URBIS

MAY 2024

CONFIDENTIAL

# MORTLAKE SOLAR FARM

## NOISE IMPACT ASSESSMENT



wsp

Question today
*Imagine tomorrow*
Create for the future

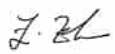
# Mortlake Solar Farm
# Noise Impact Assessment

URBIS

WSP
Level 15, 28 Freshwater Place
Southbank VIC 3006

Tel: +61 3 9861 1111
Fax: +61 3 9861 1144
wsp.com

| REV | DATE | DETAILS |
|---|---|---|
| 0 | 29/04/2024 | Draft for client review |
| 1 | 03/05/2024 | 2nd draft for client review |

| | NAME | DATE | SIGNATURE |
|---|---|---|---|
| Prepared by: | Fatematuz Zohora | 26/04/2024 |  |
| Reviewed by: | Ben Ison | 26/04/2024 |  |
| Approved by: | Ben Ison | 03/05/2024 |  |

# TABLE OF CONTENTS

# GLOSSARY

| | |
|---|---|
| A-weighting | The overall level of sound is usually expressed in terms of dBA, which is measured using a sound level meter with an 'A-weighting' filter that has a frequency response corresponding approximately to that of human hearing.<br>Peoples hearing is most sensitive to sounds at mid frequencies (500 Hz to 4 kHz), and less sensitive at lower and higher frequencies. Thus, the level of sound in dBA is a good measure of its loudness, with different sources having the same noise level in dBA generally sounding about equally loud. |
| dB | The human ear responds to changes in sound pressure over an extremely wide range, with the loudest (at the threshold of pain) ten million times greater than the softest (at the threshold of hearing). The decibel scale reduces this ratio to a more manageable size expressed as the logarithmic ratio of the sound pressure P, relative to the threshold of hearing $P_{Ref}$ = 20 µPa, i.e., dB = 20 Log ($P/P_{Ref}$) |
| dBA | A-weighted decibels. A single number descriptor of the overall sound pressure level. |
| Frequency Analysis | Frequency analysis is the process used to examine the frequency components which make up the overall noise or vibration signal.<br>The units of frequency are measured in cycles per second or Hertz (Hz). |
| $L_{eq,T}$ | The equivalent continuous noise level (basically the average noise level). It is defined as the steady sound level that contains the same amount of acoustic energy as the corresponding time-varying signal over the measurement period, T. |
| Sound, Noise | The terms "sound" and "noise" are often used interchangeably, however, in common usage "noise" is often used to refer to unwanted sound. |
| Sound Power Level | The sound power of a source is the rate at which it emits acoustic energy. As with Sound Pressure, Sound Power Levels are measured in decibel units (dB or dBA) commonly identified by the symbols SWL or $L_W$.<br>The reference sound power unit is 1 pW (or $10^{-12}$ W). |
| Sound Pressure Level | Sound consists of minute fluctuations in atmospheric pressure capable of evoking the sense of hearing. The symbols SPL, L or $L_P$ are commonly used to represent the Sound Pressure Level, measured in decibels, dB |
| 1/3 Octave Band | Provides more resolution across the frequency spectrum by dividing each octave band into three (i.e., 25 Hz, 31.5 Hz, 40 Hz, 50 Hz, 63 Hz, 80 Hz and so on). |

# EXECUTIVE SUMMARY

WSP Australia Pty Ltd (WSP) has been engaged by Urbis to undertake an operational noise assessment for the proposed Mortlake Renewable Energy Hub located on the Hamilton Highway and Connewarren Lane, near the town of Mortlake Victoria (the Project).

Operational noise criteria for the Project, in the form of statutory noise limits, have been determined in accordance with Part 2: *Noise limits – Rural area method* of EPA Publication 1826.4 *Noise limit and assessment protocol for the control of noise from commercial, industrial and trade premises and entertainment venues*, dated May 2021 (EPA 1826). EPA 1826 noise limits will form the primary assessment criteria to determine if the Project is likely to emit *unreasonable noise*, as defined in Section 166 of the Environment Protection Act 2017 (the Act).

To support the development of Project noise limit, background noise measurements were undertaken between 23 August and 5 September 2023 in accordance with EPA Publication 1997 *Technical guide: Measuring and analysing industry noise and music noise* (EPA 1997).

To assess operational noise from the facility, a predictive noise model was prepared based on supplied manufacturer data for all acoustically significant plant associated with the Project, which will include:

- Solar panels with approximately 8,455 x Solar panel tracking motors
- 44 x MV Power Stations each of which contains 2 x Solar Inverter and integrated MV Transformer
- Battery Energy Storage System (BESS):
  - Up to 950 x Battery units
  - 78 x MV Power Stations each of which contains 2 x Solar Inverter and integrated MV Transformer
- 3 x 350 MVA Substation transformer
- Circuit breaker switches

The modelling inputs and method are considered ‘worst case’, with moderate adverse meteorology and conservative assumptions applied under all modelling scenarios.

Results from predicted operational noise levels and assessment from the operational solar farm indicate that unmitigated project operations are likely to comply with relevant EPA 1826 noise limits for day, evening, and night periods at all noise sensitive areas (NSA).

Low frequency noise is not considered a potential issue at NSAs, however noise from the transformers is considered tonal and appropriate penalties have been applied.

Noise levels are predicted to be up to 33 dBA $L_{eq}$ at the worst impacted NSA 16 (593 Hamilton Highway) where the noise levels were dominated by solar inverter skids). The predicted noise level at the most impacted NSA is 1dB lower than the night-time noise limit and is more than 10 dB below daytime limits and likely to be inaudible over existing background noise during the day, particularly considering the influences of local traffic on the Hamilton Highway.

It is noted that solar tracking motors and inverters will typically only generate noise during daylight conditions, and as such are not included in the nighttime models. However, during the summer months, there is a potential one-hour window during which noise from the inverters should be assessed against the more onerous noise limit applicable during the night period (i.e. from 0600 hrs through 0700 hrs). As the noise output from the inverters also varies significantly with load it is envisaged that the predicted noise level during this time will likely be noticeably lower than predicted.

Noise levels as a result of the infrequent activation of the emergency circuit breaker switches were found to be unlikely to result in sleep disturbance impacts at any NSAs. It is understood that emergency circuit breaker switches may be activated at any time throughout the 24-hour period however will occur very infrequently (less than once per five years) for a period of less than one second and as such impacts are considered negligible.

Although not required to meet project criteria, a discussion of potential mitigation measures has been carried out in Section 5 to provided further understanding of mitigation options, if required.

It is recommended that once the project is operational, commissioning noise measurements are undertaken to validate the noise modelling assumptions and ensure compliance with EPA legislation. Where noise is found to exceed the operational noise limits from EPA 1826 (or an alternative assessment criterion such as EPA 1996), additional noise mitigation measures will need to be considered beyond those presented in this report.

# 1 INTRODUCTION

## 1.1 PROJECT DESCRIPTION

A new solar farm and Battery Energy Storage System (BESS) is being proposed at the Project site, located on the Hamilton Highway, located near the town Mortlake, Victoria. The solar farm is being developed by BrightNight Power.

The project will include a 360 MW solar energy facility and a utility installation (600 MW BESS facility), connecting via a proposed substation to the existing terminal station.

Figure 1.1 shows the Project site layout, identified Noise Sensitive Areas (NSAs) and noise monitoring locations.

## 1.2 PURPOSE OF THIS REPORT

The purpose of this report is to assess the potential noise impacts from operation of the Project. Specifically, this report has the following objectives:

- To assess the existing noise environment, including the undertaking of noise monitoring to measure pre-existing background noise levels.
- To determine assessment criteria in accordance with relevant legislation, policies, and guidelines.
- To assess potential operational noise impacts from the proposed premises.
- To provide recommendations for reasonable and practicable operational mitigation and management measures in accordance with relevant legislation, policies, and guidelines, particularly where operational noise is predicted to emit unreasonable noise.

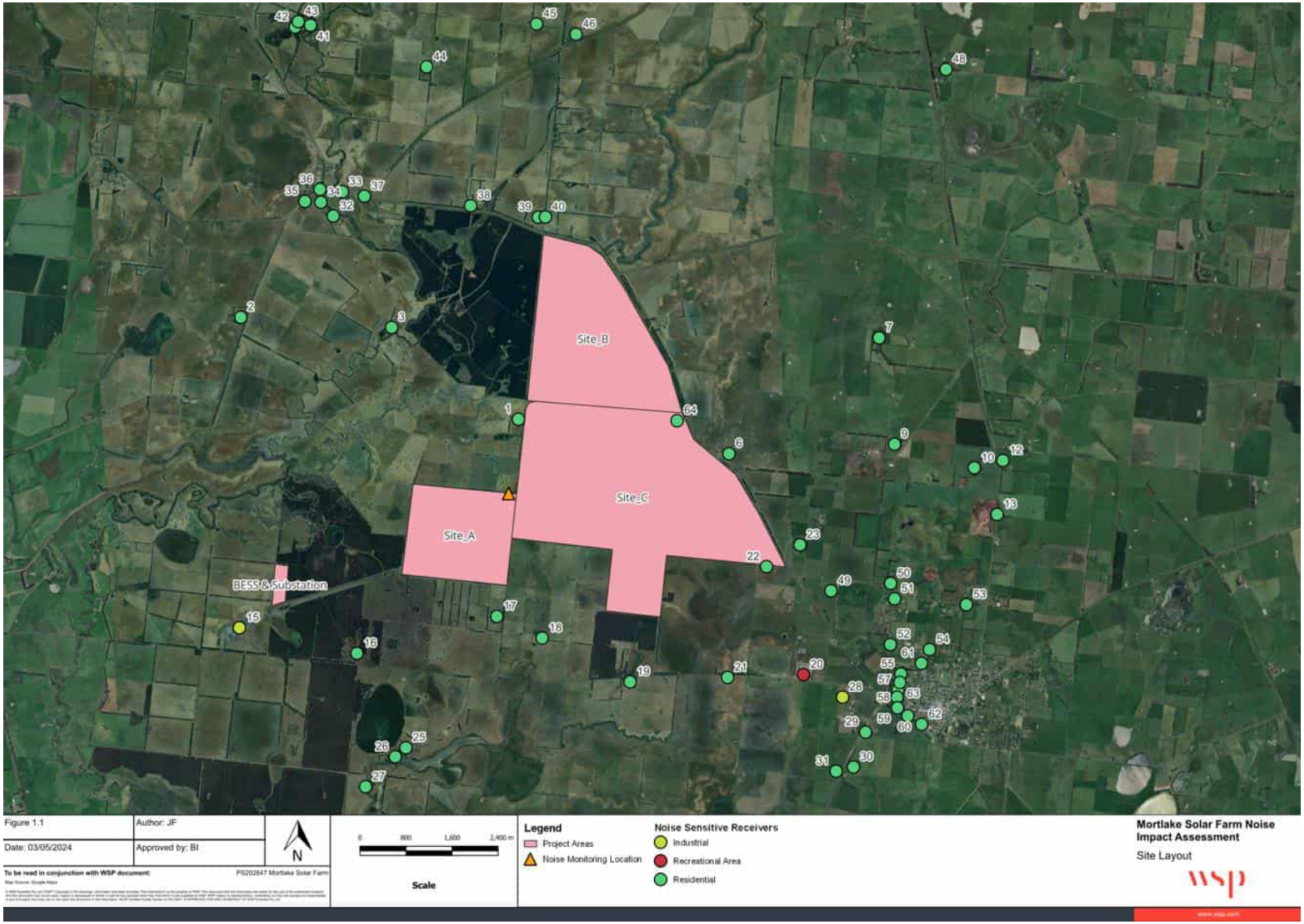



Figure 1.1 Site layout, noise sensitive receivers (NSAs) and noise monitoring location

# 2 EXISTING ENVIRONMENT

## 2.1 DESCRIPTION OF EXISTING NOISE ENVIRONMENT

The existing noise environment within the study area is generally characterised as rural and is primarily dominated by agricultural and rural residential land uses. The primary local noise sources which dominate the existing noise environment levels include road traffic noise from the Hamilton Highway, local road traffic and operations at the existing Mortlake terminal station and associated Blue Gums Switching Station. Other noise sources would include natural noises (for example birds and insects), farming noise and road traffic on local roads. Local roads within the study area include the Woolsthorpe – Hexham Road and Connecarren Lane.

## 2.2 NOISE SENSITIVE AREAS

Studies have shown that there are direct links between noise and health. Problems related to noise include stress related illnesses, high blood pressure, speech interference, hearing loss, sleep disruption, and lost productivity. Noise Sensitive Areas (NSAs) are defined in the Environment Protection Regulations 2021 (EPR), and generally include land uses potentially affected by noise impacts such as residential, educational, medical and/or outdoor recreational areas (referred to in the Environment Reference Standard (ERS)).

NSAs with the potential to be impacted by noise and vibration during operation of the project were identified by reviewing recent aerial imagery and observations made during environmental noise surveys.

Preliminary calculations show that noise risk may extend to an approximate distance of 2,000 m. 16 residential NSAs have been identified within this 2,000 m buffer. These NSAs are presented graphically with unique identifiers in Figure 1.1 and listed in Table 2.1. No non-residential NSAs have been identified within the study area.

Table 2.1 Identified Noise Sensitive Areas (NSAs)

| NSA ID | RECEIVER TYPE | ADDRESS | APPROXIMATE DISTANCE TO PROJECT (M) |
|---|---|---|---|
| 1 | Residential | 300 Boonerah Estate Road | 110 |
| 6 | Residential | 490 Hamilton Highway | 200 |
| 16 | Residential | 890 Connewarren Lane | 1,555 |
| 17 | Residential | 640 Boonerah Estate Road | 555 |
| 18 | Residential | 570 Connewarren Lane | 1,667 |
| 19 | Residential | 409 Connewarren Lane | 1,193 |
| 21 | Residential | 239 Connewarren Lane | 2,016 |
| 22 | Residential | 35 Thulborns Lane | 30 |
| 23 | Residential | 73 Kings Lane | 395 |
| 38 | Residential | 1168 Hamilton Highway | 1,364 |
| 39 | Residential | 19 Woodcutters Lane | 317 |
| 40 | Residential | 30 Woodcutters Lane | 308 |
| 49 | Residential | 69 Holdsworths Lane | 985 |
| 50 | Residential | 8 Arnotts Lane | 1,844 |
| 51 | Residential | 174 Prentices Lane | 1,970 |
| 64 | Residential | 593 Hamilton Highway | 5 |

## 2.3 NOISE MONITORING

### 2.3.1 METHODOLOGY

Determining the existing noise environment of the study area involved quantifying and characterising the existing noise environment through monitoring existing noise levels and meteorological conditions in the study area.

The baseline environmental noise surveys involved a combination of unattended and attended noise monitoring to quantify the pre-construction noise environment at locations representative of the sensitive receivers along the project. The monitoring was carried out in accordance with the *Australian Standard 1055:2018 – Acoustics – Description and Measurement of Environmental Noise* (AS 1055) and EPA Publication 1997 *Technical guide: Measuring and analysing industry noise and music noise* (EPA 1997).

Unattended noise monitoring was carried out at a single location representative of the Project area, between 11 October and 24 October 2023 using a Rion NL-42 noise logging device. Attended noise monitoring was undertaken over a 15-minute daytime interval with the same device on 24 October 2023. Field calibration was checked before and after each measurement with no drift (±0.0 dB) observed.

