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## **ADVERTISED PLAN**

# **Fulham Solar Farm**

Cnr McLarens Rd and Hopkins Rd, Fulham

**Acoustic Report – Environmental Noise Emission Assessment**

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Project	Fulham Solar Farm - Cnr McLarens Rd and Hopkins Rd, Fulham
Project No.	13091
Document Reference	13091-1jg
Document Status	Revision 1
Date	Monday, July 29, 2024
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## 1. Introduction

The proposal includes the operation of a solar farm at the land located on the corner of McLarens Road and Hopkins Road, Fulham, Victoria.

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 recognition of the above, Planning Permit PA2101365 which has been issued for the project includes Condition 18 and Condition 19 requiring assessment of potential noise emissions from the site. Each condition is included below.

18. *The use of the land must at all times comply with EPA Publication 1826.4: Noise limit and assessment protocol for the control of noise from commercial, industrial and trade premises and entertainment venues (EPA Publication 1826.4).*
19. *Prior to the endorsement of development plans in accordance with condition 1 of this permit, an updated Predictive Noise Assessment must be provided to the Minister for Planning and Wellington Shire Council and must:*
  - a. *Model the final design layout and all electrical components of the facility and assess this against EPA Publication 1826.4.*
  - b. *Demonstrate the proposal will comply with EPA Publication 1826.4 at all times without relying on limiting the operating capacity of any part of the facility.*

*All measures relied on to achieve compliance with EPA Publication 1826.4 must be shown on the development plans under condition 1 and implemented to the satisfaction of the responsible authority.*

*The Predictive Noise Assessment must be made available to the public.*

In consideration of the above, Watson Moss Growcott Acoustics (WMG) has been engaged to undertake an assessment of potential noise emissions from the site and consider the outcomes relative to Victorian legislative requirements including EPA Publication 1826.4.

This report presents the findings of the assessment and includes 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.
- Wellington Shire 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 <sub>w</sub> )	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 <sup>2</sup> ), and is relative to a reference sound power of 1pW, (10 <sup>-12</sup> Watts).
Sound Pressure Level (L <sub>p</sub> )	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 subject site occupies farm zone (FZ) land and abuts Hopkins Road to the east, McLarens Road to the south, vacant FZ land to the west, and Special Use Zone (SUZ) land associated with the Fulham Correctional Centre to the north.

The land within immediate proximity of the proposed use is generally vacant farmland which would not be considered noise sensitive in accordance with legislative or guideline criteria. However, there are several residential properties, as well as the Correctional Centre, where potential noise impacts will require consideration.

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

- **R01** – 379 McLarens Rd.
- **R02** – 344 McLarens Rd.
- **R03** – 380 McLarens Rd.
- **R04** – 378 McLarens Rd.
- **R05** – 430 McLarens Rd.
- **R06** – 995 Settlement Rd.
- **R07** – 177 Hopkins Rd.
- **R08** – 139 Hopkins Rd.
- **R09** – Fulham Correctional Centre.

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

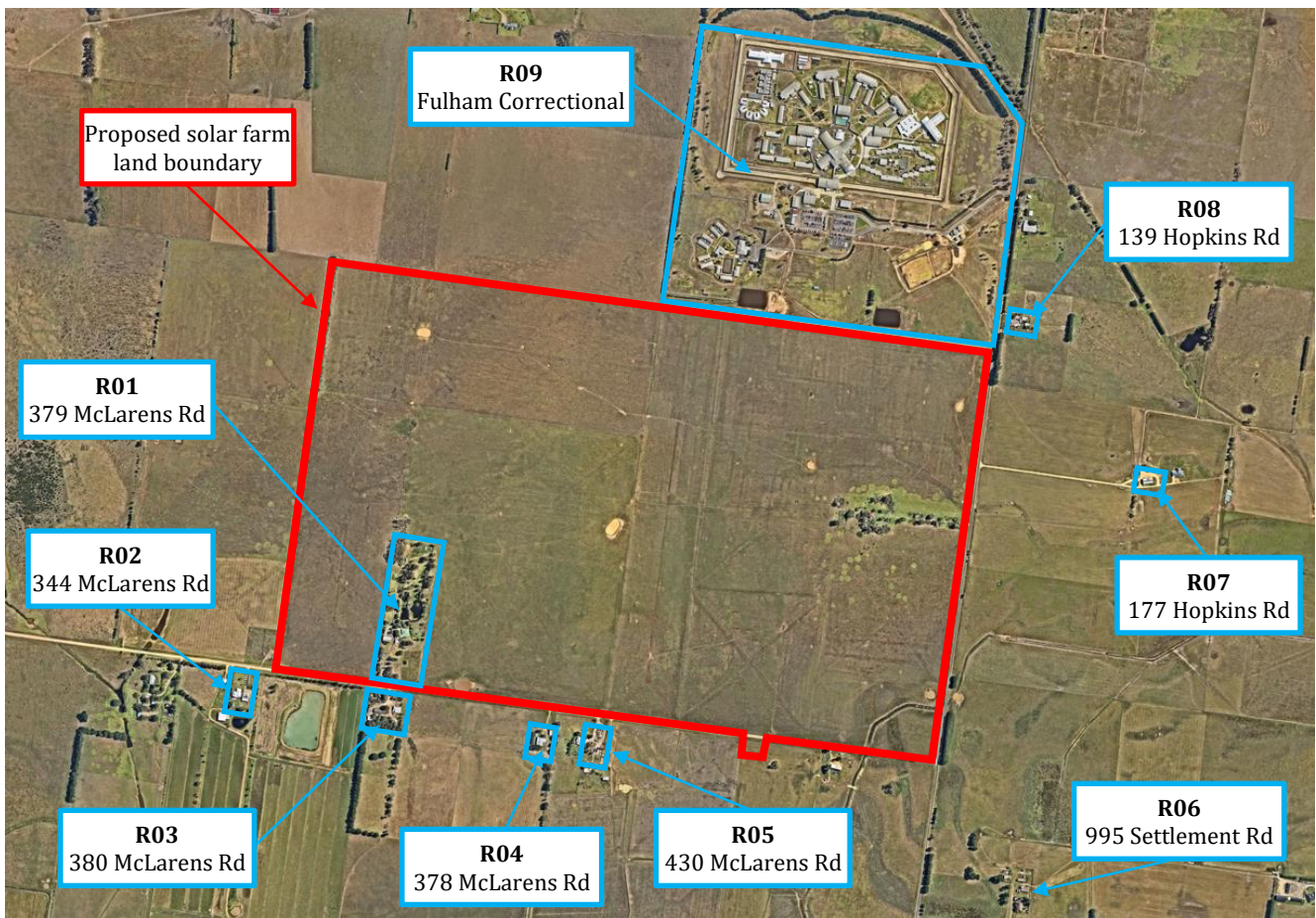


Figure 1: Aerial photo of subject site and surrounding environment



## 6. Proposed Site Layout

Based on the site layout provided, the project will include clusters of electrical infrastructure arranged in three rows across the subject site. Each cluster will incorporate generally incorporate the following:

- 1no. battery energy storage system comprising four Wartsila Quantum units.
- Collection of six SMA DPS-500 DC/DC converters.
- 1no. SMA MVPS including a 4200-UP Inverter and 4400 kVA transformer.

The clusters will then be surrounded by approximately 200,000 solar panels arranged in rows which are understood to not emit noise of potential significance. In addition to the above, the site will include a main transformer along the southern boundary of the site adjacent to McLarens Road, and approximately 400m setback from Hopkins Road.

