



**IGS** INTEGRATED  
GROUP  
SERVICES

Value | Innovation | Trust

St Leonards

21-41 Canberra Avenue & 18-32 Holdsworth Ave  
St Leonards South

---

## **Construction Noise & Vibration Management Specification**

**2 June 2021**  
**Project No. VE-N20\_243**



Suite 1.11 / 75 Mary Street  
 St Peters NSW 2044  
 ABN: 68 163 019 029  
 (02) 8488 4600  
 admin@igs.com.au

## Approvals

|                    |                                           |
|--------------------|-------------------------------------------|
| <b>PDS Group:</b>  | Sign: .....<br>Date: .....<br>Name: ..... |
| <b>Top Spring:</b> | Sign: .....<br>Date: .....<br>Name: ..... |
| <b>IGS:</b>        | Sign: .....<br>Date: .....<br>Name: ..... |

## Document Control

| Version | Date       | Issue        | Author     |    | Reviewer    |    |
|---------|------------|--------------|------------|----|-------------|----|
| 1.0     | 14/05/2021 | For Approval | Oudai Awad | OA | Mays Chalak | MC |
| 2       | 02.06.2021 | For Approval | Oudai Awad | OA | Mays Chalak | MC |
|         |            |              |            |    |             |    |

"© 2021 IGS Pty Ltd All Rights Reserved. Copyright in the whole and every part of this document belongs to IGS Pty Ltd and may not be used, sold, transferred, copied or reproduced in whole or in part in any manner or form or in or on any media to any person without the prior written consent of IGS Pty Ltd."



# Contents

|                                                            |           |
|------------------------------------------------------------|-----------|
| <b>1 INTRODUCTION .....</b>                                | <b>5</b>  |
| 1.1 Development Description .....                          | 6         |
| <b>2 EXISTING ACOUSTIC ENVIRONMENT .....</b>               | <b>7</b>  |
| 2.1 Noise Survey Results .....                             | 8         |
| <b>3 CONSTRUCTION NOISE AND VIBRATION ASSESSMENT .....</b> | <b>9</b>  |
| 3.1 Construction Noise .....                               | 9         |
| 3.2 Construction Noise Assessment Levels .....             | 9         |
| 3.2 Vibration Criteria .....                               | 11        |
| 3.3 Ground-Borne Noise Criteria .....                      | 14        |
| 3.4 Project Vibration Impacts .....                        | 14        |
| <b>4 CONSTRUCTION AND VIBRATION ASSESSMENT .....</b>       | <b>15</b> |
| 4.1 Construction Noise Assessment .....                    | 15        |
| 4.2 Construction Traffic Noise Assessment .....            | 21        |
| 4.3 Vibration Assessment .....                             | 21        |
| <b>NOISE AND VIBRATION MANAGEMENT PLAN .....</b>           | <b>23</b> |
| 5.1 Allocation of Noise Management Procedures .....        | 24        |
| 5.2 Allocation of Vibration Management Procedures .....    | 24        |
| 5.3 General Comments .....                                 | 25        |
| 5.4 Vibration Mitigation Measures .....                    | 27        |
| 5.5 Noise and Vibration Monitoring .....                   | 27        |
| <b>COMMUNITY ENGAGEMENT AND CONSULTATION .....</b>         | <b>28</b> |
| 6.1 Complaints Management System .....                     | 29        |
| 6.2 Contingency Plans .....                                | 29        |
| <b>CONCLUSION .....</b>                                    | <b>30</b> |
| <b>APPENDIX A: ACOUSTIC GLOSSARY .....</b>                 | <b>31</b> |
| <b>APPENDIX B – NOISE LOGGING RESULTS .....</b>            | <b>32</b> |



## TABLES

|                 |                                                                                                               |    |
|-----------------|---------------------------------------------------------------------------------------------------------------|----|
| <b>Table 1</b>  | Receiver Locations .....                                                                                      | 6  |
| <b>Table 2</b>  | Results of the Attended Noise Survey at the Site.....                                                         | 8  |
| <b>Table 3</b>  | Results of Noise Logging at the Site.....                                                                     | 8  |
| <b>Table 4</b>  | Noise Management Levels from Construction – Quantitative Assessment.....                                      | 10 |
| <b>Table 5</b>  | Continuous vibration acceleration criteria (m/s <sup>2</sup> ) 1 Hz-80 Hz .....                               | 11 |
| <b>Table 6</b>  | Impulsive vibration acceleration criteria (m/s <sup>2</sup> ) 1 Hz-80 Hz.....                                 | 11 |
| <b>Table 7</b>  | Intermittent vibration impacts criteria (m/s <sup>1.75</sup> ) 1 Hz-80 Hz .....                               | 12 |
| <b>Table 8</b>  | Transient vibration criteria as per standard BS 7385 Part 2 - 1993 .....                                      | 12 |
| <b>Table 9</b>  | Structural damage criteria as per standard DIN 4150 Part 3 - 1999.....                                        | 14 |
| <b>Table 10</b> | Summary of predicted sound power levels .....                                                                 | 15 |
| <b>Table 11</b> | Receiver 1 – To the North of the site - Summary of predicted construction noise levels – STANDARD HOURS ..... | 17 |
| <b>Table 12</b> | Receiver 2 – To the West of the site - Summary of predicted construction noise levels – STANDARD HOURS .....  | 18 |
| <b>Table 13</b> | Receiver 4 - Summary of predicted construction noise levels – STANDARD HOURS .....                            | 19 |
| <b>Table 14</b> | Recommended indicative safe working distances for vibration intensive plant .....                             | 22 |
| <b>Table 15</b> | Vibration Mitigation Requirements .....                                                                       | 22 |
| <b>Table 16</b> | Summary of mitigation procedures .....                                                                        | 23 |
| <b>Table 17</b> | Allocation of noise management procedures.....                                                                | 24 |
| <b>Table 18</b> | Allocation of vibration management procedures .....                                                           | 24 |

## FIGURES

|                 |                                                                                      |    |
|-----------------|--------------------------------------------------------------------------------------|----|
| <b>Figure 1</b> | Site Map, Measurement Locations and Surrounding Receivers .....                      | 6  |
| <b>Figure 2</b> | Noise logger location on the site.....                                               | 7  |
| <b>Figure 3</b> | BS 7385 Part 2 – 1993, graph of transient vibration values for cosmetic damage ..... | 13 |



## 1 INTRODUCTION

Integrated Group Services has been engaged to prepare a Construction Noise and Vibration Management Plan (CNVMP) for the construction activities required to be undertaken as part of the St Leonards project located at 21-41 Canberra Avenue and 18-32 Holdsworth Avenue, St Leonards South.

This CNVMP has been prepared to satisfy the requirements of the requirements of the EPA *Interim Construction Noise Guideline*.

Onsite unattended and attended noise levels have previously been determined for the project as part of the *Noise Impact Assessment* undertaken for the site. The results of the noise survey undertaken in the *Noise Impact Assessment* have been used as the basis of this assessment and are presented in this report.

