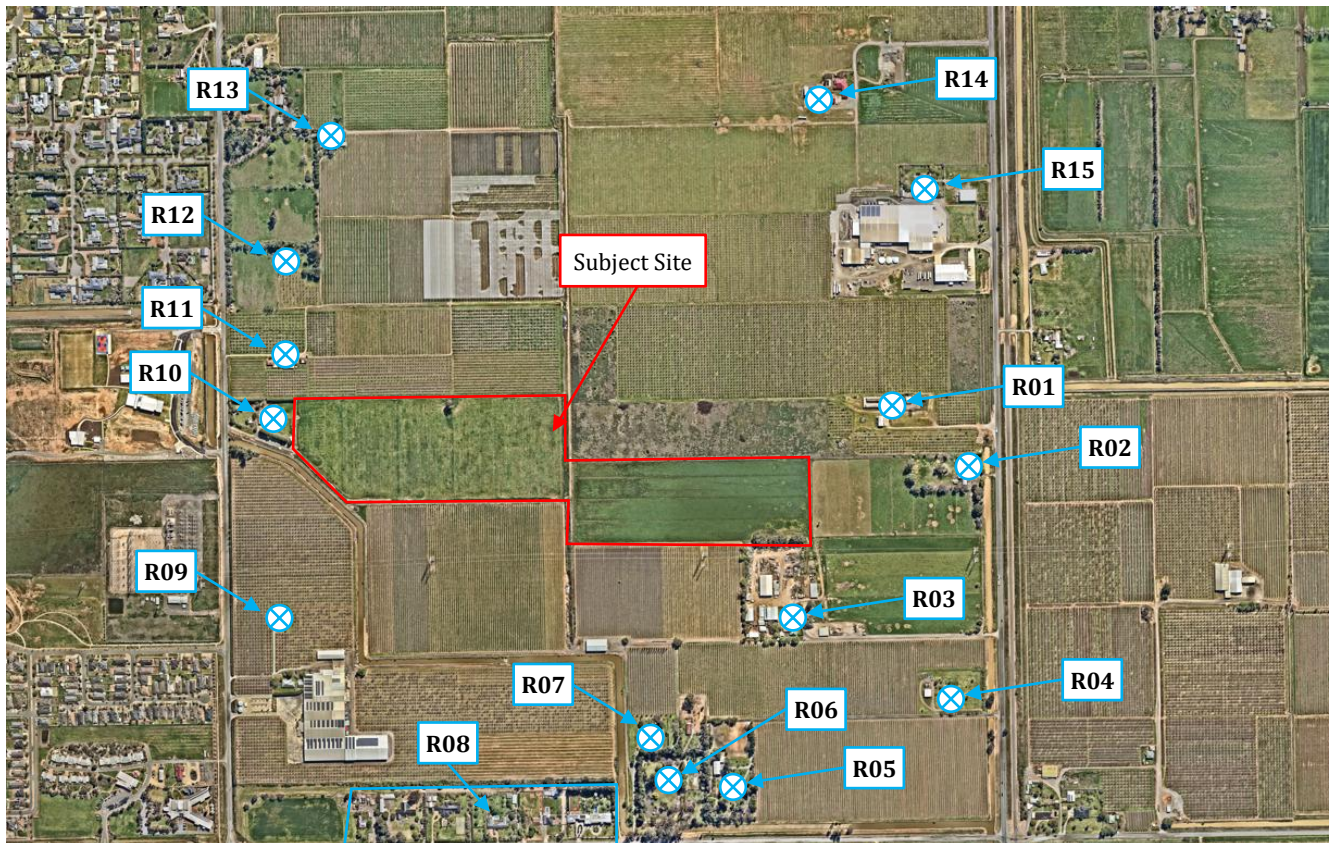


Figure 1: Aerial photo of subject site and surrounding environment

6. Proposed Site Layout and Operations

The client has advised that the electrical infrastructure equipment forming part of the proposed use will include:

- 140no. Power Conversion Systems (PCS) including one inverter and one transformer (fitted with noise control).
- 560no. Battery storage containers (fitted with noise control).
- Either 2no. 300MVA transformers or 4no. 150MVA transformers (attenuated to be non-contributory).

The site configuration includes the PCS and battery containers arranged in rows centrally and toward the eastern site boundary, with the four main transformers located toward the western boundary of the subject site.

For the purposes of this assessment, the project design incorporates the following noise mitigation measures to reduce site noise emissions from the development:

- Construction 6.0m high acoustic barriers around the site boundaries and in proximity to the equipment.
- Fitting the PCS units and BESS containers with dedicated noise reducing kits.
- Configuring PCS units and battery containers so that their highest noise emissions are angled inward toward the centre of the site, and away from off-site sensitive receptors.
- Acoustically attenuating the main site transformers, by way of enclosure to ensure that they will not contribute to the noise impact at off-site receptors.

The acoustic barriers, and other mitigation measures (ie. detailed investigations of the operational characteristics and final OEM selection) will be considered during the detailed design and construction stage of the project to ensure that compliance with relevant criteria is achieved at the relevant off-site receptors.

The noise control measures, including the acoustic barriers, source noise control kits and equipment configuration strategies have been adopted within the noise modelling to predict noise impacts within the surrounding area.

The equipment will have the potential to operate at any time during the day, evening and night periods.

Figure 2 below provides the site plan for the proposal.

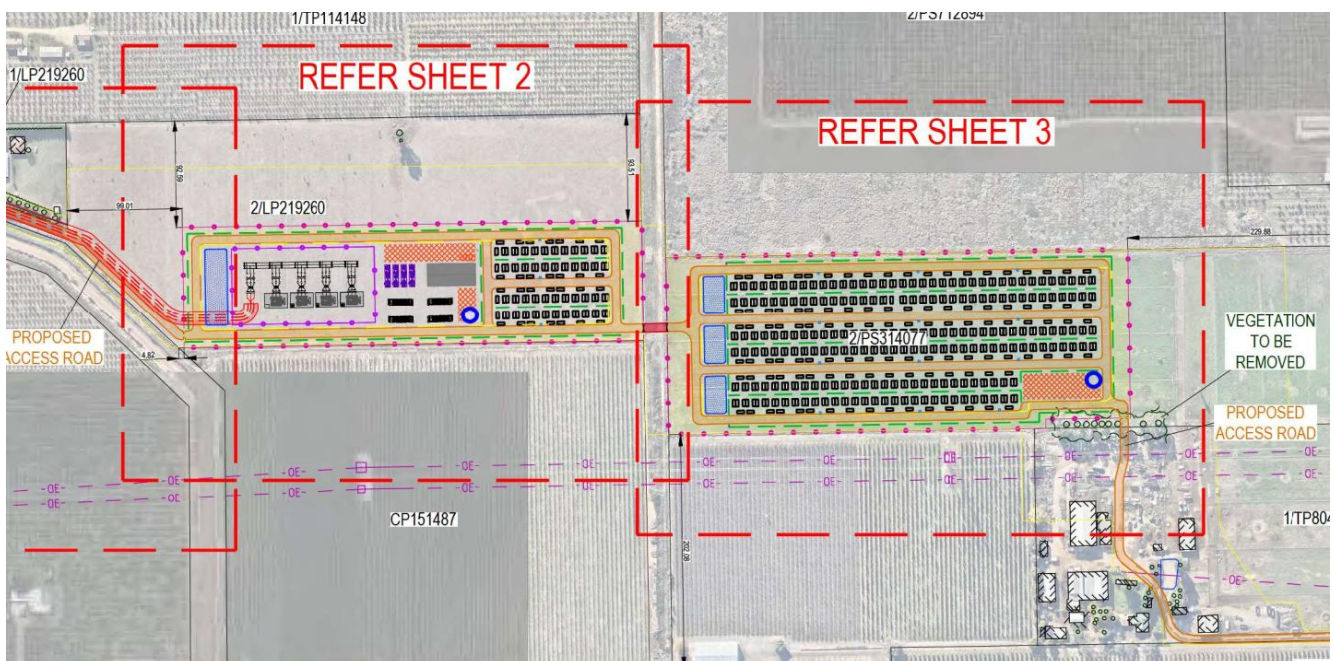


Figure 2: Proposed site plan including proposed electrical infrastructure

7. Noise Assessment Criteria

Within the State of Victoria, noise emissions from commercial operations consistent with the subject site are governed by the legislative framework within the Environment Protection Act 2017 (The Act).

The Act adopts a preventative approach to pollution (including noise) by aiming to address risks before impacts occur, rather than managing impacts after they occur, and is underpinned by the General Environment Duty (GED).

The GED requires individuals and businesses to minimise risks of harm to human health or the environment so far as reasonably practicable.

Environment Protection Authority (EPA) Publication 1856 explains how to determine what is 'reasonably practicable' and refers to the implementation of controls that are proportionate to the risk. It requires evaluation of the potential for harm to occur, the potential impacts on the environment, and considers what controls are available to reduce the risk, and their associated costs.

Operators are responsible for identifying and assessing the risks their operations may pose on human health or the environment, and once understood, implementing proportionate controls to eliminate or minimise the risk of harm.

The definition of harm in The Act introduces the concept of 'unreasonable', and more specifically 'unreasonable noise'.

When assessing commercial and industrial noise impacts within sensitive receptor areas, the Environment Protection Regulations 2021 (The Regulations), under The Act, define 'unreasonable noise' as noise that exceeds:

- *The noise limit that applies at the time the noise is emitted.*
(Noise limit is defined as 'determined in accordance with the Noise Protocol' within the Regulations).
- *The alternative assessment criterion that applies at the time the noise is emitted if the assessment of an effective noise level is conducted at an alternative assessment location as specified in the Noise Protocol.*

With the above considered, whilst evaluating risks and implementing reasonably practicable measures is necessary to comply with the GED, the basis for any noise assessment will be ensuring that emissions are not 'unreasonable'.

Assessment methodologies and guidance in relation to how to consider the above noise sources is included within the following documentation:

- The Regulations.
- 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).
- Environmental Reference Standard (ERS).
- EPA Publication 1996 Noise Guideline – assessing low frequency noise.
- EPA Publication 1856 Reasonably practicable.

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7.1. EPA Publication 1826.4 – Noise Protocol

7.1.1. Urban Area Method and Rural Area Method

Derivation of criteria for addressing potential noise emissions associated with the proposed operations at the subject site will require consideration of the land zoning of the site and the sensitive receptors in proximity to the site.

Furthermore, in accordance with methodologies described in the Noise Protocol, the location of the site and sensitive receptors relative to the major urban area boundaries in Victoria will impact on the approved method for determining the relevant noise limits.

As is shown below, the subject site and the sensitive receptors which are in closest proximity to the site are marginally outside the major urban boundary associated with Shepparton.