In addition to unattended noise monitoring, short term attended monitoring was carried out to provide additional information on the major noise sources and assist with the characterisation of the noise environment of the area surrounding the project. This monitoring was undertaken for a 15-minute period, during daytime hours only.

Existing meteorological conditions for the study area were monitored by a David Vantage Vue weather station at the noise monitoring location to determine the suitability of weather conditions during the monitoring period. Time periods where wind exceeded 5m/s or there was any observable rainfall were excluded from the processed noise monitoring data.

### 2.3.2 INSTRUMENTATION AND QUALITY CONTROL

The monitoring equipment was fitted with windshields and were field calibrated before and after monitoring. No significant drifts in calibration (± 0.5 dB) were noted.

All the monitoring equipment has a current certified calibration certificate (National Association of Testing Authorities, NATA) at the time of use. Details of all equipment used to conduct the noise survey are presented in Table 2.2. Copies of the calibration certificates can be provided upon request.

Table 2.2 Noise monitoring equipment

| NSA | SURVEY METHOD | MANUFACTURER AND MODEL NO. | SERIAL NO. | DATE OF CALIBRATION |
|---|---|---|---|---|
| 409 Boonerah Estate Road, Mortlake, VIC | Unattended measurement | Rion NL-42 | 296510 | Current (25/05/2023) |
| | Weather station | Davis Vantage Vue weather | N/A | N/A |
| | Attended measurement | NTi XL2 | A2A-06084-E0 | Current (07/10/2021) |

### 2.3.3 UNATTENDED NOISE MONITORING RESULTS

Unattended monitoring results are summarised in Table 2.3 with hourly noise levels and charts for the monitoring period presented in Appendix A. Monitoring locations are presented graphically in Figure 1.1.

In accordance with EPA 1997, the lowest calculated 'period-average' $L_{A90,\ 1\ hour}$ for each of the day, evening and night periods (during the time the premises operates) has been adopted.

Weather conditions during the monitoring period were obtained from the locally installed Davis Vantage Vue weather station Periods of adverse weather have been processed in accordance with the procedures outlined in Box 2 of EPA 1997, which includes the removal of any periods of rainfall and periods where wind was recorded at levels greater than 5 m/s. Following the removal of this data, 6 days of valid data was obtained.

Table 2.3 Unattended noise measurement results

| NSA | MEASURED LOWEST 'PERIOD-AVERAGE' BACKGROUND NOISE LEVEL, $dBL_{A90}$ | | |
|---|---|---|---|
| | DAY[1] | EVENING[1] | NIGHT[1] |
| 409 Boonerah Estate Road, Mortlake, VIC | 27 | 25 | 24 |

(1) Time period definitions are outlined in Section 3.2.

### 2.3.4 ATTENDED NOISE MONITORING RESULTS

Attended monitoring results are summarised in Table 2.4 with a description of the observed noise influences at the time of testing.

Table 2.4 Attended noise measurement results

| NSA | DATE AND TIME | MONITORED NOISE LEVEL dBA | | | NOTES |
|---|---|---|---|---|---|
| | | $L_{eq}$ | $L_{90}$ | $L_{Max}$ | |
| 409 Boonerah Estate Road, Mortlake, VIC | 24/10/ 2023<br>12.15 – 12:30pm | 50 | 42 | 63 | The environment was noted to be very quiet. Noise sources included farm and native animals. Road traffic was very minimal and the only cars that passed during the monitoring period were of the resident's neighbours. The loudest noted sound was birds, sheep, and cattle. |

# 3 LEGISLATION & GUIDELINES

The Department of Environment, Land, Water and Planning (DELWP) recently released the *Solar Energy Facilities – Design and Development Guideline* (DELWP Guideline), dated October 2022. This guideline provides an overview of the policy, legislative and statutory planning arrangements for solar energy facility projects in Victoria.

The DELWP Guideline recommends expert support and advice is considered in support of the planning permit application to identify potential risks that could potentially impact surrounding sensitive uses.

The DELWP Guideline states the following in relation to noise:

> *A facility should manage noise impacts in accordance with the Environment Protection Regulations under the Environment Protection Act 2017. More information about the laws that control noise is available on the EPA Victoria website.*
>
> *Noise attenuation measures could include:*
>
> - *ensuring any components operate to relevant standards*
> - *acoustic housing or baffles at the noise source*
> - *conducting maintenance and other operational activity during the daytime*
> - *using landscaping or locating noisier components centrally within a site.*

A summary of the relevant legislation and guidelines as managed by the Victorian Environment Protection Authority (EPA) applicable to this Project as referenced in the DELWP Guideline is provided in the following section.

## 3.1 RELEVANT POLICY AND GUIDELINES

The assessment has adopted regulatory guidelines and standards to establish operational noise criteria and limits to define where impacts may be experienced and to quantify the performance of any required mitigation and management measures. The relevant legislation, policy, and guidance for the assessment of noise impacts from the Project are summarised in Table 3.1. Detailed descriptions and applications of relevant policies are presented throughout Section 3.

Table 3.1 Relevant Victorian Legislation and Guidelines

| DOCUMENT | SUMMARY |
|---|---|
| *Environment Protection Act 2017* (The Act) | The Act (as amended by the *Environment Protection Act* 2018) provides the overarching legislative framework for the protection of human health and the environment from pollution or waste in Victoria.<br><br>The Act gives the EPA enhanced powers and tools to prevent and minimise the risks of harm to human health and the environment from pollution and waste. It also provides the EPA with the ability to pursue stronger sanctions and penalties to hold environmental polluters to account.<br><br>While the Act does not prescribe noise limits, it does prohibit the emission of *unreasonable noise*[1] from non-residential premises. It includes environmental obligations and protections for |

[1] *Unreasonable noise* is defined in Section 3(1) of the Act as 'Noise that is unreasonable having regard to the following:
(i) its volume, intensity, or duration
(ii) its character
(iii) the time, place, and other circumstances in which it is emitted
(iv) how often it is emitted
(v) any prescribed factors

| DOCUMENT | SUMMARY |
|---|---|
| | all Victorians focusing on preventing waste and pollution impacts rather than managing those impacts after they have occurred.<br><br>The General Environmental Duty (GED) as defined in Part 3.2 of the Act requires anyone engaging in an activity posing a risk of harm to human health and/or the environment to minimise those risks to prevent harm as far as reasonably practicable.<br><br>Further to the above the Act includes subordinate legislation, of which the Environment Protection Regulations and Environment Reference Standard are discussed below. |
| Environment Protection Regulations 2021<br><br>(the Regulations) | The Regulations aim to further the purpose of and give effect to the Act.<br><br>Part 1.2, Section 4 includes definitions of the terminology used in other subordinate policy documents, including the Noise Protocol (EPA 1826) used to assess environmental noise from commercial and industrial operations in Victoria (see below).<br><br>Part 5.3 of the Regulations includes requirements specific to environmental noise, with Division 1, Section 113 stating *'a person who conducts a prediction, measurement, assessment or analysis of noise within a noise sensitive area for the purposes of the Act or these Regulations, must conduct the prediction, measurement, assessment or analysis in accordance with the Noise Protocol'.*<br><br>Division 3 includes definitions and general requirements that are specific to commercial, industrial and trade premises. In accordance with Section 118 noise from these types of premises is prescribed as unreasonable if it exceeds a noise limit or alternative criterion determined in accordance with the Noise Protocol. The Act also defines 'unreasonable noise' in Section 166 of the Act.<br><br>Additional matters addressed in Divisions 3 and 4 include assessment time periods, minimum noise limit values, management of cumulative noise from multiple premises, noise sensitive areas where assessment requirements apply, definition of frequency spectrum as a prescribed factor, and a definition for aggravated noise. |
| EPA Publication 1826.4 *Noise limit and assessment protocol for the control of noise from commercial, industrial and trade premises and entertainment venues*<br><br>(EPA 1826) | EPA 1826, a.k.a the Noise Protocol, defines the method for setting noise limits for new and existing commercial, industrial and trade premises and entertainment venues in Victoria.<br><br>It also outlines the steps that must be followed to undertake an assessment (either measurement or prediction based) of the effective noise level within a noise sensitive area or alternative assessment location. A comparison between the effective noise level and the relevant noise limit (or alternative assessment criterion) will determine whether the noise that is emitted from the premises is unreasonable under the Regulations.<br><br>The noise limits are determined based on the land use zoning of the area as defined by the relevant planning scheme, and measured background noise levels, with different limits applicable during the day, evening, and night periods. |
| General Environmental Duty<br><br>(GED) | The General Environmental Duty (GED) is outlined in Part 3.2 of the Act.<br><br>The GED requires anyone engaging in an activity posing a risk of harm to human health and/or the environment from pollution (including noise), to minimise those risks to prevent harm as far as reasonably practicable. Commercial premises are therefore required to continue to review and eliminate or reduce the risk of harm from noise as far as reasonably practicable, even if compliant with the Noise Protocol.<br><br>It is applied to eliminate or reduce the risk of harm to human health and the environment. This means that proportionate controls should be applied to mitigate or minimise the risk of harm |

| DOCUMENT | SUMMARY |
|---|---|
| | accounting for the likelihood of the risk, degree of harm, current state of knowledge, and available noise mitigation controls, and their associated costs. |
| Environment Reference Standard (ERS) | The current Environment Reference Standard (ERS) is detailed in Victoria Government Gazette No. S245 and is made under Section 93 of the Act. It may be used as a reference tool in the assessment of planning proposals and provision of advice and recommendations to decision makers where a proposal involves significant risks to human health or the environment.<br>Outside 'natural areas', the ERS makes use of outdoor $L_{Aeq}$ noise levels as indicators. Different objectives are associated with different land use categories, recognising the reality of current ambient sound levels that can reasonably be expected in developed areas.<br>The noise levels specified in the ERS objectives are neither compliance limits, nor design criteria, but they can be used to facilitate assessing whether the environmental values are being achieved, maintained, or threatened. |

## 3.2 *ENVIRONMENT PROTECTION ACT 2017* (THE ACT)

The General Environmental Duty (Section 25 of the Act) requires people who are engaging in any activity that may give rise to risks of harm to human health or the environment from pollution or waste to minimise those risks, so far as reasonably practicable. This requires those risks to be eliminated so far as reasonably practicable, or if that is not possible, to be reduced so far as reasonably practicable. A discussion of reasonably practicable noise management options to reduce noise from the project is provided in Section 5.

Separately, the Act also prohibits the emission of unreasonable noise. Section 166 of the Act imposes an obligation on any individual not to emit unreasonable noise or permit an unreasonable noise to be emitted. The assessment of unreasonable noise is considered in Section 4.

## 3.3 EPA 1826 (NOISE PROTOCOL)

EPA Publication 1826.4: Noise limit and assessment protocol for the control of noise from commercial, industrial and trade premises and entertainment venues (EPA 1826) is the applicable legislative document for the assessment of environmental noise from commercial, industrial, and trade premises within Victoria.

The protocol prescribes a methodology to determine noise limits to protect people from noise emissions from the Project. It particularly refers to noise emissions that may affect normal domestic or recreational activities, such as sleep during the night period.

Definitions adopted by EPA 1826 are outlined in Section 5.3 (Noise) of the Environment Protection Regulations 2021 (EPR), which is subordinate legislation to support the Environment Protection Act 2017 (the Act).

A Noise Sensitive Area (NSA) is defined in the EPR as that part of the land within the apparent boundaries of any piece of land, which is within a distance of 10m outside the external walls of a noise sensitive building (such as residential buildings or building with similar types of accommodation, and sensitive educational uses). The noise limits are to be determined for the noise sensitive area that may be the worst affected by noise emitted from the proposed development.

To determine if noise is 'unreasonable' per Section 166 of the Act, the effective noise level ($L_{eff}$) from the industry is compared with the derived noise limits. The effective noise level ($L_{eff}$) is the level due to the industry measured or predicted at a residential dwelling or noise sensitive location over a continuous 30-minute period, which has had adjustments applied to account for certain characteristics such as tonality, impulsiveness, duration, intermittency, etc.

Different limits are applicable for different times of the day. Time periods defined by the EPR are presented in Table 3.2.

Table 3.2 Time Period Definitions

| WEEKDAY | TIME PERIOD | | |
|---|---|---|---|
| | DAY | EVENING | NIGHT |
| Monday to Saturday | 0700 to 1800 hours | 1800 to 2200 hours | 2200 to 0700 hours |
| Sundays and Public Holidays | - | 0700 to 2200 hours | |

### 3.3.1 NOISE LIMITS (RURAL AREA METHOD)

As the Project site and surrounding noise sensitive areas are located well outside of the Melbourne Urban Growth Boundary (UGB) and any identified Major Urban Areas (i.e. UGB identified in the planning scheme where the population is greater than 7,000 people), noise limits have been derived in accordance with EPA 1826 Part I.A.2 *Noise Limits – Rural Area Method*.

The method uses land use zoning of the industry and receiver as the basis for establishing noise limits. Where the receiver is in a background relevant area (for example, where the ambient noise environment is dominated by high levels of road traffic/Freeway noise) adjustments can be applied to increase the noise limits. Other adjustments can be included where there are multiple industries, based on the distance to the industry/boundary, or where the noise source under assessment is classified as an extractive industry.

#### 3.3.1.1 DISTANCE ADJUSTED LEVELS

Under EPA 1826.4, the Project is classified as a utility and the surrounding area is classified as a Farming Zone (FZ). Clause 31 of the protocol states that:

> *"If the utility is located in a Farming Zone, Rural Activity Zone or Green Wedge Zone and the distance adjustment is 0 dB, and unless a background level assessment is conducted in accordance with clauses 21 to 23, then:*
>
> ***a. the distance-adjusted level for each period is –***
>
> *i. Day: 45 dB(A)*
>
> *ii. Evening: 39 dB(A)*
>
> *iii. Night: 34 dB(A).*
>
> ***b. The noise limit is the distance-adjusted level defined in clause 31, unless a background level assessment is conducted in accordance with clauses 21 to 23."***

#### 3.3.1.2 BACKGROUND LEVEL ADJUSTMENTS

Clause 32 of EPA 1826 states that where background noise monitoring has been undertaken in accordance with Clauses 21 to 23, the noise limit for each NSA is determined as per Clause 24 by comparing the distance adjusted zoning levels and background noise levels for each time period as follows:

***a. for the day period, the noise limit is the greater of:***

*i) the distance-adjusted level*

*ii) the day background level plus 8 dB*

***b. for the evening period, the noise limit is the greater of:***

*i) the distance-adjusted level*

*ii) the evening background level plus 5 dB*

***c. for the night period, the noise limit:***

*i) is the greater of-*

*- the distance-adjusted level*

*- the night background level plus 5 dB*

*ii) Noise limits for the night period must not be greater than 55 dB(A)*

### 3.3.2 SUMMARY OF OPERATIONAL NOISE LIMITS

In accordance with EPA 1826, EPA 1997 and noise monitoring results presented in Section 2.2, Table 3.3 details the noise limits derived for the identified NSAs based on the existing land use zoning. The result of noise monitoring outlined in Section 2.2 indicates that the noise environment is not influenced by high levels of traffic noise.

