WatsonMossGrowcott Acoustics

Mt Cottrell Terminal Station

Southwest cnr Boundary Rd, and Derrimut Rd, Truganina

Acoustic Report – Preliminary noise modelling

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The information contained within this report and adopted as the basis for any assessment has been provided by the Client.

The findings of any assessment and/or recommendations provided within this document are based on noise and vibration factors only.

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This may include but is not limited to structural engineers, mechanical services engineers etc.

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1. Introduction

The proposal includes the operation of a terminal station within the boundaries of the land located on the southwest corner of Boundary Road and Derrimut Road, Truganina.

The terminal station is expected to commence operations with two outdoor transformers operating continuously. In future, the site may increase capacity to allow for up to five outdoor units to operate at the site.

New equipment forming part of the subject site operations will generate noise emissions with the potential to impact on the acoustic environment in the surrounding area including at existing and potential future residential receptors.

In consideration of the above, Watson Moss Growcott Acoustics (WMG) has been engaged to review the proposal and undertake an assessment of noise emissions from the site in accordance with relevant Victorian legislation.

This report presents the findings of the assessment.

2. Noise Assessment Objectives

When addressing potential noise emissions associated with the noise sources under consideration, the assessment must consider the requirements of the Environmental Protection Act 2017, and referral documentation including:

- Environment Protection Regulations 2021.
- EPA Publication 1826.5 '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.

In consideration of the above, the primary objective of the noise assessment is to determine whether the proposed site operating conditions satisfy the minimum requirements of the Environment Protection Act, and whether noise emissions comply with the requirements of the above Regulations and guideline documentation.

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 (Lw)	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 (Lp)	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.

4. Measurement Equipment

As part of the assessment works, WMG 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 Noise Logging Measurements

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

5. Site and Surrounding Environment

The subject site is located on the southwest corner of Boundary Road and Derrimut Road, Truganina. The site land is currently vacant and abuts independent vacant land to the south and west, Boundary Road to the north and Derrimut Road to the east.

The site forms part of the Tarneit North Precinct Structure Plan (PSP) which includes designations for industrial type use, as well as sensitive residential use in proximity to the subject site boundaries. Furthermore, there are existing residential sensitive receptors which are scattered within Urban Growth Zone (UGZ) and Farm Zone (FZ) land to the north, as well as dwellings which have been constructed in more recent years forming part of the residential precincts to the south.

Due to their proximity to the subject site, the most relevant existing and potential future receptors which have been considered as part of the noise assessment include:

- **R01** – 690-810 Hopkins Rd – existing residence.
- **R02** – 687 Hopkins Rd (Eastern lot) – existing residence.
- **R03** – 687 Hopkins Rd (Western lot) – existing residence.
- **R04** – Existing residential receptor area A – southwest of subject site.
- **R05** – Existing residential receptor area B – south of subject site.
- **R06** – Existing residential receptor area C – southeast of subject site,
- **R07** – Potential future residential area 1 – southwest of subject site.
- **R08** – Potential future residential area 2 – south of subject site.
- **R09** – Potential future school.

An aerial image identifying the subject site and nearest existing and proposed sensitive receptors in proximity to the site is included below.

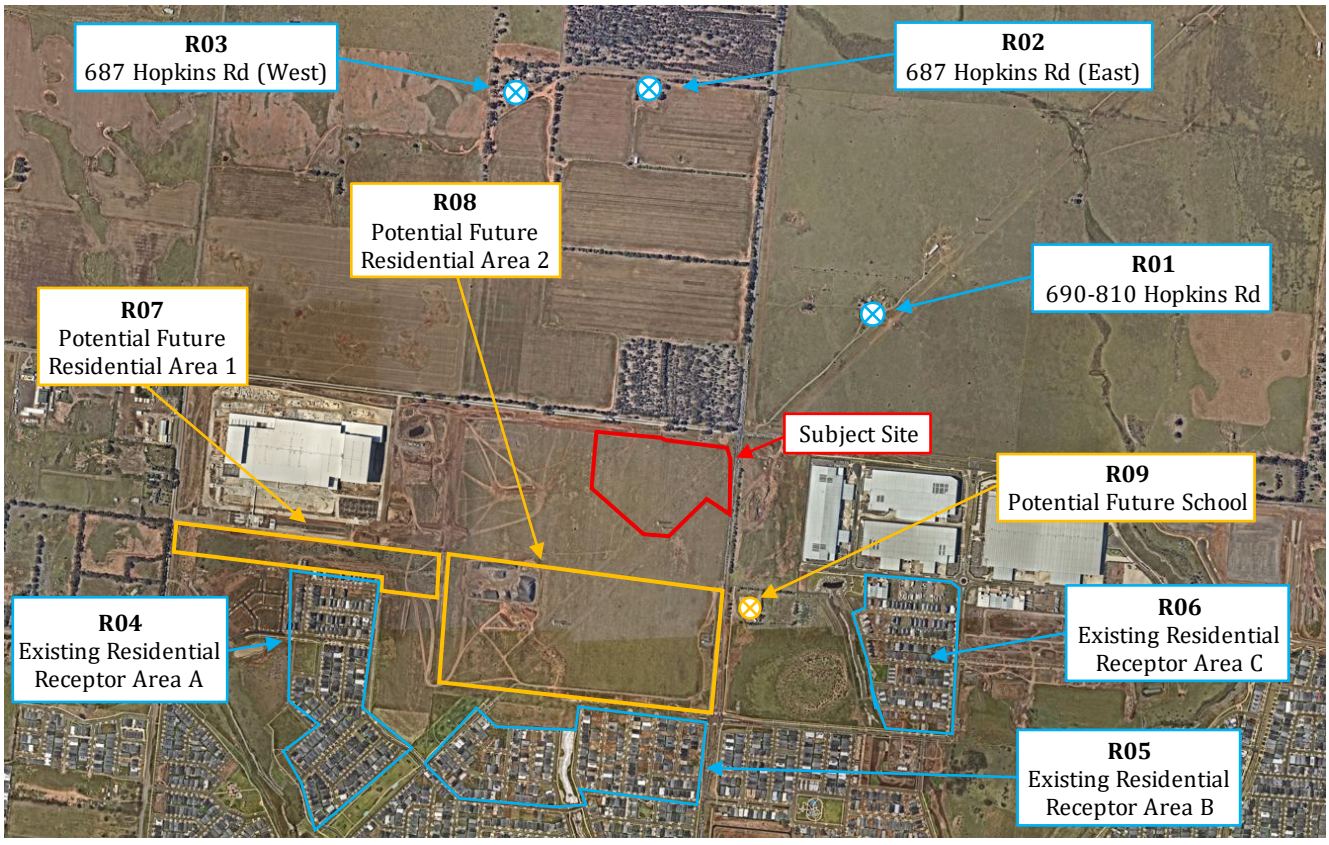


Figure 1: Aerial photo of subject site and surrounding environment including existing and potential future sensitive uses

6. Noise Assessment Criteria

Within the State of Victoria, noise emissions from commercial operations consistent with the venue 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 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'.

Methodologies, specific criteria, and guidance regarding unreasonable noise emissions are included in the following Regulations and guideline documentation referred to within The Act and provided by the EPA:

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

6.1. EPA Publication 1826.5 – Noise Protocol

6.1.1. General Methodologies

The subject site land and relevant receptors are located within a 'major urban area'.

In accordance with the Noise Protocol, noise limits for the proposed site operations will be determined in accordance with Part I, A1 of the Noise Protocol document referenced as the 'urban area method'. Using the 'urban area method', relevant 'zoning levels' are calculated using the area of differing land zoning types surrounding residential receptors as described in Clause 7-15 of the Noise Protocol.

The calculated 'zone levels' 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 day, evening, and night assessment periods are shown below.