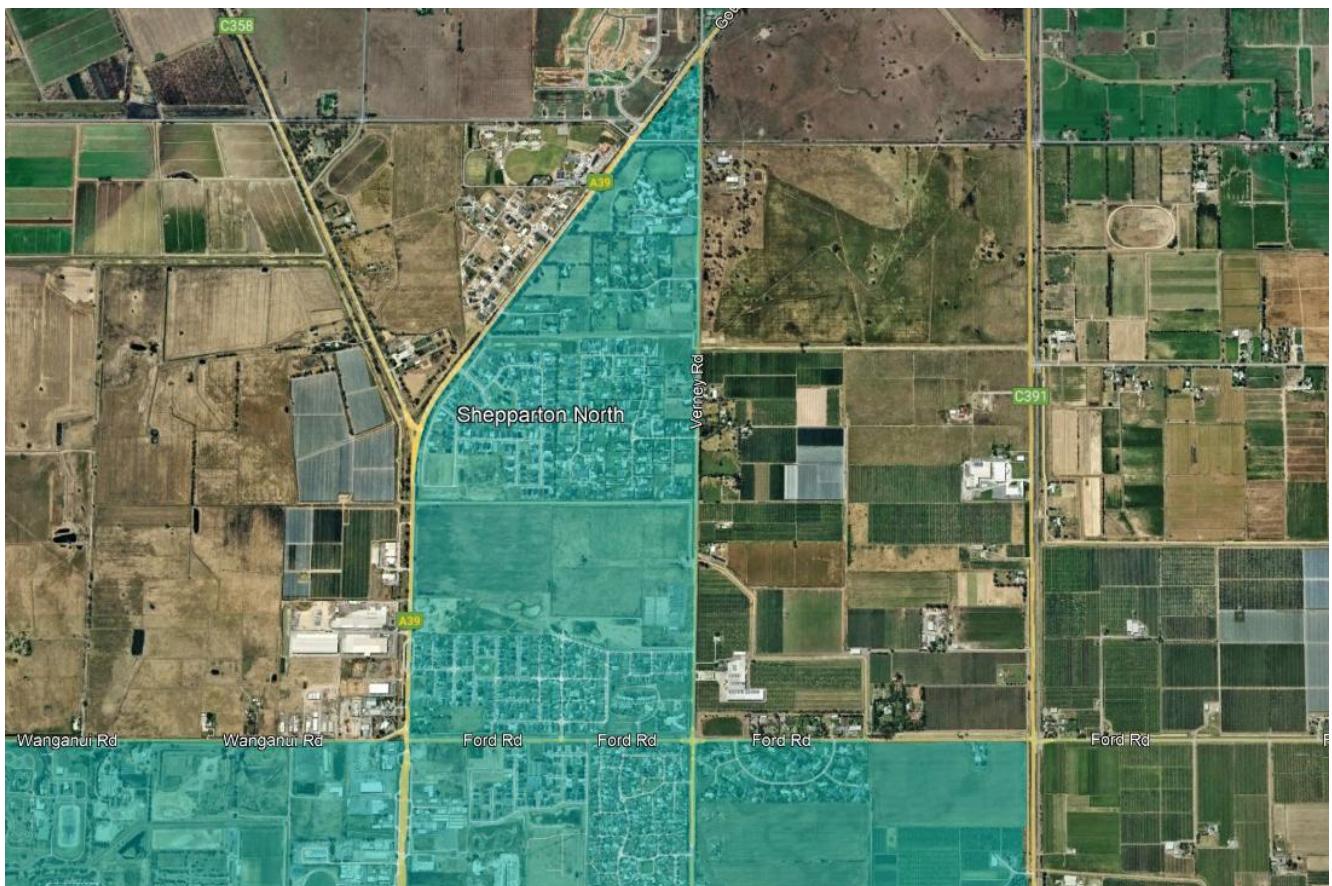


Figure 3: Shepparton Major Urban Area Boundary

In consideration of the above, at present, the calculation approach for determining the Noise Protocol noise limits will align with the 'rural area method'.

Should the Shepparton major urban area be extended to incorporate the subject site and sensitive receptors in future, then the assessment methodology would convert to the 'urban area method', and noise limits would increase at least during the evening and night period, but also potentially during the day period pending the background noise levels.

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7.1.2. General Methodologies – rural area method

The noise limits for addressing noise emissions from the proposed operations will be determined in accordance with Part I, A2 of the Noise Protocol referenced as the ‘rural area method’.

Further to the above, it is understood that the site operations will be considered as a ‘utility installation’ in accordance with clause 73.03 of the Victorian Planning Provisions (VPP) and will therefore be subject to specific Noise Protocol requirements. These requirements are nominated in Section 2.6 of the Noise Protocol.

The calculated ‘noise limits’ vary depending on the time of the day, evening, or night with the highest permitted values occurring during day periods and the lowest during night periods.

The relevant day, evening, and night assessment periods are shown in Table 3.

Table 3: Details of EPA Assessment Periods

EPA Assessment Period	Relevant Days	Relevant Time Periods
Day	Monday to Saturday	7:00am to 6:00pm
Evening	All Days	6:00pm to 10:00pm
	Sunday, Public Holidays	7:00am to 6:00pm
Night	All Days	10:00pm to 7:00am

In accordance with the Noise Protocol, ‘zoning levels’ for commercial noise emissions are determined based on the land zoning for the ‘noise generator’ and the ‘noise receiver’.

Where relevant, ‘zoning levels’ can then be adjusted based on the distance separation between the noise generating zone and the noise receivers, and by the presence of elevated ‘ambient background’ noise levels.

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7.1.3. Determination of Noise Protocol Noise Limits

The subject site and each of the critical receptors surrounding the site occupy FZ land as shown below.

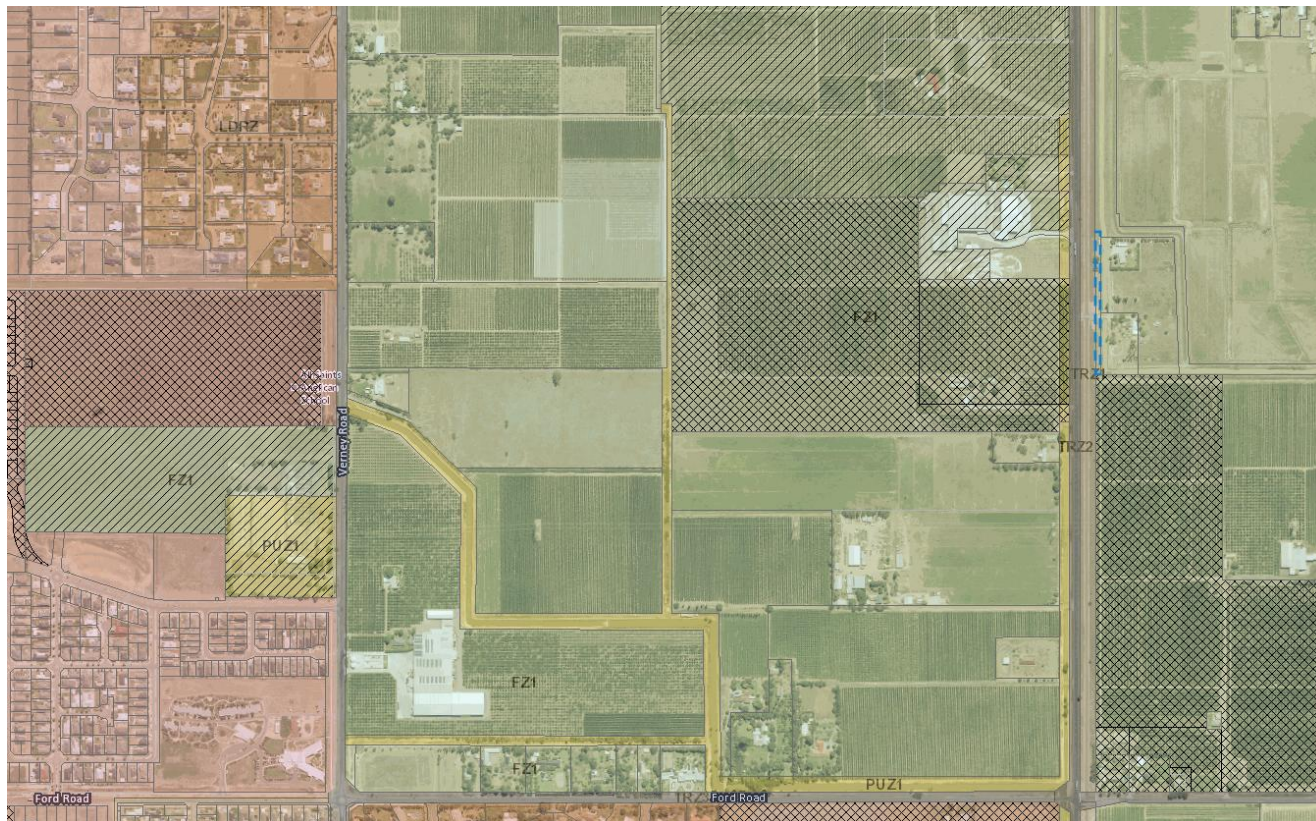


Figure 4: Land zoning of site and surrounding environment

In accordance with the methodologies nominated within the Noise Protocol, which includes consideration of the noise 'generating' zone, the noise 'receiving' zone, and the use, which is a 'utility installation' the 'zone levels' for the relevant receptors will be as summarised in Table 4.

Table 4: Noise Protocol Zone Levels (Utility Installation)

EPA Assessment Period	Relevant Days	Time Periods	Noise Protocol Zone Levels
Day	Monday to Saturday	7:00am to 6:00pm	45 dB(A) Leq
Evening	All Days	6:00pm to 10:00pm	39 dB(A) Leq
	Sunday, Public Hols.	7:00am to 6:00pm	
Night	All Days	10:00pm to 7:00am	34 dB(A) Leq

Due to the contiguous land zoning between the subject site and the surrounding receptors, as well as the proximity of the receptors to the PUZ1 land which abuts the site, a distance adjustment will not be applicable to the assessment.

In consideration of the above, the zone levels can only be adjusted based on the ambient background noise levels/

In order to determine whether the sensitive receptors located in proximity to the site are located within a 'background relevant area', WMG undertook unattended noise monitoring at the site during the period Wednesday 23rd October to Wednesday 30th October 2024.

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The equipment was deployed toward the eastern and western site boundaries, as well as centrally to understand any variation in ambient background across the subject site. The monitoring locations are identified below.