The proposed development includes the development of a residential development. As part of the proposed constructions to be undertaken on the site the project will require the removal of the exiting buildings on the site, excavation and construction of the proposed multistorey residential buildings.

A glossary of acoustic terminology used throughout this report is included in Appendix A.



## 1.1 Development Description

The site located at 21-41 Canberra Avenue and 18-32 Holdsworth Avenue, St Leonards South project is located within the block bound by Canberra Avenue to the east, River Road to the south and Holdsworth Avenue to the west. The surrounding receivers to the site include existing and future residential properties.

The site location is detailed in Figure 1 below.

**Figure 1 Site Map, Measurement Locations and Surrounding Receivers**



The surrounding receivers potentially affected by construction works are identified below.

**Table 1 Receiver Locations**

| Receiver Number | Receiver Type | Address                                     | Cardinal Direction       |
|-----------------|---------------|---------------------------------------------|--------------------------|
| Receiver 1      | Residential   | 29 Canberra Avenue and 28 Holdsworth Avenue | To the north of the site |
| Receiver 2      | Residential   | 25-31 Holdsworth Avenue and 42 River Road   | To the west of the site  |
| Receiver 3      | Residential   | 11 Russel Street                            | To the south of the site |

A map showing the site location, receiver locations and all measurement locations is provided in Figure 1 above.



## 2 EXISTING ACOUSTIC ENVIRONMENT

As part of the previously completed *Noise Impact Assessment of the site* an acoustic survey of the existing acoustic environment at the site was undertaken, which have been used as the basis of the Construction Noise Assessment.

The survey included attended noise level measurements at the site, during various times of the day on the 21<sup>st</sup> January, 2021 as well as long term unattended noise logging which was undertaken between the 14<sup>th</sup> and 21<sup>st</sup> of January, 2021. During the testing periods there was no inclement weather periods.

The results of noise logging undertaken at the site are included in Appendix B.

Noise logging was undertaken using a Rion NL-42EX type noise monitor with serial number 00998079 and calibration with calibration number C19678. The noise logger was located to the rear of the existing property as detailed in Figure 1 above to obtain representative background noise levels. The logger was positioned such that it included façade corrects which have been applied in this assessment. Figure 2 below details the location of the noise logger on the site.



**Figure 2 Noise logger location on the site**

Attended noise level testing was conducted using a Bruel and Kjaer 2236C type meter. The meter was calibrated before and after testing and no significant drift was recorded.



## 2.1 Noise Survey Results

The attended and unattended noise locations were selected to obtain suitable noise levels for the assessment of background noise levels ( $L_{90(t)}$ ) as well as the existing ambient noise levels ( $L_{eq(t)}$ ). The results of the acoustic survey are detailed in the tables below which have been used as the basis of this assessment.

**Table 2 Results of the Attended Noise Survey at the Site**

| Measurement Location                                     | Time of the Measurement | $L_{Aeq, 15min}$ dB(A) | $L_{A90, 15min}$ dB(A) | Comments                                                     |
|----------------------------------------------------------|-------------------------|------------------------|------------------------|--------------------------------------------------------------|
| Attended noise measurement location on Canberra Avenue   | 9.30am to 9.45 am       | 54                     | 45                     | Noise resulting from traffic<br>Noise on surrounding streets |
| Attended noise measurement location on Holdsworth Avenue | 9.50am to 10.05 am      | 52                     | 43                     |                                                              |

**Table 3 Results of Noise Logging at the Site**

| Measurement Location                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Time of Measurement | Maximum Repeatable $L_{Aeq, 15min}$ dB(A) | Representable Background noise Level (RBL) $L_{A90, 15min}$ dB(A) |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|-------------------------------------------|-------------------------------------------------------------------|
| Noise logger location, see figure 1 above                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Day                 | 54                                        | 45                                                                |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Evening             | 46                                        | 41                                                                |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Night               | 45                                        | 31                                                                |
| <p><i>Note 1: For Monday to Saturday, Daytime 7:00 am – 6:00 pm; Evening 6:00 pm – 10:00 pm; Night-time 10:00 pm – 7:00 am. On Sundays and Public Holidays, Daytime 8:00 am – 6:00 pm; Evening 6:00 pm – 10:00 pm; Night-time 10:00 pm – 8:00 am</i></p> <p><i>Note 2: The <math>L_{A90}</math> noise level is representative of the "average minimum background sound level" (in the absence of the source under consideration), or simply the background level.</i></p> <p><i>Note 3: The <math>L_{Aeq}</math> is the energy average sound level. It is defined as the steady sound level that contains the same amount of acoustical energy as a given time-varying sound.</i></p> |                     |                                           |                                                                   |



### 3 CONSTRUCTION NOISE AND VIBRATION ASSESSMENT

This section of the report details the assessment of construction noise and vibration resulting from the required construction activities to be undertaken on the site.

#### 3.1 Construction Noise

The assessment of construction noise from the site has been undertaken in accordance with the EPA's *Interim Construction Noise Guideline* which includes the requirements detailed in this section of the report.

##### 3.1.1 EPA Interim Construction Noise Guideline Recommended Working Hours

The EPA's Interim Construction Noise Guideline defines normal day time hours as the following:

#### 2.2 Recommended standard hours

The recommended standard hours for construction work are shown in Table 1; however, they are not mandatory. There are some situations, as described below, where construction work may need to be undertaken outside of these hours. The likely noise impacts and the ability to undertake works during the recommended standard hours should be considered when scheduling work.

**Table 1:** Recommended standard hours for construction work

| Work type           | Recommended standard hours of work*                                                                 |
|---------------------|-----------------------------------------------------------------------------------------------------|
| Normal construction | Monday to Friday 7 am to 6 pm<br>Saturday 8 am to 1 pm<br>No work on Sundays or public holidays     |
| Blasting            | Monday to Friday 9 am to 5 pm<br>Saturday 9 am to 1 pm<br>No blasting on Sundays or public holidays |

\* The relevant authority (consent, determining or regulatory) may impose more or less stringent construction hours.

Construction works on the site will be undertaken in accordance with the hours approved and included in the projects *Conditions of Consent*.

#### 3.2 Construction Noise Assessment Levels

Noise criteria for construction activities are discussed in the *Interim Construction Noise Guideline* (ICNG). The ICNG also recommends procedures to address potential impacts of construction noise on residences and other sensitive land uses. The main objectives of the ICNG are summarised as follows:

- Promote a clear understanding of ways to identify and minimise noise from construction works;
- Focus on applying all "feasible" and "reasonable" work practices to minimise construction noise impacts;
- Encourage construction to be undertaken only during the recommended standard hours unless approval is given for works that cannot be undertaken during these hours;
- Streamline the assessment and approval stages and reduce time spent dealing with complaints at the project implementation stage; and
- Provide flexibility in selecting site-specific feasible and reasonable work practices in order to minimise noise impacts.