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

Further derivation of 'noise limits' applicable for the proposed operations are based on measurement of the existing ambient background noise level at nearby sensitive receptors in accordance with Clause 39-51 of the Noise Protocol.

Where ambient background noise levels at sensitive receptors fall within the range considered 'neutral' in accordance with the Noise Protocol methodologies, the calculated 'zoning levels' will apply as noise limits for the site operations.

The 'neutral' range represents an ambient background noise level which is considered 'typical' for the relevant land zoning types surrounding the receptor location. Where ambient background noise levels are measured to be higher or lower than the 'neutral range', background level adjusted noise limits will apply for the site operations.

6.1.2. Ambient Background Noise Monitoring

When measuring the ambient background noise levels associated with the acoustic environment at receptor locations, the EPA defines the noise descriptor as the dB(A)L_{90}. This value is considered representative of the lower noise levels in a varying noise environment and is commonly due to traffic noise along nearby and distant roads.

The approach to measuring the ambient background noise levels within a receptor area generally includes unattended noise monitoring over an extended period (nominally 5 days). However, in scenarios where access cannot be provided to safe and secure monitoring locations, attended monitoring is often adopted as a reasonable alternative approach.

For this project, the client was able to provide access within the subject site boundaries and within the vacant land to the south and west which allowed fixed unattended logging over an extended period.

Access could not be provided to off-site receptor locations, and hence, supplementary attended noise measurements were undertaken within the various surrounding receptor areas for comparison with the fixed position monitoring.

The attended and unattended noise monitoring was undertaken during the following dates and times:

- Attended noise monitoring during the period 12:45pm to 4:00pm on Tuesday 2nd December 2025.
- Attended noise monitoring during the period 11:00pm to 1:30am on Monday 8th December 2025.
- Attended noise monitoring during the period 2:00pm to 4:00pm on Tuesday 9th December 2025.
- Unattended noise monitoring for the period Tuesday 2nd December to Tuesday 9th December 2025.

The aerial photo shown in Figure 2 identifies the attended and unattended noise monitoring locations.

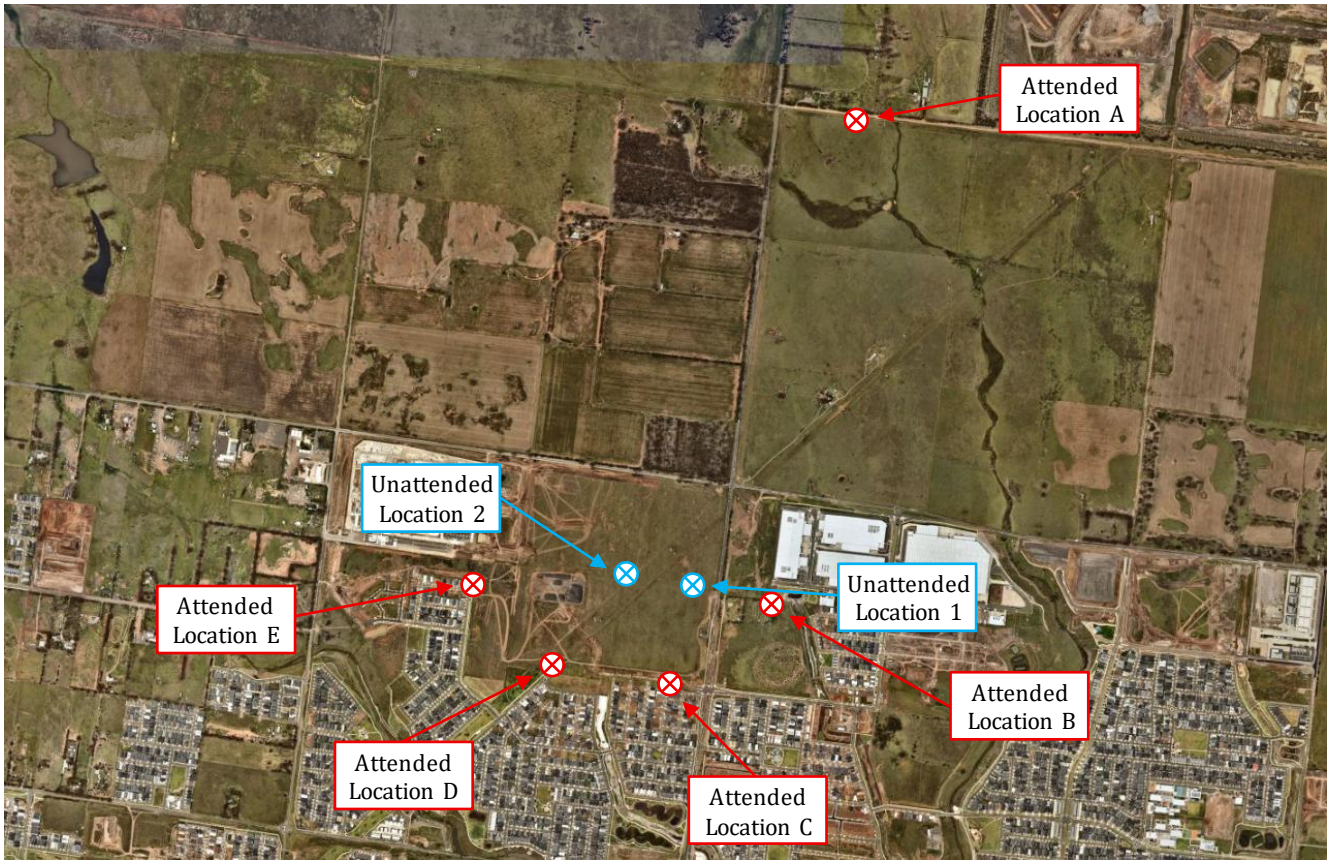


Figure 2: Aerial image identifying unattended and attended monitoring locations

During attendance at site, WMG observed several construction sites which were operational to the west, south and to the southwest of the subject site.

In addition, due to roadworks, traffic movements along Derrimut Road were generally limited to speeds of 40km/hr in proximity to the subject site.

A temporary traffic light was also installed at the corner of Derrimut and Boundary Road.

Several intersections included limited access or no access to vehicles.

Based on analysis of the data obtained, a summary of the measured ambient background noise levels recorded at the unattended locations during each of the EPA assessment periods is included below.

Table 4: Summary of Unattended Noise Monitoring Results (Lowest values during each EPA period highlighted)

Day / Date	Measurement Period	Measured Noise Levels (L_{90})	
		Location 1	Location 2
Tuesday 2nd December 2025	Day Period – 7:00am to 6:00pm	-	-
	Evening Period – 6:00pm to 10:00pm	46	42
	Night Period – 10:00pm to 7:00am	43	40
Wednesday 3rd December 2025	Day Period – 7:00am to 6:00pm	45	43
	Evening Period – 6:00pm to 10:00pm	48	49
	Night Period – 10:00pm to 7:00am	41	41
Thursday 4th December 2025	Day Period – 7:00am to 6:00pm	48	46
	Evening Period – 6:00pm to 10:00pm	44	41
	Night Period – 10:00pm to 7:00am	40	38
Friday 5th December 2025	Day Period – 7:00am to 6:00pm	44	41
	Evening Period – 6:00pm to 10:00pm	44	42
	Night Period – 10:00pm to 7:00am	39	37
Saturday 6th December 2025	Evening Period – 7:00am to 6:00pm	43	39
	Evening Period – 6:00pm to 10:00pm	42	38
	Night Period – 10:00pm to 7:00am	37	34
Sunday 7th December 2025	Day Period – 7:00am to 6:00pm	39	-
	Evening Period – 6:00pm to 10:00pm	44	-
	Night Period – 10:00pm to 7:00am	41	-
Monday 8th December 2025	Day Period – 7:00am to 6:00pm	44	-
	Evening Period – 6:00pm to 10:00pm	43	-
	Night Period – 10:00pm to 7:00am	41	-
Tuesday 9th December 2025	Day Period – 7:00am to 6:00pm	43	-
	Evening Period – 6:00pm to 10:00pm	-	-
	Night Period – 10:00pm to 7:00am	-	-

Based on observations during the attended site surveys, and through analysis of the audio files obtained by the fixed unattended noise loggers, WMG provides the following comments:

- During the attended noise surveys conducted during the EPA day period, the attending consultant noted that the existing acoustic environment generally included noise contributions due to nearby and distant traffic, birds and insects, and wind exciting nearby flora. At locations in proximity to the subject site, noise due to construction was commonly audible.
- During the attended noise surveys conducted during the EPA evening and night periods, the attending consultant noted that the existing acoustic environment included noise contributions due to nearby and distant traffic, birds and insects, and wind exciting nearby flora. WMG also noted that noise associated with several diesel generators operating construction lighting were also audible within the surrounding area.