Table 3.3 EPA 1826 Noise Limits: Rural Method

| DESCRIPTOR | NOISE LIMITS, dBA | | |
|---|---|---|---|
| | DAY | EVENING | NIGHT |
| Zoning level (Clause 19) – Farming Zone (FZ) | 46 | 41 | 36 |
| **Distance adjusted levels - Utilities (Clause 31)** | **45** | **39** | **34** |
| Measured lowest 'period-average' background noise level $L_{90}$ (Clause 21 – 22) | 27 | 25 | 24 |
| **Background level check (Clause 24)** | **35** | **30** | **29** |
| **Project Noise limit, $L_{eq,30min}$** | **45** | **39** | **34** |

## 3.4 ENVIRONMENTAL REFERENCE STANDARD

The current Environment Reference Standard (ERS) is detailed in Victoria Government Gazette No. S245 and is made under Section 93 of the Act. It sets out the environmental values of noise that are sought to be achieved or maintained in Victoria. The noise criteria should be treated as targets and objectives, rather than statutory noise limits. The noise criteria are presented in terms of ambient noise targets ($L_{Aeq}$) for day and night external sound environments.

Five land use categories are assigned noise indicators and objectives, ranging from high density urban areas (CBDs) to environmental sensitive areas (uninhabited rural areas). The land use categories and associated noise level indicators and objectives are outlined in Table 3.4.

Table 3.4 ERS: Indicators and objectives for the ambient sound environment

| LAND USE CATEGORY | INDICATORS | NOISE LEVEL OBJECTIVE |
|---|---|---|
| **Category I** High density urban areas (CBDs) | Outdoor $L_{Aeq,\ 8h}$ (10pm to 6am) | 55 dBA |
| | Outdoor $L_{Aeq,\ 16h}$ (6am to 10pm) | 60 dBA |
| **Category II** Medium density urban areas (outskirts of CBDs) | Outdoor $L_{Aeq,\ 8h}$ (10pm to 6am) | 50 dBA |
| | Outdoor $L_{Aeq,\ 16h}$ (6am to 10pm) | 55 dBA |
| **Category III** Low density urban areas (suburbs) | Outdoor $L_{Aeq,\ 8h}$ (10pm to 6am) | 40 dBA |
| | Outdoor $L_{Aeq,\ 16h}$ (6am to 10pm) | 50 dBA |
| **Category IV** Regional areas (rural towns) | Outdoor $L_{Aeq,\ 8h}$ (10pm to 6am) | 35 dBA |
| | Outdoor $L_{Aeq,\ 16h}$ (6am to 10pm) | 40 dBA |
| **Category V** Environmentally sensitive areas (national parks) | Qualitative | A sound quality that is conducive to human tranquillity and enjoyment having regard to the ambient natural soundscape |

Under the ERS methodology, noise sensitive receivers in the Project area would be classified as Land use category IV. This is described as being *'Lower density or sparce populations with settlements that include smaller hamlets, villages and small towns that are generally unsuited for further expansion. Land uses include primary industry and farming'.*

The planning objectives adopted for the Project are:

- Outdoors $L_{Aeq}$ (8 hour) 35 dBA
- Outdoors $L_{Aeq}$ (16 hour) 40 dBA

It is important to note that these are neither compliance limits, nor design criteria, but they can be used to facilitate assessing whether the environmental values are being achieved, maintained, or threatened.

## 3.5 ADJUSTMENTS FOR NOISE CHARACTER

In addition to the assessment of Project noise levels against these criteria, EPA 1997 requires the consideration of potentially annoying noise characteristics. These may include:

- Impulsive noise
- Intermittent noise
- Tonal noise
- Low frequency noise

Note that compliance with the values outlined here do not necessarily demonstrate compliance with the GED, as concerns from human health may still arise even at lower levels. For example, if a tonal noise exists (a peak of noise energy at a specific frequency), then this component of noise may cause discomfort to a listener.

### *3.5.1 IMPULSIVE NOISE*

Impulsive noise is defined as impulses of noise from a Project with a gap between impulses of approximately 10 seconds.

When the noise is impulsive in character the following adjustments apply:

a) when the impulsive character of the noise is just detectable then a correction of +2 dB should be applied

b) when the impulsive character of the noise is prominent then a correction of +5 dB should be applied.

Circuit breaker switches form part of the emergency management system at the site and would trigger infrequently where a short circuit occurs. These switches typically generate a single, short, sharp impulse which would be categorised as impulsive.

It is noted that Clause 37 of EPA 1826 states that:

> *'Where the noise source under consideration is equipment used solely in relation to emergencies, the relevant noise limit applying to the testing or maintenance of such equipment… is increased by 10 dB for a day period and by 5 dB for all other periods'.*

The potential emergency operation of circuit breaker switches have been considered in Section 4.2.1. Due to the infrequent nature of these events, they have also been considered as potential sleep disturbance $L_{Amax}$ events in Section 4.2.3.

### *3.5.2 INTERMITTENT NOISE*

Clause 87 of EPA 1826 describes that an intermittency adjustment applies when the noise:

a) increases in level rapidly, and by at least 5 dB, on at least two occasions during a 30-minute period; and

b) maintains the higher level for at least a one-minute duration.

Corrections due to intermittent noise have been presented in Table 3.5.

Table 3.5 Intermittency adjustment for noise from industrial premises

| TIME PERIOD | INCREASE IN LEVEL | ADJUSTMENT |
|---|---|---|
| Day period | > 10 dB | + 3 dB |
| Evening or night period | 5 – 10 dB | +3 dB |
| | > 10 dB | +5 dB |

Noise from the site is not considered to be intermittent in nature and this correction has not been considered further.

### 3.5.3 TONAL NOISE

Annex C of EPA 1826 describes the methodology for determining the extent of tonal noise associated with a Project. This method is based on the analysis of 1/3 octave noise levels, where a single octave extends more than 3 dB above the level of adjacent octave bands.

When the noise is tonal in character then the following adjustment is made to the noise level.

a) when the tonal character of the noise is just detectable then a +2 dB adjustment is made

b) when the tonal character of the noise is prominent then a +5 dB adjustment is made.

Tonal noise calculations for the primary noise sources associated with this Project have been presented in Section 4.1.4, which shows that tonal noise may be a feature of noise from the substation transformers.

### 3.5.4 LOW FREQUENCY NOISE

EPA Publication 1996 *Assessing low frequency noise – June 2021* (EPA 1996) is the applicable guideline for duty holders of commercial, industrial, and trade premises within Victoria to manage low frequency noise emissions. It is also used by EPA officers to determine whether the emission of low frequencies from a premises are unreasonable under Section 166 of the Act. Low Frequency Noise (LFN) is defined from 10 Hz to 160 Hz (third octave bands).

LFN emitted from a premises should be assessed by comparing its frequency spectrum to the relevant threshold levels. Table 3.6 provides the EPA 1996 outdoor noise threshold criterion to be used for outdoor measurements (Table 3 in EPA 1996). It is important to note that the threshold levels are not set limits, as outlined by the EPA. Rather, they are levels that indicate a potential risk of problematic low frequency noise. The disturbance from low frequency noise depends on the:

- Noise level and duration
- Other characteristics that can increase annoyance with the noise, for example, tonality, frequency modulation
- Baseline noise levels in the absence of the noise of concern (e.g. influence from traffic or aircraft noise).

Table 3.6 Outdoor low frequency threshold criterion

| OUTDOOR ONE-THIRD OCTAVE LOW FREQUENCY NOISE THRESHOLD LEVELS | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **One-third Octave (Hz)** | **10** | **12.5** | **16** | **20** | **25** | **31.5** | **40** | **50** | **63** | **80** | **100** | **125** | **160** |
| Threshold level, Leq (dB) | 92 | 89 | 86 | 77 | 69 | 61 | 54 | 50 | 50 | 48 | 48 | 46 | 44 |

Where LFN is found to be a potential feature of the noise impact, further consideration should be given to management or mitigation measures to reduce the noise impact.

Section 4.1.4 outlines the results of the LFN assessment, and in summary presents a risk that low frequency noise may be a feature of the project at nearby NSAs.

# 4 OPERATIONAL NOISE ASSESSMENT

The Project includes noise generating plant associated with the proposed Solar Farm and associated infrastructure that may generate unreasonable noise at surrounding NSAs. A predictive noise assessment has been undertaken to quantify potential noise impacts and provide mitigation recommendations where required.

## 4.1 NOISE ASSESSMENT INPUTS

### *4.1.1 GENERAL MODELLING SETUP*

A detailed 3-dimensional noise model has been prepared for the project to assess potential noise impacts during operation of the Project.

A noise model was created with SoundPLAN 8.2 modelling software and noise modelling of the Project was undertaken using the methodology provided in International Standard ISO9613-2:1996 *Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation* (ISO 9613-2:1996).

This internationally recognised standard was designed to assume conditions that favour the propagation of noise from meteorological effects, described as a slight wind (1 to 5 m/s) blowing from source to receiver, or a well-developed moderate ground-based temperature inversion. As such the standard always predicts noise levels slightly higher than levels under calm or neutral propagation conditions and represents a conservative approach.

Key modelling parameters and assumptions are shown in Table 4.1.

Table 4.1 Operational noise modelling inputs and assumptions

| PARAMETER | MODELLING INPUT |
|---|---|
| Ground absorption | Ground absorption factors are set 50% hard / 50% soft ground which is indicative of mixed grass/open vegetation located throughout the study area. |
| Terrain data | Terrain data have been provided by VICMAP.<br>Topography within the site boundary has been flatted to account for the approximately final elevation. |
| Meteorological conditions | Winds (1 to 5 m/s) blowing from source to receiver, or a well-developed moderate ground-based temperature inversion (i.e. moderate worst case) |
| Buildings | NSAs are modelled as point receivers only (free-field levels). No buildings are included in the noise model. |
| Receiver height | The receiver heights are set at 1.5 m above ground level. |
| Location of noise sources | Refer Figure 4.1 |
| Modelled sound power levels | As described in Section 4.1.2. |
| Assessment parameter/ duration | $L_{Aeq,\ 30\ minutes}$ (all noise sources, except circuit breaker switches)<br>Instantaneous $L_{Amax}$ (circuit breaker switches). |
| Assumed hours | Operational noise may occur at any time of day (day, evening, night). Unless otherwise stated for mitigation scenarios. |

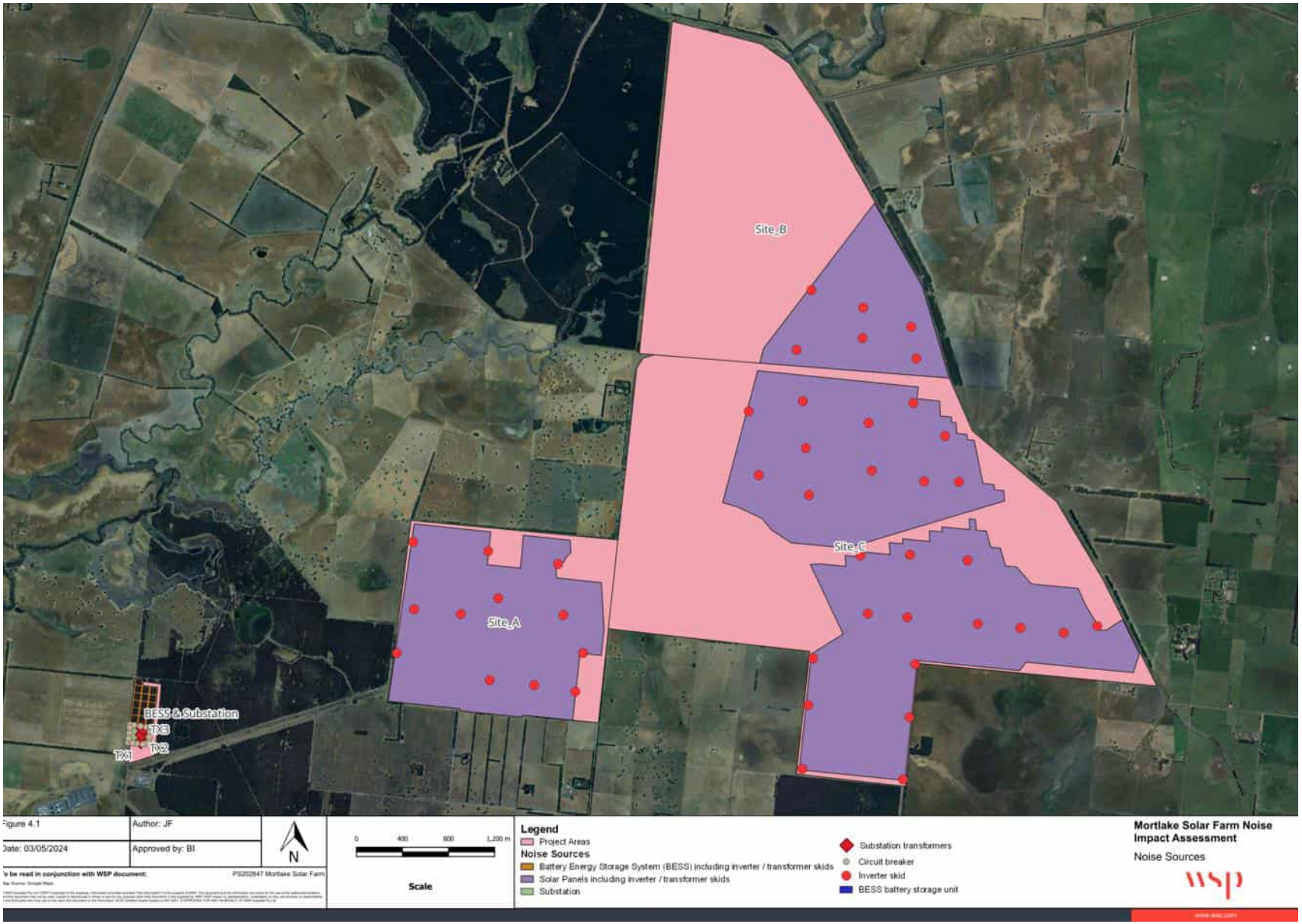



Figure 4.1 Locations of noise sources

### 4.1.2 MODELLED SOUND POWER LEVELS

The key infrastructure components associated with the proposed solar farm is captured in Table 4.2 together with estimated Sound Power Levels (SWLs). Information captured in Table 4.2 has been modelled for the Project, based on available Project information and the Concept Design. Descriptions of the provided source data is provided and key assumptions are outlined in Table 4.2.

~~It is noted that the BESS will be developed in four development stages. The breakdown of each stage has been itemised in Table 4.2 and discussed in Section 4.2.1.~~

It is noted that circuit breaker switches would operate infrequently and would be a very short-term impulsive type of noise event, which does is not likely to impact $L_{Aeq}$ noise levels and as such have been assessed separately as impulsive noise sources.

Table 4.2 Primary noise generating equipment at the Project site

| EQUIPMENT | MAKE | NUMBER OF PLANT | SWL dBA, PER UNIT | MODELLED NOISE SOURCE HEIGHT (M) |
|---|---|---|---|---|
| **Solar farm components** | | | | |
| Solar Panel Tracking motors[1] | NEXTracker | 8,455 | 50 $L_{eq,30min}$ | 1[6] |
| MV Power Station (with 2 Solar Inverters and integrated MV transformer)[2] | HEMK PCSK | 44 | 88 $L_{eq,30min}$ | 1.5[7] |
| **BESS components** | | | | |
| Battery Pack System[3] | B-Vault Lithium ion BESS | 950 | 81 $L_{eq,30min}$ | 0.5-2.7[8] |
| MV Power Station (with 2 Solar Inverters and integrated MV transformer)[2] | HEMK PCSK | 78 | 88 $L_{eq,30min}$ | 1.5[6] |
| **Substation components** | | | | |
| 165MVA Transformer[4] | Hyundai electric | 3 | 93 $L_{eq,30min}$ | 2[7] |
| Circuit breaker switches[5] | Unknown | 3 | 75 $L_{eq,30min}$<br>115 $L_{max}$ | 1[7] |

(1) The solar panel tracking motor has been modelled as area sources evenly distributing the number of motors based on the area of the solar panels. Sourced from the NEXTracker report '*NEXTracker Motor Sound Test Summary', dated* March 2017. No spectral data was provided, and this item has therefore been modelled as an overall level per unit.