The ICNG contains a quantitative assessment method which is applicable to this project. Guidance levels are given for airborne noise at residences and other sensitive land uses.

The quantitative assessment method involves predicting noise levels at sensitive receivers and comparing them with the Noise Management Levels (NMLs). The NML affectation categories for receivers have been reproduced from the guideline and are listed in the table below.

**Table 4 Noise Management Levels from Construction – Quantitative Assessment**

| Receiver Type                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Time of Day                                                                                         | Noise Management Level<br>$L_{Aeq}(15\text{minute})^{1,2}$ | How To Apply                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------|------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Residential                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Approved working hours of the project, including those included in the <i>Conditions of Consent</i> | Noise affected<br>RBL + 10 dB                              | <p>The noise affected level represents the point above which there may be some community reaction to noise.</p> <ul style="list-style-type: none"> <li>Where the predicted or measured <math>L_{Aeq}(15\text{minute})</math> is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level.</li> </ul> <p>The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.</p>                                                                                                                                                                                                           |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                     | Highly noise affected<br>75 dBA                            | <p>The highly noise affected level represents the point above which there may be strong community reaction to noise.</p> <ul style="list-style-type: none"> <li>Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities can occur, taking into account:               <ol style="list-style-type: none"> <li>Times identified by the community when they are less sensitive to noise (such as before and after school for works near schools, or mid-morning or mid-afternoon for works near residences.</li> <li>If the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.</li> </ol> </li> </ul> |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Outside recommended standard hours                                                                  | Noise affected<br>RBL + 5 dB                               | <p>A strong justification would typically be required for works outside the recommended standard hours.</p> <p>The proponent should apply all feasible and reasonable work practices to meet the noise affected level.</p> <p>Where all feasible and reasonable practices have been applied and noise is more than 5 dB above the noise affected level, the proponent should negotiate with the community.</p>                                                                                                                                                                                                                                                                                                                                                                               |
| Commercial and retail outlets                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | When in use                                                                                         | Highly noise affected<br>70 dBA                            | The external noise levels should be assessed at the most-affected occupied point of the premises                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <p><i>Note 1 Noise levels apply at the property boundary that is most exposed to construction noise, and at a height of 1.5 m above ground level. If the property boundary is more than 30 m from the residence, the location for measuring or predicting noise levels is at the most noise-affected point within 30 m of the residence. Noise levels may be higher at upper floors of the noise affected residence.</i></p> <p><i>Note 2 The RBL is the overall single-figure background noise level measured in each relevant assessment period (during or outside the recommended standard hours). The term RBL is described in detail in the NSW Industrial Noise Policy (EPA 2000).</i></p> |                                                                                                     |                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |



### 3.2 Vibration Criteria

Effects of ground borne vibration on buildings may be segregated into the following three categories:

- Human comfort – vibration in which the occupants or users of the building are inconvenienced or possibly disturbed. Refer to further discussion in Section 3.3.1.
- Effects on building contents – where vibration can cause damage to fixtures, fittings and other non-building related objects. Refer to further discussion in Section 3.3.2.
- Effects on building structures – where vibration can compromise the integrity of the building or structure itself. Refer to further discussion in Section 3.3.2.

#### 3.2.1 Vibration Criteria – Human Comfort

Vibration effects relating specifically to the human comfort aspects of the project are taken from the guideline titled *"Assessing Vibration – A Technical Guideline"* (AVTG) This type of impact can be further categorised and assessed using the appropriate criterion as follows:

- Continuous vibration – from uninterrupted sources (refer to Table 5).
- Impulsive vibration – up to three instances of sudden impact e.g. dropping heavy items, per monitoring period (refer to Table 6).
- Intermittent vibration – such as from drilling, compacting or activities that would result in continuous vibration if operated continuously (refer to Table 7).

**Table 5 Continuous vibration acceleration criteria (m/s<sup>2</sup>) 1 Hz-80 Hz**

| Location                                                         | Assessment period | Preferred Values |               | Maximum Values |               |
|------------------------------------------------------------------|-------------------|------------------|---------------|----------------|---------------|
|                                                                  |                   | z-axis           | x- and y-axis | z-axis         | x- and y-axis |
| Residences                                                       | Daytime           | 0.010            | 0.0071        | 0.020          | 0.014         |
|                                                                  | Night-time        | 0.007            | 0.005         | 0.014          | 0.010         |
| Offices, schools, educational institutions and places of worship | Day or night-time | 0.020            | 0.014         | 0.040          | 0.028         |
|                                                                  |                   | 0.04             | 0.029         | 0.080          | 0.058         |
| Workshops                                                        | Day or night-time | 0.04             | 0.029         | 0.080          | 0.058         |

**Table 6 Impulsive vibration acceleration criteria (m/s<sup>2</sup>) 1 Hz-80 Hz**

| Location                                                         | Assessment period | Preferred Values |               | Maximum Values |               |
|------------------------------------------------------------------|-------------------|------------------|---------------|----------------|---------------|
|                                                                  |                   | z-axis           | x- and y-axis | z-axis         | x- and y-axis |
| Residences                                                       | Daytime           | 0.30             | 0.21          | 0.60           | 0.42          |
|                                                                  | Night-time        | 0.10             | 0.071         | 0.20           | 0.14          |
| Offices, schools, educational institutions and places of worship | Day or night-time | 0.64             | 0.46          | 1.28           | 0.92          |
| Workshops                                                        | Day or night-time | 0.64             | 0.46          | 1.28           | 0.92          |

**Table 7 Intermittent vibration impacts criteria (m/s<sup>1.75</sup>) 1 Hz-80 Hz**

| Location                                                         | Daytime          |                | Night-time       |                |
|------------------------------------------------------------------|------------------|----------------|------------------|----------------|
|                                                                  | Preferred Values | Maximum Values | Preferred Values | Maximum Values |
| Residences                                                       | 0.20             | 0.40           | 0.13             | 0.26           |
| Offices, schools, educational institutions and places of worship | 0.40             | 0.80           | 0.40             | 0.80           |
| Workshops                                                        | 0.80             | 1.60           | 0.80             | 1.60           |

### 3.2.2 Vibration Criteria – Building Contents and Structure

The vibration effects on the building itself are assessed against international standards as follows:

- For transient vibration: British Standard BS 7385: Part 2-1993 "*Evaluation and measurement for vibration in buildings Part 2: Guide to damage levels from ground borne vibration*" (BSI 1993); and
- For continuous or repetitive vibration: German DIN 4150: Part 3 – 1999 "*Effects of Vibration on Structure*" (DIN 1999).

#### 3.2.2.1 Standard BS 7385 Part 2 - 1993

For transient vibration, as discussed in standard BS 7385 Part 2-1993, the criteria are based on peak particle velocity (mm/s) which is to be measured at the base of the building. These are summarised in Table 8 and illustrated in Figure 2.