In order to further understand the ambient background noise levels within the surrounding area, WMG presents the following summary of the relevant measured values recorded during the attended noise surveys.

Table 5: Summary of Attended Measurements Results

Location	Date	Time	Measured Noise Levels	
			dB(A)L_{90} – Raw	dB(A)L_{90} – insects removed
Location A	9th December 2025	12:27am	38	38
Location A	9th December 2025	2:15pm	42	42
Location B	9th December 2025	12:39am	35	34
Location C	9th December 2025	2:56pm	39	39
Location D	2nd December 2025	3:51pm	39	39
Location D	9th December 2025	1:10am	31	30
Location E	8th December 2025	11:30pm	34-35	32-34

In accordance with the Noise Protocol, the background level used to determine relevant noise limits must:

- be measured outdoors within the noise sensitive area, or at a background equivalent location.
- include all noise sources except industry noise which appears to be intrusive at the measurement point.
- exclude data affected by rain or windy weather and atypical or extraneous noise events eg. construction activities or insect noise.

In consideration of the above, WMG has analysed the data recorded during times when extraneous noise sources were less prominent, and/or not contributing to the acoustic environment when adopting ambient background noise levels for the project.

On this basis, WMG has determined that the ambient background noise levels within the surrounding area have been generally captured by the unattended monitoring equipment with higher levels applicable closer to Derrimut Road.

The ambient background noise levels adopted as the basis for the assessment are therefore as follows.

Table 6: Adopted ambient background noise levels during EPA Assessment Periods

Period	Relevant Days	Time Periods	Ambient background noise levels – dB(A)L_{90}								
			R01	R02	R03	R04	R05*	R06	R07	R08*	R09
Day	Monday to Saturday	7:00am to 6:00pm	39	39	39	39	43	39	39	43	43
Evening	Monday to Saturday	6:00pm to 10:00pm	38	38	38	38	42	38	38	42	42
	Sunday, Public Hols.	7:00am to 10:00pm									
Night	All Days	10:00pm to 7:00am	34	34	34	34	37	34	34	37	37

** Note – For locations which are setback from Derrimut Road by greater than 300m from Derrimut Road, WMG has adopted ambient background noise levels of 39dB(A), 38dB(A) and 34dB(A) for the day, evening and night periods respectively.*

6.1.3. Determination of Noise Protocol Noise Limits

A component of determining the Noise Protocol noise limits relies on the zoning of the land surrounding the critical sensitive receptor locations.

The subject site and surrounds are currently under development with various areas being designated under 'UGZ'.

In order to determine the Noise Protocol noise limits, WMG has adopted the UGZ designations which are included in the Noise Protocol documentation. Despite the above, WMG expects that land zoning may change pending decisions of Council in relation to the use of the surrounding area.

These changes may influence the determined noise limits, and hence WMG recommends that the client requests that Council provides notification if any changes are being considered and/or are proposed.

Based on the existing designations, WMG has determined that the adopted ambient background noise levels west of Derrimut Road, and north of Boundary Road generally fall within the Noise Protocol 'neutral' range.

When considered to the east of Derrimut Road, the adopted ambient background noise levels were generally lower than the Noise Protocol 'neutral' range.

A component of this may have been due to the reduced traffic speeds along the roadway, however, for the purposes of this assessment, WMG has adopted the values measured under the existing conditions.

On this basis, WMG provides the following summary of the Noise Protocol noise limits adopted for the assessment.

For reference, the designations of 'A' and 'B' refer to components of the receptor area setback from Derrimut Road by 300m ('A'), and in proximity to Derrimut Road ('B').

Table 7: Relevant Noise Limit Summary

Period	Time Periods	Calculated Noise Limits – dB(A)L_{eq}										
		R01	R02	R03	R04	R05A	R05B	R06	R07	R08A	R08B	R09
Day	7:00am to 6:00pm	51*	50	50	50	50	51	54*	50	50	51	56*
Evening	6:00pm to 10:00pm	47	44	44	44	44	45	49*	44	44	45	50*
	7:00am to 10:00pm											
Night	10:00pm to 7:00am	42	39	39	39	39	40	44*	39	39	40	45*

** Determined based on ambient background noise level being 'low' relative to the Noise Protocol 'neutral' range.*

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.

For the proposed school, it will be applicable within 10 metres of the outside of the external walls of a classroom or any room in which learning occurs. The relevant assessment period will be 30 minutes.

The new equipment forming part of the proposal will have the potential to operate 24 hours per day, therefore, noise emissions during the night period, when relevant noise limits will be at their lowest will provide the limiting criterion.

For the school, the noise impacts will only be assessable when the facility is in use, and hence the EPA day period.

6.1.4. Cumulative Contributions from Other Noise Sources

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 x log10(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*'.

The subject site and surrounding environment forms part of a precinct which will continue to be developed over time.

In consideration of the above, it would be reasonable that the proposed operations introduce reasonably practicable measures and adopt project design objectives below the Noise Protocol noise limits in order to allow for cumulative noise impacts to remain below the overall noise limits in future.

Based on previous experience involving the EPA, WMG expects that, in conjunction with implementing all reasonably practicable measures, a design target 5dB(A) below the determined Noise Protocol noise limits be adopted.

This would allow for the operational noise emissions from the site plus two other commercial operations to contribute equally to the acoustic environment at each of the sensitive receptors whilst complying with the overall noise limits.

This would be a balanced approach to an area which includes a combination of commercial and residential use.

The project design objectives are therefore summarised below.

Table 8: Relevant Project Design Objective Summary

Period	Time Periods	Calculated Noise Limits – dB(A)L_{eq}										
		R01	R02	R03	R04	R05A	R05B	R06	R07	R08A	R08B	R09
Day	7:00am to 6:00pm	46	44	44	44	44	45	49	45	45	46	51
Evening	6:00pm to 10:00pm	42	39	39	39	39	40	44	39	39	40	45
	7:00am to 10:00pm											
Night	10:00pm to 7:00am	37	34	34	34	34	35	39	34	34	35	40

6.1.5. 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.

Table 9: 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 5 dB, 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.

6.2. 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 clearly 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 is 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 existing and potential 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 as part of the on-site operational noise assessment.

6.3. 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.*

In the Regulations, unreasonable noise is based on exceedances determined in accordance with the Noise Protocol, however, the Regulations also include consideration of the frequency spectrum associated with a noise emission.

To provide some basis for addressing low frequency noise emissions and determining whether the noise emission is deemed 'unreasonable' the EPA released Publication 1996 Noise Guideline – assessing low frequency noise.

The guideline document provides 'threshold levels for assessing low frequency noise' which are not set limits, but levels that indicate a potential risk of problematic low frequency noise.