(2) Modelled as non-directional point source located at average height of unit. Sourced from *Technical report, Sound pressure level in Freemaq PCSK / Freesun HEMK Gen3 inverters, Power Electronics, 2023*. Spectral data is provided in Section 4.1.2.

(3) Modelled as non-directional point source located at average height of unit. The adopted sound power levels match the provided sound pressure levels reported by the manufacturer (Report: *B-VAULT Litium-ion battery storage for operational flexibility datasheet, NRGV07-PDS-0020-V10, Energy Vault*). WSP have assumed a spectrum based on previous experience with previous similar projects, outlined in Section 4.1.2.

(4) Sourced from manufacturer datasheet *Eltas Test laboratories, Transformator sanayi ve ticaret, Detrermination of sound level, YT-22-12185*

(5) Total $L_{Amax}$ level sourced from typical emission data obtained on similar projects. $L_{Aeq}$ level calculated from 0.1 second event each 30 minute time period. An overall level per unit has been assumed.

(6) Modelled as area source

(7) Modelled as point source

(8) Modelled as an industrial building with area source on one side

### 4.1.1 SITE LAYOUT

The locations of noise sources in the Project site are provided in Figure 4.1. The total noise emission from all BESS units and BESS inverter skids has been calculated and spread evenly across the BESS area. A similar approach has been adopted for solar tracking motors, which have been spread across each proposed solar panel area. Substation transformers and solar inverter skids have been modelled at the proposed design locations. The circuit breaker has been assumed to be associated with the substation boundary.

### 4.1.2 KEY MODELLING ASSUMPTIONS

The assessment has been based on the conservative assumption that all plant has is required to operate at 100 % at all times (24-hour operation). It is noted that the solar motors have a negligible noise impact for the Project. It is also noted that solar panel motors will be inactive during night-time hours and as such they were removed from the noise model during night time hours.

Plant siting as indicated by URBIS Pty Ltd drawing Mortlake Solar Farm Landscape Site Plan (ref 004-CS Detail Plan 04, Rev E) dated 29.04.2024 (see Figure 4.1).

### 4.1.3 DISCUSSION OF POTENTIAL MODELLING UNCERTAINTY

All modelling predictions may include a degree of uncertainty due to a range of influencing factors. Specifically, the following factors have been identified as issues potentially influencing the outcomes of this assessment.

As outlined in Section 4.1 and 4.1.2, a number of assumptions have been adopted for the sound sources (BESS and solar inverters, BESS MV transformers, and circuit breakers). WSP have based these assumptions on previous experience with similar projects and consider them to be representative. But it is acknowledged that there is a range in noise emission levels from this type of equipment and it would be recommended that monitoring is undertaken to confirm final source noise levels during the commissioning period of the project.

Noise modelling will typically adopt a potential variation of +/- 2dB to account for modelling uncertainty.

These potential sources of uncertainty have been considered and a conservative +2dB correction has been applied to all predicted noise levels to account for this uncertainty.

### 4.1.4 ADJUSTMENTS FOR NOISE CHARACTER

As outlined in Section 3.5, tonal and low frequency noise should be considered as potentially annoying characteristics. The assessment of these characteristics for the noise emission from each major noise source has been presented in Figure 4.2.

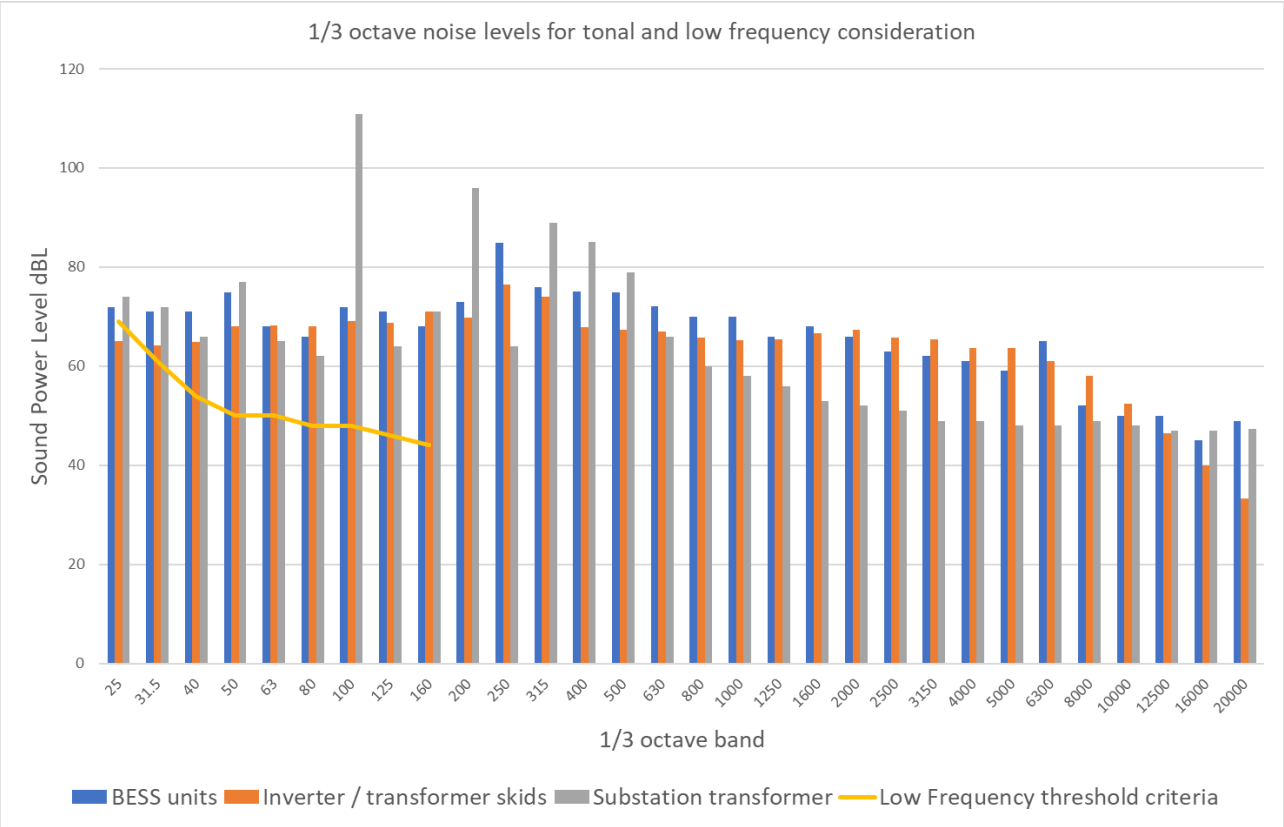



Figure 4.2 Tonal and low frequency noise consideration

The analysis above shows that both low frequency noise and tonal noise may be detectable in the noise spectrum as a result of contributions at 100Hz from the substation transformers. As such, a 5dB penalty has been applied to all noise emissions – where an exceedance is noted, further analysis of the results will be carried out for individual receivers. This additional analysis is presented in Section 4.2.2.

## 4.2 PREDICTED NOISE LEVELS

### *4.2.1 PREDICTED OPERATIONAL NOISE LEVELS*

Noise from the operational solar farm was predicted to the surrounding NSAs based on the anticipated 'worst case' conditions, assuming the inverter banks and BESS infrastructure is operating simultaneously at maximum load during all periods.

A summary of the predicted noise levels is provided in Table 4.3 which shows the predicted noise levels at each NSA for the day, evening, and night periods. Predictions for all NSAs are provided in Appendix B and noise contours are presented in Appendix C.

Results are displayed without any mitigation controls in place. The modelling results show:

- Compliance with EPA 1826 noise limits is predicted for the day, evening, and night-time periods at all NSAs except for one location (593 Hamilton Highway)
- The dominant noise sources are dependent on the location of the receiver relevant to the Project. For the worst affected receiver, the dominant noise sources are:
  - Substation transformers
- These levels are highly conservative as compliance is shown where a +7dB penalty is included which may or may not apply at each receiver. This correction will be further assessed in section 4.2.2 where it may impact the outcome of the assessment.

Table 4.3 Predicted operational noise levels and assessment – Unmitigated levels (nearest NSAs)

| NSA ID | ADDRESS | NOISE LIMIT $L_{EQ(30\ MIN)}$ dBA | | | PREDICTED NOISE LEVEL[1,2] $L_{EQ(30\ MIN)}$ dBA | |
|---|---|---|---|---|---|---|
| | | DAY | EVENING | NIGHT | DAY | NIGHT |
| 1 | 300 Boonerah Estate Road | 45 | 39 | 34 | <25 | <25 |
| 6 | 490 Hamilton Highway | | | | 27 | 26 |
| 16 | 890 Connewarren Lane | | | | 35 | 35 |
| 17 | 640 Boonerah Estate Road | | | | <25 | <25 |
| 18 | 570 Connewarren Lane | | | | <25 | <25 |
| 19 | 409 Connewarren Lane | | | | <25 | <25 |
| 21 | 239 Connewarren Lane | | | | <25 | <25 |
| 22 | 35 Thulborns Lane | | | | 29 | 28 |
| 23 | 73 Kings Lane | | | | <25 | <25 |
| 38 | 1168 Hamilton Highway | | | | <25 | <25 |
| 39 | 19 Woodcutters Lane | | | | <25 | <25 |
| 40 | 30 Woodcutters Lane | | | | <25 | <25 |
| 49 | 69 Holdsworths Lane | | | | <25 | <25 |
| 50 | 8 Arnotts Lane | | | | <25 | <25 |
| 51 | 174 Prentices Lane | | | | <25 | <25 |
| 64 | 593 Hamilton Highway | | | | 38 | 38 |

(1) Includes +2 dB penalty to account for potential modelling inaccuracy

(2) Includes +5 dB penalty for potential tonal characteristics (refer section 4.2.2).

### 4.2.2 PREDICTED TONAL AND LOW FREQUENCY NOISE

The screening assessment provided in Section 3.5.4 indicated that tonal and low frequency noise may be potential issues arising from emissions primarily from the substation transformers. As such, a conservative 5dB penalty has been added to the noise predictions at all properties. Where this penalty has resulted in an exceedance of criteria, the application of this penalty has been further reviewed in this section.

A detailed assessment of potential tonal and low frequency content has been provided below for the worst impacted properties located at 890 Connewarren Lane (ID 16) and 593 Hamilton Highway (ID 64).

Figure 4.3 outlines the detailed assessment for these two receivers and shows that predicted noise levels are below the threshold noise levels where low frequency impacts may occur. As such low frequency noise from the project is not anticipated to impact any NSAs. It also shows that noise in the 100Hz bandwidth is considered to be tonal at 890 Coonewarren Lane.

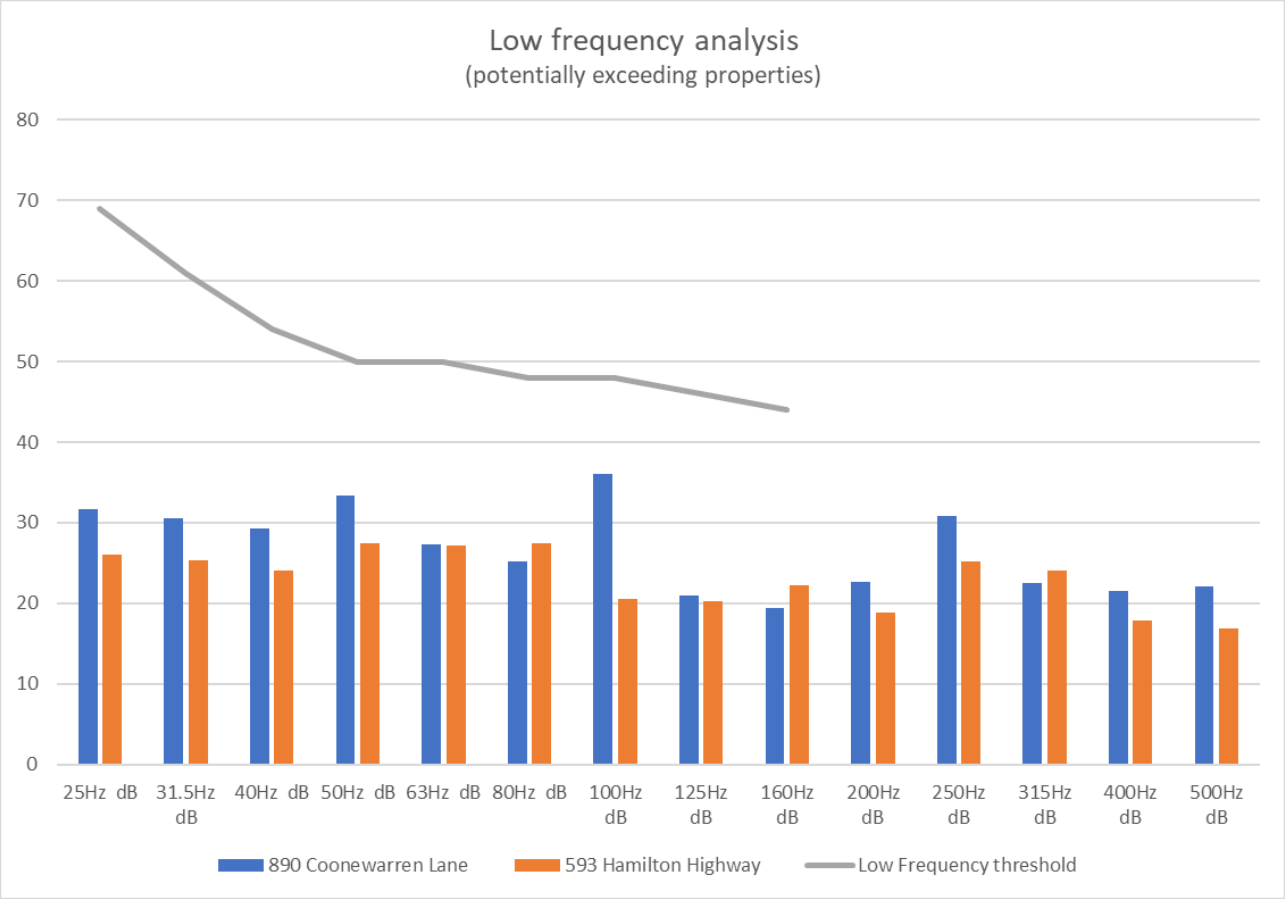



Figure 4.3 Low frequency assessment (exceeding properties only)

Further analysis of tonal properties of predicted noise at 890 Coonewarren Lane (ID 16) is outlined in Appendix D, which shows that the tonal noise is considered to be just detectable and as such a 2dB penalty is imposed.

The outcome of these adjustments for noise character is that the +5 penalty applied to each of these NSAs is required to be updated. This adjusted analysis is provided in Table 4.4.