**Table 8 Transient vibration criteria as per standard BS 7385 Part 2 - 1993**

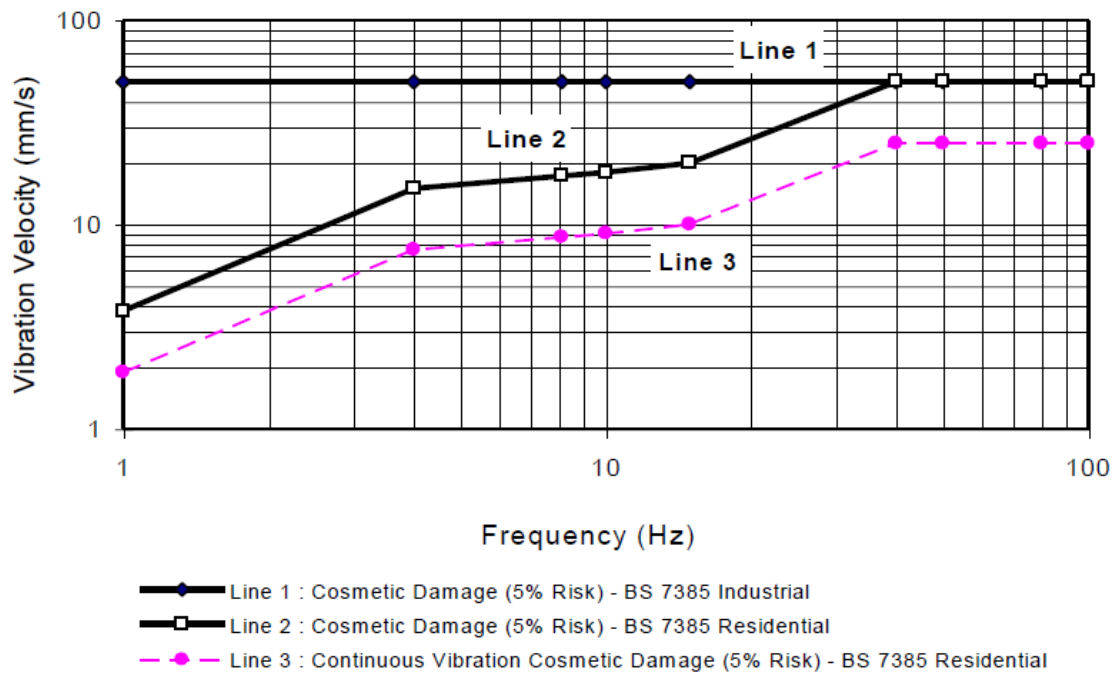
| Line in Figure 3 | Type of Building                                                                          | Peak Component Particle Velocity in Frequency Range of Predominant Pulse |                                                           |
|------------------|-------------------------------------------------------------------------------------------|--------------------------------------------------------------------------|-----------------------------------------------------------|
|                  |                                                                                           | 4 Hz to 15 Hz                                                            | 15 Hz and Above                                           |
| 1                | Reinforced or framed structures<br>Industrial and heavy commercial buildings              | 50 mm/s at 4 Hz and above                                                |                                                           |
| 2                | Unreinforced or light framed structures<br>Residential or light commercial type buildings | 15 mm/s at 4 Hz increasing to 20 mm/s at 15 Hz                           | 20 mm/s at 15 Hz increasing to 50 mm/s at 40 Hz and above |

Standard BS 7385 Part 2 – 1993 states that the values in Table 8 relate to transient vibration which does not cause resonant responses in buildings.

Where the dynamic loading caused by continuous vibration events is such as that results in dynamic magnification due to resonance (especially at the lower frequencies where lower guide values apply), then the values in Table 8 may need to be reduced by up to 50% (refer to Line 3 in Figure 2).



**Figure 3 BS 7385 Part 2 – 1993, graph of transient vibration values for cosmetic damage**



In the lower frequency region where strains associated with a given vibration velocity magnitude are higher, the recommended values corresponding to Line 2 are reduced. Below a frequency of 4 Hz where a high displacement is associated with the relatively low peak component particle velocity value, a maximum displacement of 0.6 mm (zero to peak) is recommended. This displacement is equivalent to a vibration velocity of 3.7 mm/s at 1 Hz.

The standard also states that minor damage is possible at vibration magnitudes which are greater than twice those given in Table 8, and major damage to a building structure may occur at values greater than four times the tabulated values.

Fatigue considerations are also addressed in the standard and it is concluded that unless calculation indicates that the magnitude and number of load reversals is significant (in respect of the fatigue life of building materials) then the values in Table 8 should not be reduced for fatigue considerations.



### 3.2.2.2 Standard DIN 4150 Part 3 - 1999

For continuous or repetitive vibration, standard DIN 4150 Part 3-1999 provides criteria based on values for peak particle velocity (mm/s) measured at the foundation of the building; these are summarised in Table 9. The criteria are frequency dependent and specific to particular categories of structures.

**Table 9 Structural damage criteria as per standard DIN 4150 Part 3 - 1999**

| Type of Structure                                                                                                                                                                                    | Peak Component Particle Velocity, mm/s        |                |                              |                                                                   |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------|----------------|------------------------------|-------------------------------------------------------------------|
|                                                                                                                                                                                                      | Vibration at the foundation at a frequency of |                |                              | Vibration of horizontal plane of highest floor at all frequencies |
|                                                                                                                                                                                                      | 1 Hz to 10 Hz                                 | 10 Hz to 50 Hz | 50 Hz to 100 Hz <sup>1</sup> |                                                                   |
| Buildings used for commercial purposes, industrial buildings and buildings of similar design                                                                                                         | 20                                            | 20 to 40       | 40 to 50                     | 40                                                                |
| Dwellings and buildings of similar design and/or use                                                                                                                                                 | 5                                             | 5 to 15        | 15 to 20                     | 15                                                                |
| Structures that, because of their sensitivity to vibration, do not correspond to those listed in lines 1 and 2 and are of great intrinsic value (e.g. buildings that are under a preservation order) | 3                                             | 3 to 8         | 8 to 10                      | 8                                                                 |
| <i>Note 1: For frequencies above 100Hz, at least the values specified in this column shall be applied.</i>                                                                                           |                                               |                |                              |                                                                   |

### 3.3 Ground-Borne Noise Criteria

According to the NSW EPA *Interim Construction Noise Guideline* (ICNG) 2009, the criteria for ground-borne noise at residences is defined as follows:

- Maximum internal noise levels of 40 dB LAeq(15mins) between 6:00pm and 10:00pm.

It is noted that the ground borne criteria will apply for construction works undertaken outside of standard hours. That is, work conducted during the evening period Monday to Friday between 6:00pm and 7:00pm only.

### 3.4 Project Vibration Impacts

Based on the discussions included in the sections above the recommended construction vibration limits for surrounding receivers includes the following:

- Residential Receivers – 7mm/s.



## 4 CONSTRUCTION AND VIBRATION ASSESSMENT

This section of the report details the assessment of noise and vibration resulting from the proposed construction activities to be undertaken on the site.