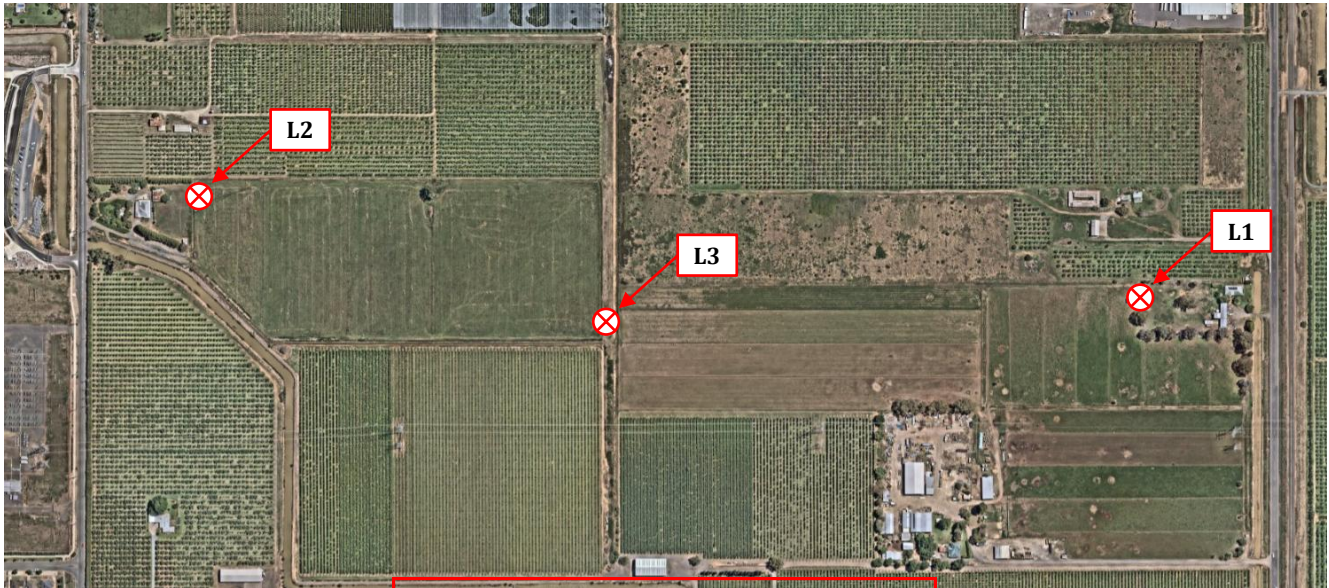


Figure 5: Unattended noise monitoring locations
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The results of the unattended noise monitoring during the proposed operating hours are summarised below with the lowest ambient background noise levels measured for each period highlighted.

Table 3: Results of Unattended Noise Monitoring Results

Day / Date	Measurement Period	Measured Noise Levels (L ₉₀)		
		Location 1	Location 2	Location 3
Wednesday 23 rd October 2024	Day Period – 7:00am to 6:00pm	-	-	-
	Evening Period – 6:00pm to 10:00pm	39	41	43
	Night Period – 10:00pm to 7:00am	36	35	37
Thursday 24 th October 2024	Day Period – 7:00am to 6:00pm	42	42	39
	Evening Period – 6:00pm to 10:00pm	38	39	42
	Night Period – 10:00pm to 7:00am	35	35	36
Friday 25 th October 2024	Day Period – 7:00am to 6:00pm	42	44	40
	Evening Period – 6:00pm to 10:00pm	39	39	43
	Night Period – 10:00pm to 7:00am	34	32	33*
Saturday 26 th October 2024	Day Period – 7:00am to 6:00pm	34	35	33
	Evening Period – 6:00pm to 10:00pm	34	36	42
	Night Period – 10:00pm to 7:00am	29	29	36
Sunday 27 th October 2024	Evening Period – 7:00am to 6:00pm	36	39	35
	Evening Period – 6:00pm to 10:00pm	38	39	43
	Night Period – 10:00pm to 7:00am	35	39	40
Monday 28 th October 2024	Day Period – 7:00am to 6:00pm	43	46	42
	Evening Period – 6:00pm to 10:00pm	39	41	43
	Night Period – 10:00pm to 7:00am	35	38	37
Tuesday 29 th October 2024	Day Period – 7:00am to 6:00pm	40	42	39
	Evening Period – 6:00pm to 10:00pm	38	39	42
	Night Period – 10:00pm to 7:00am	36	-	39
Wednesday 30 th October 2024	Day Period – 7:00am to 6:00pm	40	-	38
	Evening Period – 6:00pm to 10:00pm	38	-	41*
	Night Period – 10:00pm to 7:00am	35	-	40

* insect noise dominant which cannot be included in ambient background noise level, hence adopt values measured at Location 1 & 2.

Based on the results of the ambient background noise monitoring, the sensitive receptors in proximity to the subject site will **not** be located within a 'background relevant area'.

In consideration of the above, the zone levels nominated in Table 4 will be adopted as project noise limits.

The noise limits must be met within a '**noise sensitive area**', which for this site will be within the boundary of any of the nearby sensitive receptors, and within 10 metres of the outside of the external walls of the dwelling or building.

The relevant assessment period will be 30 minutes.

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7.1.4. Cumulative Contributions from Other Noise Sources

When addressing potential cumulative noise due to other commercial and industrial operations within the surrounds, there appears to be in the order of four sites which include either independent commercial uses, or commercial uses which are associated with an existing residential dwelling.

The relevant properties include:

- Commercial site A – ‘Vadpak and VISY’ located at 305 Grahamvale Road (includes receptor R15 within boundary).
- Commercial site B – ‘Keith Mcrae’ located at 221 Grahamvale Road (includes receptor R03 within boundary).
- Commercial site C – ‘Masalki’ located at 255 Verney Road (includes receptor R09 within boundary).
- Commercial site D – Terminal station located at 280 Verney Road (does not include residential receptor).

Figure 6 below includes the commercial sites of relevance.

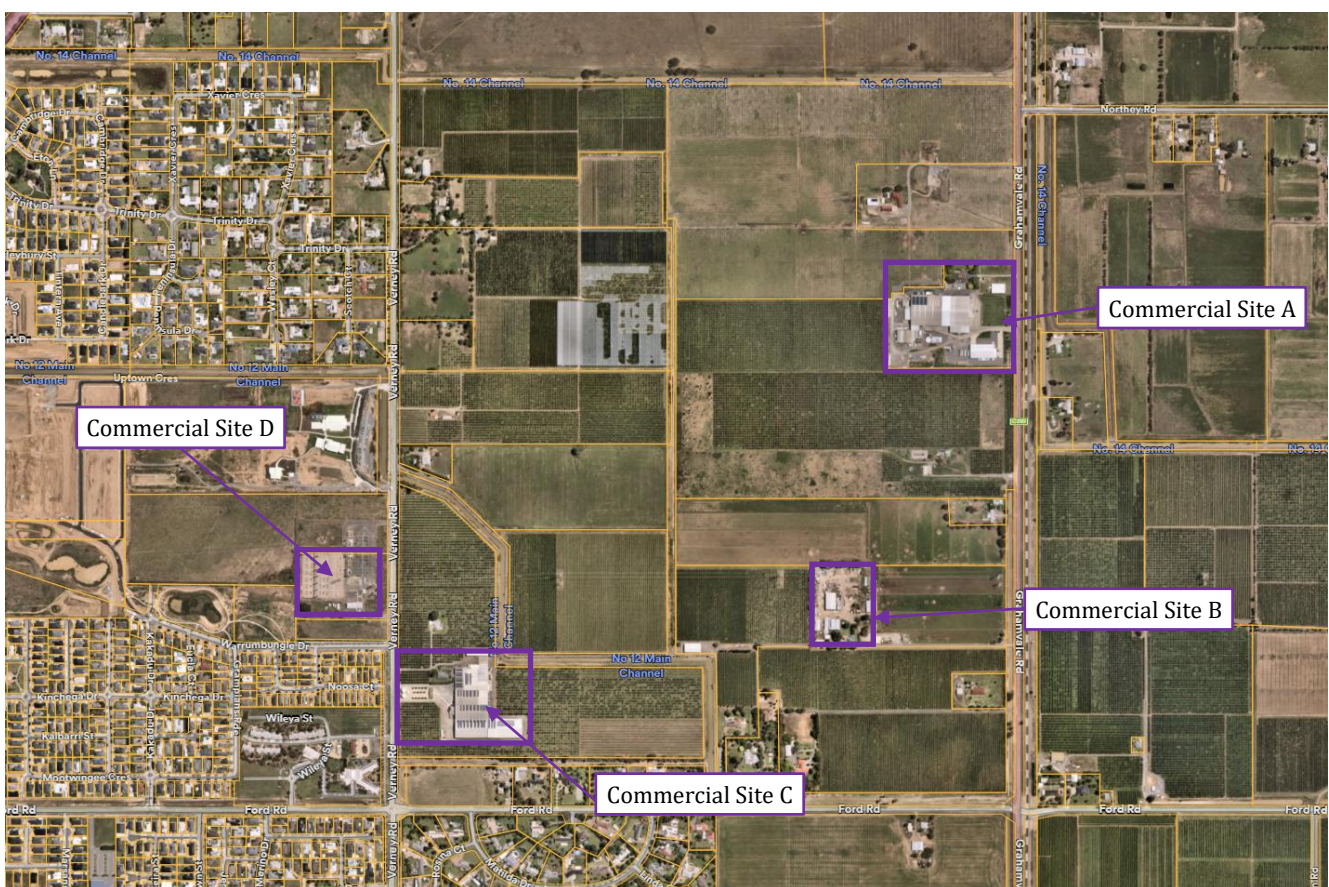


Figure 6: Aerial image including commercial type uses in proximity to the site

The commercial operations in proximity to the site are unique as some operations include their own accommodation building which is considered as a ‘noise sensitive area’ in the context of the BESS assessment.

Due to their associated use, the occupiers of these accommodation buildings are already subject to commercial noise from their own operations which in some instances may be well above the Noise Protocol noise limits. In future, these buildings will also receive noise contributions from the BESS located at the subject site.

Whilst this does not eliminate the need for the subject site to consider cumulative noise at these locations, it is relevant that commercial noise already forms part of the acoustic environment at these receptors.

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In accordance with the guidance provided in EPA Publication 1997 *Technical guide: Measuring and analysing industry noise and music noise*, potential noise emissions associated with the subject site operations should also consider noise contributions associated with existing or anticipated future industry.

The approach within the Publication adopts an 'equal sharing' principle whereby the noise criteria for a single use is reduced by an amount calculated from the number of premises contributing to the noise, where N is the total number of industrial premises. A value of $10 \times \log_{10}(N)$ is subtracted from the noise limit to establish criteria.

However, Publication 1997 also notes that *the equal sharing principle may be too simplistic in complex situations where the amount of noise each individual premises contributes to the cumulative noise within sensitive areas varies to a large degree. This can be the case if, for example:*

- *there is a large diversity in the size or nature of the industries affecting noise sensitive areas,*
- *the distance from each individual premises to the noise sensitive area varies greatly, or*
- *the practicability of noise control varies greatly between the different premises.*

For these scenarios, Publication 1997 notes that *rather than applying the equal sharing principle, the noise reductions achievable from each site need to be investigated to obtain a suitable outcome. It may then be relevant to adopt individual criteria that give regard to the circumstances of each premises.*

This approach is also adopted within Regulation 119 of the Regulations which indicates that 'If 2 or more commercial, industrial and trade premises (whether existing or proposed) emit, or are likely to emit, noise that contributes to the effective noise level, a person in management or control of one or more of those premises must take all reasonable steps to ensure that the contribution from each of the premises, when combined, does not exceed the noise limit for the noise sensitive area'.