The site has been configured to maximise distance separation between the noise sources of relevance and the relevant nearby sensitive receptors. Where minimum distance separations have not been achievable, acoustic barriers have been proposed to reduce potential noise impacts at sensitive receptors.

Figure 2 below provides the site plan for the proposal.

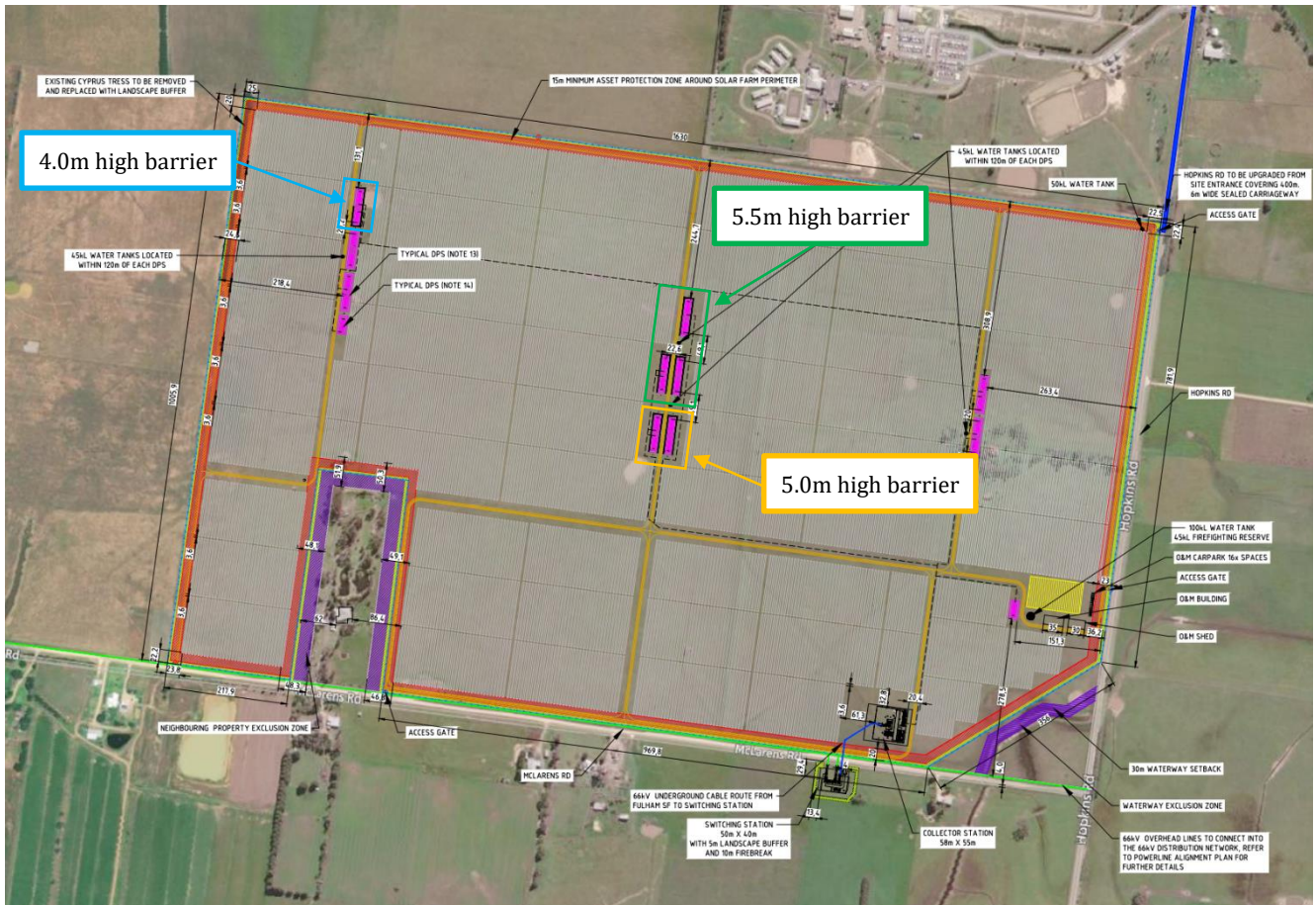


Figure 2: Site plan including electrical infrastructure and solar panel layout

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## 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 approach within The Act focuses on prevention of pollution impacts rather than managing the impacts after they have occurred and is based on a person or entities General Environmental Duty (GED) for the protection of human health and the environment from pollution and waste.

The GED is explained within Part 3.2 of The Act and stipulates that ‘a person who is engaging in an activity that may give rise to risks of harm to human health or the environment from pollution or waste must minimise those risks, so far as reasonably practicable’.

Determining what is deemed ‘reasonably practicable’ is explained within Environment Protection Authority (EPA) Publication 1856 and relates to the implementation of controls that are proportionate to the potential risk.

It relates to 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.

It is deemed the responsibility of the operator to understand and assess the risks which their operations may pose on human health or the environment, and once understood, implement proportionate controls to mitigate or minimise the risk of harm.

The definition of harm within The Act introduces the concept of what is deemed ‘unreasonable’ generally, and in particular ‘unreasonable noise’. The Environment Protection Regulations 2021 (The Regulations) under the Act essentially define unreasonable noise as noise that exceeds the noise limit that applies under the Noise Protocol (EPA Publication 1826.4) at the time the noise is emitted.

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.

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

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## 7.1. EPA Publication 1826.4 – Noise Protocol

### 7.1.1. General Methodologies

The subject site land and the sensitive receptors located within proximity of the subject site are **not** located within a 'major urban area' and will therefore be defined as a 'rural area' in accordance with the Noise Protocol.

In consideration of the above, relevant noise limits for addressing noise emissions from the site will be determined in accordance with Part I, A2 of the Noise Protocol referenced as the 'rural area method'.

It is understood that due to the nature of the proposal which includes power generation, the proposed use will not be defined as a 'utility installation' in accordance with Clause 73.03 of the Victorian Planning Provisions.

In consideration of the above, the relevant 'zone levels' for the proposed operations will be determined using Clause 16-28 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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## 7.1.2. Determination of Noise Protocol Noise Limits

As is shown below, the subject site and the majority of the surrounding receptors occupy FZ land, whilst the Fulham Correctional Centre occupies SUZ2 zone land.