Table 4.4 Detailed adjustments for noise character (potentially exceeding properties)

| NSA ID | ADDRESS | NOISE LIMIT $L_{EQ(30\ MIN)}$ dBA | | | ORIGINAL PENALTY dB | PREDICTED NOISE LEVEL $L_{EQ(30\ MIN)}$ dBA | | UPDATED PENALTY dB | PREDICTED NOISE LEVEL $L_{EQ(30\ MIN)}$ dBA | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | DAY | EVENING | NIGHT | | DAY | NIGHT | | DAY | NIGHT |
| 16 | 890 Connewarren Lane | 45 | 39 | 34 | + 5 | 35 | 35 | + 2 | 32 | 32 |
| 64 | 593 Hamilton Highway | | | | + 5 | 38 | 38 | - | 33 | 33 |

This detailed assessment shows that both properties are predicted to comply with project noise limits.

### 4.2.3 PREDICTED IMPULSIVE NOISE LEVELS (EMERGENCY CIRCUIT BREAKER)

Further to the noise impacts of steady state noise sources, as discussed in Section 3.5.1, operations may involve the occasional activation of circuit breaker switches. The circuit breaker is located near the transformer in the BESS area and

forms a key safety measure on site. When activated, which would be expected to occur infrequently, this item would generate high noise levels for a short period of time (less than 1 second).

These events have been included in the total ($L_{eq}$) noise emission outlined above, however would also be expected to generate short term maximum noise levels, potentially generating sleep disturbance impacts if occurring during the sensitive night-time period. It is noted that $L_{Amax}$ criteria do not apply to this source, and this assessment has been included to provide an indication of the likely acceptability of this infrequent noise event only. $L_{Amax}$ goals are based on the standard night-time $L_{Aeq}$ criteria, plus 5dB to account for the emergency nature of the noise source and night-time nature of the potential sleep disturbance impact.

Table 4.5 shows the predicted noise levels at each receiver for all assessment periods. The predicted $L_{Amax}$ levels are expected to comply with the nominated guidance levels at all NSAs.

Table 4.5 Predicted impulsive operational noise levels and assessment (Circuit breaker switches)

| NSA ID | ADDRESS | NOISE GOAL $L_{AMAX}$ [1] | PREDICTED NOISE LEVEL, $L_{MAX}$ dBA[2] |
|---|---|---|---|
| | | NIGHT | ALL PERIODS |
| 1 | 300 Boonerah Estate Road | 39 | <25 |
| 6 | 490 Hamilton Highway | | <25 |
| 16 | 890 Connewarren Lane | | 37 |
| 17 | 640 Boonerah Estate Road | | 26 |
| 18 | 570 Connewarren Lane | | <25 |
| 19 | 409 Connewarren Lane | | <25 |
| 21 | 239 Connewarren Lane | | <25 |
| 22 | 35 Thulborns Lane | | <25 |
| 23 | 73 Kings Lane | | <25 |
| 38 | 1168 Hamilton Highway | | <25 |
| 39 | 19 Woodcutters Lane | | <25 |
| 40 | 30 Woodcutters Lane | | <25 |
| 49 | 69 Holdsworths Lane | | <25 |
| 50 | 8 Arnotts Lane | | <25 |
| 51 | 174 Prentices Lane | | <25 |
| 64 | 593 Hamilton Highway | | <25 |

(1) Includes adjustments for infrequent emergency equipment in accordance with Section 3.5.1

(2) Includes +2dB correction to account for potential uncertainty in noise modelling as discussed in Section 4.1.3.

## 4.3 DISCUSSION

Noise levels from the operational solar farm and BESS are presented in Table 4.3 and indicate that unmitigated project operations are likely to comply with relevant EPA 1826 noise limits for day, evening, and night periods at all NSAs.

The modelling inputs and method are considered conservative, based on the anticipated ‘worst case’ conditions and assuming all infrastructure is operating simultaneously at maximum load during daytime periods. The same assumptions, however with the removal of solar panel motors have been implanted during night-time hours.

Noise levels are predicted to be up to 33 dBA $L_{eq}$ at the worst impacted NSA 16 (593 Hamilton Highway) where the noise levels were dominated by contributions from each of the closest three solar inverter skids. No NSAs are predicted to exceed the project noise limits.

It is noted that solar tracking motors and inverters will only generate noise during daylight conditions. However, during the summer months, there is a potential one-hour window during which noise from the inverters should be assessed against the more onerous noise limit applicable during the night period (i.e. from 0600 hrs through 0700 hrs). As the noise output from the inverters also varies significantly with load it is envisaged that the predicted noise level during this time will likely be noticeably lower than predicted.

Noise levels as a result of the infrequent activation of the emergency circuit breaker switches were found to be unlikely to result in sleep disturbance impacts at any NSAs. It is understood that emergency circuit breaker switches may be activated at any time throughout the 24-hour period however will occur very infrequently (less than once per five years) for a period of less than one second and as such impacts are considered negligible.

It is noted the location of the circuit breaker was not known at the time of this assessment and the selected location is a conservative approach at the closest area within the substation to the NSAs. Additionally, the precise unit has not been determined and as such a conservative likely maximum level has been assessed. With further information available the predicted noise levels would be expected to be lower.

Mitigation measures to reduce these noise impacts further have been investigated and are presented in Section 5.

# 5 NOISE MANAGEMENT AND MITIGATION

## 5.1 INTRODUCTION

The noise modelling results presented in Section 0 indicate that the predicted noise from the operational solar farm is not expected to exceed the operational noise limits at any locations. Low frequency noise is not considered a potential issue however noise from the transformers is considered tonal at a single receiver and appropriate penalties have been applied.

Mitigation is not required to reduce noise impacts, however where mitigation options are considered, it is recommended that measures are targeted at the BESS and solar inverters.

From an acoustic perspective, possible strategies to mitigate noise are typically investigated in the following order (decreasing preference):

a. **Land use planning** and provision of appropriate buffer distances through Project design (omitted here due this being a measure relevant only prior to site selection)

b. **Noise control at the noise source**

c. **Noise control along the noise transfer path**

d. **Noise control at the receiver** (omitted at this stage pending confirmation of agreed mitigation).

This mitigation assessment is focused at providing reasonable and practicable mitigation options and/or combination of options to achieve compliance and minimise risk of environmental harm to the surrounding areas. The mitigation options are to be agreed in discussion with the URBIS and the client.

## 5.2 NOISE CONTROL AT THE NOISE SOURCE

Generally, noise control at the source is considered as most effective in improving the overall acoustic outcome at sensitive receivers. Possible mitigation options that may reduce emitted noise levels from the equipment include:

### *5.2.1 SELECTION OF EQUIPMENT WITH A LOWER SOUND POWER LEVEL*

For the operational noise, the biggest potential for source control for the Project has been identified to be the BESS units, substation transformers and solar inverter skids. Consultation with equipment manufacturers may identify potential lower noise emitting units or standard mitigation add-ons.

### *5.2.2 ORIENTATION OF NOISY EQUIPMENT*

All equipment has been modelled as omnidirectional point or area sources. In actuality, emission from these sources are unlikely to be omnidirectional, and higher emitting faces (for example cooling fan vents) should be orientated to the west and north (away from the nearest receivers) where possible.

### *5.2.3 LOCATION OF NOISY EQUIPMENT*

Following preliminary noise modelling, the location of the nearest solar inverter skid was moved to the maximum feasible distance from the NSA. This substantially reduced noise from this source, however increased the relative contribution from other nearby inverters. As such, other methods of mitigation will be required and are considered in the following sections.

# 5.3 NOISE CONTROL ALONG THE NOISE TRANSFER PATH

## *5.3.1 EQUIPMENT BARRIERS*

### 5.3.1.1 SUBSTATION TRANSFORMERS

Although not required for compliance, an opportunity for noise reduction would be the consideration of barriers within the substation to reduce noise from the proposed transformers. It is noted that transformers are typically required to be contained by blast shields. These large concrete barriers provide additional benefit through the screening of noise. Where required, it is recommended that openings are orientated towards the west where reasonable and feasible in order to screen noise towards the south and east.

### 5.3.1.2 SOLAR INVERTERS

To further reduce noise levels at 593 Hamilton Highway, individual equipment screens may provide a reasonable approach to noise mitigation. The screening of the closest solar inverters to this receiver has been investigated.

The model was modified to include a 3-metre high enclosure around the three nearest solar inverters (extending 1.5m above the inverter) to reduce noise at 593 Hamilton Highway. The barrier was located 4 metres away from inverter enclosing three sides, open at the south or north, to allow for access for maintenance and avoid reflections towards the closest NSAs.


Figure 5.1 Noise mitigation - Modelled inverter barriers

Noise modelling results from this mitigation scenario is presented in Table 5.1. The results indicate that the installation of these enclosures would effectively reduce the noise levels up to 4 dB during all periods at the nearest NSAs.

Table 5.1 Predicted mitigated operational noise levels and assessment

| NSA ID | ADDRESS | NOISE LIMIT $L_{EQ(30\ MIN)}$ dBA | | | PREDICTED NOISE LEVEL[1] $L_{EQ(30\ MIN)}$ dBA | |
|---|---|---|---|---|---|---|
| | | DAY | EVENING | NIGHT | DAY | NIGHT |
| 64 | 593 Hamilton Highway | 45 | 39 | 34 | 29 | 29 |

(1) Includes +2 dB penalty to account for potential modelling inaccuracy

### *5.3.2 SITE BARRIERS*

Given the conservative assumptions in this assessment, and as no exceedances have been predicted, more substantial barriers, in particular site boundary noise barriers, are not a reasonable approach to noise control at this site. However if they are preferred, barriers along the south and eastern sides of the BESS and substation may be investigated. These should be constructed at a sufficient height to interrupt a direct line of sight from source to receiver.

## 5.4 NOISE CONTROL AT THE RECEIVER

Again, given the conservative assumptions in this assessment, and that no exceedances of project criteria have been predicted, it is likely that noise control will not be required at any NSAs, however if they are considered, they should be undertaken following a building inspection of proposed properties and in close consultation with the property owner.

## 5.5 QUALITATIVE RISK ASSESSMENT

In support of the Project's obligations to comply with the General Environmental Duty (GED), WSP prepared a qualitative risk assessment to summarise the potential noise impacts from the project and assess the efficiency of the recommended mitigation measures to address unreasonable noise. The likelihood ranges from Rare (occurs in exceptional circumstances) to Almost Certain (occur in most circumstances). The consequence ranges from Insignificant (no measurable reduction in amenity) to Catastrophic (extended period of major reduction in amenity). The risk rating matrix is presented in Table 5.2. The risk register is detailed in Table 5.3.

Table 5.2 Risk rating

| | | LIKELIHOOD | | | | |
|---|---|---|---|---|---|---|
| | | Almost certain | Likely | Moderate | Unlikely | Rare |
| CONSEQUENCE | Catastrophic | Critical | Critical | High | High | Moderate |
| | Major | Critical | High | High | Moderate | Low |
| | Moderate | High | High | Moderate | Low | Low |
| | Minor | High | Moderate | Low | Low | Low |
| | Insignificant | Moderate | Low | Low | Low | Low |

Table 5.3 Risk Register

| RISK | HAZARD AND POTENTIAL HARM | INITIAL RISK RATING | | | MITIGATION MEASURES | RESIDUAL RISK RATING | | |
|---|---|---|---|---|---|---|---|---|
| | | LIKELIHOOD | CONSEQUENCE | RISK RATING | | LIKELIHOOD | CONSEQUENCE | RISK RATING |
| 1 | Modelling assumptions:<br>Under prediction from corrections (uncertainty) | Moderate | Minor | Mod | Add +2dB modelling uncertainty to ensure mitigation measures predict compliance with noise limits | Minor | Insignificant | Low |
| 2 | Noise emissions:<br>Solar and BESS inverters | Moderate | Minor | Mod | Select quieter equipment (if engineering constraints permit) | Moderate | Insignificant | Low |
| 3 | Noise emissions:<br>Emergency circuit breakers | Rare | Moderate | Low | Selection of equipment with SWL < 110dB | Rare | Minor | Low |
| 4 | Noise emissions:<br>BESS | Moderate | Minor | Low | No specific actions | Moderate | Minor | Low |
| 5 | Noise emissions:<br>Solar trackers | Unlikely | Minor | Low | No specific actions | Unlikely | Insignificant | Low |
| 6 | Noise emissions:<br>Transformers | Moderate | Minor | Low | No specific actions | Unlikely | Minor | Low |

## 5.6 RECOMMENDATIONS

As previously discussed, without mitigation and including several conservative assumptions, the noise levels from typical operations are predicted to comply with the EPA 1826 noise limits at all locations and is expected to only be audible at external areas of the closest location during night-time hours only.

It is recommended that once the project is operational, commissioning noise measurements are undertaken to validate the noise modelling assumptions and ensure compliance with EPA legislation. Where noise is found to exceed the operational noise limits from EPA 1826 (or an alternative assessment criterion such as EPA 1996), additional noise mitigation measures will need to be considered beyond those presented in this report.

# 6 CONCLUSION

WSP has been retained by Urbis to assess noise from the proposed solar farm located at Hamilton Highway, located near the town Mortlake, Victoria.

The noise assessment has been based on supplied noise data provided by the manufacturer, the limitations of which have been discussed throughout the report.

By developing land which will introduce new sources of noise that could potentially impact surrounding land uses, the developer is required under the General Environmental Duty (GED) to minimise those risks of harm so far as reasonably practicable.

To this extent, a noise modelling assessment has been undertaken, with noise from the operational Solar Farm found to meet the relevant EPA Publication 1826 noise limits all receivers without further mitigation.

The primary noise sources vary for each receiver, however at the most impacted properties, noise from the BESS units, including inverter skids and solar inverter skids is likely to be dominant. Some contribution may be noted from the substation transformers.

Noise levels as a result of the infrequent activation of the emergency circuit breaker switches were found to be unlikely to result in sleep disturbance impacts at any NSAs. It is understood that emergency circuit breaker switches may be activated at any time throughout the 24-hour period however will occur very infrequently (less than once per five years) for a period of less than one second and as such impacts are considered negligible.

Although not required to meet project requirement, a high level of potential noise mitigation measures has been discussed in this report to provide further understanding of mitigation options.

As such, the residual risk that noise from the Project will cause adverse noise impacts is low. However it is nonetheless recommended that a compliance survey is undertaken once the Project is operational for verification purposes.

# 7 LIMITATIONS

This Report is provided by WSP Australia Pty Limited (*WSP*) for Urbis in response to specific instructions from the Client and in accordance with WSP's proposal PP140597 entitled *"Mortlake Solar Farm – Noise Impact Assessment Proposal"*.

## 7.1 PERMITTED PURPOSE

This Report is provided by WSP for the purpose described in the Agreement and no responsibility is accepted by WSP for the use of the Report in whole or in part, for any other purpose (*Permitted Purpose*).

## 7.2 QUALIFICATIONS AND ASSUMPTIONS

The services undertaken by WSP in preparing this Report were limited to those specifically detailed in the Report and are subject to the scope, qualifications, assumptions, and limitations set out in the Report or otherwise communicated to the Client.

Except as otherwise stated in the Report and to the extent that statements, opinions, facts, conclusion and / or recommendations in the Report (*Conclusions*) are based in whole or in part on information provided by the Client and other parties identified in the report (*Information)*, those Conclusions are based on assumptions by WSP of the reliability, adequacy, accuracy and completeness of the Information and have not been verified. WSP accepts no responsibility for the Information.