Given the extent of the noise control proposed for the BRT system and the inclusion of acoustic barriers, equipment configuration, and source noise control, WMG expects that the proposed project complies with the intent of the GED, and the provisions included in Publication 1997 and Regulation 111. **WMG and the operator have taken all reasonable steps** to allow for cumulative noise levels to remain below the noise threshold. **This document must not be used for any**

However, for the purposes of this assessment, WMG has also investigated and evaluated the likelihood of cumulative noise contributions from the surrounding operations based on observations at site, as well as client input.

On this basis, WMG provides the following comments in relation to the existing commercial uses:

- **Commercial site A** – Due to increased wind speeds which arose during the attended survey, noise measurements could not be conducted for the property. From previous experience including similar facilities the site may include processing plant internally within the warehouse buildings in combination with mobile plant used externally. The client has advised that the site does not operate during the EPA evening and night periods.
- **Commercial site B** – Appears to be a relatively modest operation with heavy vehicles departing site from 7:00am and returning to the site around 3:30pm, Monday to Friday. The client has advised that the site does not operate during the EPA evening and night periods.
- **Commercial site C** – Fixed equipment generally adjacent to eastern building facade. Noise due to equipment was audible at 500m, resulting in noise levels higher than the Noise Protocol noise limits. Site is expected to include elements of operation 24 hours per day.
- **Commercial site D** – Site equipment was audible when considered adjacent to Verney Road and included a tonal character at the 100Hz one-third octave frequency. Residual noise impacts are expected to be compliant with the Noise Protocol noise limits at existing receptors which are relevant to the assessment. Site is expected to include elements of operation 24 hours per day.

In the context of the assessment, it is expected that non-compliances with relevant noise limits at residential receptors due to existing operations would be a breach of the operator's GED and hence would require an improvement notice or the like to be issued by the EPA or Council.

Generally, this process wouldn't arise unless a noise complaint was received, however, it would seem reasonable that this proposal only allows for surrounding uses to be emitting 'compliant' noise emissions.

In consideration of the above, and for the purposes of this assessment, WMG has adopted the following project design objectives based on the expected number of equally contributing commercial operations.

Table 6: Project Design Objectives based on surrounding commercial operations

Receptor	No. of contributing commercial operations (inc. subject site)			Cumulative Noise Adjustment to Noise Protocol Noise Limit			Proposed Design Objectives L_{Aeq} (Allowing for cumulative noise)		
	Day	Eve	Night	Day	Eve	Night	Day	Eve	Night
R01	3	1	1	-5 dB(A)	0 dB(A)	0 dB(A)	40	39	34
R02	3	1	1	-5 dB(A)	0 dB(A)	0 dB(A)	40	39	34
R03	3	1	1	-5 dB(A)	0 dB(A)	0 dB(A)	40	39	34
R04	2	1	1	-3 dB(A)	0 dB(A)	0 dB(A)	42	39	34
R05	3	2	2	-5 dB(A)	-3 dB(A)	-3 dB(A)	40	36	31
R06	3	2	2	-5 dB(A)	-3 dB(A)	-3 dB(A)	40	36	31
R07	3	2	2	-5 dB(A)	-3 dB(A)	-3 dB(A)	40	36	31
R08	3	2	2	-5 dB(A)	-3 dB(A)	-3 dB(A)	40	36	31
R09	3	3	3	-5 dB(A)	-5 dB(A)	-5 dB(A)	40	34	29
R10	3	3	3	-5 dB(A)	-5 dB(A)	-5 dB(A)	40	34	29
R11	3	3	3	-5 dB(A)	-5 dB(A)	-5 dB(A)	40	34	29
R12	2	1	1	-3 dB(A)	0 dB(A)	0 dB(A)	42	39	34
R13	2	1	1	-3 dB(A)	0 dB(A)	0 dB(A)	42	39	34
R14	2	1	1	-3 dB(A)	0 dB(A)	0 dB(A)	42	39	34
R15	2	1	1	-3 dB(A)	0 dB(A)	0 dB(A)	42	39	34

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7.1.5. Noise Protocol Assessment Adjustments

When considering noise impacts at sensitive receptors, the Noise Protocol methodology includes relevant adjustment factors which account for the potential for the noise source to impact on the acoustic amenity of the noise sensitive receptor. The relevant adjustments include:

- Tonal Adjustment
- Impulsive Adjustment.
- Intermittency Adjustment.
- Reflection Adjustment.
- Duration Adjustment.

Clarification regarding each of the adjustments is shown below in Table 7.

Table 7: Noise Protocol Assessment Adjustments

Relevant Adjustment	Description
Tonal Adjustment	When the noise is tonal in character then an adjustment shall be made as follows: ▪ When the tonal character of the noise is just detectable then + 2 dB(A). ▪ When the tonal character of the noise is prominent then + 5 dB(A).
Impulsive Adjustment	When the noise is impulsive in character then an adjustment shall be made as follows: ▪ When the impulsive character of the noise is just detectable then + 2 dB(A). ▪ When the impulsive character of the noise is prominent then + 5 dB(A).
Intermittency Adjustment	An intermittency adjustment applies when the noise increases in level rapidly by at least 5dB, on at least two occasions during a 30-minute period and maintains the higher level for at least one minute duration. The relevant intermittency adjustments applicable include: ▪ When the level increase is >10 dB during the day period, then apply an adjustment of +3 dB(A). ▪ When the level increase is 5-10 dB during the night period, then apply an adjustment of +3 dB(A). ▪ When the level increase is >10 dB during the night period, then apply an adjustment of +5 dB(A).
Reflection Adjustment	When the measurement point is located outdoors and the microphone is located from 1 to 2 metres from an acoustically reflecting surface, an adjustment of -2.5 dB shall be made.
Duration Adjustment	When the noise emissions do not occur over the whole of a continuous 30-minute period, then a duration adjustment based upon the total amount of time for which the noise occurs over that continuous 30-minute period shall be determined.

Where applicable, the adjustments are applied to measured/predicted values at sensitive receptors to determine the 'effective' noise level impacting on the receptor.

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7.2. Environment Reference Standard

The ERS provides environmental values which have been developed to reflect the ambient soundscape associated with different land use settings, from highly urbanised areas to natural environments.

Through consideration of land zoning types, and varying assessment periods for the day and night, it is understood that the ERS intends to provide consideration of noise levels which may impact on:

- Sleep during the night.
- Domestic and recreational activities.
- Normal conversation.
- Child learning and development.
- Human tranquility and enjoyment outdoors in natural areas.
- Musical entertainment.

Whilst included within the Act, the ERS is not a compliance standard and states that 'the objectives for each land use category are typical ambient sound level values and are neither noise limits nor noise design criteria'.

It's understood that the primary function of the ERS is to provide environmental assessment benchmarks to assist 'decision makers' with evaluating noise emissions in areas not already captured in the Regulations and Noise Protocol.

The ERS will not require consideration when addressing noise emissions from the proposal at the nearby residential premises as these are captured by the Noise Protocol.

Furthermore, given the proximity of the residential receptors to the proposed use, it is expected that compliance with Noise Protocol will adequately address potential impacts at any further setback natural areas.

In consideration of the above, the ERS has not been considered further within the assessment.

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7.3. EPA Noise Guideline – Assessing Low Frequency Noise

As defined in the Act, *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.*

Within the Regulations, ‘unreasonable noise’ is based noise which exceeds the noise limit (Noise Protocol) that applies at the time the noise is emitted, however, the Regulations also consider ‘**frequency spectrum**’ as a prescribed factor for evaluating noise emissions from commercial, industrial and trade premises.

To provide some basis for evaluating low frequency noise emission and determining whether the low frequency noise could be deemed ‘unreasonable’, the EPA released *Publication 1996 Noise Guideline – assessing low frequency noise*.

The guideline includes ‘threshold levels for assessing low frequency noise’ which are not limits, but levels that indicate a potential risk of problematic low frequency noise. The threshold levels for indoor and outdoor measurements are included within Table 8 below.

Table 8: Indoor and outdoor measurement one-third octave band noise level thresholds

Location	One-third octave band noise levels Hz												
	10	12.5	16	20	25	31.5	40	50	63	80	100	125	160
Indoor noise dB Leq	92	87	83	74	64	56	49	43	42	40	38	36	34
Outdoor noise dB Leq	92	89	86	77	69	61	54	50	50	48	48	46	44

Whilst Publication 1996 is presented as a guideline, it is understood that the EPA requires that reasonably practicable measures are considered where values are measured or predicted to be higher than the thresholds.

Previous experience has shown that electrical infrastructure can generate tonal noise emissions at low frequency and will therefore require consideration as part of this assessment.

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7.4. Greater Shepparton Planning Scheme

Clause 13.05-1S of the Greater Shepparton Planning Scheme includes requirements related to noise management and ensuring development does not adversely impact upon amenity and human health.

The **objective** of Clause 13.05-1S seeks to assist the management of noise effects on sensitive land uses.

The **Key Strategies** of the Clause are to:

- Ensure that development is not prejudiced, and community amenity and human health is not adversely impacted by noise emissions.
- Minimise the impact on human health from noise exposure to occupants of sensitive land uses (residential use, child care centre, school, education centre, residential aged care centre or hospital) near the transport system and other noise emission sources through suitable building siting and design (including orientation and internal layout), urban design and land use separation techniques as appropriate to the land use functions and character of the area.

The relevant documentation applicable under the Clause for this project includes:

- Environment Protection Regulations under the Environment Protection Act 2017.
- Noise Limit and Assessment Protocol for the Control of Noise from Commercial, Industrial and Trade Premises and Entertainment Venues (Publication 1826, Environment Protection Authority, May 2021).
- Environment Reference Standard.

Consideration of potential noise impacts relative to the criteria described in Section 8.1-8.4 is expected to adequately address the requirements of the Planning Scheme.

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8. Operational Noise Emission Assessment

8.1. Noise Prediction Methodology

Modelling of operational noise emissions from the site has been conducted using DataKustik CadnaA environmental noise modelling software.

Relevant information regarding site elevations, site buildings and the surrounding environment has been provided by the client and sourced online including via Nearmaps, VicMaps and from the ANZLIC Committee on Surveying and Mapping.

With the utilisation of the above, the model has been developed and configured with sufficient detail for appropriate noise emission calculations to be undertaken.

For this assessment, the modelling software has implemented the calculation procedures defined within International Standard ISO 9613.2. The ISO Standard has been considered and approved as part of many previous projects requiring noise emission assessment works.

Through implementation of the Standard, the noise modelling considers the following attenuation measures:

- Geometrical spreading.
- Atmospheric absorption.
- Ground attenuation.
- Meteorological effects.
- Source/receiver height effects.
- Attenuation due to the surrounding environment including existing buildings/structures.