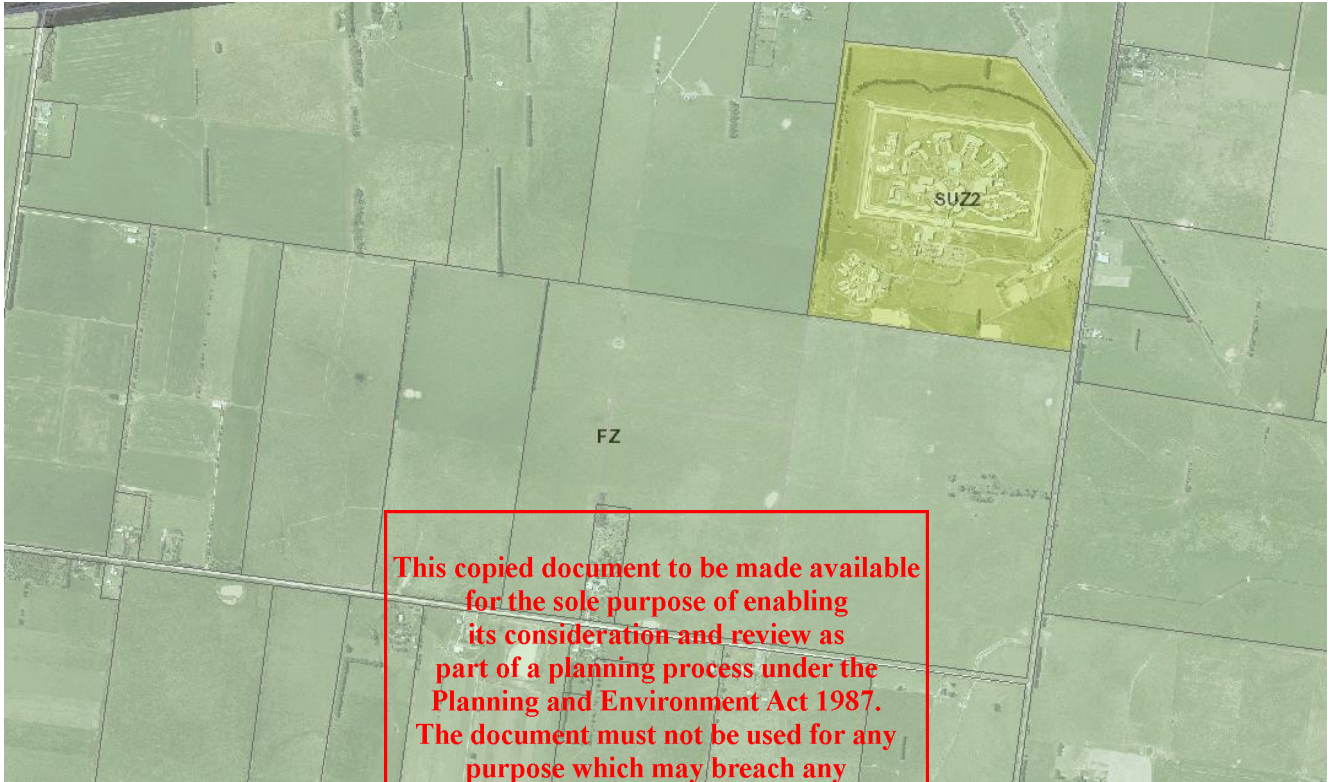


Figure 3: Land zoning of site and surrounding environment

In accordance with the methodologies nominated within the Noise Protocol, which includes consideration of the land zoning of the noise 'generating' zone and 'receiving' zone, the 'zone levels' for the nearest relevant receptors will be as summarised below in Table 4.

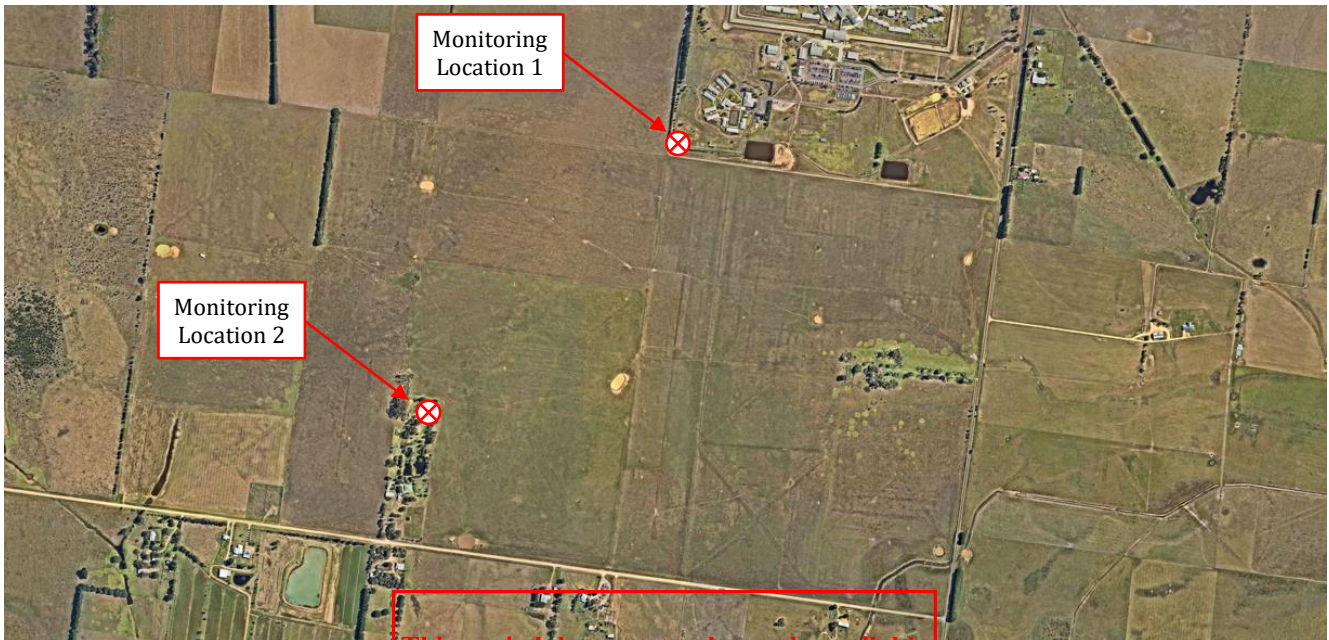
Table 4: Noise Protocol Zone Levels

EPA Assessment Period	Relevant Days	Time Periods	Noise Protocol Zone Levels
Day	Monday to Saturday	7:00am to 6:00pm	46 dB(A) $L_{eq}$
Evening	All Days	6:00pm to 10:00pm	41 dB(A) $L_{eq}$
	Sunday, Public Holidays	7:00am to 6:00pm	
Night	All Days	10:00pm to 7:00am	36 dB(A) $L_{eq}$

Due to the contiguous land zoning between the subject site and the surrounding receptors, a distance adjustment will not be applicable for the critical receptor locations, and hence the values can only be adjusted based on the presence of elevated ambient background noise levels in the surrounding environment.

In consideration of the above, WMG has undertaken unattended monitoring at the subject site to determine whether the sensitive receptors considered critical for the assessment are located in a 'background relevant area'.

The monitoring was undertaken between 13<sup>th</sup> December to Tuesday 19<sup>th</sup> December 2023 and included deployment of two unattended monitoring devices at locations representative of the critical receptors as shown below.



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The results of the unattended noise monitoring during the proposed operating hours are summarised below.

Table 3: Summary of Unattended Noise Monitoring Results

Day / Date	Measurement Period	Measured Noise Levels (L <sub>90</sub> )	
		Location 1	Location 2
Wednesday 13 <sup>th</sup> December 2023	Day Period – 7:00am to 6:00pm	N/A	N/A
	Evening Period – 6:00pm to 10:00pm	40 dB(A)	42 dB(A)
	Night Period – 10:00pm to 7:00am	45 dB(A)	42 dB(A)
Thursday 14 <sup>th</sup> December 2023	Day Period – 7:00am to 6:00pm	50 dB(A)	47 dB(A)
	Evening Period – 6:00pm to 10:00pm	43 dB(A)	43 dB(A)
	Night Period – 10:00pm to 7:00am	42 dB(A)	40 dB(A)
Friday 15 <sup>th</sup> December 2023	Day Period – 7:00am to 6:00pm	35 dB(A)	36 dB(A)
	Evening Period – 6:00pm to 10:00pm	36 dB(A)	37 dB(A)
	Night Period – 10:00pm to 7:00am	36 dB(A)	35 dB(A)
Saturday 16 <sup>th</sup> December 2023	Day Period – 7:00am to 6:00pm	45 dB(A)	43 dB(A)
	Evening Period – 6:00pm to 10:00pm	40 dB(A)	41 dB(A)
	Night Period – 10:00pm to 7:00am	31 dB(A)	34 dB(A)
Sunday 17 <sup>th</sup> December 2023	Day Period – 7:00am to 6:00pm	32 dB(A)	32 dB(A)
	Evening Period – 6:00pm to 10:00pm	35 dB(A)	36 dB(A)
	Night Period – 10:00pm to 7:00am	34 dB(A)	33 dB(A)
Monday 18 <sup>th</sup> December 2023	Day Period – 7:00am to 6:00pm	35 dB(A)	34 dB(A)
	Evening Period – 6:00pm to 10:00pm	37 dB(A)	37 dB(A)
	Night Period – 10:00pm to 7:00am	34 dB(A)	35 dB(A)

Based on the results of the site monitoring, the measured ambient background noise levels were generally low enough that they will not influence the Noise Protocol zone levels for the subject site. The measured results also often included extraneous noise (ie insects and birds) which once removed from the measurement data would be expected to result in even lower values than those presented above.