The threshold levels for indoor and outdoor measurements are included below.

Table 10: Indoor and outdoor measurement one-third octave band noise level thresholds

Measurement 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 L_{eq}	92	87	83	74	64	56	49	43	42	40	38	36	34
Outdoor noise dB L_{eq}	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 will require reasonably practicable measures to be considered where values are measured or predicted to be higher than the thresholds.

In consideration of the above, WMG has evaluated potential low frequency noise emissions relative to the thresholds.

7. Operational Noise Emission Assessment

7.1. Source Sound Power Levels

The dominant sources of noise emissions from the subject site will include the outdoor transformer units. The client has advised that each transformer will have a rating of 350 mega volt amps (MVA), however, has not provided source sound power levels for the equipment at this stage.

In consideration of the above, WMG has utilised the calculation methodologies included within *AS/NZS 60076.10:2009 – Power Transformers Determination of Sound Levels* (AS 60076) to adopt sound power levels for the equipment.

AS 60076 includes 'standard maximum' and 'reduced maximum' source sound power levels. Reduced maximum levels are nominated for scenarios where quieter operation is desirable and would also be expected to align with the general commentary provided within the GED including minimising risks of harm to human health and the environment.

For a 350MVA transformer, the standard maximum, and reduced maximum sound power levels are included below.

Table 11: Source Sound Power Levels for 350MVA Transformer Units

Rating	Octave band noise levels Hz							
	63	125	250	500	1000	2000	4000	dB(A)
Standard Maximum	104	106	101	101	95	90	85	102
Reduced Maximum	96	98	93	93	87	82	77	94

Given the proximity of the existing and potential future sensitive receptors, WMG has adopted the 'reduced maximum' sound power level as the basis for the assessment.

It is anticipated that each transformer may be fitted with cooling fans which will have the potential to operate during warmer conditions, however, for the purposes of this assessment, WMG has considered that fans will be acoustically attenuated so that they do not contribute to the overall site noise emissions.

7.2. Site Configuration

As part of the assessment, the client has provided an overall development plan in combination with a terminal station site plan for the project.

The overall development plan including the site plan is included below.

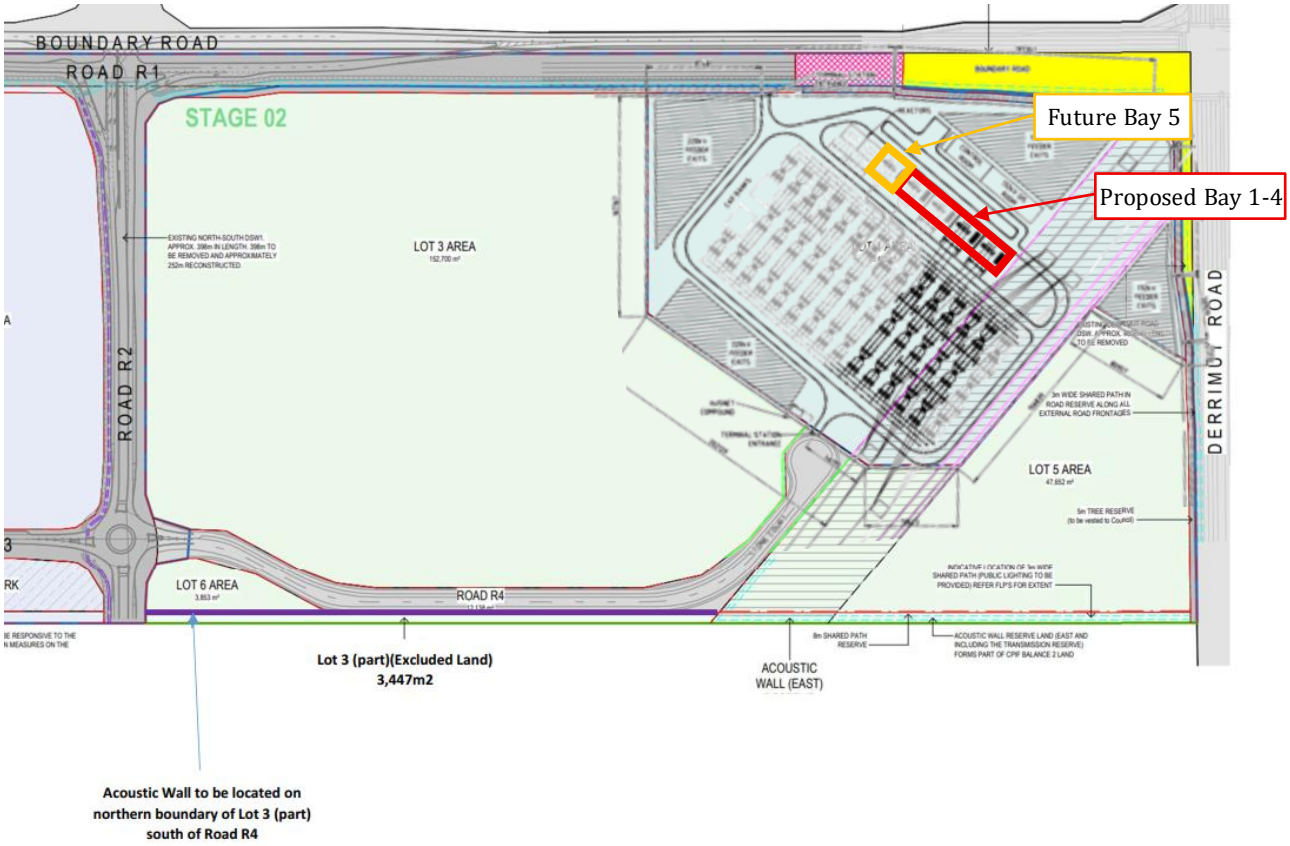


Figure 3: Site plan including location of transformer bays

Based on discussions with the client, the subject site and the residential development to the south will include 9.0m high barrier sections as follows:

- Constructed between the independent transformers and at each end of the transformers for fire protection.
- Along the southern boundary of Lot 6 and Road R4 (purple) and the southern boundary of Lot 5 (red).

There barriers have been included within the assessment and are considered to be solid non-porous materials with a minimum weight of 15kg/m^2 hence providing noise reduction.

7.3. Assessment Scenarios and Noise Modelling Limitations

The assessment scenarios which have been requested by the client include the following:

- **Scenario 1** – Two 350MVA outdoor transformers operating within the eastern most bays, cooling fans operating, but not contributing to noise emissions.
- **Scenario 2** – Four 350MVA outdoor transformers operating within the designated bays, cooling fans operating, but not contributing to noise emissions.
- **Scenario 3** – Total of Five outdoor transformers operating within designated bays, plus potential future west bay, cooling fans operating, but not contributing to noise emissions.

WMG has previously made the client aware of the general parameters of transformer noise control, and the maximum reduction that can be expected when introducing certain strategies.

- Where exceedances are determined to be in the order of 5-10dB(A), acoustic barriers providing shielding in the direction of sensitive receptors is an effective method of reducing noise impacts.
- Within the range 10-15dB(A), acoustic barriers may be appropriate, pending the noise frequency of the impact.
- Where exceedances are determined to be in the order of 15dB(A) or greater, and/or the site is already configured to include significant noise control, options are generally limited to either replacing or enclosing the problematic transformer units. These options are understood to be costly, impact on the longevity of the equipment, and hence are often not preferred.

Further to the above, WMG has made the client aware of the noise level variations which can occur with transformers and the difficulties and inaccuracies which can arise when undertaking 3D noise modelling of transformers.

WMG has therefore always suggested that conservatism be adopted when evaluating potential noise control options.

7.4. 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 land elevations and site buildings, and the surrounding environment has been sourced from online databases including Nearmaps, VicMaps and topography from the ANZLIC Committee on Surveying and Mapping.