WSP has prepared the Report without regard to any special interest of any person other than the Client when undertaking the services described in the Agreement or in preparing the Report.

## 7.3 USE AND RELIANCE

This Report should be read in its entirety and must not be copied, distributed or referred to in part only. The Report must not be reproduced without the written approval of WSP. WSP will not be responsible for interpretations or conclusions drawn by the reader. This Report (or sections of the Report) should not be used as part of a specification for a project or for incorporation into any other document without the prior agreement of WSP.

WSP is not (and will not be) obliged to provide an update of this Report to include any event, circumstance, revised Information or any matter coming to WSP's attention after the date of this Report. Data reported and Conclusions drawn are based solely on information made available to WSP at the time of preparing the Report. The passage of time; unexpected variations in ground conditions; manifestations of latent conditions; or the impact of future events (including (without limitation) changes in policy, legislation, guidelines, scientific knowledge; and changes in interpretation of policy by statutory authorities); may require further investigation or subsequent re-evaluation of the Conclusions.

This Report can only be relied upon for the Permitted Purpose and may not be relied upon for any other purpose. The Report does not purport to recommend or induce a decision to make (or not make) any purchase, disposal, investment, divestment, financial commitment or otherwise. It is the responsibility of the Client to accept (if the Client so chooses) any Conclusions contained within the Report and implement them in an appropriate, suitable and timely manner.

In the absence of express written consent of WSP, no responsibility is accepted by WSP for the use of the Report in whole or in part by any party other than the Client for any purpose whatsoever. Without the express written consent of WSP, any use which a third party makes of this Report or any reliance on (or decisions to be made) based on this Report is at the sole risk of those third parties without recourse to WSP. Third parties should make their own enquiries and obtain independent advice in relation to any matter dealt with or Conclusions expressed in the Report.

## 7.4 DISCLAIMER

No warranty, undertaking or guarantee whether expressed or implied, is made with respect to the data reported or the Conclusions drawn. To the fullest extent permitted at law, WSP, its related bodies corporate and its officers, employees and agents assumes no responsibility and will not be liable to any third party for, or in relation to any losses, damages or expenses (including any indirect, consequential or punitive losses or damages or any amounts for loss of profit, loss of revenue, loss of opportunity to earn profit, loss of production, loss of contract, increased operational costs, loss of business opportunity, site depredation costs, business interruption or economic loss) of any kind whatsoever, suffered on incurred by a third party.

# APPENDIX A

## NOISE MONITORING RESULTS

## NM01 monitoring summary – Sheet 1

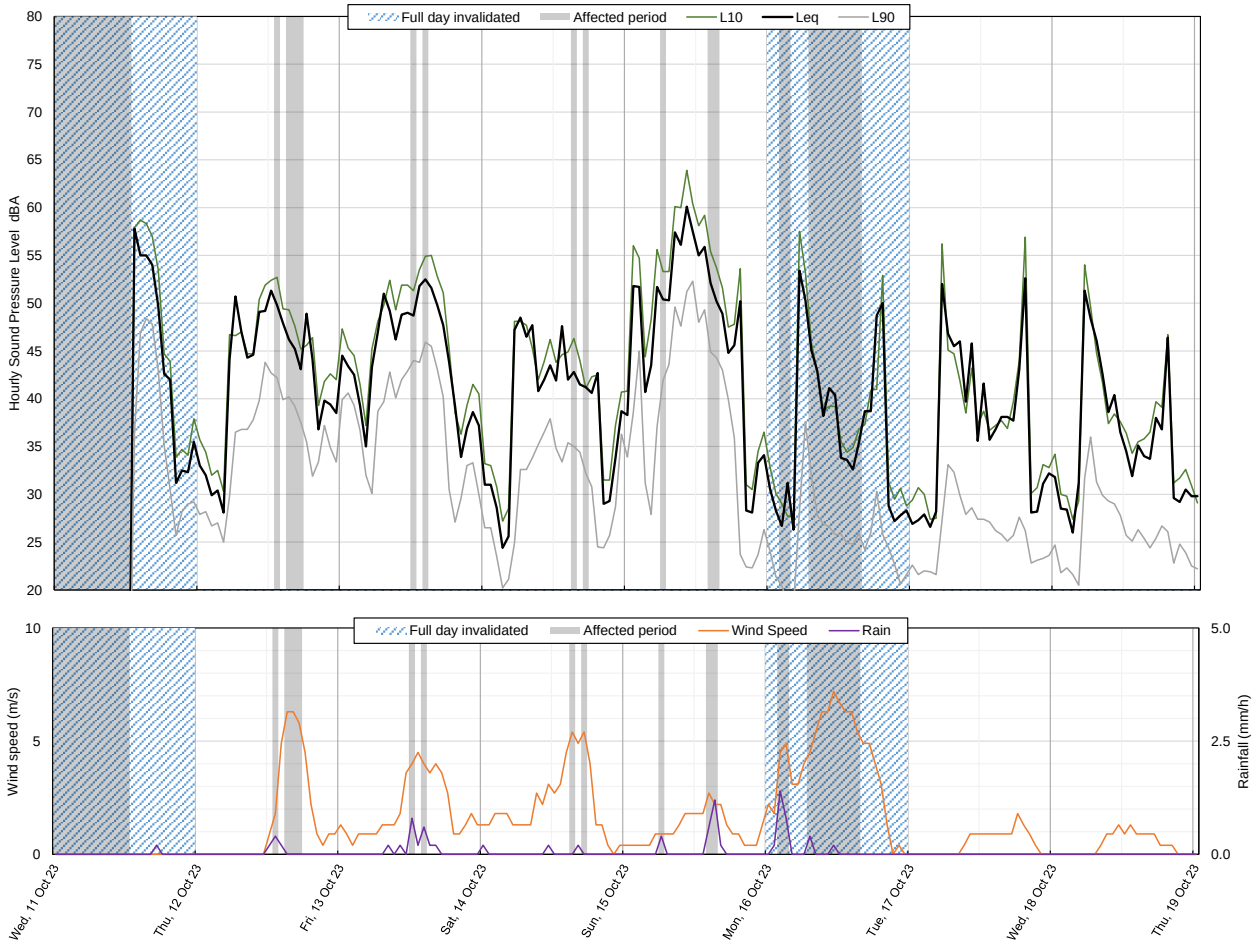
| | | | | | |
|---|---|---|---|---|---|
| Project No. | PS202847 | Date | 25/10/2023 | Sheet | 1 |
| Project Title | Urbis Mortlake | Engineer | IC | Rev | 1 |
| Location | Mortlake VIC | | | Type | LG |

| | |
|---|---|
| Address | 409 Boonerah Estate Road Mortlake VIC |
| Microphone Position | Height:1.8m |

| | | Wed, 11 Oct 2023 | | | Thu, 12 Oct 2023 | | | Fri, 13 Oct 2023 | | | Sat, 14 Oct 2023 | | | Sun, 15 Oct 2023 | | | Mon, 16 Oct 2023 | | | Tue, 17 Oct 2023 | | | Wed, 18 Oct 2023 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | $L_{A10}$ | $L_{Aeq}$ | $L_{A90}$ | $L_{A10}$ | $L_{Aeq}$ | $L_{A90}$ | $L_{A10}$ | $L_{Aeq}$ | $L_{A90}$ | $L_{A10}$ | $L_{Aeq}$ | $L_{A90}$ | $L_{A10}$ | $L_{Aeq}$ | $L_{A90}$ | $L_{A10}$ | $L_{Aeq}$ | $L_{A90}$ | $L_{A10}$ | $L_{Aeq}$ | $L_{A90}$ | $L_{A10}$ | $L_{Aeq}$ | $L_{A90}$ |
| Daily Averages | $L_{A10,18h}$ (6am to 12am) | – | | | 46 | | | 47 | | | 43 | | | 49 | | | – | | | 39 | | | 38 | | |
| | $L_{A10,12h}$ (6am to 6pm) | – | | | 47 | | | 51 | | | 45 | | | 55 | | | – | | | 40 | | | 39 | | |
| | $L_{Aeq,15h}$ (7am to 10pm) | | – | | | 47 | | | 48 | | | 43 | | | 54 | | | – | | | 44 | | | 40 | |
| | $L_{Aeq,16h}$ (6am to 10pm) | | – | | | 47 | | | 48 | | | 44 | | | 54 | | | – | | | 44 | | | 41 | |
| | $L_{Aeq,9h}$ (10pm to 7am) | | – | | | 43 | | | 42 | | | 48 | | | – | | | – | | | 44 | | | 42 | |
| | $L_{Aeq,8h}$ (10pm to 6am) | | – | | | 42 | | | 39 | | | 48 | | | – | | | – | | | 43 | | | 40 | |
| | $L_{A90,Day}$ (7am to 6pm) | | | – | | | 38 | | | 41 | | | 35 | | | 45 | | | – | | | 28 | | | 27 |
| | $L_{A90,Evening}$ (6pm to 10pm) | | | – | | | 35 | | | 30 | | | 26 | | | 26 | | | – | | | 25 | | | 25 |
| | $L_{A90,Night}$ (10pm to 7am) | | | – | | | 36 | | | 27 | | | 35 | | | – | | | – | | | 25 | | | 24 |
| Hourly Values | 00:00 to 01:00 | – | – | – | 36 | 33 | 28 | 47 | 45 | 40 | 33 | 31 | 27 | 41 | 38 | 34 | *33* | *31* | *24* | 29 | 27 | 23 | 34 | 32 | 25 |
| | 01:00 to 02:00 | – | – | – | 34 | 32 | 28 | 45 | 43 | 41 | 33 | 31 | 27 | 56 | 52 | 39 | *30* | *28* | *21* | 31 | 27 | 22 | 30 | 29 | 22 |
| | 02:00 to 03:00 | – | – | – | 32 | 30 | 27 | 45 | 43 | 39 | 31 | 29 | 24 | 55 | 52 | 45 | *29* | *27* | *20* | 30 | 28 | 22 | 30 | 28 | 22 |
| | 03:00 to 04:00 | – | – | – | 33 | 30 | 27 | 42 | 39 | 37 | 27 | 24 | 20 | 44 | 41 | 31 | *28* | *31* | *19* | 27 | 27 | 22 | 27 | 26 | 22 |
| | 04:00 to 05:00 | – | – | – | 30 | 28 | 25 | 37 | 35 | 32 | 29 | 26 | 21 | 48 | 44 | 28 | *28* | *26* | *18* | 28 | 28 | 22 | 29 | 31 | 21 |
| | 05:00 to 06:00 | – | – | – | 47 | 44 | 30 | 45 | 43 | 30 | 48 | 47 | 25 | 56 | 52 | 37 | *58* | *53* | *28* | 56 | 52 | 27 | 54 | 51 | 32 |
| | 06:00 to 07:00 | – | – | – | 47 | 51 | 37 | 48 | 47 | 39 | 48 | 49 | 33 | *48 (53)* | *48 (50)* | *38 (42)* | *53* | *50* | *38* | 45 | 47 | 33 | 50 | 48 | 36 |
| | 07:00 to 08:00 | – | – | – | 47 | 47 | 37 | 50 | 51 | 40 | 48 | 47 | 33 | 53 | 50 | 44 | *46* | *45* | *32* | 45 | 46 | 32 | 45 | 46 | 31 |
| | 08:00 to 09:00 | – | – | – | 45 | 44 | 37 | 52 | 49 | 43 | 45 | 48 | 34 | 60 | 57 | 50 | *43* | *43* | *28* | 42 | 46 | 30 | 42 | 43 | 30 |
| | 09:00 to 10:00 | – | – | – | 45 | 45 | 38 | 49 | 46 | 40 | 42 | 41 | 35 | 60 | 56 | 48 | *39* | *38* | *27* | 39 | 40 | 28 | 37 | 39 | 29 |
| | 10:00 to 11:00 | – | – | – | 50 | 49 | 40 | 52 | 49 | 42 | 44 | 42 | 37 | 64 | 60 | 51 | *39* | *41* | *27* | 43 | 46 | 29 | 38 | 40 | 29 |
| | 11:00 to 12:00 | – | – | – | 52 | 49 | 44 | 52 | 49 | 43 | 46 | 44 | 38 | 60 | 58 | 52 | *39* | *40* | *26* | 37 | 36 | 27 | 38 | 37 | 28 |
| | 12:00 to 13:00 | – | – | – | 52 | 51 | 43 | *46 (51)* | *45 (49)* | *36 (44)* | 44 | 42 | 35 | 58 | 55 | 48 | *36* | *34* | *26* | 39 | 42 | 27 | 36 | 35 | 26 |
| | 13:00 to 14:00 | *58* | *58* | *36* | *45 (53)* | *43 (50)* | *35 (42)* | 54 | 52 | 44 | 45 | 48 | 33 | 59 | 56 | 49 | *34* | *34* | *25* | 37 | 36 | 27 | 34 | 32 | 25 |
| | 14:00 to 15:00 | *59* | *55* | *47* | 49 | 48 | 40 | *46 (55)* | *44 (53)* | *37 (46)* | 45 | 42 | 35 | *46 (55)* | *44 (52)* | *37 (45)* | *35* | *33* | *25* | 37 | 37 | 26 | 36 | 35 | 26 |
| | 15:00 to 16:00 | *58* | *55* | *48* | *46 (49)* | *44 (46)* | *36 (40)* | 55 | 52 | 46 | *46 (46)* | *44 (43)* | *36 (35)* | *46 (54)* | *44 (50)* | *36 (44)* | *37* | *35* | *26* | 38 | 38 | 26 | 36 | 34 | 25 |
| | 16:00 to 17:00 | *57* | *54* | *48* | *46 (48)* | *44 (45)* | *36 (39)* | 53 | 50 | 43 | 44 | 42 | 34 | 52 | 49 | 43 | *37* | *39* | *24* | 37 | 38 | 25 | 37 | 34 | 24 |
| | 17:00 to 18:00 | *54* | *50* | *43* | *45 (45)* | *43 (43)* | *34 (38)* | 51 | 48 | 40 | *45 (41)* | *43 (41)* | *34 (32)* | 48 | 45 | 40 | *41* | *39* | *26* | 40 | 38 | 26 | 40 | 38 | 25 |
| | 18:00 to 19:00 | *45* | *43* | *35* | 46 | 49 | 36 | 45 | 44 | 31 | 42 | 41 | 31 | 48 | 46 | 36 | *41* | *49* | *30* | 44 | 43 | 28 | 39 | 37 | 27 |
| | 19:00 to 20:00 | *44* | *42* | *31* | 46 | 44 | 32 | 39 | 39 | 27 | 43 | 43 | 25 | 54 | 50 | 24 | *53* | *50* | *26* | 57 | 53 | 26 | 47 | 46 | 26 |
| | 20:00 to 21:00 | *34* | *31* | *26* | 39 | 37 | 33 | 36 | 34 | 30 | 32 | 29 | 24 | 31 | 28 | 22 | *31* | *29* | *24* | 30 | 28 | 23 | 31 | 30 | 23 |
| | 21:00 to 22:00 | *35* | *33* | *28* | 42 | 40 | 37 | 39 | 37 | 33 | 32 | 29 | 26 | 31 | 28 | 22 | *30* | *27* | *23* | 31 | 28 | 23 | 32 | 29 | 25 |
| | 22:00 to 23:00 | *34* | *32* | *29* | 43 | 39 | 35 | 42 | 39 | 33 | 37 | 34 | 29 | 35 | 33 | 24 | *31* | *28* | *21* | 33 | 31 | 23 | 33 | 31 | 24 |
| | 23:00 to 0:00 | *38* | *36* | *29* | 42 | 39 | 33 | 41 | 37 | 30 | 41 | 39 | 36 | 37 | 34 | 26 | *29* | *28* | *22* | 33 | 32 | 24 | 31 | 30 | 23 |

NOTE: Measurements affected by inclement weather (wind >5m/s or rain >0mm) or other extraneous factors have been discounted from measurement summaries. Affected periods lasting ≤3 hours have been interpolated, with original data displayed in parentheses. For affected periods lasting >3 hours, the entire day has been invalidated as indicated with asterisked data.