In consideration of the above, the zone levels described in Table 4 will apply as noise limits at each of the receptors.

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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### 7.1.3. 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 6.

*Table 6: Noise Protocol Assessment Adjustments*

Relevant Adjustment	Description
Tonal Adjustment	<p>When the noise is tonal in character then an adjustment shall be made as follows:</p> <ul style="list-style-type: none"> <li>▪ When the tonal character of the noise is just detectable then + 2 dB(A).</li> <li>▪ When the tonal character of the noise is prominent then + 5 dB(A).</li> </ul>
Impulsive Adjustment	<p>When the noise is impulsive in character then an adjustment shall be made as follows:</p> <ul style="list-style-type: none"> <li>▪ When the impulsive character of the noise is just detectable then + 2 dB(A).</li> <li>▪ When the impulsive character of the noise is prominent then + 5 dB(A).</li> </ul>
Intermittency Adjustment	<p>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:</p> <ul style="list-style-type: none"> <li>▪ When the level increase is &gt;10 dB during the day period, then apply an adjustment of +3 dB(A).</li> <li>▪ When the level increase is 5-10 dB during the night period, then apply an adjustment of +3 dB(A).</li> <li>▪ When the level increase is &gt;10 dB during the night period, then apply an adjustment of +5 dB(A).</li> </ul>
Reflection Adjustment	<p>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.</p>
Duration Adjustment	<p>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.</p>

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 being 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 within areas not already captured within the Regulations and Noise Protocol.

Given the proximity of the residential receptors to the subject site, noise emissions due to the site will be governed by the requirements of the Noise Protocol. The ERS has therefore not been considered further.

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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.

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 within Table 7 below.

*Table 7: 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.

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

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#### 7.4. Wellington Shire Planning Scheme

Clause 13.05-1S of the Wellington Shire Planning Scheme includes requirements relating 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 7.1-7.3 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 from online databases including Nearmaps, VicMaps and topography 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: 1996 Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation (ISO 9613).

The described 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.

The critical receptors located in proximity of the subject site are understood to be single level dwellings, therefore an assessment height of 1.5m has been adopted as the basis for the noise model.

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. General Environmental Duty – Evaluation and Implementation

As part of the design process, the following measures have been evaluated and will be implemented where reasonably practicable to minimise risk to human health and the environment in relation to noise:

- The client has evaluated the technology which is available in the marketplace, and has made equipment selections with consideration to source noise levels.
- In response to discussions between WMG and the client, the design has been amended to maximise the distance separation between the main noise sources at the subject site and the sensitive receptors in proximity to the site.
- Where minimum distance separations have not been able to be achieved, acoustic barriers have been provided which will reduce residual noise impacts at the relevant receptors.
- The client has evaluated the solar panel operations and concluded that they can implement operational processes which angle the solar panels during the critical night period. The angled position will provide noise shielding in the direction of several sensitive receptors hence reducing potential noise impacts.
- The DC DC converters have been arranged in a manner whereby their dominant source of noise emission is angled inward and not in the direction of sensitive receptors surrounding the subject site. The client also requested that the DC DC converter supplier investigate the possibility of noise control kits for their units however, this was not able to be provided for this project.

Further to the above, the client investigated the possibility of introducing noise control kits to the inverter units which form part of the subject site operations. After several meetings with the unit supplier, it was determined that the noise control kits would not be reasonably practicable for the project, as they would significantly reduce the capacity of the units and would jeopardise the commercial viability of the project.

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### 8.3. Site Configuration and Relevant Noise Sources

When considering noise emissions associated with the proposal, the client has advised that the relevant noise sources will form part of clusters of electrical infrastructure scattered across the subject site. Each cluster will include:

- 1no. battery energy storage system comprising four Wartsila Quantum units.
- Collection of six SMA DPS-500 DC/DC converters.
- 1no. SMA MVPS including a 4200-UP Inverter and 4400 kVA transformer.

The proposed cluster configuration is included below.

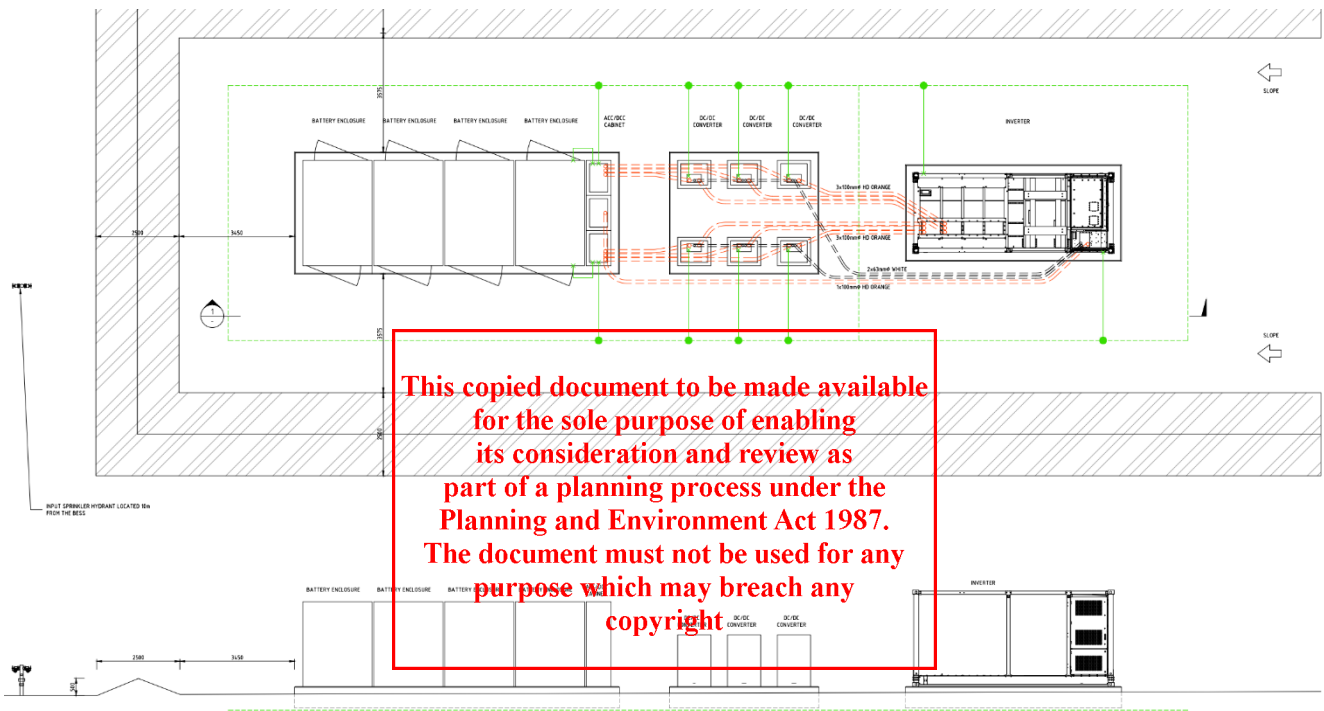


Figure 5: Cluster configuration inc. battery container, DC/DC converters and MVPS

For the purposes of this assessment, WMG has considered source noise data provided by the inverter and battery unit manufacturers in combination with input from the client. A summary of the sound power/pressure levels adopted for each item of equipment is included within Table 6.