It is noted that the existing site land and surrounds included varying land heights. The model has adopted the natural land height obtained from online sources and has included adjustments based on observations made by the attending consultant. WMG would recommend that the client provide more detailed information regarding building heights and land topography for the most accurate noise modelling outcome.

For this assessment, the modelling software has implemented the calculation procedures defined within International Standard ISO 9613-2. This Standard has been considered and approved as part of many previous projects requiring noise emission assessment works.

Through implementation of the standard, the noise model considers the following attenuation:

- 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 dwellings located at R01-R03 are single storey, and hence, for the purposes of the assessment WMG has adopted an assessment height of 1.5m above ground level.

For each of the other existing and potential future receptors, WMG has considered it a possibility that buildings may be two storey and hence has also considered an assessment height of 4.5m above ground level to reflect the first floor level (FFL) of the dwelling.

This approach is consistent with other similar assessments conducted by WMG and other firms in Victoria.

7.5. Predicted Noise Levels and Noise Protocol Assessment

From previous experience, there is potential for noise emissions from the transformer equipment to include a tonal character which, in accordance with the Noise Protocol will require an adjustment.

In accordance with the EPA requirements, where the noise impact includes potential for tonality, but the prominence of the tonality is unknown, a conservative approach should be adopted.

In consideration of the above, and for the purposes of this assessment, WMG has adopted a +5 dB(A) 'prominent' tonal character adjustment.

The results of the noise model are presented below in Table 12-14.

The results have been highlighted in green and red to reflect compliance or otherwise with Noise Protocol noise limits for each assessment scenario.

Table 12: Noise Protocol Assessment – Scenario 1 (two transformers operating)

Assessment Location	Predicted Level dB(A) L_{eq}		Noise Protocol Adjustments	Effective Noise Level dB(A) L_{eq}		Noise Protocol Noise Limit dB(A) L_{eq}		
	GL	FFL	Tonal	GL	FFL	Day	Evening	Night
R01 – single storey	28	-	5 dB(A)	33	-	51	47	42
R02 – single storey	23	-	5 dB(A)	28	-	50	44	39
R03 – single storey	15	-	5 dB(A)	20	-	50	44	39
R04	26	26	5 dB(A)	31	31	50	44	39
R05A – setback Derrimut Rd	28	29	5 dB(A)	33	34	50	44	39
R05B – near Derrimut Rd	30	31	5 dB(A)	35	36	51	45	40
R06	30	31	5 dB(A)	35	36	54	49	44
R07	26	29	5 dB(A)	31	34	50	44	39
R08A – setback Derrimut Rd	25	30	5 dB(A)	30	35	50	44	39
R08B – near Derrimut Rd	33	34	5 dB(A)	38	39	51	45	40
R09 – near Derrimut Rd	34	35	5 dB(A)	39	40	56	N/A	N/A

Table 13: Noise Protocol Assessment – Scenario 2 (four transformers operating)

Assessment Location	Predicted Level dB(A) L_{eq}		Noise Protocol Adjustments	Effective Noise Level dB(A) L_{eq}		Noise Protocol Noise Limit dB(A) L_{eq}		
	GL	FFL	Tonal	GL	FFL	Day	Evening	Night
R01 – single storey	31	31	5 dB(A)	36	36	51	47	42
R02 – single storey	24	24	5 dB(A)	29	29	50	44	39
R03 – single storey	17	17	5 dB(A)	22	22	50	44	39
R04	29	30	5 dB(A)	34	35	50	44	39
R05A – setback Derrimut Rd	31	32	5 dB(A)	36	37	50	44	39
R05B – near Derrimut Rd	33	34	5 dB(A)	38	39	51	45	40
R06	32	33	5 dB(A)	37	38	54	49	44
R07	29	32	5 dB(A)	34	37	50	44	39
R08A – setback Derrimut Rd	28	33	5 dB(A)	33	38	50	44	39
R08B – near Derrimut Rd	36	38	5 dB(A)	41	43	51	45	40
R09 – near Derrimut Rd	36	37	5 dB(A)	41	42	56	N/A	N/A

Table 14: Noise Protocol Assessment – Scenario 3 (five transformers operating)

Assessment Location	Predicted Level dB(A) L_{eq}		Noise Protocol Adjustments	Effective Noise Level dB(A) L_{eq}		Noise Protocol Noise Limit dB(A) L_{eq}		
	GL	FFL	Tonal	GL	FFL	Day	Evening	Night
R01 – single storey	32	-	5 dB(A)	37	-	51	47	42
R02 – single storey	24	-	5 dB(A)	29	-	50	44	39
R03 – single storey	18	-	5 dB(A)	23	-	50	44	39
R04	30	31	5 dB(A)	35	36	50	44	39
R05A – setback Derrimut Rd	32	33	5 dB(A)	37	38	50	44	39
R05B – near Derrimut Rd	34	35	5 dB(A)	39	40	51	45	40
R06	33	34	5 dB(A)	38	39	54	49	44
R07	30	33	5 dB(A)	35	38	50	44	39
R08A – setback Derrimut Rd	29	34	5 dB(A)	34	39	50	44	39
R08B – near Derrimut Rd	37	39	5 dB(A)	42	44	51	45	40
R09 – near Derrimut Rd	37	38	5 dB(A)	42	43	56	N/A	N/A

As is shown above, the results of the noise model indicate general compliance with the Noise Protocol noise limits at each of the nearby receptors during the EPA day and evening periods.

During the night period however, the predicted levels indicate potential exceedances of Noise Protocol limits within the boundaries of 'Potential Future Residential Area 2' for Scenario 2 and 3 as follows:

- **Scenario 1** – compliance predicted during all periods.
- **Scenario 2** – exceedances of 1dB(A) at GL and 3dB(A) at FFL with four transformers operating.
- **Scenario 3** – exceedances of 2dB(A) at GL and 4dB(A) at FFL with five transformers operating.

Further to the above, when considered relative to the adopted project design objectives, WMG provides the following summary tables which indicate additional non-compliances including during the evening period.

Table 15: Project Design Objective Cumulative Noise Assessment – Scenario 1 (two transformers operating)

Assessment Location	Predicted Level dB(A) L_{eq}		Noise Protocol Adjustments	Effective Noise Level dB(A) L_{eq}		Noise Protocol Noise Limit dB(A) L_{eq}		
	GL	FFL	Tonal	GL	FFL	Day	Evening	Night
R01 – single storey	28	-	5 dB(A)	33	-	46	42	37
R02 – single storey	23	-	5 dB(A)	28	-	44	39	34
R03 – single storey	15	-	5 dB(A)	20	-	44	39	34
R04	26	26	5 dB(A)	31	31	44	39	34
R05A – setback Derrimut Rd	28	29	5 dB(A)	33	34	44	39	34
R05B – near Derrimut Rd	30	31	5 dB(A)	35	36	45	40	35*
R06	30	31	5 dB(A)	35	36	49	44	39
R07	26	29	5 dB(A)	31	34	45	39	34
R08A – setback Derrimut Rd	25	30	5 dB(A)	30	35	45	39	34*
R08B – near Derrimut Rd	33	34	5 dB(A)	38	39	46	40	35
R09 – near Derrimut Rd	34	35	5 dB(A)	39	40	51	N/A	N/A

** Exceedance determined at FFL only. GL compliance is predicted.*

Table 16: Project Design Objective Cumulative Noise Assessment – Scenario 2 (four transformers operating)