The required construction required to be undertaken as part of the project include equipment and activities which are commonly used on construction projects.

### 4.1 Construction Noise Assessment

Sound power levels have been predicted for the construction tasks identified in the project program. The equipment anticipated for use in each task is based on previous project experience. The sound power levels for the equipment likely to be used for each of the listed tasks are provided in Table 10 below.

**Table 10 Summary of predicted sound power levels**

| Tasks                       | Equipment                         | Sound Power Levels (dBA re 1pW) | Aggregate Sound Power Level per Task (dBA re 1pW) |
|-----------------------------|-----------------------------------|---------------------------------|---------------------------------------------------|
| Site Establishment Works    | Mobile crane                      | 110                             | 113                                               |
|                             | Power hand tools                  | 109                             |                                                   |
|                             | Semi Rigid Vehicle <sup>1</sup>   | 105                             |                                                   |
| Ground Works and Demolition | Excavator                         | 112                             | 120                                               |
|                             | Hydraulic Hammer                  | 118                             |                                                   |
|                             | Piling Rig                        | 110                             |                                                   |
|                             | Handheld jack hammer <sup>1</sup> | 111                             |                                                   |
|                             | Dump truck <sup>1</sup>           | 104                             |                                                   |
|                             | Concrete saw <sup>1</sup>         | 114                             |                                                   |
|                             | Skid steer                        | 110                             |                                                   |
|                             | Power hand tools                  | 109                             |                                                   |
| Structure                   | Handheld jack hammer <sup>1</sup> | 106                             | 117                                               |
|                             | Concrete saw <sup>1</sup>         | 114                             |                                                   |
|                             | Power hand tools                  | 109                             |                                                   |
|                             | Welder                            | 101                             |                                                   |
|                             | Concrete pump truck               | 110                             |                                                   |
|                             | Concrete agitator truck           | 108                             |                                                   |
| Internal Works              | Power hand tools                  | 109                             | 109                                               |
| Common and External Works   | Concrete agitator truck           | 108                             | 114                                               |
|                             | Saw cutter <sup>1</sup>           | 104                             |                                                   |
|                             | Dump truck <sup>1</sup>           | 104                             |                                                   |
|                             | Concrete saw <sup>1</sup>         | 114                             |                                                   |
|                             | Power hand tools                  | 109                             |                                                   |

*Note 1: An assumed time correction has been applied, this being 5 minutes of operation in any 15-minute interval.*



---

#### **4.1.1 Qualitative Construction Noise Assessment**

An assessment of the expected construction noise levels resulting from the proposed works to be undertaken as part of the project on surrounding receivers has been undertaken. The assessment has been based on the expected noise levels to be generated on the site including those detailed in the Section above. Calculations of the resulting construction noise levels of the receivers within proximity to the site is detailed in the table below.

**Table 11 Receiver 1 – To the North of the site - Summary of predicted construction noise levels – STANDARD HOURS**

| Phase                       | Activity                | Aggregate Sound Power Level (dBA re 1pW) | Predicted Individual Noise Level at Receiver dBA L <sub>Aeq</sub> 15 minutes | Predicted Combined Noise Level at Receiver dBA L <sub>Aeq</sub> 15 minutes | Noise Management Level dBA L <sub>Aeq</sub> 15 minutes           | Summary of Result                                                                                                                                  |
|-----------------------------|-------------------------|------------------------------------------|------------------------------------------------------------------------------|----------------------------------------------------------------------------|------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|
| Site Establishment Works    | Mobile crane            |                                          | 65 to 88                                                                     |                                                                            | During Approved Working Hours – 55 dB(A) L <sub>Aeq</sub> 15 min | Works near the receiver expected be above the BG + 10dBA and therefore management is required. Recommended mitigations are included in this report |
|                             | Power hand tools        | 113                                      | 64 to 87                                                                     | 68 to 91                                                                   |                                                                  |                                                                                                                                                    |
|                             | Semi Rigid Vehicle      |                                          | 55 to 78                                                                     |                                                                            |                                                                  |                                                                                                                                                    |
|                             | Excavator               |                                          | 67 to 90                                                                     |                                                                            |                                                                  |                                                                                                                                                    |
|                             | Hydraulic Hammer        |                                          | 73 to 96                                                                     |                                                                            |                                                                  |                                                                                                                                                    |
|                             | Piling Rig              |                                          | 63 to 86                                                                     |                                                                            |                                                                  |                                                                                                                                                    |
| Ground Works and Demolition | Handheld jack hammer    | 120                                      | 61 to 84                                                                     | 75 to 98                                                                   |                                                                  |                                                                                                                                                    |
|                             | Dump truck              |                                          | 54 to 77                                                                     |                                                                            |                                                                  |                                                                                                                                                    |
|                             | Concrete saw            |                                          | 64 to 87                                                                     |                                                                            |                                                                  |                                                                                                                                                    |
|                             | Skid steer              |                                          | 65 to 88                                                                     |                                                                            |                                                                  |                                                                                                                                                    |
|                             | Power hand tools        |                                          | 64 to 87                                                                     |                                                                            |                                                                  |                                                                                                                                                    |
|                             | Handheld jack hammer    |                                          | 56 to 79                                                                     |                                                                            |                                                                  |                                                                                                                                                    |
|                             | Concrete saw            |                                          | 64 to 87                                                                     |                                                                            |                                                                  |                                                                                                                                                    |
| Structure                   | Power hand tools        | 117                                      | 64 to 87                                                                     | 72 to 95                                                                   |                                                                  |                                                                                                                                                    |
|                             | Welder                  |                                          | 56 to 79                                                                     |                                                                            |                                                                  |                                                                                                                                                    |
|                             | Concrete pump truck     |                                          | 65 to 88                                                                     |                                                                            |                                                                  |                                                                                                                                                    |
|                             | Concrete agitator truck |                                          | 63 to 86                                                                     |                                                                            |                                                                  |                                                                                                                                                    |
| Internal Works              | Power hand tools        | 109                                      | 44 to 67                                                                     | 44 to 67                                                                   |                                                                  |                                                                                                                                                    |
|                             | Concrete agitator truck |                                          | 63 to 86                                                                     |                                                                            |                                                                  |                                                                                                                                                    |
| Common and External Works   | Saw cutter              | 114                                      | 54 to 77                                                                     | 69 to 92                                                                   |                                                                  |                                                                                                                                                    |
|                             | Dump truck              |                                          | 54 to 77                                                                     |                                                                            |                                                                  |                                                                                                                                                    |
|                             | Concrete saw            |                                          | 64 to 87                                                                     |                                                                            |                                                                  |                                                                                                                                                    |
|                             | Power hand tools        |                                          | 64 to 87                                                                     |                                                                            |                                                                  |                                                                                                                                                    |