Table 8: Adopted source sound power levels

Noise Source	Adopted Noise Level
MVPS inverter – per unit (SMA)	93 dB(A) – sound power
MVPS transformer – 4400 kVA – per unit	68 dB(A) – sound power
Battery cabinet liquid cooling – per container (Wartsila Quantum)	74 dB(A) – sound power
SMA DPS-500 DC/DC converter – per unit	86 dB(A) – sound power
Grid transformer – 100MVA – per unit	86 dB(A) – sound power

When modelling noise emissions from the noise sources at the subject site, WMG has configured the model as follows:

- The MVPS inverter and transformer as a point source elevated above the ground by 2.5m. As a point source, the model will not include consideration of directivity from the source, and hence noise will be emitted equally in all directions toward the sensitive receptors. In practice, the SMA units may be directional, hence reducing potential noise emissions in some directions.
- The battery container has been built as a structure with a point source at one end of the container. The container height has been nominated 3.0m, and hence will provide noise shielding as well as noise reflections in the model.
- Based on the information available regarding the SMA DPS-500 unit, it is understood that the unit is effectively a container with a grille on the front which is expected to emit all noise from the unit. Each cluster nominates that the DC/DC converter grilles will effectively face each other, and hence their noise emission will be angled toward each other rather than in the direction of the sensitive receptors. The adopted source height for the unit is 1.7m.

In addition to the above, the client has advised that during the night period, the solar panels will be angled to the east with a 60deg pitch to be ready for the early morning sun. In most instances, the pitch of the solar panel is expected to block line of sight between the noise source and the sensitive receptors, and hence will shield noise emissions.

For the purposes of the noise model, WMG has omitted the solar panels from the day and evening assessment where the panels may be flat and provide little to no noise shielding. During the night period assessment, WMG has modelled the panel at a 60deg angle facing east.

The image below illustrates how the cluster has been modelled and includes some of the angled solar panels which have been included in the night period model.

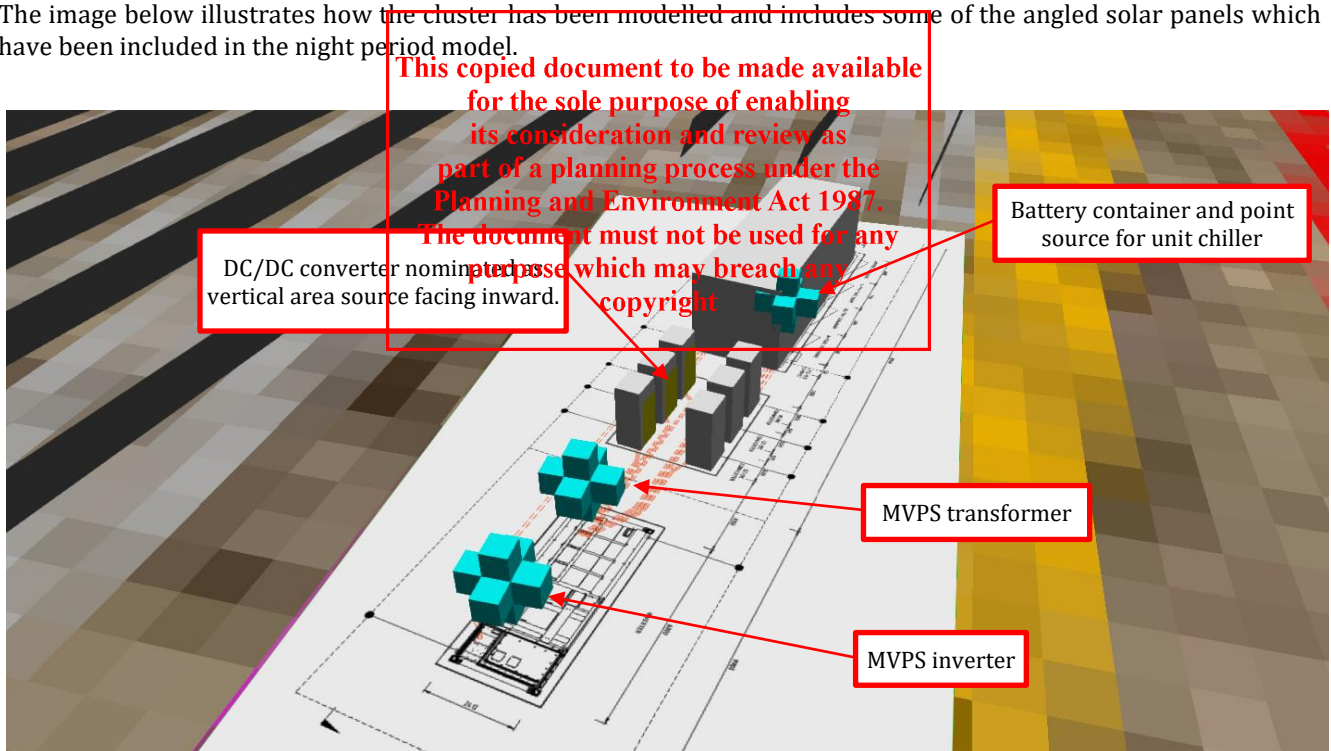


Figure 6: Image of how noise sources have been modelled for the assessment

Once commissioned, the electrical equipment at the site may operate continuously 24 hours per day, 7 days per week.

The assessment therefore considers emissions during the day, evening, and night periods.

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## 8.4. Predicted Noise Levels

### 8.4.1. Noise Protocol Assessment at Residential Receptors

The results of the noise model are presented below in Table 9.

*Table 9: Noise Protocol Assessment - no noise mitigation or tonal adjustment*

Assessment Location	Predicted Noise Level - $L_{Aeq}$			Noise Protocol Noise Limits - $L_{Aeq}$		
	Day	Evening	Night	Day	Evening	Night
R01 - 379 McLarens Rd	36	36	32	46	41	36
R02 - 344 McLarens Rd	32	32	28	46	41	36
R03 - 380 McLarens Rd	33	33	30	46	41	36
R04 - 378 McLarens Rd	36	36	31	46	41	36
R05 - 430 McLarens Rd	37	37	34	46	41	36
R06 - 995 Settlement Rd	30	30	28	46	41	36
R07 - 177 Hopkins Rd	32	32	27	46	41	36
R08 - 139 Hopkins Rd	36	36	31	46	41	36
R09 - Fulham Correctional Centre	37	37	34	46	41	36

The predicted outcomes indicate that the raw noise levels will comply with the Noise Protocol noise limits during the day, evening, and night periods.

As part of previous assessments, WMG has identified that electrical infrastructure has the potential to include a tonal character which may be audible at nearby receptors and warrant an adjustment in accordance with the NPFI.