Assessment Location	Predicted Level dB(A) L_{eq}		Noise Protocol Adjustments	Effective Noise Level dB(A) L_{eq}		Noise Protocol Noise Limit dB(A) L_{eq}		
	GL	FFL	Tonal	GL	FFL	Day	Evening	Night
R01 – single storey	31	31	5 dB(A)	36	36	46	42	37
R02 – single storey	24	24	5 dB(A)	29	29	44	39	34
R03 – single storey	17	17	5 dB(A)	22	22	44	39	34
R04	29	30	5 dB(A)	34	35	44	39	34*
R05A – setback Derrimut Rd	31	32	5 dB(A)	36	37	44	39	34
R05B – near Derrimut Rd	33	34	5 dB(A)	38	39	45	40	35
R06	32	33	5 dB(A)	37	38	49	44	39
R07	29	32	5 dB(A)	34	37	45	39	34*
R08A – setback Derrimut Rd	28	33	5 dB(A)	33	38	45	39	34*
R08B – near Derrimut Rd	36	38	5 dB(A)	41	43	46	40	35
R09 – near Derrimut Rd	36	37	5 dB(A)	41	42	51	N/A	N/A

** Exceedance determined at FFL only. GL compliance is predicted.*

Table 17: Project Design Objective Cumulative Noise Assessment – Scenario 3 (five transformers operating)

Assessment Location	Predicted Level dB(A) L_{eq}		Noise Protocol Adjustments	Effective Noise Level dB(A) L_{eq}		Noise Protocol Noise Limit dB(A) L_{eq}		
	GL	FFL	Tonal	GL	FFL	Day	Evening	Night
R01 – single storey	32	-	5 dB(A)	37	-	46	42	37
R02 – single storey	24	-	5 dB(A)	29	-	44	39	34
R03 – single storey	18	-	5 dB(A)	23	-	44	39	34
R04	30	31	5 dB(A)	35	36	44	39	34
R05A – setback Derrimut Rd	32	33	5 dB(A)	37	38	44	39	34
R05B – near Derrimut Rd	34	35	5 dB(A)	39	40	45	40	35
R06	33	34	5 dB(A)	38	39	49	44	39
R07	30	33	5 dB(A)	35	38	45	39	34
R08A – setback Derrimut Rd	29	34	5 dB(A)	34	39	45	39	34*
R08B – near Derrimut Rd	37	39	5 dB(A)	42	44	46	40	35
R09 – near Derrimut Rd	37	38	5 dB(A)	42	43	51	N/A	N/A

** Exceedance determined at FFL only. GL compliance is predicted.*

In consideration of the above and based on previous direction from the client on other projects, WMG has investigated the possible noise reduction provided by localised acoustic barriers constructed around the transformers.

For the purposes of the assessment, the 9m fire walls separating the transformers has been retained and a 6.5m high barrier has been modelled along the southwestern opening of the transformer bays with the northeastern wall open to allow for ventilation. This is illustrated below.

Figure 4: Indicative localised 6.5m acoustic barrier alignment

With the introduction of the acoustic barrier, WMG has determined that predicted noise levels at each of the sensitive receptors comply with the relevant Noise Protocol noise limits and adopted design objectives during all periods.

The client must be aware that the outcome remains marginal with the predicted noise levels often being equal to the project design objective at the sensitive receptors.

The barrier would be constructed with no gaps between panels, or between panels and the ground below, and would be constructed using materials with a minimum weight of 15kg/m^2. Suitable materials will include 9mm cement sheet, 3 x 0.48 mm Colorbond steel sheeting, 6 mm glass, 15 mm polycarbonate or 25mm thick timber panels.

Masonry options including precast concrete and brickwork would also be acceptable ensuring that gaps were sealed, and full depth mortar was installed.

Based on the results of the noise model, WMG expects that sound absorption would also be necessary to the sides of the barriers facing the transformers. The sound absorbing materials would be not less than 100mm thick and achieve a Noise Reduction Coefficient (NRC) 0.9.

An alternative strategy to introducing acoustic barriers at the subject site will be to ensure that the transformer units are designed and constructed to achieve a **maximum allowable sound power level**.

The current assessment has been based on an indicative sound power level of 94dB(A) which has been adopted based on relevant Standards and assessed at potential first floor levels of future sensitive receptors. However, the barriers could be avoided if the supplied transformers had a maximum allowable sound power level of 85dB(A), or 87dB(A) if there was a restriction of building height to single storey within the adjoining allotment.

This may be difficult for a supplier to achieve, but could be considered.

8. Consideration of Low Frequency Noise Emissions

The one-third octave frequency band spectrum noise levels for the transformers have not been provided by the client and is not included within the AS 60076 methodologies.

In consideration of the above, WMG has used the octave band values obtained using AS 60076 to consider the potential for resultant noise levels to exceed the outdoor thresholds nominated in EPA Publication 1996.

Based on the results of the noise model, the predicted values at 63Hz and 125Hz are well below the outdoor thresholds and hence, WMG expects that with suitable equipment selections, the resultant one-third octave frequency band noise levels at existing and future off-site sensitive receptors will remain below the thresholds.

In consideration of the above, and in accordance with EPA Publication 1996, the predicted one-third octave band values indicate that the asset does 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.

9. General Environmental Duty and Design Review

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.

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

10. Conclusion

WMG has undertaken an assessment to consider potential noise emissions associated with the new terminal station proposed for construction within the boundaries of the land located on the southwest corner of Boundary Road and Derrimut Road, Truganina.

As part of the assessment, WMG has undertaken monitoring of ambient background noise levels within the boundary of the subject site and the surrounding area.

The measured ambient background noise levels have then been used to determine the Noise Protocol noise limits applicable at residential receptors for the proposed operations.

Based on the results of the assessment, WMG has concluded the following:

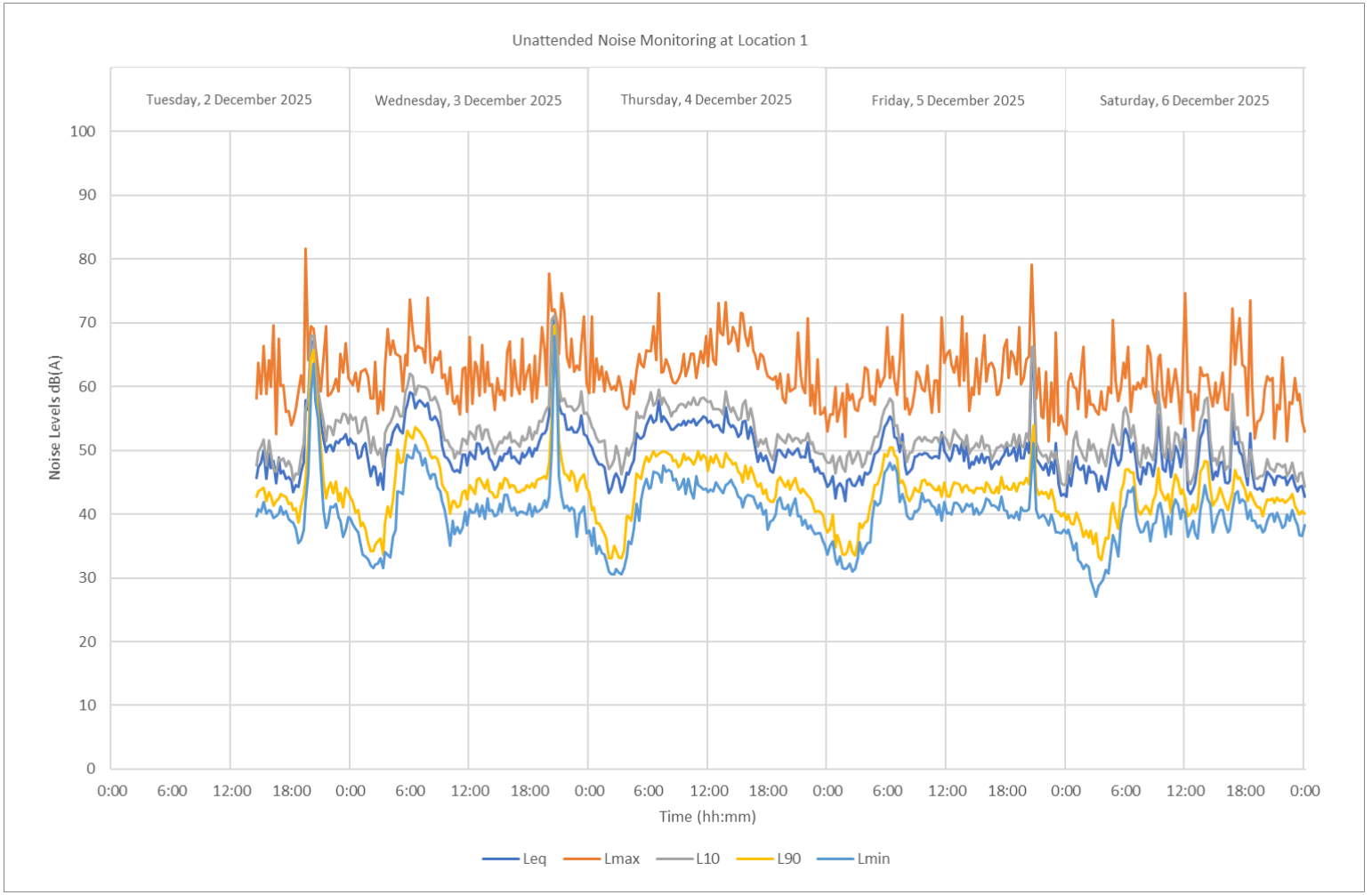
- Noise emissions associated with the proposed installation have the potential to exceed relevant Noise Protocol noise limits at each of the nearby sensitive receptors during the EPA night period.
- With the inclusion of 6.5m localised acoustic barriers to the transformer units, predicted off-site noise levels were compliant with the relevant Noise Protocol noise limits, and hence have been recommended by WMG.
- The calculated values indicate that the asset **does not** present a 'potential risk of problematic low frequency noise' when considered at nearby residential properties.