The modelling input parameters also incorporate assessment methodology requirements of EPA Victoria including:

- Residual noise levels at noise sensitive receptor locations have been considered when weather conditions assist with propagation of emissions in the direction of the relevant receptor.
- Predicted values have been considered within 10 metres of the noise sensitive external facades.

It is understood that the sensitive residential receptors in proximity to the subject site are single storey construction.

In consideration of the above, WMG has adopted a receptor height of 1.50m above ground level to align with what is typically adopted for a single storey construction.

Predicted values at receptor locations have been calculated in the 'free-field', which do not include reflections from localised surfaces other than the ground.

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8.2. Noise Source Sound Power Levels

The noise sources relevant to the operational assessment will include:

- Power Conversion Systems (PCS) each including one inverter and one transformer.
- Battery storage containers.
- Either 2no. 300MVA transformers or 4no. 150MVA transformers.

When determining source sound power levels for the proposed equipment, the client has provided manufacturer data which includes noise levels at various operating capacities.

Based on discussions with the client in relation to unit operations, and for the purposes of the assessment, WMG has adopted the following operating parameters for the battery containers and PCS Inverters during the EPA periods:

- Day and Evening Periods – 100% operating capacity.
- Night Period – 60% operating capacity.

The sound power levels adopted as the basis for the assessment are included below.

Table 9: Source sound power levels adopted as the basis for the assessment

Equipment	Source Sound Power Level	
	Day/Evening	Night
Battery Units – inc. noise control	77dB(A)	71dB(A)
PCS Inverter – charging/discharging – inc. noise control	84dB(A)	78dB(A)
PCS Transformer	64dB(A)	64dB(A)
Main site transformers	Fully enclosed – non contributory	

For the purposes of the assessment, the noise sources have been modelled as follows:

- **PCS inverter & transformer**
The unit has been modelled as an enclosure with radiating area sources to each vertical/horizontal surface. The directionality is based on information provided by equipment manufacturer and will be implemented by the client as part of configuring the PCS noise source at site.
- **Battery container**
The container has been modelled as an enclosure with a vertical area source where the chiller will be located. The main source of noise from the unit is understood to be the chiller.
- **Main site transformers** – not modelled as the client has committed to attenuating these noise sources to ensure that their noise emissions do not contribute to off-site noise impacts.

The outcomes of the assessment are reliant on the directionality of the noise sources, and hence the client will commit to ensuring that the finalised design incorporates the directional requirements for the project.

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8.3. Noise Protocol Assessment

8.3.1. Noise Protocol Adjustments

Due to the tonal character which is expected to be associated with electrical infrastructure noise sources forming part of the proposal, a prominent tonal adjustment of + 5dB(A) has been applied to the predicted noise impacts at sensitive receptor locations within proximity to the site.

This approach aligns with the conservative noise prediction assessment requirements nominated by the EPA when it is unclear what adjustment will be required for future operations.

In practice, with this site's distance separation between the electrical infrastructure and the sensitive receptors, there is potential that residual tonal noise may be either 'just detectable' warranting a lesser adjustment of plus 2 dB, or not present and therefore not requiring an adjustment.

WMG does not expect that any other adjustments, including intermittency and impulse will be applicable for the site.

8.3.2. Predicted Noise Levels and Assessment Relative to Noise Limits and Design Objectives

The results of the noise model, including a +5dB(A) tonal adjustment are presented below in Table 10.

The results have been highlighted in **green** where predicted values comply with the Noise Protocol noise limits and the project design objectives.

Table 10: Noise modelling results compared with Noise Protocol Noise Limits and Project Design Objectives

Assessment Location	Predicted Noise Level L_{Aeq}		Noise Protocol Limits L_{Aeq}			Design Objectives L_{Aeq}		
	Day/Eve	Night	Day	Eve	Night	Day	Eve	Night
R01	35	30	45	39	34	40	39	34
R02	39	34	45	39	34	40	39	34
R03	35	30	45	39	34	40	39	34
R04	31	26	45	39	34	42	39	34
R05	31	26	45	39	34	40	36	31
R06	31	26	45	39	34	40	36	31
R07	32	27	45	39	34	40	36	31
R08	31	25	45	39	34	40	36	31
R09	34	28	45	39	34	40	34	29
R10	34	29	45	39	34	40	34	29
R11	32	26	45	39	34	40	34	29
R12	29	24	45	39	34	42	39	34
R13	28	23	45	39	34	42	39	34
R14	28	23	45	39	34	42	39	34
R15	27	22	45	39	34	42	39	34

The findings of the assessment indicate that noise emissions from the proposal are predicted to comply with the Noise Protocol noise limits and project design objectives adopted in Table 6 at the noise sensitive receptors during the EPA day, evening and night periods.

Based on previous experience, technological advances in the BESS industry continue to improve, allowing for greater operating capacity whilst maintaining and/or reducing noise emission output. In consideration of the above, and pending further advances in technology and noise mitigation, the operator may be able to operator the site at 100% capacity during the night period whilst complying with Noise Protocol noise limits and project design objectives.

It is envisaged that this will be further refined during detailed design and construction.

8.4. Consideration of Low Frequency Noise Emissions

In order to provide a basis for understanding low frequency noise emissions from the proposal, WMG has considered one-third octave band values which have been provided by the equipment manufacturers.

The results of the noise modelling indicate that residual one-third octave band noise levels at each of the residential receptors will be below the outdoor threshold values nominated in EPA Publication 1996.

In consideration of the above, the calculated values indicate that noise emissions from the proposal do not present a 'potential risk of problematic low frequency noise'.

As is discussed within EPA Publication 1996, predicting low frequency noise at sensitive receptors can be problematic and of limited accuracy. WMG has therefore used the results of the noise model as a screening tool to assess the risk of low frequency noise from the proposal.

It must be noted that the noise model does not provide predicted noise levels between 10-20Hz which are included within the low frequency guideline. Based on analysis of noise levels measured at an independent site with similar electrical infrastructure, it is unlikely that the source will include significant low frequency noise at these frequencies.

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9. General Environmental Duty and Design Review

In accordance with the requirements of the GED, the client must consider potential risks associated with the proposed use and reduce these risks as far as reasonably practicable.

The current design incorporates acoustic barriers, as well as source noise control to minimise noise emissions due to the subject site operations so far as 'reasonably practicable'. With the implementation of these reasonably practicable measures, WMG has determined compliance with Noise Protocol noise limits and project design objectives at nearby sensitive receptors during the proposed day and evening operating periods.

During the night period, the assessment confirms compliance during reduced operating capacity which is expected to align with 'real world' operating conditions for the subject site.

Despite the above, WMG expects that with further advances in technology and noise mitigation, the operator may be able to operate the subject site equipment at 100% capacity during the night period whilst complying with the Noise Protocol noise limits and project design objectives.

These measures will be refined during detailed design and construction.

From previous experience, the battery storage industry is continuing to evolve, and the available noise control options also continue to evolve. In consideration of the above, the client will continue to correspond with industry leaders as well as manufacturers to minimise noise emissions so far as reasonably practicable.

Further to the above, and in accordance with the requirements of The Act, the client and/or future operator would be in breach of the GED if they fail to do any of the following in the course of conducting the business or the undertaking so far as reasonably practicable:

- use and maintain plant, equipment, processes and systems in a manner that minimises risks of harm to human health and the environment from pollution and waste;
- use and maintain systems for identification, assessment and control of risks of harm to human health and the environment from pollution and waste that may arise in connection with the activity, and for the evaluation of the effectiveness of controls;
- use and maintain adequate systems to ensure that if a risk of harm to human health or the environment from pollution or waste were to eventuate, its harmful effects would be minimised;
- ensure that all substances are handled, stored, used or transported in a manner that minimises risks of harm to human health and the environment from pollution and waste;
- provide information, instruction, supervision and training to any person engaging in the activity to enable those persons to comply with the general environmental duty.

These items will likely be internal processes involving training and documentation to address any potential emissions from the site in the event that they occur.

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10. Conclusion

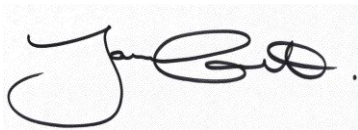
WMG has carried out an acoustic assessment to address potential noise emissions from the operation of a new battery energy storage system (BESS) facility at a site located at 305 Verney Rd and 221 Grahamvale Rd, Grahamvale.

The assessment has included a review of the proposed site configuration and noise sources, and preparation of a noise model to predict noise emissions at off-site sensitive receptor locations.

The findings of the assessment have concluded that with the implementation of **reasonably practicable** measures, noise emissions associated with the proposed operations comply with Noise Protocol noise limits and suitable project design objectives at the nearby sensitive residential receptors.

Given the preliminary nature of the assessment, it is recommended that further investigations and noise assessments are undertaken during detailed design to confirm that calculated operational noise emissions continue to comply with relevant noise criteria.

This would logically include a review of the final design including equipment selections and locations and may include site investigations to measure the proposed equipment and confirm the source sound power levels.