## NM01 monitoring summary graph – Sheet 1



## NM01 monitoring summary – Sheet 2

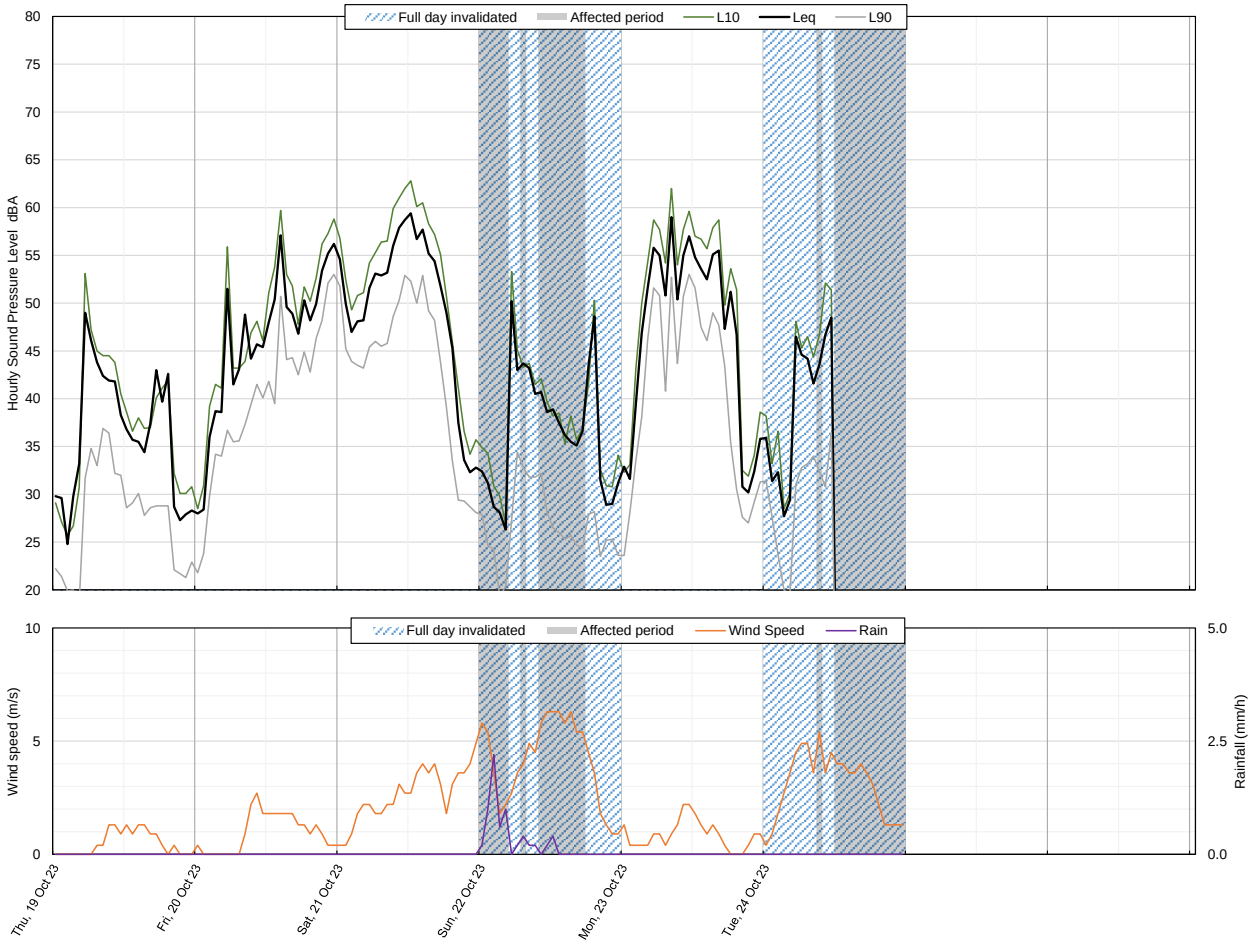
| | | | | | |
|---|---|---|---|---|---|
| Project No. | PS202847 | Date | 25/10/2023 | Sheet | 2 |
| Project Title | Urbis Mortlake | Engineer | IC | Rev | 1 |
| Location | Mortlake VIC | | | Type | LG |

| | |
|---|---|
| Address | 409 Boonerah Estate Road Mortlake VIC |
| Microphone Position | Height:1.8m |

| | | Thu, 19 Oct 2023 | | | Fri, 20 Oct 2023 | | | Sat, 21 Oct 2023 | | | Sun, 22 Oct 2023 | | | Mon, 23 Oct 2023 | | | Tue, 24 Oct 2023 | | | Wed, 25 Oct 2023 | | | Thu, 26 Oct 2023 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | $L_{A10}$ | $L_{Aeq}$ | $L_{A90}$ | $L_{A10}$ | $L_{Aeq}$ | $L_{A90}$ | $L_{A10}$ | $L_{Aeq}$ | $L_{A90}$ | $L_{A10}$ | $L_{Aeq}$ | $L_{A90}$ | $L_{A10}$ | $L_{Aeq}$ | $L_{A90}$ | $L_{A10}$ | $L_{Aeq}$ | $L_{A90}$ | $L_{A10}$ | $L_{Aeq}$ | $L_{A90}$ | $L_{A10}$ | $L_{Aeq}$ | $L_{A90}$ |
| Daily Averages | $L_{A10,18h}$ (6am to 12am) | 39 | | | 51 | | | 53 | | | – | | | 51 | | | – | | | – | | | – | | |
| | $L_{A10,12h}$ (6am to 6pm) | 41 | | | 49 | | | 59 | | | – | | | 57 | | | – | | | – | | | – | | |
| | $L_{Aeq,15h}$ (7am to 10pm) | | 40 | | | 50 | | | 55 | | | – | | | 54 | | | – | | | – | | | – | | |
| | $L_{Aeq,16h}$ (6am to 10pm) | | 41 | | | 50 | | | 55 | | | – | | | 54 | | | – | | | – | | | – | | |
| | $L_{Aeq,9h}$ (10pm to 7am) | | 43 | | | 53 | | | – | | | – | | | – | | | – | | | – | | | – | | |
| | $L_{Aeq,8h}$ (10pm to 6am) | | 43 | | | 53 | | | – | | | – | | | – | | | – | | | – | | | – | | |
| | $L_{A90,Day}$ (7am to 6pm) | | | 31 | | | 42 | | | 49 | | | – | | | 48 | | | – | | | – | | | – | |
| | $L_{A90,Evening}$ (6pm to 10pm) | | | 25 | | | 46 | | | 33 | | | – | | | 30 | | | – | | | – | | | – | |
| | $L_{A90,Night}$ (10pm to 7am) | | | 29 | | | 47 | | | – | | | – | | | – | | | – | | | – | | | – | |
| Hourly Values | 00:00 to 01:00 | 29 | 30 | 22 | 29 | 28 | 22 | 57 | 55 | 52 | *35* | *32* | *28* | 32 | 33 | 24 | *38* | *36* | *31* | 0 | 0 | 0 | 0 | 0 | 0 |
| | 01:00 to 02:00 | 27 | 30 | 21 | 31 | 28 | 24 | 52 | 50 | 45 | *34* | *31* | *25* | 33 | 32 | 28 | *33* | *31* | *28* | 0 | 0 | 0 | 0 | 0 | 0 |
| | 02:00 to 03:00 | 26 | 25 | 20 | 39 | 36 | 30 | 49 | 47 | 44 | *31* | *29* | *24* | 43 | 39 | 34 | *37* | *32* | *24* | 0 | 0 | 0 | 0 | 0 | 0 |
| | 03:00 to 04:00 | 27 | 30 | 20 | 42 | 39 | 34 | 51 | 48 | 44 | *30* | *28* | *19* | 50 | 47 | 38 | *29* | *28* | *20* | 0 | 0 | 0 | 0 | 0 | 0 |
| | 04:00 to 05:00 | 31 | 33 | 19 | 41 | 39 | 34 | 51 | 48 | 43 | *27* | *26* | *20* | 54 | 52 | 46 | *30* | *29* | *20* | 0 | 0 | 0 | 0 | 0 | 0 |
| | 05:00 to 06:00 | 53 | 49 | 32 | 56 | 52 | 37 | 54 | 52 | 45 | *53* | *50* | *27* | 59 | 56 | 52 | *48* | *47* | *31* | 0 | 0 | 0 | 0 | 0 | 0 |
| | 06:00 to 07:00 | 47 | 46 | 35 | 43 | 42 | 36 | 55 | 53 | 46 | *45* | *43* | *34* | 58 | 55 | 51 | *45* | *45* | *33* | 0 | 0 | 0 | 0 | 0 | 0 |
| | 07:00 to 08:00 | 45 | 44 | 33 | 43 | 43 | 36 | 56 | 53 | 46 | *43* | *44* | *33* | 54 | 51 | 41 | *47* | *44* | *33* | 0 | 0 | 0 | 0 | 0 | 0 |
| | 08:00 to 09:00 | 45 | 42 | 37 | 44 | 49 | 37 | 57 | 53 | 46 | *44* | *43* | *32* | 62 | 59 | 53 | *44* | *42* | *34* | 0 | 0 | 0 | 0 | 0 | 0 |
| | 09:00 to 10:00 | 45 | 42 | 36 | 47 | 44 | 39 | 60 | 56 | 49 | *42* | *41* | *32* | 54 | 50 | 44 | *47* | *44* | *32* | 0 | 0 | 0 | 0 | 0 | 0 |
| | 10:00 to 11:00 | 44 | 42 | 32 | 48 | 46 | 42 | 61 | 58 | 50 | *42* | *41* | *32* | 58 | 55 | 51 | *52* | *47* | *31* | 0 | 0 | 0 | 0 | 0 | 0 |
| | 11:00 to 12:00 | 41 | 38 | 32 | 46 | 45 | 40 | 62 | 59 | 53 | *40* | *39* | *28* | 60 | 57 | 53 | *51* | *49* | *36* | 0 | 0 | 0 | 0 | 0 | 0 |
| | 12:00 to 13:00 | 39 | 37 | 29 | 51 | 48 | 42 | 63 | 59 | 52 | *38* | *39* | *27* | 57 | 55 | 52 | – | – | – | 0 | 0 | 0 | 0 | 0 | 0 |
| | 13:00 to 14:00 | 37 | 36 | 29 | 54 | 50 | 40 | 60 | 57 | 50 | *39* | *38* | *26* | 57 | 54 | 48 | – | – | – | 0 | 0 | 0 | 0 | 0 | 0 |
| | 14:00 to 15:00 | 38 | 36 | 30 | 60 | 57 | 51 | 61 | 58 | 53 | *35* | *36* | *25* | 56 | 53 | 46 | – | – | – | 0 | 0 | 0 | 0 | 0 | 0 |
| | 15:00 to 16:00 | 37 | 34 | 28 | 53 | 50 | 44 | 58 | 55 | 49 | *38* | *36* | *26* | 58 | 55 | 49 | – | – | – | 0 | 0 | 0 | 0 | 0 | 0 |
| | 16:00 to 17:00 | 37 | 37 | 29 | 52 | 49 | 44 | 57 | 54 | 48 | *36* | *35* | *25* | 59 | 56 | 48 | – | – | – | 0 | 0 | 0 | 0 | 0 | 0 |
| | 17:00 to 18:00 | 40 | 43 | 29 | 48 | 47 | 43 | 55 | 52 | 44 | *37* | *37* | *24* | 50 | 47 | 43 | – | – | – | 0 | 0 | 0 | 0 | 0 | 0 |
| | 18:00 to 19:00 | 41 | 40 | 29 | 52 | 50 | 45 | 51 | 49 | 39 | *42* | *43* | *28* | 54 | 51 | 35 | – | – | – | 0 | 0 | 0 | 0 | 0 | 0 |
| | 19:00 to 20:00 | 42 | 43 | 29 | 50 | 48 | 43 | 46 | 45 | 34 | *50* | *49* | *28* | 51 | 47 | 31 | – | – | – | 0 | 0 | 0 | 0 | 0 | 0 |
| | 20:00 to 21:00 | 32 | 29 | 22 | 53 | 50 | 46 | 41 | 38 | 29 | *33* | *32* | *24* | 33 | 31 | 28 | – | – | – | 0 | 0 | 0 | 0 | 0 | 0 |
| | 21:00 to 22:00 | 30 | 27 | 22 | 56 | 53 | 48 | 37 | 34 | 29 | *31* | *29* | *25* | 32 | 30 | 27 | – | – | – | 0 | 0 | 0 | 0 | 0 | 0 |
| | 22:00 to 23:00 | 30 | 28 | 21 | 57 | 55 | 52 | 34 | 32 | 29 | *31* | *29* | *25* | 34 | 32 | 29 | – | – | – | 0 | 0 | 0 | 0 | 0 | 0 |
| | 23:00 to 0:00 | 31 | 28 | 23 | 59 | 56 | 53 | 36 | 33 | 28 | *34* | *31* | *24* | 39 | 36 | 31 | – | – | – | 0 | 0 | 0 | 0 | 0 | 0 |

NOTE: Measurements affected by inclement weather (wind >5m/s or rain >0mm) or other extraneous factors have been discounted from measurement summaries. Affected periods lasting ≤3 hours have been interpolated, with original data displayed in parentheses. For affected periods lasting >3 hours, the entire day has been invalidated as indicated with asterisked data.