Due to the distance separation between the electrical infrastructure and nearby sensitive receptors however, there is potential that residual tonal noise may not be present and therefore not require an adjustment for this project.

When determining whether a noise impact includes a tonal character, the Noise Protocol nominates that the assessor undertake a 'subjective' assessment within the noise sensitive area and apply a +2dB adjustment when the tonal noise is 'just detectable', or a +5dB adjustment when the tonal noise is prominent.

Given that this is a desktop study for a proposed use, such an assessment will not be possible, and hence an objective methodology will be required.

The noise modelling software utilised as part of the assessment includes the capability to predict the one-third octave band noise levels at the sensitive receptors.

To provide a basis for understanding the potential for a tonal character adjustment to be necessary for the assessment, WMG has considered the predicted one-third octave band values at each receptor using the 'objective tonal method' nominated within Annex C of the Noise Protocol.

Using the objective tonal method, WMG has determined that the predicted levels at each receptor will warrant a +2dB tonal character adjustment.

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In consideration of the above, the effective noise levels (inc. the +2dB adjustment) have been compared with the Noise Protocol noise limits below.

*Table 10: Noise Protocol Assessment – inc. 2dB tonal adjustment*

Assessment Location	Predicted Noise Level – LAeq			Noise Protocol Noise Limits – LAeq		
	Day	Evening	Night	Day	Evening	Night
R01 – 379 McLarens Rd	38	38	34	46	41	36
R02 – 344 McLarens Rd	34	34	30	46	41	36
R03 – 380 McLarens Rd	35	35	32	46	41	36
R04 – 378 McLarens Rd	38	38	33	46	41	36
R05 – 430 McLarens Rd	39	39	36	46	41	36
R06 – 995 Settlement Rd	32	32	30	46	41	36
R07 – 177 Hopkins Rd	34	34	29	46	41	36
R08 – 139 Hopkins Rd	38	38	33	46	41	36
R09 – Fulham Correctional Centre	39	39	36	46	41	36

The findings of the above assessment indicate that with the implementation of the reasonably practicable measures at the subject site, the predicted noise levels comply with Noise Protocol noise limits at each of the sensitive receptors surrounding the subject site.

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#### 8.4.2. Consideration of Low Frequency Noise

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 model 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.

Despite the above, and with the margins for compliance below the low frequency guideline outdoor values, it would be expected that the implementation of the reasonably practicable measures adopted within the assessment will sufficiently address low frequency noise.

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

*Table 11: Predicted low frequency noise levels at sensitive receptors*

Measurement Location	One-third octave band noise levels Hz												
	10	12.5	16	20	25	31.5	40	50	63	80	100	125	160
Outdoor noise dB $L_{eq}$	92	89	86	77	69	61	54	50	50	48	48	46	44
R01 – 379 McLarens Rd	-	-	-	-	32	33	31	32	33	32	28	32	26
R02 – 344 McLarens Rd	-	-	-	-	29	31	28	29	30	29	25	29	23
R03 – 380 McLarens Rd	-	-	-	-	31	32	30	31	32	31	27	30	25
R04 – 378 McLarens Rd	-	-	-	-	31	33	30	32	33	32	29	32	27
R05 – 430 McLarens Rd	-	-	-	-	32	34	31	32	33	33	30	33	28
R06 – 995 Settlement Rd	-	-	-	-	28	30	27	29	30	29	26	29	24
R07 – 177 Hopkins Rd	-	-	-	-	29	30	28	29	30	29	25	29	23
R08 – 139 Hopkins Rd	-	-	-	-	31	33	30	31	32	31	28	31	26
R09 – Fulham Correctional	-	-	-	-	34	36	33	34	35	34	32	35	29

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## 9. Acoustic Barrier Construction

In order to provide the required noise reducing properties, the barriers proposed for construction at the subject site must be constructed as follows:

- Manufactured from materials weighing at least 15 kg/m<sup>2</sup>.
- If constructed from timber/plywood, be stable so that the materials do not crack or warp (thus potentially creating gaps between panels) during the life of the fence.
- Installed in a manner that does not allow gaps between panels, and ideally between the barrier and ground below.
- If access doors are to form part of acoustic barrier fences, then the doors must be constructed as per the fence and include an overlapping section to minimise the gaps around the perimeter of the openable section. Rubber seals must also be included to eliminate gaps between the openable section and the adjoining panels/ground.

In addition to the above, the acoustic barriers constructed at the subject site must be lined on the eastern face (facing the site equipment) using 100mm thick sound absorbing materials which achieve a Noise Reduction Coefficient (NRC) not less than 0.9.

Suitability of the materials for external applications, and for installation within proximity of the proposed equipment must be considered and approved by others. Suitable material suppliers may include Megasorber or an equivalent.

Fibrous insulation faced with perforated metal may also be a suitable alternative, however, would require a specific detail to ensure it was suitable for outdoor applications and could prevent rain ingress.

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## 10. Consideration of Building Air Conditioning Systems

The client has advised that the project will also include air conditioning systems which will service the Operation and Maintenance building and the switch room building.

The location of the equipment will generally be in the order of 500m setback from sensitive residential receptors.

It is understood that the air conditioning equipment selections have not been made at this stage, however with setback distances of 500m it would be anticipated that the selection of equipment with sound power levels toward the lower end of what is available in the market will adequately address potential noise impacts.

WMG would recommend that the air conditioning units are selected with their sound power level as a consideration and that only units with a sound power level less than 75 dB(A) be considered for the project.

Where practical, WMG would also recommend that the air conditioning equipment is located so that it receives noise shielding in the direction of the critical sensitive residential receptors.

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## 11. General Environmental Duty – General Requirements

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.

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## 12. Conclusion

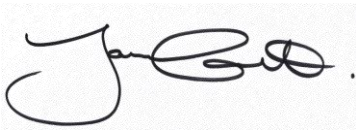
WMG has carried out an acoustic assessment to address potential noise emissions from the operation of a solar farm at the land located on the corner of McLarens Road and Hopkins Road, Fulham, Victoria.

The assessment has included attendance at the subject site to consider the existing acoustic environment as well as 3D modelling to predict noise emissions associated with the proposed operations at sensitive receptors.

Based on the results of the assessment, WMG has concluded that with implementation of the reasonably practicable measures developed as part of the project design process, predicted noise levels are below Noise Protocol noise limits, as well as low frequency guideline values at nearby sensitive receptors.

The outcomes of the assessment will rely on the following:

- Ensure that low noise equipment is selected and installed as part of the proposal.
- Construct acoustic barriers around identified electrical infrastructure clusters to provide noise shielding to the critical receptors in closest proximity to the equipment.
- Ensure that during the night period (10:00pm to 7:00am), the solar panels are set to maximum tilt (60deg) and a height of 2.76m to provide additional noise shielding in the direction of sensitive receptors.