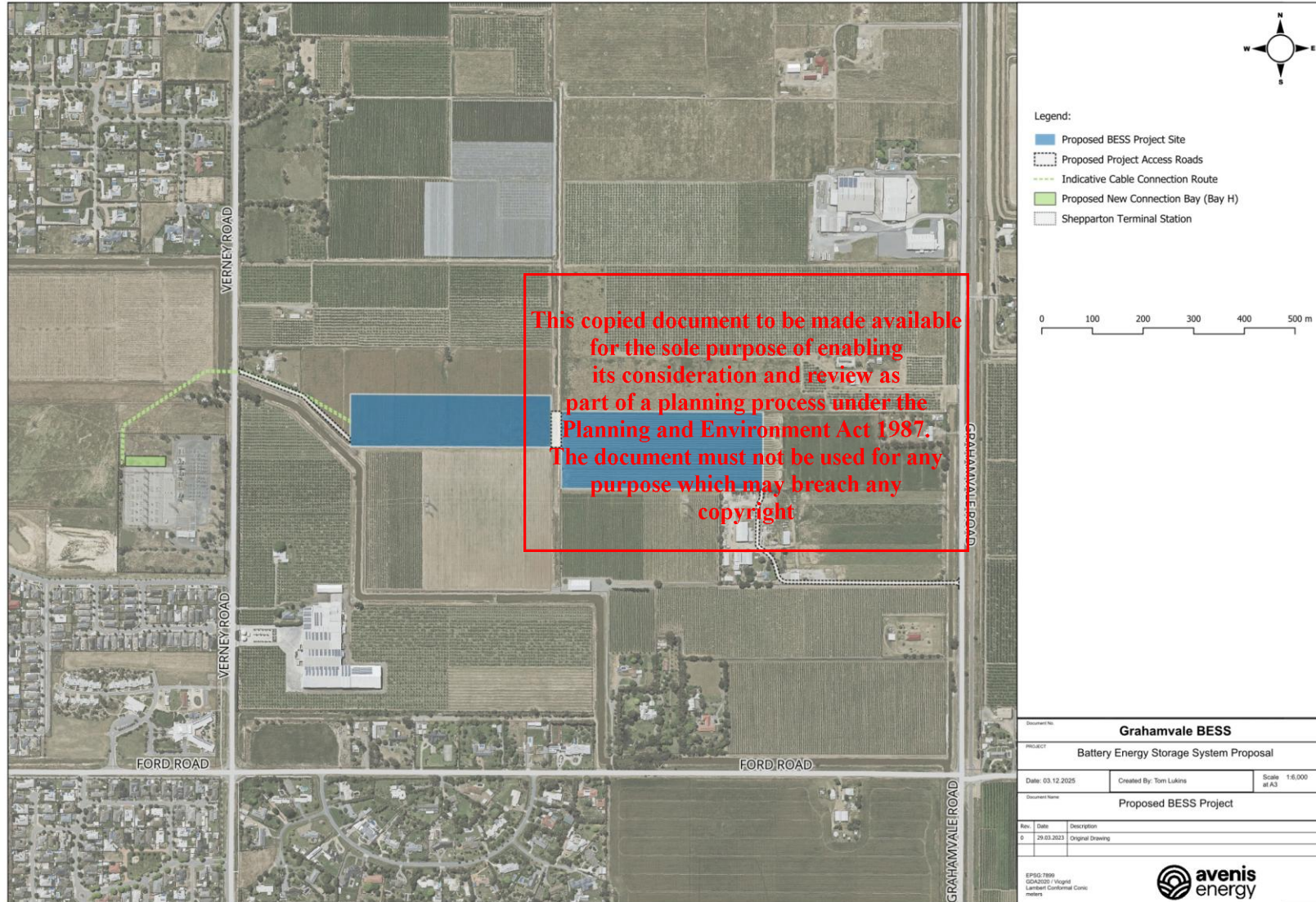


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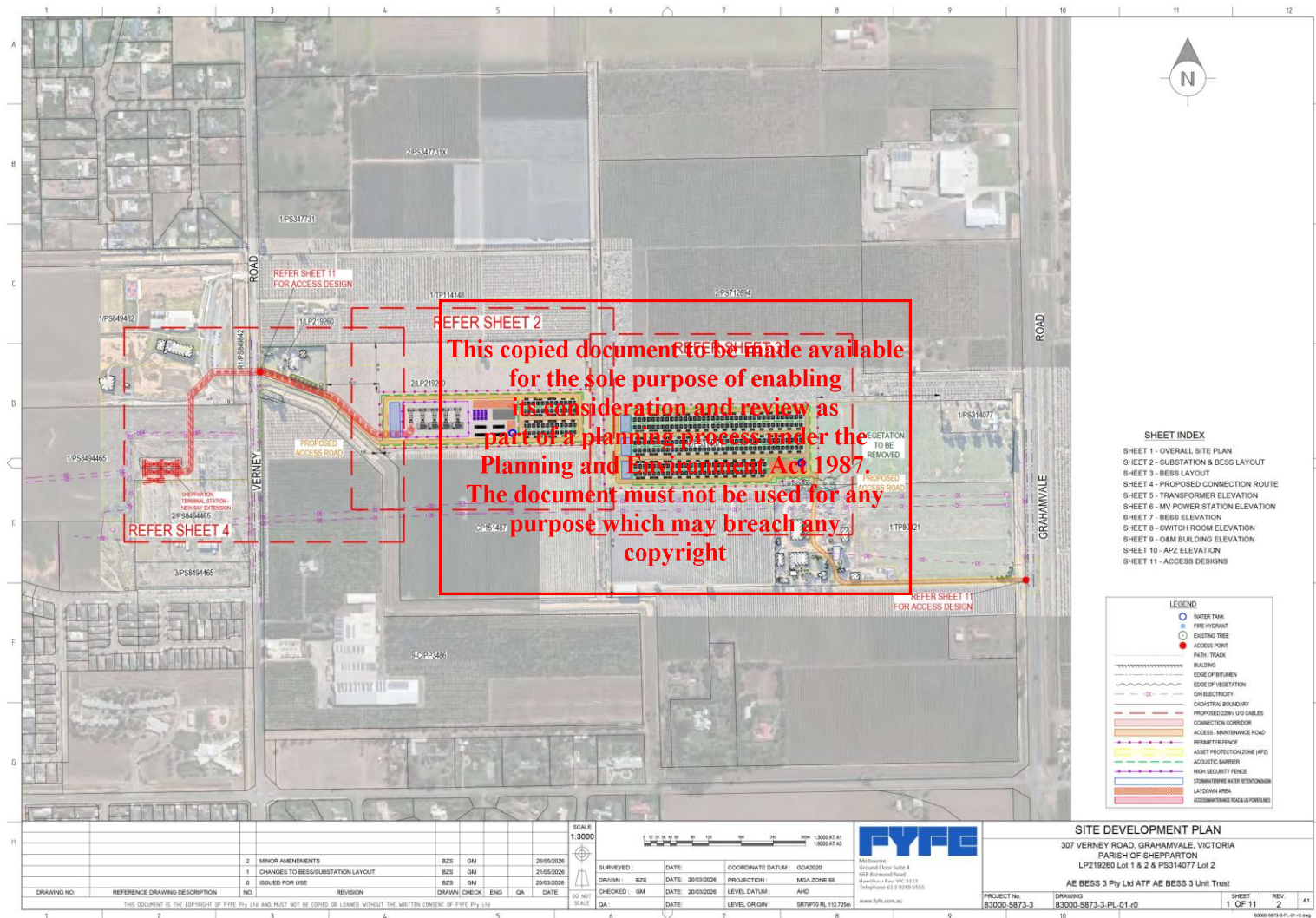
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Appendix 1 – Proposed Project Site