**Table 12 Receiver 2 – To the West of the site - Summary of predicted construction noise levels – STANDARD HOURS**

| Phase                       | Activity                | Aggregate Sound Power Level (dBA re 1pW) | Predicted <u>Individual</u> Noise Level at Receiver dBA $L_{Aeq}$ 15 minutes | Predicted <u>Combined</u> Noise Level at Receiver dBA $L_{Aeq}$ 15 minutes | Noise Management Level dBA $L_{Aeq}$ 15 minutes           | Summary of Result                                                                                                                                  |
|-----------------------------|-------------------------|------------------------------------------|------------------------------------------------------------------------------|----------------------------------------------------------------------------|-----------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|
| Site Establishment Works    | Mobile crane            |                                          | 60 to 88                                                                     |                                                                            | During Approved Working Hours – 55 dB(A) $L_{Aeq}$ 15 min | Works near the receiver expected be above the BG + 10dBA and therefore management is required. Recommended mitigations are included in this report |
|                             | Power hand tools        | 113                                      | 59 to 87                                                                     | 63 to 86                                                                   |                                                           |                                                                                                                                                    |
|                             | Semi Rigid Vehicle      |                                          | 51 to 78                                                                     |                                                                            |                                                           |                                                                                                                                                    |
|                             | Excavator               |                                          | 62 to 90                                                                     |                                                                            |                                                           |                                                                                                                                                    |
|                             | Hydraulic Hammer        |                                          | 68 to 96                                                                     |                                                                            |                                                           |                                                                                                                                                    |
|                             | Piling Rig              |                                          | 59 to 86                                                                     |                                                                            |                                                           |                                                                                                                                                    |
| Ground Works and Demolition | Handheld jack hammer    | 120                                      | 57 to 84                                                                     | 70 to 93                                                                   |                                                           |                                                                                                                                                    |
|                             | Dump truck              |                                          | 50 to 77                                                                     |                                                                            |                                                           |                                                                                                                                                    |
|                             | Concrete saw            |                                          | 60 to 87                                                                     |                                                                            |                                                           |                                                                                                                                                    |
|                             | Skid steer              |                                          | 60 to 88                                                                     |                                                                            |                                                           |                                                                                                                                                    |
|                             | Power hand tools        |                                          | 59 to 87                                                                     |                                                                            |                                                           |                                                                                                                                                    |
|                             | Handheld jack hammer    |                                          | 52 to 79                                                                     |                                                                            |                                                           |                                                                                                                                                    |
|                             | Concrete saw            |                                          | 60 to 87                                                                     |                                                                            |                                                           |                                                                                                                                                    |
| Structure                   | Power hand tools        | 117                                      | 59 to 87                                                                     | 68 to 90                                                                   |                                                           |                                                                                                                                                    |
|                             | Welder                  |                                          | 51 to 79                                                                     |                                                                            |                                                           |                                                                                                                                                    |
|                             | Concrete pump truck     |                                          | 60 to 88                                                                     |                                                                            |                                                           |                                                                                                                                                    |
|                             | Concrete agitator truck |                                          | 58 to 86                                                                     |                                                                            |                                                           |                                                                                                                                                    |
| Internal Works              | Power hand tools        | 109                                      | 39 to 67                                                                     | 39 to 62                                                                   |                                                           |                                                                                                                                                    |
|                             | Concrete agitator truck |                                          | 58 to 86                                                                     |                                                                            |                                                           |                                                                                                                                                    |
| Common and External Works   | Saw cutter              | 114                                      | 50 to 77                                                                     | 64 to 87                                                                   |                                                           |                                                                                                                                                    |
|                             | Dump truck              |                                          | 50 to 77                                                                     |                                                                            |                                                           |                                                                                                                                                    |
|                             | Concrete saw            |                                          | 60 to 87                                                                     |                                                                            |                                                           |                                                                                                                                                    |
|                             | Power hand tools        |                                          | 59 to 87                                                                     |                                                                            |                                                           |                                                                                                                                                    |

**Table 13 Receiver 4 - Summary of predicted construction noise levels – STANDARD HOURS**

| Phase                       | Activity                | Aggregate Sound Power Level (dBA re 1pW) | Predicted <u>Individual</u> Noise Level at Receiver dBA L <sub>Aeq</sub> 15 minutes | Predicted <u>Combined</u> Noise Level at Receiver dBA L <sub>Aeq</sub> 15 minutes | Noise Management Level dBA L <sub>Aeq</sub> ~15 minutes          | Summary of Result                                                                                                                                  |
|-----------------------------|-------------------------|------------------------------------------|-------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|
| Site                        | Mobile crane            |                                          | 60 to 88                                                                            |                                                                                   | During Approved Working Hours – 55 dB(A) L <sub>Aeq</sub> 15 min | Works near the receiver expected be above the BG + 10dBA and therefore management is required. Recommended mitigations are included in this report |
| Establishment               | Power hand tools        | 113                                      | 59 to 87                                                                            | 63 to 86                                                                          |                                                                  |                                                                                                                                                    |
| Works                       | Semi Rigid Vehicle      |                                          | 51 to 78                                                                            |                                                                                   |                                                                  |                                                                                                                                                    |
|                             | Excavator               |                                          | 62 to 90                                                                            |                                                                                   |                                                                  |                                                                                                                                                    |
|                             | Hydraulic Hammer        |                                          | 68 to 96                                                                            |                                                                                   |                                                                  |                                                                                                                                                    |
|                             | Piling Rig              |                                          | 59 to 86                                                                            |                                                                                   |                                                                  |                                                                                                                                                    |
| Ground Works and Demolition | Handheld jack hammer    | 120                                      | 57 to 84                                                                            | 70 to 93                                                                          |                                                                  |                                                                                                                                                    |
|                             | Dump truck              |                                          | 50 to 77                                                                            |                                                                                   |                                                                  |                                                                                                                                                    |
|                             | Concrete saw            |                                          | 60 to 87                                                                            |                                                                                   |                                                                  |                                                                                                                                                    |
|                             | Skid steer              |                                          | 60 to 88                                                                            |                                                                                   |                                                                  |                                                                                                                                                    |
|                             | Power hand tools        |                                          | 59 to 87                                                                            |                                                                                   |                                                                  |                                                                                                                                                    |
|                             | Handheld jack hammer    |                                          | 52 to 79                                                                            |                                                                                   |                                                                  |                                                                                                                                                    |
|                             | Concrete saw            |                                          | 60 to 87                                                                            |                                                                                   |                                                                  |                                                                                                                                                    |
| Structure                   | Power hand tools        | 117                                      | 59 to 87                                                                            | 68 to 90                                                                          |                                                                  |                                                                                                                                                    |
|                             | Welder                  |                                          | 51 to 79                                                                            |                                                                                   |                                                                  |                                                                                                                                                    |
|                             | Concrete pump truck     |                                          | 60 to 88                                                                            |                                                                                   |                                                                  |                                                                                                                                                    |
|                             | Concrete agitator truck |                                          | 58 to 86                                                                            |                                                                                   |                                                                  |                                                                                                                                                    |
| Internal Works              | Power hand tools        | 109                                      | 39 to 67                                                                            | 39 to 62                                                                          |                                                                  |                                                                                                                                                    |
|                             | Concrete agitator truck |                                          | 58 to 86                                                                            |                                                                                   |                                                                  |                                                                                                                                                    |
| Common and External Works   | Saw cutter              | 114                                      | 50 to 77                                                                            | 64 to 87                                                                          |                                                                  |                                                                                                                                                    |
|                             | Dump truck              |                                          | 50 to 77                                                                            |                                                                                   |                                                                  |                                                                                                                                                    |
|                             | Concrete saw            |                                          | 60 to 87                                                                            |                                                                                   |                                                                  |                                                                                                                                                    |
|                             | Power hand tools        |                                          | 59 to 87                                                                            |                                                                                   |                                                                  |                                                                                                                                                    |