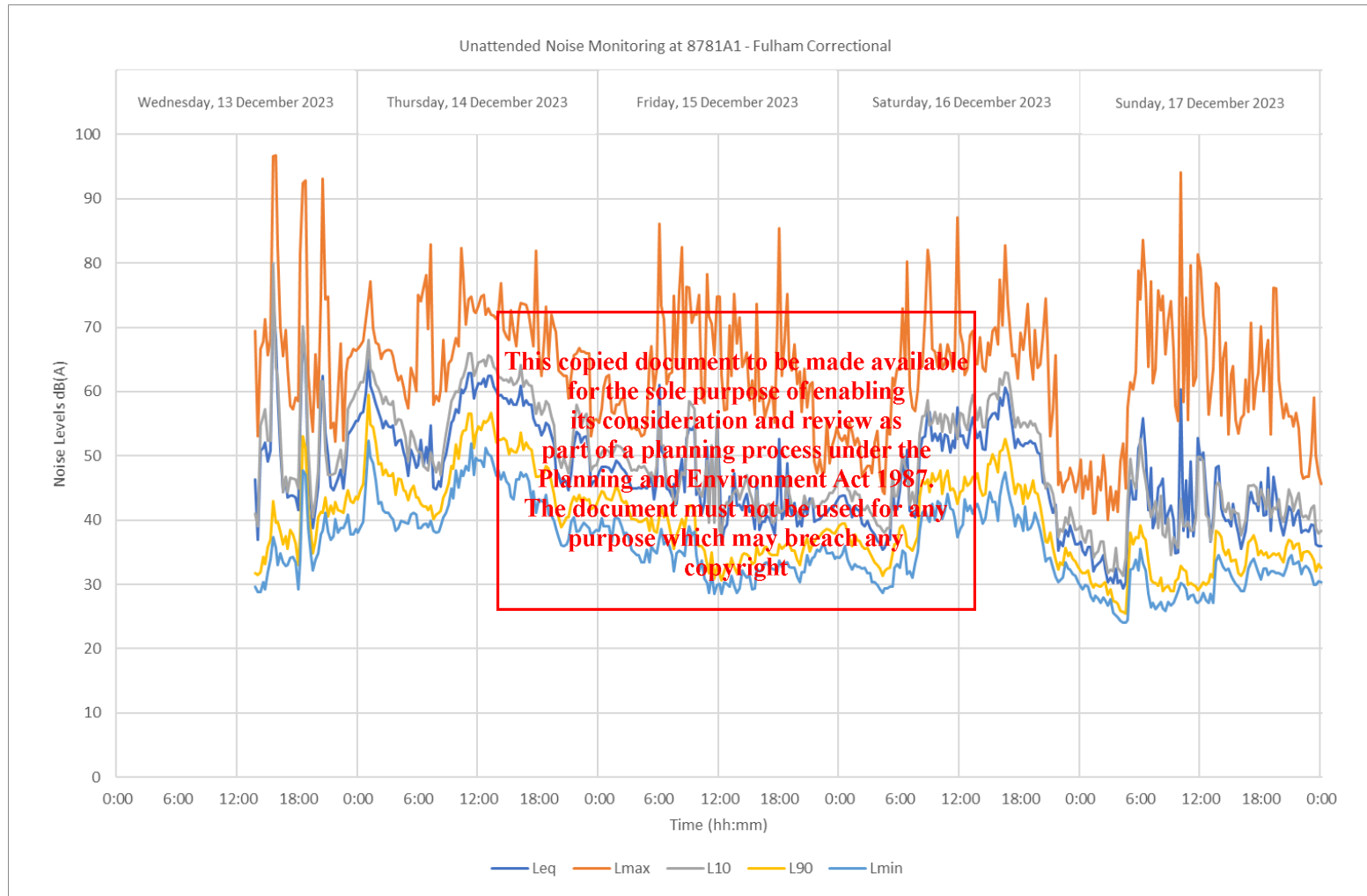
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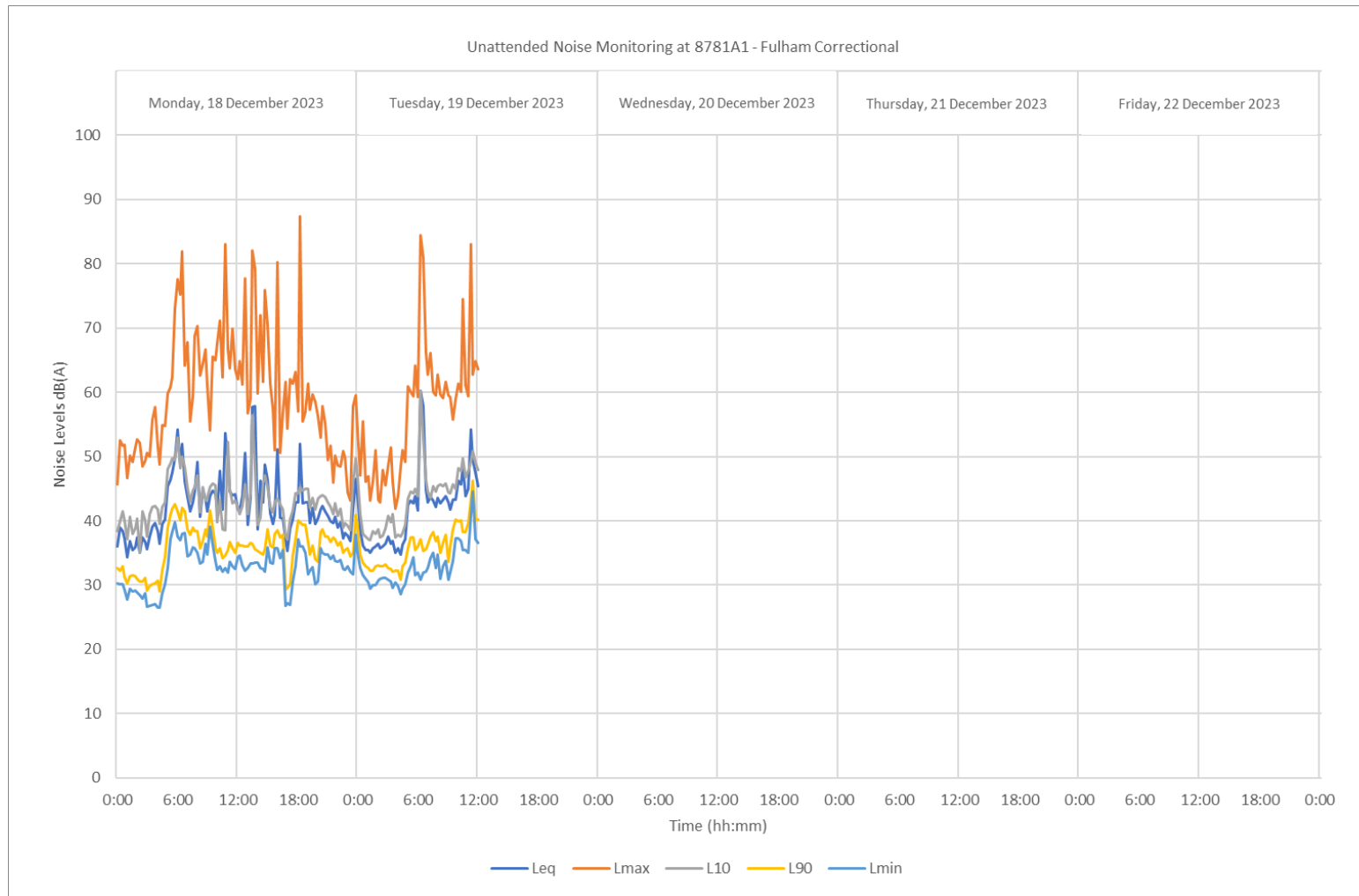
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## Appendix 2 – Unattended Noise Monitoring Results