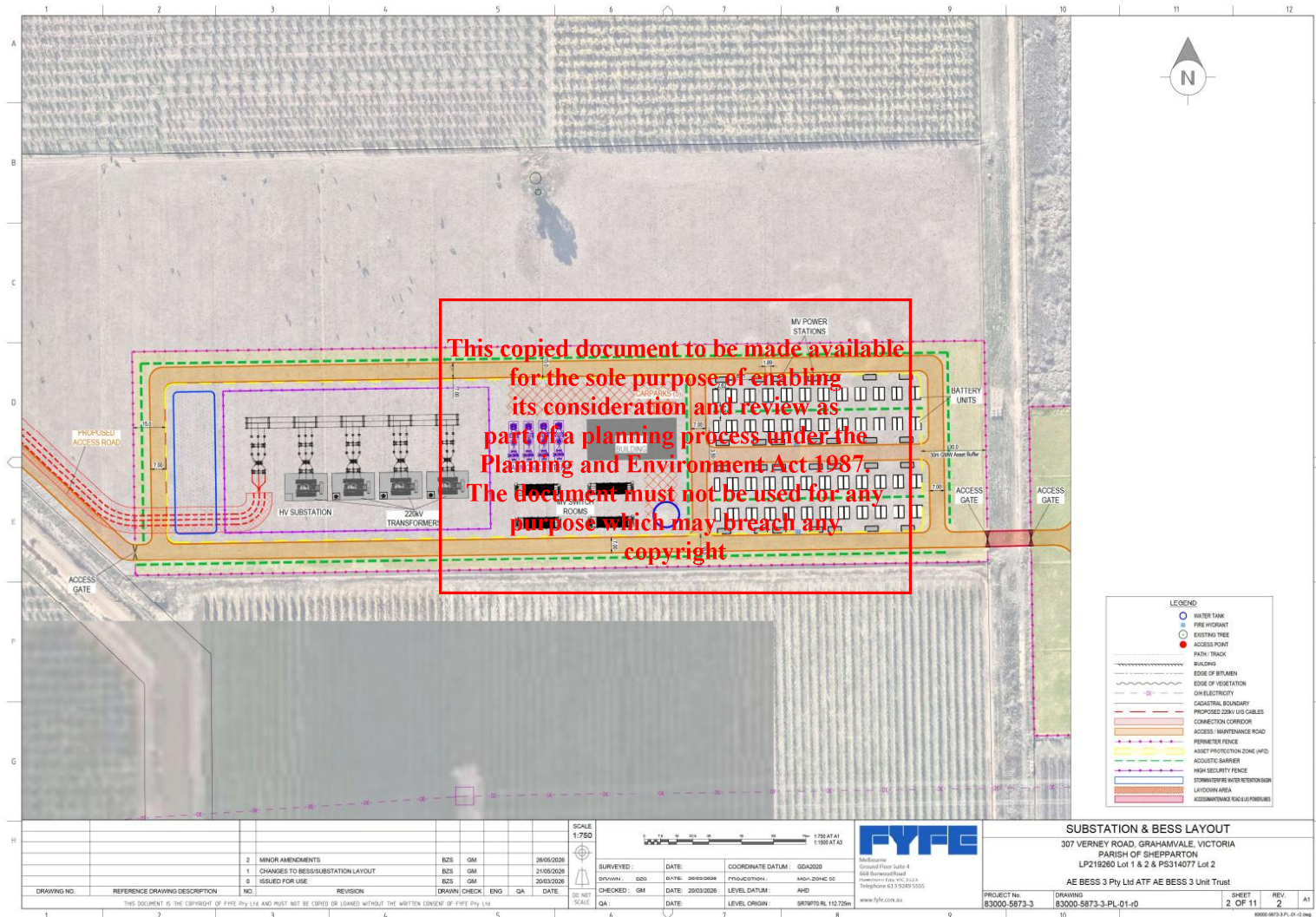
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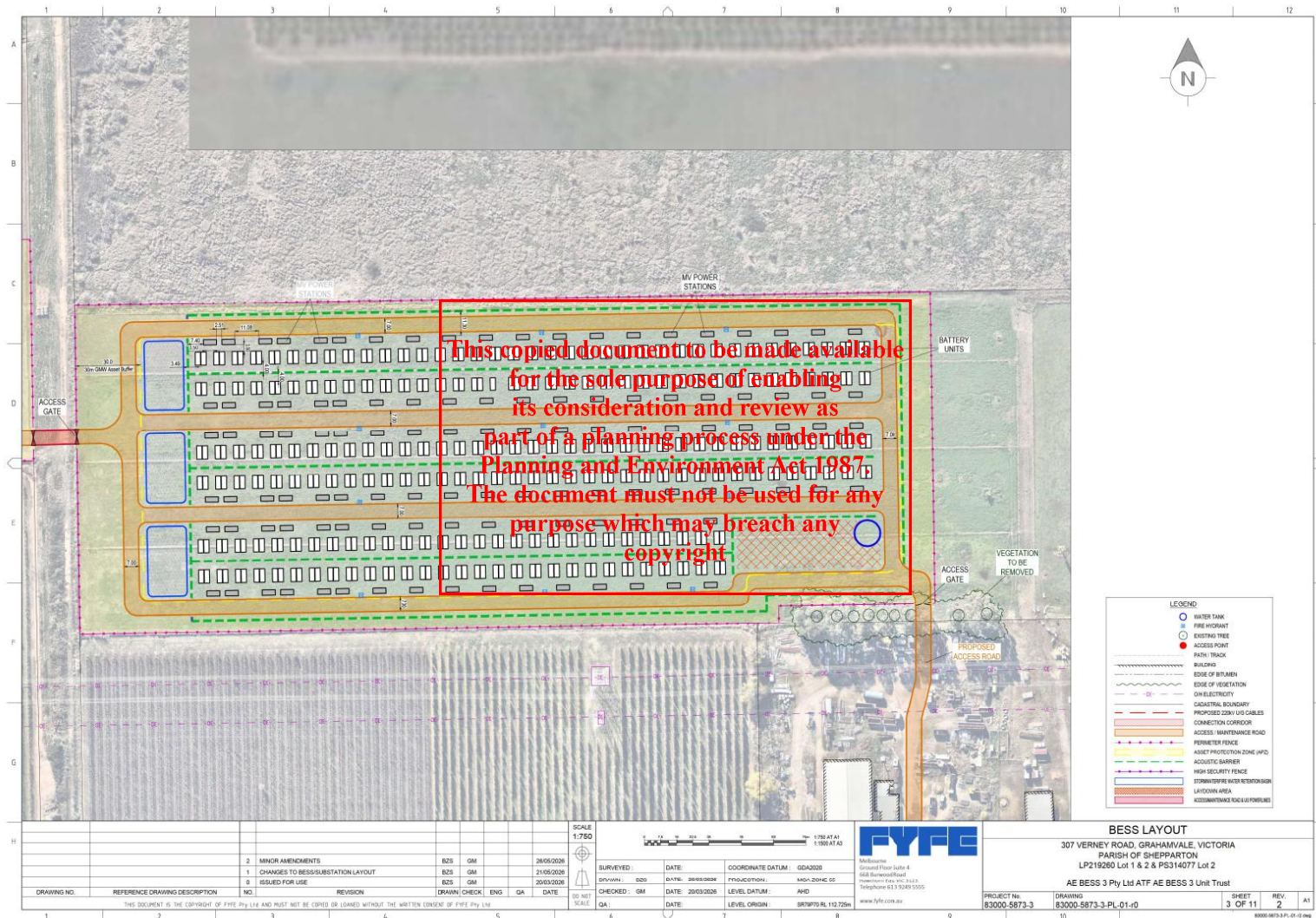
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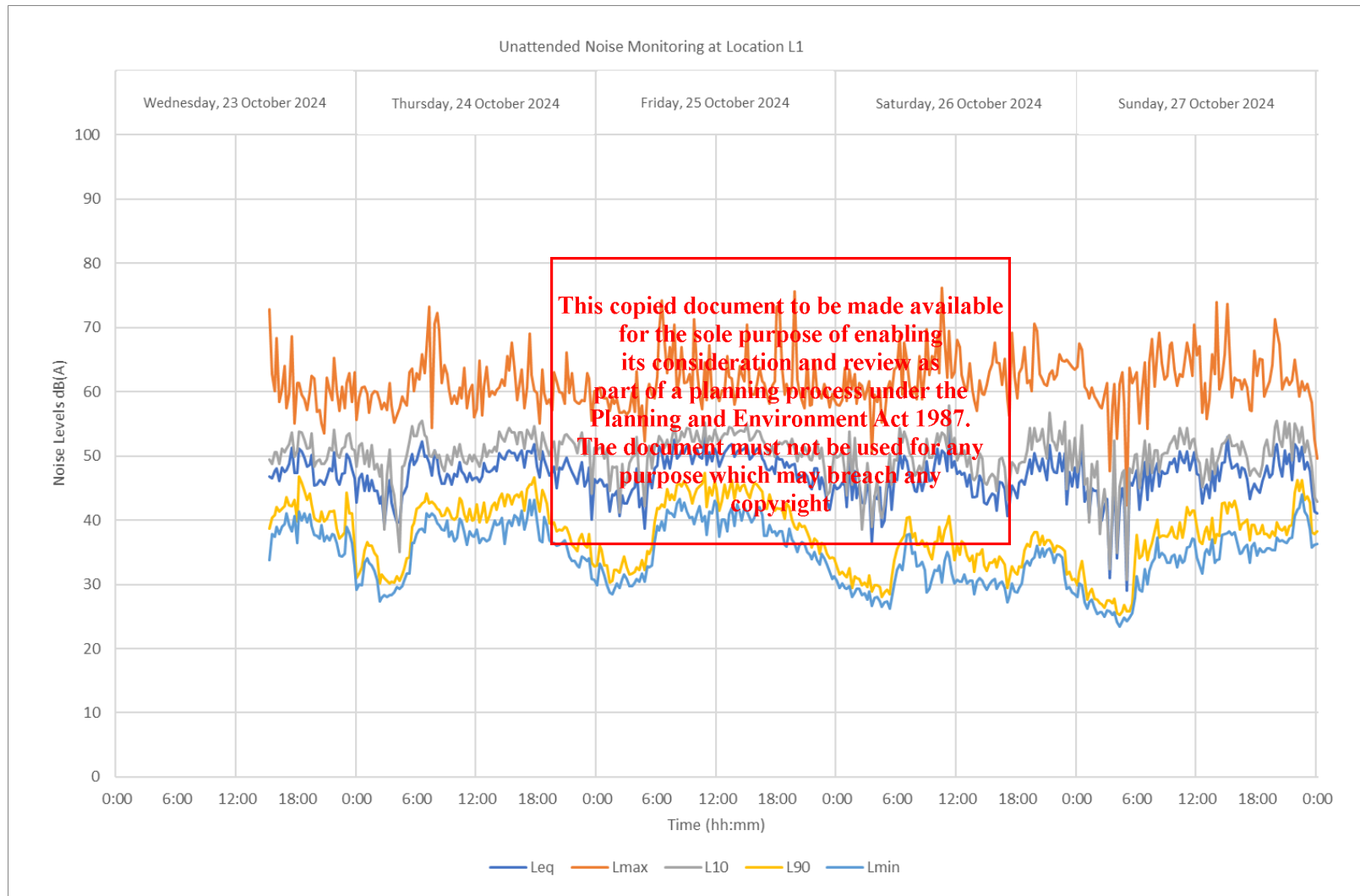