#### 4.1.2 Construction Noise Management – Qualitative Assessment

Based on the assessment conducted of the expected construction noise levels generated from the ground works and construction to be conducted on the site, levels are generally expected to require the building contractor to engage in management of activities on the site and engagement with the local community.

Notwithstanding, the following management controls are recommended to mitigate construction noise levels on the site:

1. Toolbox meetings should be undertaken with all contractors commencing works on the site detailing the requirements to limit noise impacts to neighbouring including their responsibilities detailed in this report.
2. All plant and equipment are to be maintained such that they are in good working order.
3. A register of complaints is to be recorded in the event of complaints being received, including location, time of complaint, nature of the complaint and actions resulting from the complaint.
4. If required a noise level measurement of the offending plant item generating complaints is to be conducted and noise mitigations undertaken to reduce noise levels to within Noise Management levels in the event magnitude of noise levels is found to be above suitable levels.
5. The use of percussive and concrete sawing should be undertaken behind the existing façades of buildings when possible.
6. The use of percussive equipment including hydraulic hammering should be limited such that they comply with the requirements of the projects Conditions of Consent.
7. Access for trucks entering and exiting the site are required to follow the traffic management plan, including use of Alfred Street.

In addition to the recommended mitigations above details of the proposed construction works to be conducted on the site, including type of activities to be conducted as well as the expected duration of activities should be provided to the neighbouring receivers.

In the event noise levels are found to required additional noise reduction then all possible and practical mitigations are required to be included in the construction of the project. Possible acoustic treatments and controls may include the following:

1. Use of alternative appliances to complete the required works which result in reduced noise impacts on surrounding neighbours.
2. Period when noisy appliances are undertaken, such as undertaking noisy works to be conducted outside of sensitive period if possible, in communication with affected receivers.
3. Construction of acoustic screening to permanently located high noise generating equipment such as pumps and generators.
4. Scheduling of high noise generating works outside of noise sensitive periods if possible.
5. Other site-specific treatments and controls which may become possible once works commence.
6. The consideration should be given for the short term (3-4 months) rental of office accommodation for nearby work from home residents to use for the excavation phase of the project, so to manage noise complaints and provide local residents with respite from noise and vibration during the proposed demolition and excavation period of the project.



## 4.2 Construction Traffic Noise Assessment

It is proposed that the construction traffic could access the site via Canberra Avenue.

Construction traffic accessing the site including the movements of heavy vehicles are required to comply with the projects *Conditions of Consent* and will be detailed in the sites *Construction Management Plan*.

## 4.3 Vibration Assessment

In order to maintain compliance with the human comfort vibration criteria discussed in Section 0, it is recommended that the indicative safe distances listed in Table 14 should be maintained. These indicative safe distances should be validated prior to the start of construction works by undertaking measurements of vibration levels generated by construction equipment to be used on site.

If applicable, the criteria for scientific or medical equipment (should any of these exist close to the site) can be more stringent than those required for human comfort, vibration validating measurements should be conducted at each site to determine the vibration level and potential impact onto this sensitive equipment.

Additionally, any vibration levels should be assessed in accordance with the criteria discussed in Section 3.3.



Recommended safe working distances for various items of plant are included in the following table.

**Table 14 Recommended indicative safe working distances for vibration intensive plant**

| Plant                   | Rating / Description                        | Safe Working Distances (m)                               |                                                       |
|-------------------------|---------------------------------------------|----------------------------------------------------------|-------------------------------------------------------|
|                         |                                             | Cosmetic Damage<br>(BS 7385: Part 2<br>DIN 4150: Part 3) | Human Comfort<br>(AVTG)                               |
|                         | < 50 kN (Typically 1 – 2 tonnes)            | 5                                                        | 15 – 20                                               |
|                         | < 100 kN (Typically 2 – 4 tonnes)           | 6                                                        | 20                                                    |
| Vibratory roller        | < 200 kN (Typically 4 – 6 tonnes)           | 12                                                       | 40                                                    |
|                         | < 300 kN (Typically 7 – 13 tonnes)          | 15                                                       | 100                                                   |
|                         | > 300 kN (Typically more than 13 tonnes)    | 20                                                       | 100                                                   |
| Small hydraulic hammer  | 300 kg, typically 5 – 12 tonnes excavator   | 2                                                        | 7                                                     |
| Medium hydraulic hammer | 900 kg, typically 12 – 18 tonnes excavator  | 7                                                        | 23                                                    |
| Large hydraulic hammer  | 1600 kg, typically 18 – 34 tonnes excavator | 22                                                       | 73                                                    |
| Vibratory pile driver   | Sheet piles                                 | 2 – 20                                                   | 20                                                    |
| Jackhammer              | Hand held                                   | 1                                                        | Avoid contact with structure and steel reinforcements |

An assessment of the potential for vibration generated as part of the required construction activities on the project (including excavation) has been undertaken based on the expected vibration detailed in the table above.

To ensure the vibration impact criteria detailed in this report are complied with the following safe working mitigations and/or working distances should be implemented as detailed in the table below.

**Table 15 Vibration Mitigation Requirements**

| Construction Phase | Activity                        | Vibration Mitigation                                                                                                                                                                                                                                                              |
|--------------------|---------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Excavation         | Removal of Rock                 | Prior to the use of hydraulic hammering within 20m of neighbouring building a saw cut to the perimeter of the basement to be excavated is required to be undertaken. Saw cutting of the perimeter of the excavation is required to be undertaken on each level of the excavation. |
| Construction       | General Construction activities | General construction activities are not expected to exceed project vibration limits detailed in this report.                                                                                                                                                                      |



## 5 NOISE AND VIBRATION MANAGEMENT PLAN

Table 16 below summarises the management procedures recommended for airborne noise and vibration impact. These procedures are also further discussed in the report. Hence, where applicable, links to further references are provided in Table 16.