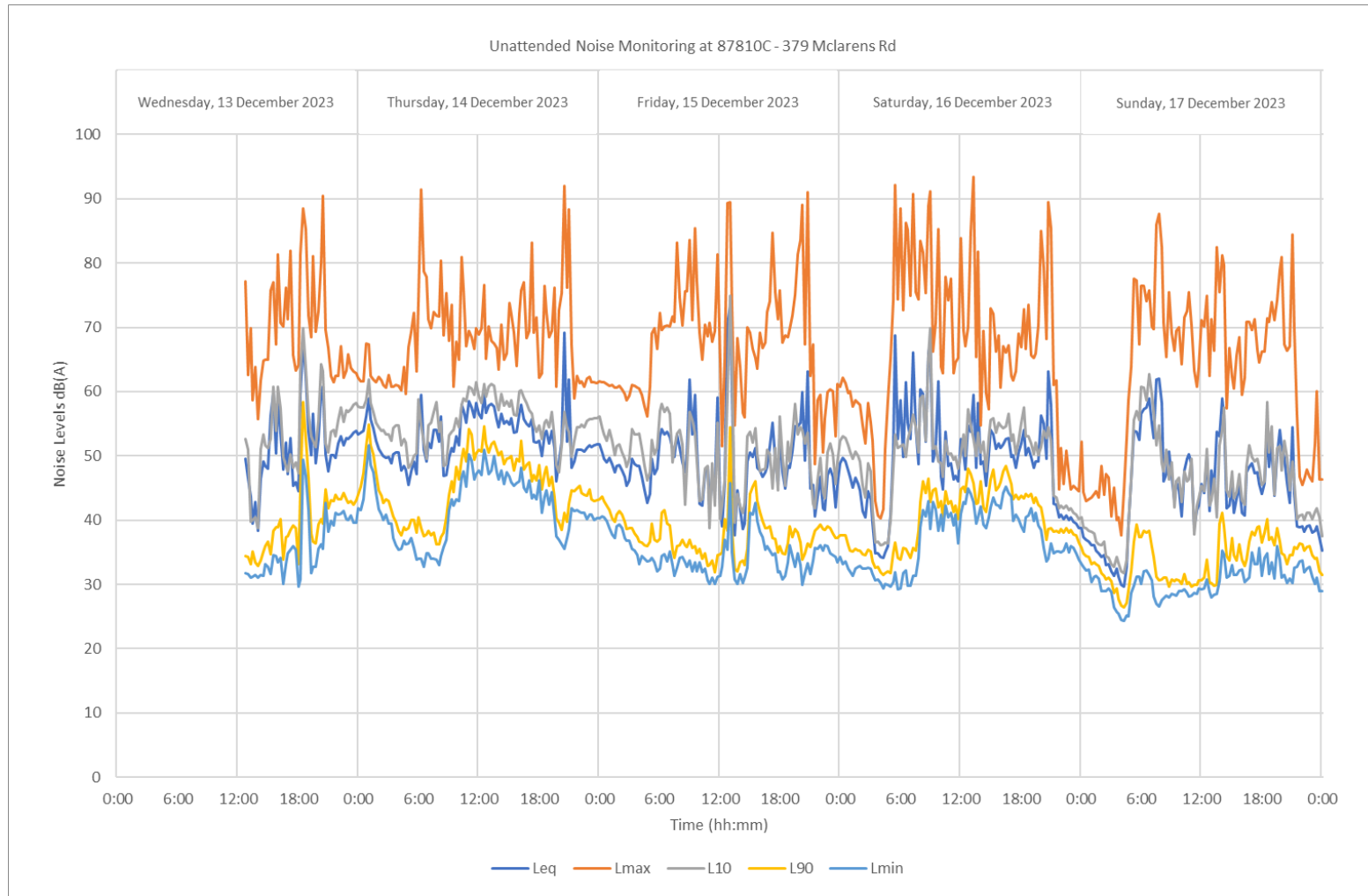
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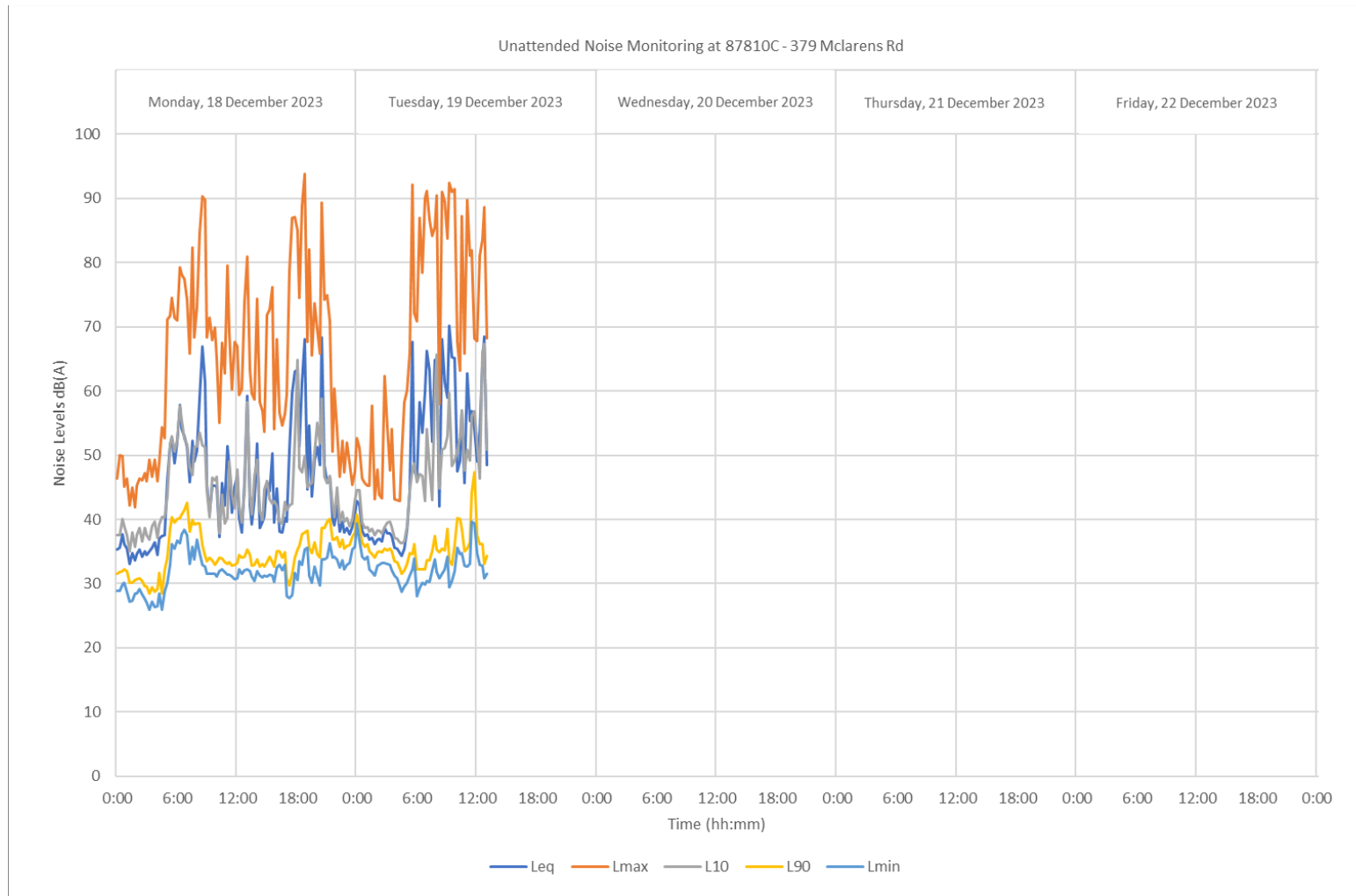




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