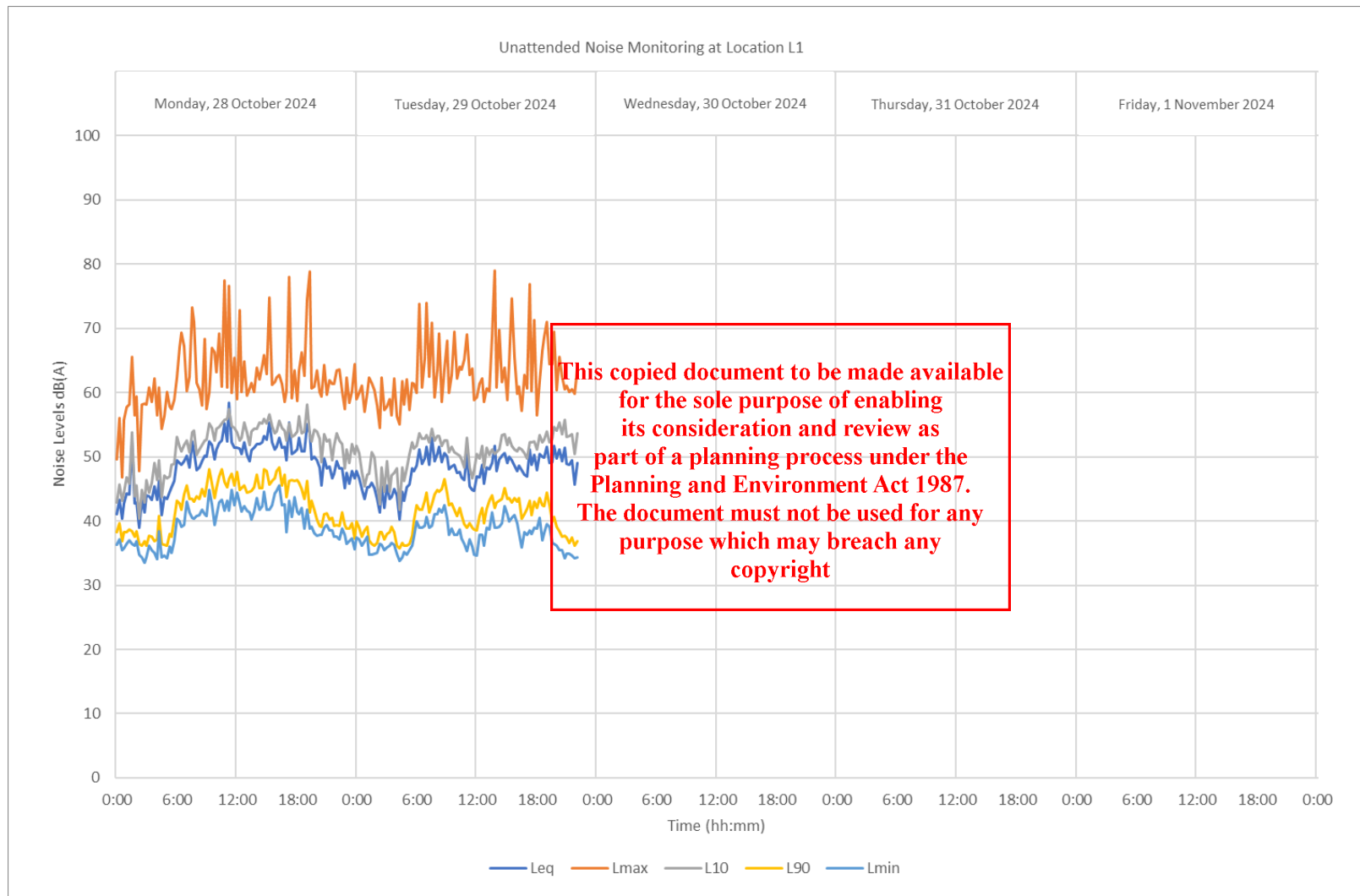
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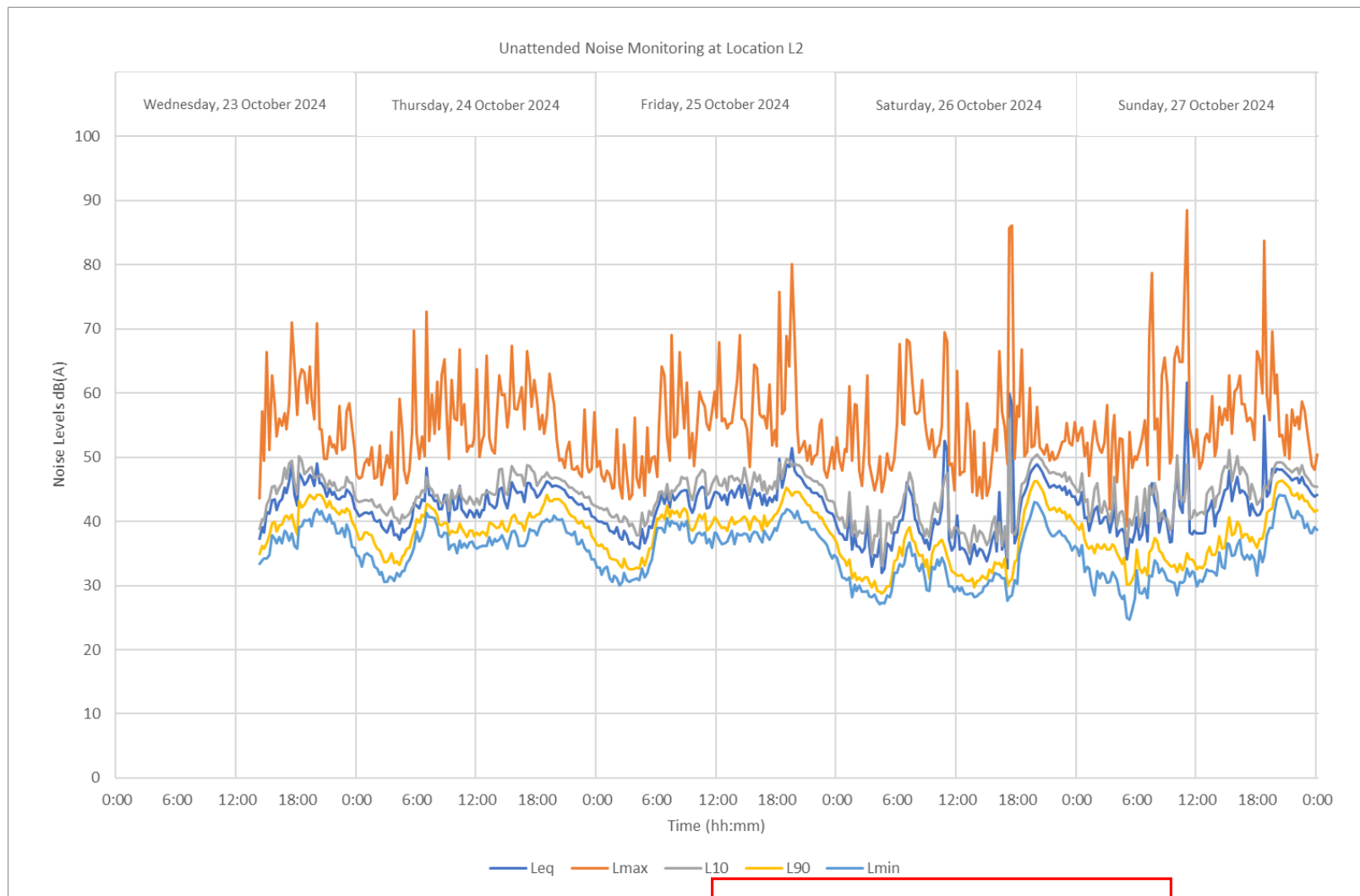
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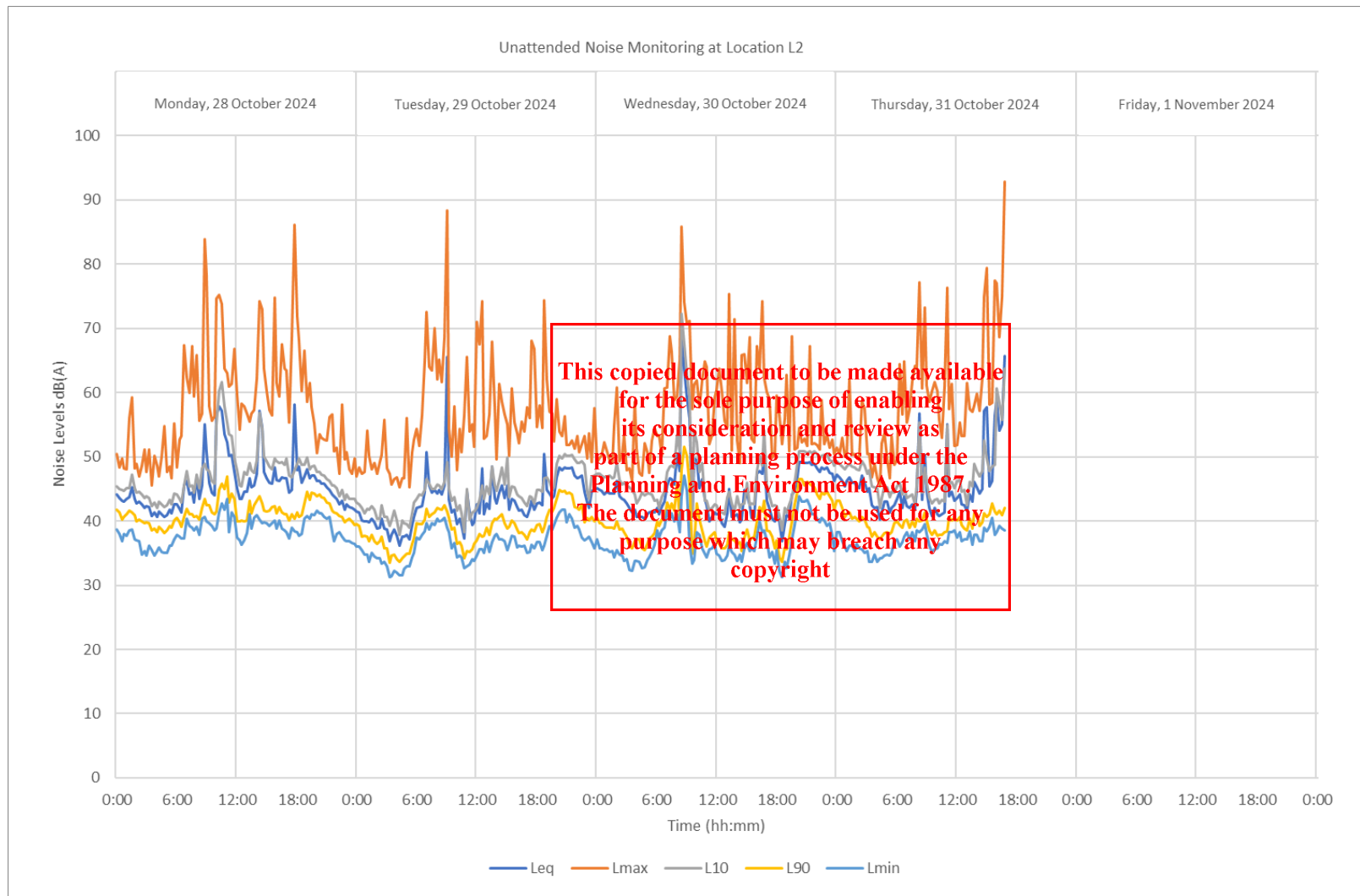
Appendix 2 – Unattended Noise Monitoring Data

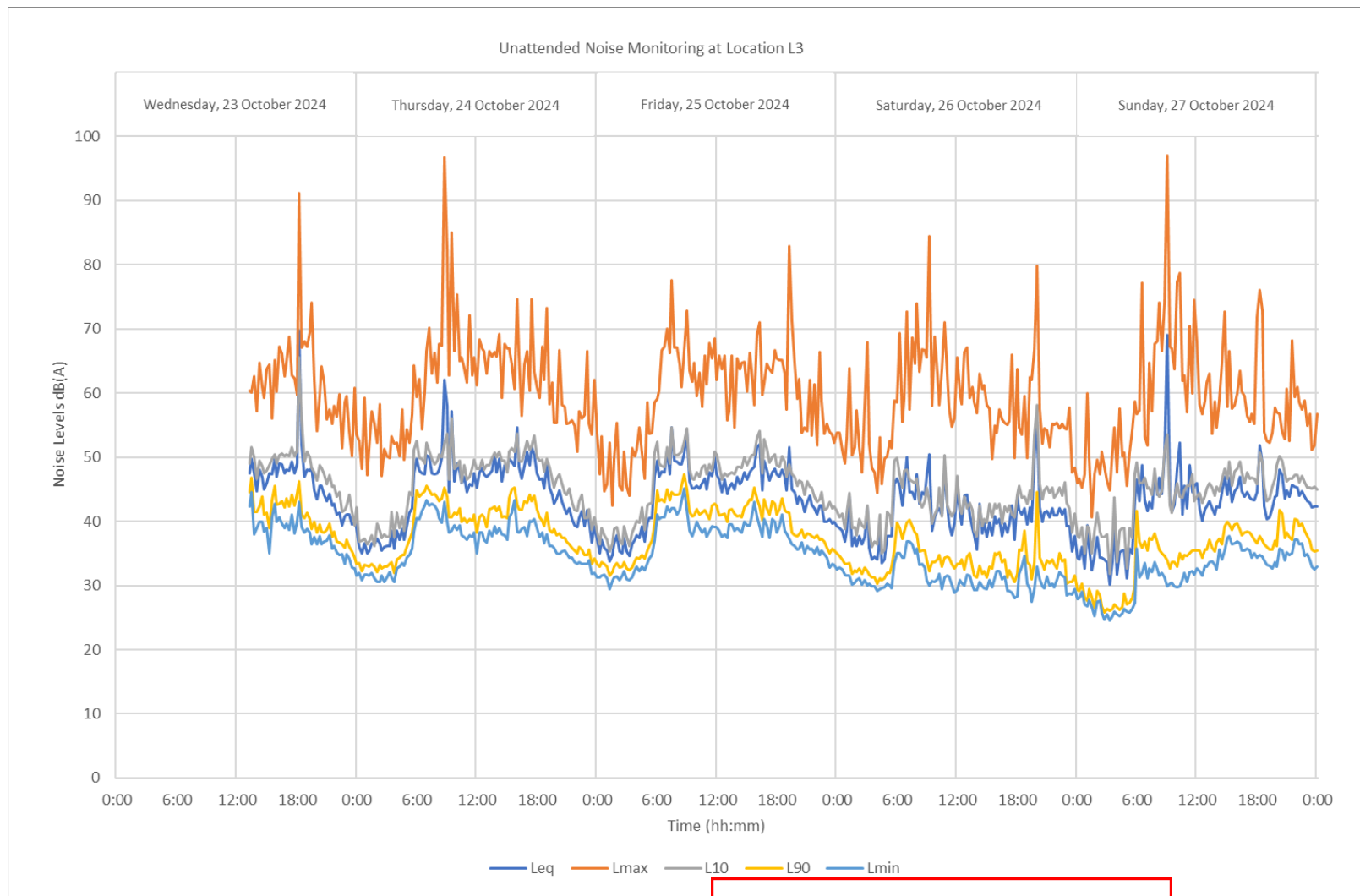






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