## NM01 monitoring summary graph – Sheet 2



# APPENDIX B

## PREDICTED OPERATIONAL NOISE LEVELS AND ASSESSMENT FOR ALL RECEIVERS

| NSA ID | ADDRESS | NOISE LIMIT $L_{EQ(30\ MIN)}$ dBA | | | PREDICTED NOISE LEVEL[1] $L_{EQ(30\ MIN)}$ dBA | |
|---|---|---|---|---|---|---|
| | | DAY | EVENING | NIGHT | DAY | NIGHT |
| 1 | 300 Boonerah Estate Road | 45 | 39 | 34 | <25[2] | <25[2] |
| 6 | 490 Hamilton Highway | | | | 27[2] | 26[2] |
| 16 | 890 Connewarren Lane | | | | 32[3] | 32[3] |
| 17 | 640 Boonerah Estate Road | | | | <25[2] | <25[2] |
| 18 | 570 Connewarren Lane | | | | <25[2] | <25[2] |
| 19 | 409 Connewarren Lane | | | | <25[2] | <25[2] |
| 21 | 239 Connewarren Lane | | | | <25[2] | <25[2] |
| 22 | 35 Thulborns Lane | | | | 29[2] | 28[2] |
| 23 | 73 Kings Lane | | | | <25[2] | <25[2] |
| 38 | 1168 Hamilton Highway | | | | <25[2] | <25[2] |
| 39 | 19 Woodcutters Lane | | | | <25[2] | <25[2] |
| 40 | 30 Woodcutters Lane | | | | <25[2] | <25[2] |
| 49 | 69 Holdsworths Lane | | | | <25[2] | <25[2] |
| 50 | 8 Arnotts Lane | | | | <25[2] | <25[2] |
| 51 | 174 Prentices Lane | | | | <25[2] | <25[2] |
| 64 | 593 Hamilton Highway | | | | 33[4] | 33[4] |
| 63 | 1 Boorook Street | | | | <25[2] | <25[2] |
| 59 | 1 Dunlop Street | | | | <25[2] | <25[2] |
| 55 | 1 Hopetoun Street | | | | <25[2] | <25[2] |
| 57 | 1 Kerr Street | | | | <25[2] | <25[2] |
| 58 | 1 Townsend Street | | | | <25[2] | <25[2] |
| 52 | 2 Waggs Lane | | | | <25[2] | <25[2] |
| 34 | 19 Boonerah Road | | | | <25[2] | <25[2] |
| 10 | 19 Steeles Lane | | | | <25[2] | <25[2] |
| 53 | 27 Cairnlea Lane | | | | <25[2] | <25[2] |
| 60 | 28 Scott Street | | | | <25[2] | <25[2] |
| 48 | 33 North Road | | | | <25[2] | <25[2] |
| 61 | 46 Mill St | | | | <25[2] | <25[2] |
| 32 | 49 Boonerah Road | | | | <25[2] | <25[2] |
| 62 | 55 Spring Street | | | | <25[2] | <25[2] |
| 54 | 74 Waggs Lane | | | | <25[2] | <25[2] |

| NSA ID | ADDRESS | NOISE LIMIT $L_{EQ(30\ MIN)}$ dBA | | | PREDICTED NOISE LEVEL[1] $L_{EQ(30\ MIN)}$ dBA | |
|---|---|---|---|---|---|---|
| | | DAY | EVENING | NIGHT | DAY | NIGHT |
| 3 | 81 Boonerah Road | 45 | 39 | 34 | <25[2] | <25[2] |
| 44 | 109 Crearers Lane | | | | <25[2] | <25[2] |
| 9 | 166 Steeles Lane | | | | <25[2] | <25[2] |
| 43 | 210 Hexham-chatsworth Road | | | | <25[2] | <25[2] |
| 42 | 292 Hexham-chatsworth Road | | | | <25[2] | <25[2] |
| 13 | 302 Mortlake-Ararat Road | | | | <25[2] | <25[2] |
| 41 | 350 Hexham-chatsworth Road | | | | <25[2] | <25[2] |
| 45 | 359 Woodcutters Lane | | | | <25[2] | <25[2] |
| 12 | 402 Mortlake-Ararat Road | | | | <25[2] | <25[2] |
| 27 | 448 Reichmans Lane | | | | <25[2] | <25[2] |
| 46 | 453 Hexham-woorndoo Road | | | | <25[2] | <25[2] |
| 7 | 583 Mortlake-ararat Road | | | | <25[2] | <25[2] |
| 25 | 689 Connewarren Lane | | | | <25[2] | <25[2] |
| 37 | 1350 Hamilton Highway | | | | <25[2] | <25[2] |
| 33 | 1386 Hamilton Highway | | | | <25[2] | <25[2] |
| 36 | 1426 Hamilton Highway | | | | <25[2] | <25[2] |
| 35 | 1455 Hamilton Highway | | | | <25[2] | <25[2] |
| 2 | 2399 Woolsthorpe-Hexham Road | | | | <25[2] | <25[2] |
| 31 | 4565 Hopkins Highway | | | | <25[2] | <25[2] |
| 30 | 4580 Hopkins Highway | | | | <25[2] | <25[2] |
| 29 | 4660 Hopkins Highway | | | | <25[2] | <25[2] |
| 26 | Unidentified receiver | | | | <25[2] | <25[2] |

(1) Includes +2 dB penalty to account for potential modelling inaccuracy

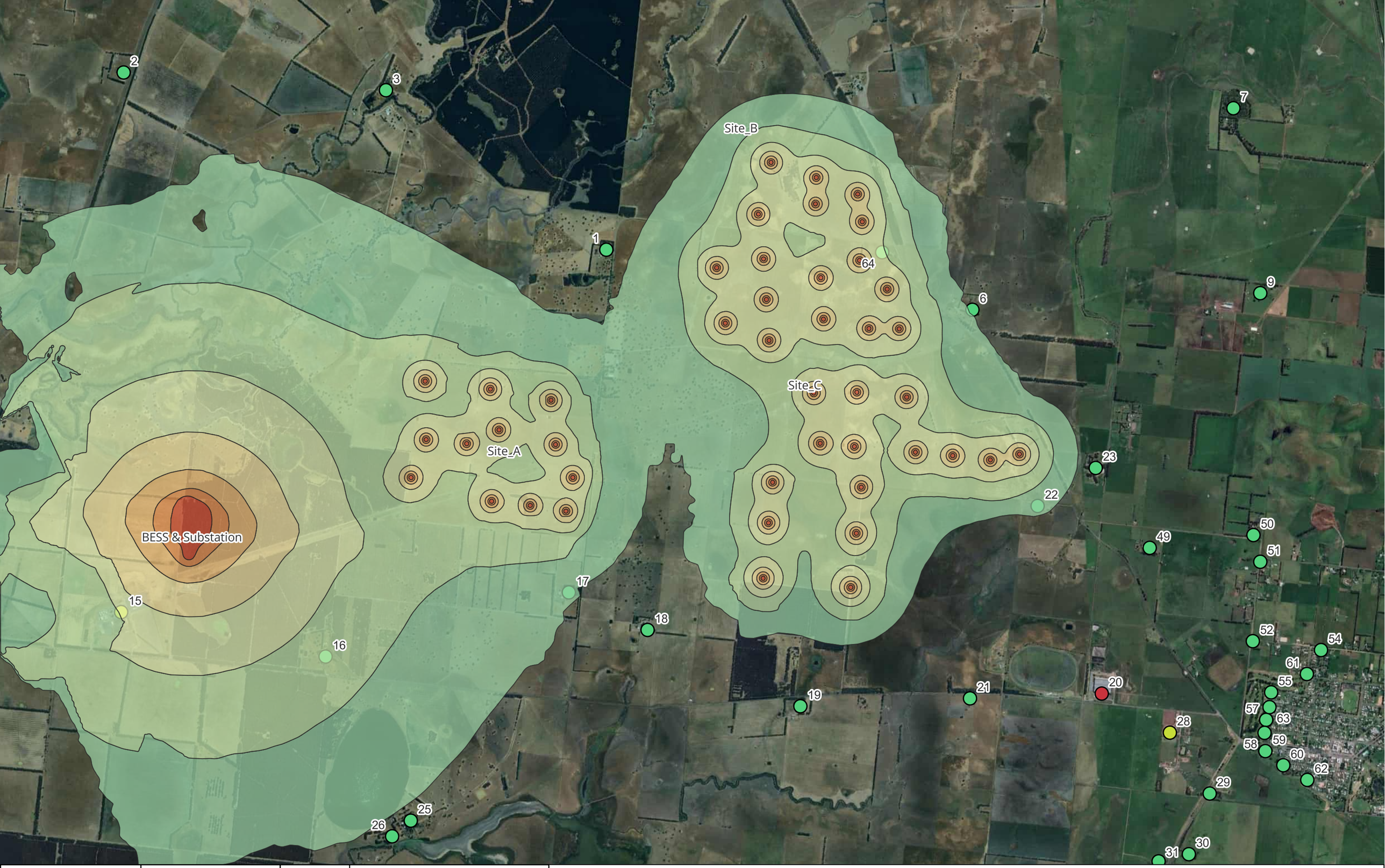
(2) Includes +5 dB penalty for potential tonal characteristics

(3) Includes +2 dB penalty for potential tonal characteristics

(4) Includes no penalty for tonal characteristics

# APPENDIX C

## NOISE CONTOUR MAPS




| | | |
|---|---|---|
| Appendix C | Author: JF | N |
| Date: 03/05/2024 | Approved by: BI | |

**To be read in conjunction with WSP document:** PS202847 Mortlake Solar Farm

Map Source: Google Maps



0 400 800 1,200 m

1:33,000 at A3

**Scale**

## Legend

**Predicted Noise Level, Leq dBA**

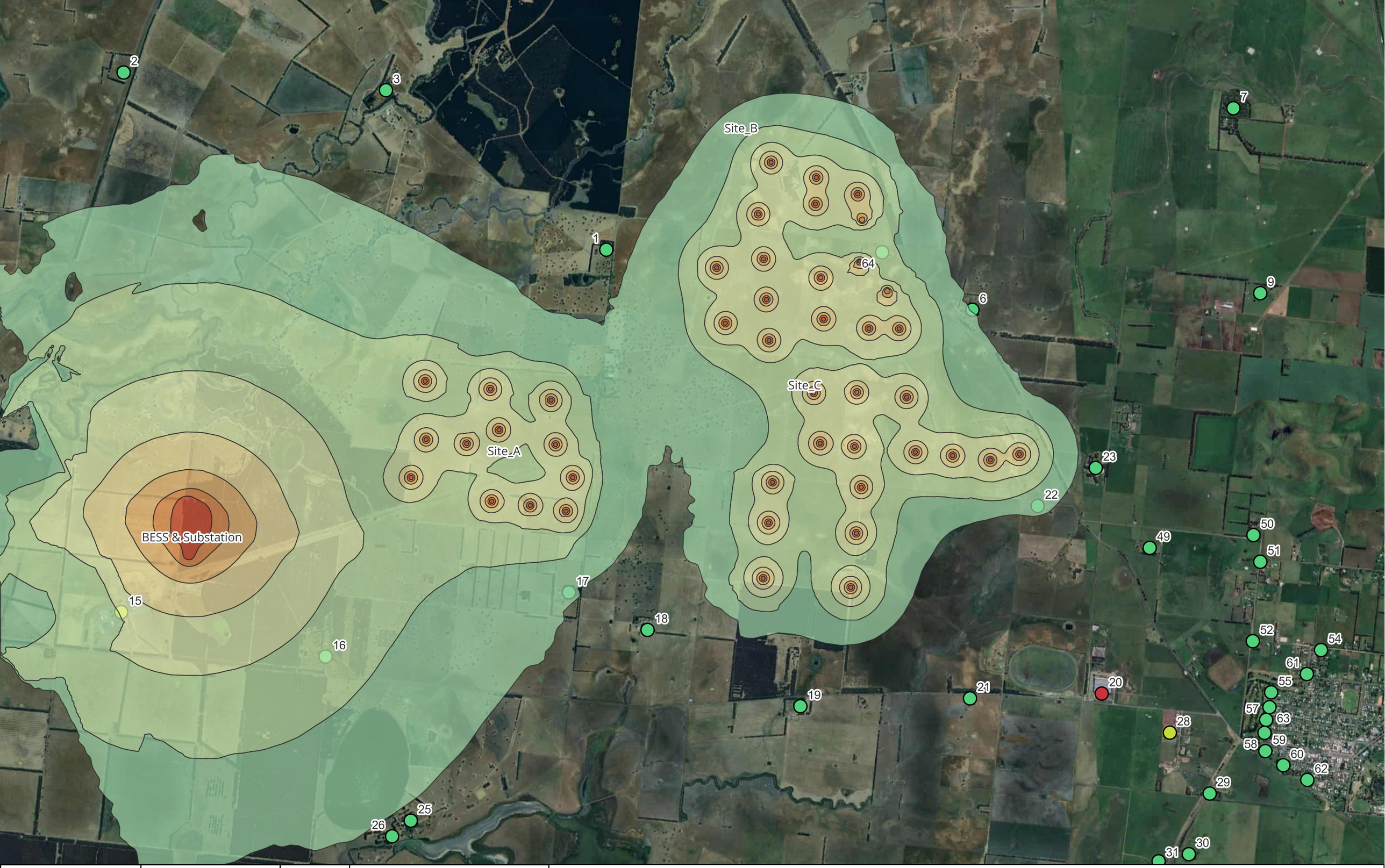
- 20 to 25
- 25 to 30
- 30 to 35
- 35 to 40
- 40 to 45
- 45 to 50
- > 50

**Noise Sensitive Receivers**

- Industrial
- Recreational Area
- Residential

# Mortlake Solar Farm Noise Impact Assessment

Noise Contour Map - Night (unmitigated)




| | | |
|---|---|---|
| Appendix C | Author: JF | N |
| Date: 03/05/2024 | Approved by: BI | |

**To be read in conjunction with WSP document:** PS202847 Mortlake Solar Farm

Map Source: Google Maps



0 400 800 1,200 m

1:33,000 at A3

**Scale**

## Legend

**Predicted Noise Level, Leq dBA**

- 20 to 25
- 25 to 30
- 30 to 35
- 35 to 40
- 40 to 45
- 45 to 50
- > 50

**Noise Sensitive Receivers**

- Industrial
- Recreational Area
- Residential

# Mortlake Solar Farm Noise Impact Assessment

Noise Contour Map - Night (mitigated)

wsp

# APPENDIX D

## DETAILED NOISE CHACRTERISTICS ASSESSMENTS

| Receiver | | 25Hz dB(A) | 31.5Hz dB(A | 40Hz dB(A) | 50Hz dB(A) | 63Hz dB(A) | 80Hz dB(A) | 100Hz dB(A) | 125Hz dB(A) | 160Hz dB(A) | 200Hz dB(A) | 250Hz dB(A) | 315Hz dB(A) | 400Hz dB(A) | 500Hz dB(A) | 630Hz dB(A) | 800Hz dB(A) | 1kHz dB(A) | 1.25kHz dB(A | 1.6kHz dB(A) | 2kHz dB(A) | 2.5kHz dB(A | 3.15kHz dB(A | 4kHz dB(A) | 5kHz dB(A) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 890 Connewarren Ln | Predicted LAeq | -13 | -9 | -5.3 | 3.1 | 1.1 | 2.7 | 16.8 | 4.8 | 6 | 11.9 | 22.2 | 15.9 | 16.7 | 18.9 | 16.2 | 16.8 | 16.8 | 12.5 | 11.9 | 5.1 | -5.9 | -20.1 | -42.4 | -75.9 |
| | Bei | | 0.2 | -2.4 | 5.2 | -1.8 | -6.3 | 13.1 | -6.6 | -2.4 | -2.2 | 8.3 | -3.6 | -0.7 | 2.5 | -1.7 | 0.3 | 2.2 | -1.9 | 3.1 | 2.1 | 1.6 | 4.1 | 5.6 | -0.8 |
| | TFi | | 0 | 0 | 9.25 | 0 | 0 | 19.0625 | 0 | 0 | 0 | 13.1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6.625 | 0 | 0 | 0 | 0 | 0 |
| | *Corrected spectrum* | *0.0* | *0.0* | *0.0* | *10.2* | *1.1* | *2.7* | *21.1* | *4.8* | *6.0* | *11.9* | *22.7* | *15.9* | *16.7* | *18.9* | *16.2* | *16.8* | *16.8* | *12.5* | *13.0* | *5.1* | *0.0* | *0.0* | *0.0* | *0.0* |
| | Uncorrected LAeq | 28 | | | | | | | | | | | | | | | | | | | | | | | |
| | Corrected LAeq | 28 | | | | | | | | | | | | | | | | | | | | | | | |
| | Difference | 0.8 | | 2 dB correction | | 30 | | | | | | | | | | | | | | | | | | | |