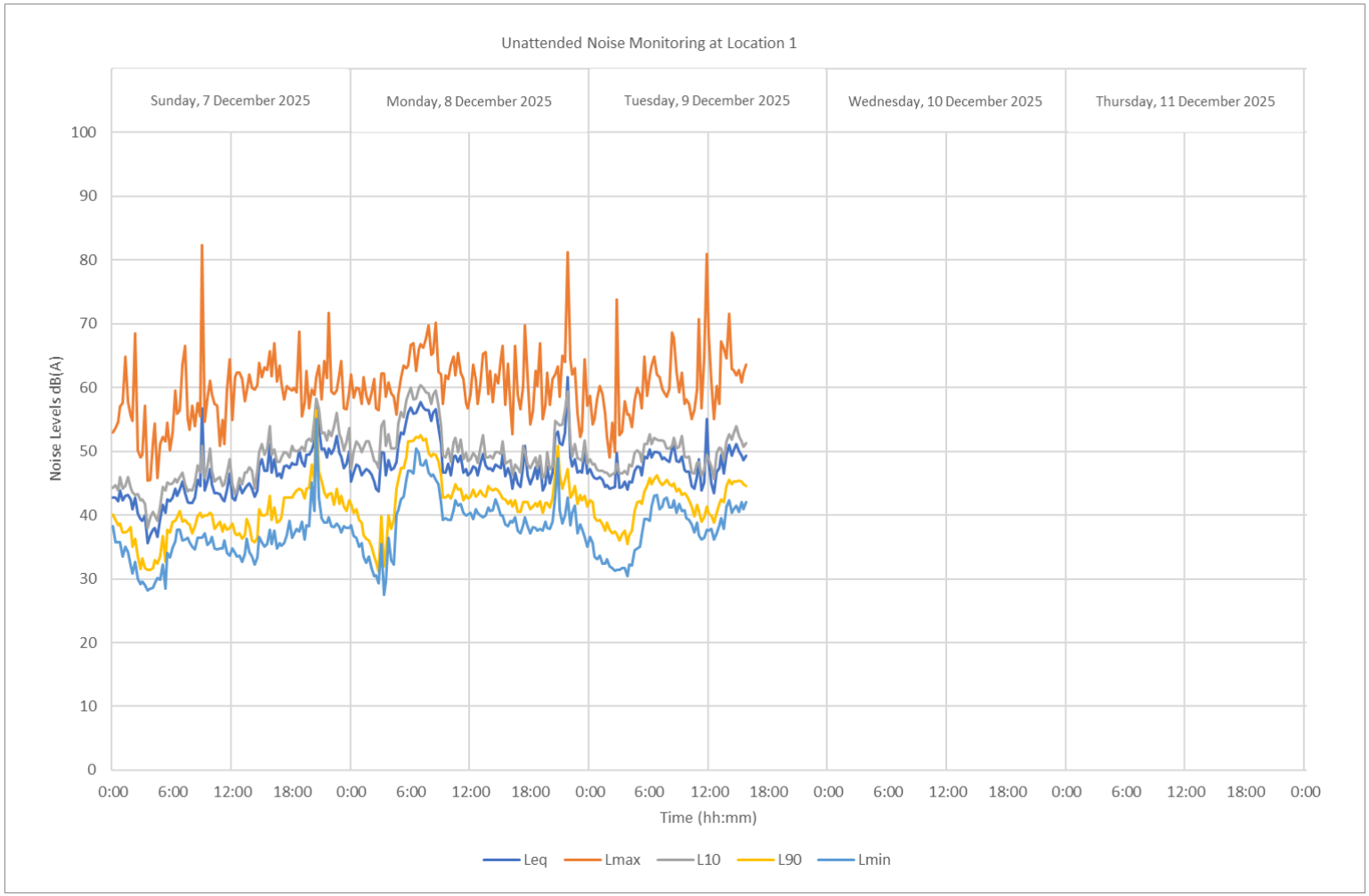
Given the uncertainty regarding the tonal adjustment applicable for the assessment, and the incomplete nature of the source noise level data, the above should be considered as an indicative risk assessment with regard to the potential for non-compliances to occur at the subject site.

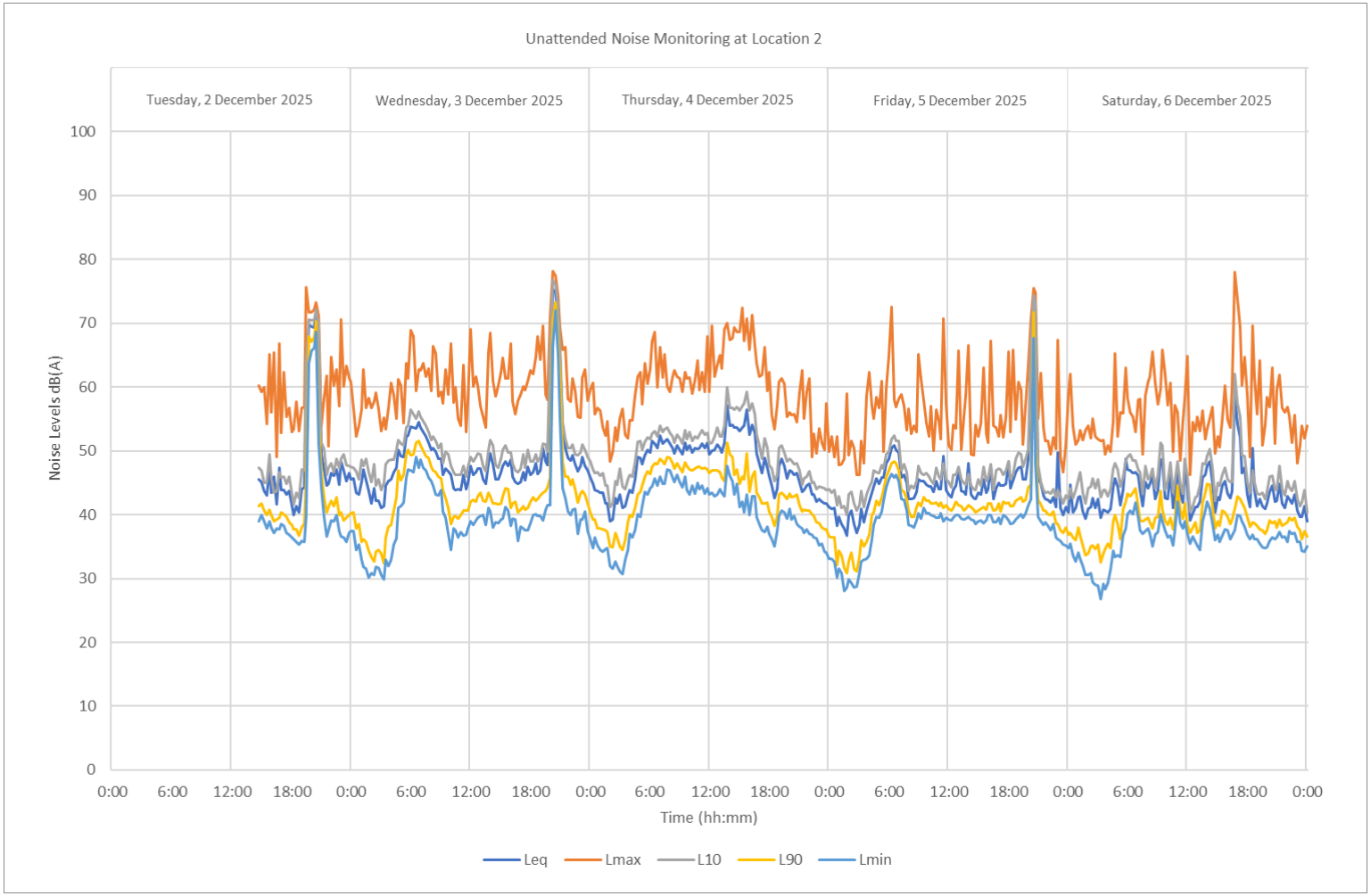
It is recommended that a further assessment is undertaken once the equipment selections and design are finalised.

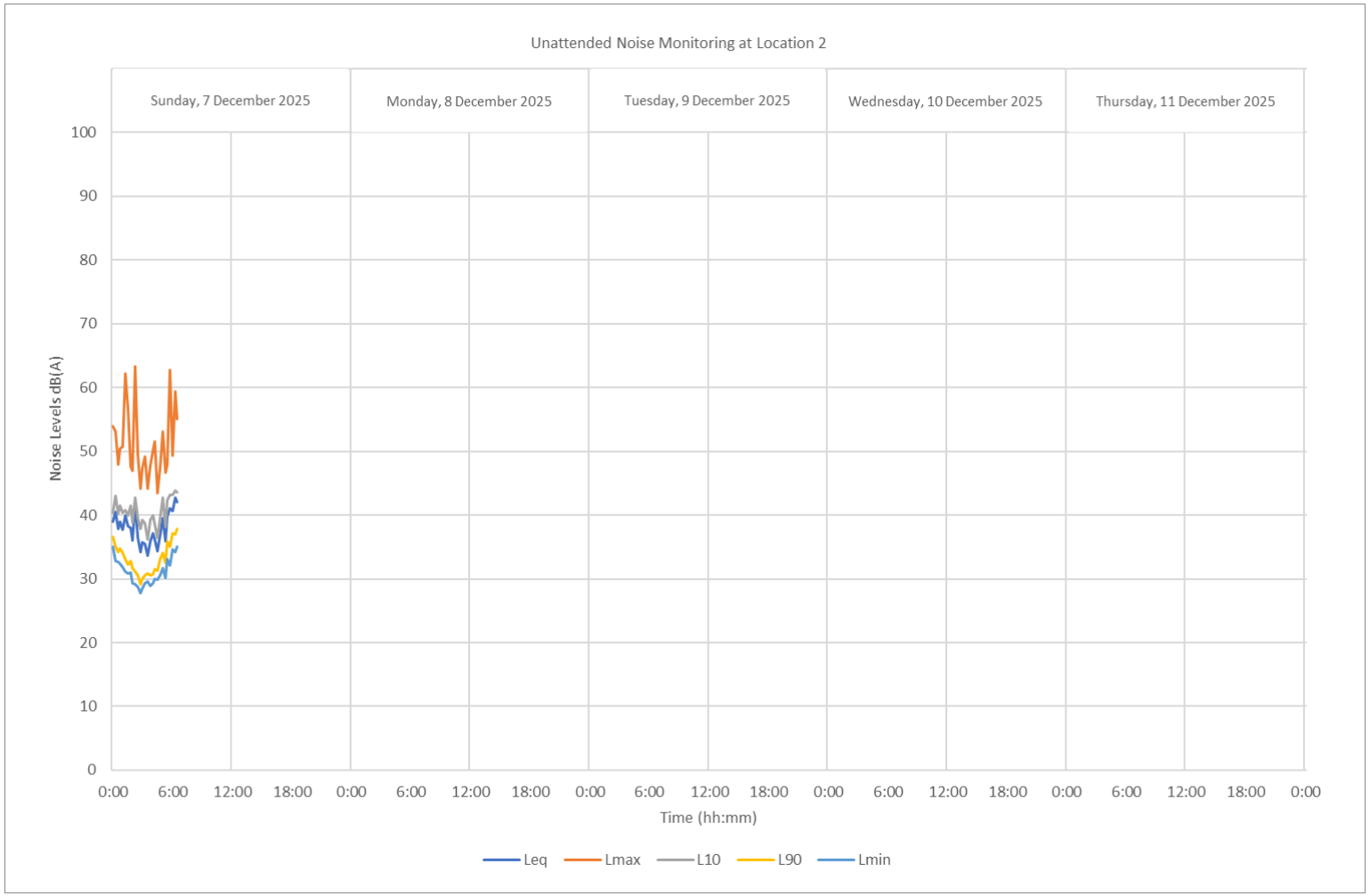
JORDAN GROWCOTT
WATSON MOSS GROWCOTT
ACOUSTICS PTY LTD

Appendix 1 – Unattended Noise Monitoring Data




Unattended Noise Monitoring at Location 1
Sunday, 7 December 2025
Monday, 8 December 2025
Tuesday, 9 December 2025
Wednesday, 10 December 2025
Thursday, 11 December 2025
Noise Levels dB(A)
100
90
80
70
60
50
40
30
20
10
0
0:00
6:00
12:00
18:00
Time (hh:mm)
Leq
Lmax
L10
L90
Lmin


Unattended Noise Monitoring at Location 2
Tuesday, 2 December 2025
Wednesday, 3 December 2025
Thursday, 4 December 2025
Friday, 5 December 2025
Saturday, 6 December 2025
Noise Levels dB(A)
100
90
80
70
60
50
40
30
20
10
0
0:00
6:00
12:00
18:00
Time (hh:mm)
Leq
Lmax
L10
L90
Lmin


Unattended Noise Monitoring at Location 2
Sunday, 7 December 2025
Monday, 8 December 2025
Tuesday, 9 December 2025
Wednesday, 10 December 2025
Thursday, 11 December 2025
Noise Levels dB(A)
100
90
80
70
60
50
40
30
20
10
0
0:00
6:00
12:00
18:00
Time (hh:mm)
Leq
Lmax
L10
L90
Lmin

Appendix 2 – Project Drawings