**Table 16 Summary of mitigation procedures**

| Procedure                            | Abbreviation | Description                                                                                                                                                                                                                                                                                                                                                                                                                                     | Further Reference                                                                     |
|--------------------------------------|--------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| General Management Measures          | GMM          | Introduce best-practice general mitigation measures in the workplace which are aimed at reducing the acoustic impact onto the nearest affected receivers.                                                                                                                                                                                                                                                                                       | Refer to Section 5.3.3<br>For vibration impact, also refer to section 4.3             |
| Project Notification                 | PN           | Issue project updates to stakeholders, discussing overviews of current and upcoming works. Advanced warning of potential disruptions can be included.<br><br>Content and length to be determined on a project-by-project basis.                                                                                                                                                                                                                 | Refer to Section 6                                                                    |
| Verification Monitoring              | V            | Monitoring to comprise attended or unattended acoustic surveys. The purpose of the monitoring is to confirm measured levels are consistent with the predictions in the acoustic assessment, and to verify that the mitigation procedures are appropriate for the affected receivers.<br><br>If the measured levels are higher than those predicted, then the measures will need to be reviewed and the management plan will need to be amended. | For noise impact, refer to Section 5.4.<br>For vibration impact, refer to Section 4.3 |
| Complaints Management System         | CMS          | Implement a management system which includes procedures for receiving and addressing complaints from affected stakeholders                                                                                                                                                                                                                                                                                                                      | Refer to Section 6                                                                    |
| Specific Notification                | SN           | Individual letters or phone calls to notify stakeholders that noise levels are likely to exceed noise objectives.<br><br>Alternatively, contractor could visit stakeholders individually in order to brief them in regards to the noise impact and the mitigation measures that will be implemented.                                                                                                                                            | Refer to Section 6                                                                    |
| Respite Offer                        | RO           | Offer provided to stakeholders subjected to an ongoing impact. The offer could include movie tickets, meal vouchers, gift cards or equivalent measures.                                                                                                                                                                                                                                                                                         | -                                                                                     |
| Alternative Construction Methodology | AC           | Contractor to consider alternative construction options that achieve compliance with relevant criteria. Alternative option to be determined on a case-by-case basis. It is recommended that the selection of the alternative option should also be determined by considering the assessment of on-site measurements (refer to Verification Monitoring above).                                                                                   | -                                                                                     |

The application of these procedures is in relation to the exceedances over the relevant criteria. For airborne noise, the criteria are based on NMLs. The allocation of these procedures is discussed in Section 5.1

For vibration, the criteria either correspond to human comfort, building damage or scientific and medical equipment. The application of these procedures is discussed in Section 5.2.



## 5.1 Allocation of Noise Management Procedures

For residences, the management procedures have been allocated based on noise level exceedances at the affected properties, which occur over the designated NMLs (refer to section 0). The allocation of these procedures is summarised in Table 17 below.

**Table 17 Allocation of noise management procedures**

| Construction Hours                                                                                           | Exceedance over NML (dB) | Management Procedures (see definition above) |
|--------------------------------------------------------------------------------------------------------------|--------------------------|----------------------------------------------|
| <b>Standard Hours</b><br>Mon – Fri: 8:00 am to 7:00 pm<br>Sat: 8:00 am – 5:00 pm                             | 0 - 3                    | GMM                                          |
|                                                                                                              | 4 - 10                   | GMM, PN, V <sup>1</sup> , CMS, AC            |
|                                                                                                              | > 10                     | GMM, PN, V, CMS, SN, AC                      |
| <b>Outside Standard Hours</b><br>Mon – Fri: 7:00 am to 8:00 am<br>Sat: 7:00 am to 8:00 am                    | 0 - 10                   | GMM, AC                                      |
|                                                                                                              | 11 - 20                  | GMM, PN, V <sup>1</sup> , CMS, AC            |
|                                                                                                              | > 20                     | GMM, PN, V, CMS, SN, RO, AC                  |
| <i>Notes</i><br>1. Verification monitoring to be undertaken upon complaints received from affected receivers |                          |                                              |

Please note the following regarding the allocation of these procedures:

- The exceedances have been estimated as part of the acoustic assessment, and these are summarised in Section 4.1.
- The allocation of procedures is based on the assumptions used for noise level predictions (refer to Section 4.1). Consequently, these allocations can be further refined once additional details of the construction program become available.

## 5.2 Allocation of Vibration Management Procedures

Table 18 below summarises the vibration management procedures to be adopted based on exceedance scenarios (i.e., whether the exceedance occurs over human comfort criteria, building damage criteria, or criteria for scientific and medical equipment). Please note these management procedures apply for any type of affected receiver.

**Table 18 Allocation of vibration management procedures**

| Construction Hours                                                                        | Exceedance Scenario                                  | Management Procedures |
|-------------------------------------------------------------------------------------------|------------------------------------------------------|-----------------------|
| <b>Standard Hours</b><br>Mon – Fri: 8:00 am to 7:00 pm<br>Sat: 8:00 am – 5:00 pm          | Over human comfort criteria (refer to Section 3.3)   | GMM, PN, V, RO        |
|                                                                                           | Over building damage criteria (refer to Section 3.3) | GMM, V, AC            |
| <b>Outside Standard Hours</b><br>Mon – Fri: 7:00 am to 8:00 am<br>Sat: 7:00 am to 8:00 am | Over human comfort criteria (refer to Section 3.3)   | GMM, SN, V, RO, CMS   |
|                                                                                           | Over building damage criteria (refer to Section 3.3) | GMM, V, AC            |



### 5.3 General Comments

The contractor will, where reasonable and feasible, apply best practice noise mitigation measures. These measures shall include the following:

- Maximising the offset distance between plant items and nearby noise sensitive receivers.
- Preventing noisy plant working simultaneously and adjacent to sensitive receivers.
- Minimising consecutive works in the same site area.
- Orienting equipment away from noise sensitive areas.
- Carrying out loading and unloading away from noise sensitive areas.

In order to minimise noise impacts during the works, the contractor will take all reasonable and feasible measures to mitigate noise effects.

The contractor will also take reasonable steps to control noise from all plant and equipment. Examples of appropriate noise control include efficient silencers and low noise mufflers.

The contractor should apply all feasible and reasonable work practices to meet the NMLs and inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels, duration of noise generating construction works, and the contact details for the proposal.

#### 5.3.1 Alternate Equipment or Process

Exceedance of the site's NMLs should result in an investigation as to whether alternate equipment could be used, or a difference process could be undertaken.

In some cases, the investigation may conclude that no possible other equipment can be used, however, a different process could be undertaken.

#### 5.3.2 Acoustic Enclosures/Screening

Typically, on a construction site there are three different types of plant that will be used: mobile plant (i.e., excavators, skid steers, etc.), semi mobile plant (i.e., hand tools generally) or static plant i.e. (diesel generators).

For plant items which are static it is recommended that, in the event exceedances are being measured due to operation of the plant item, an acoustic enclosure/screen is constructed to reduce impacts. These systems can be constructed from Fibre Cement (FC) sheeting or, if airflow is required, acoustic attenuators or louvres.

For semi mobile plant, relocation of plant should be investigated to either be operated in an enclosed space or at locations away from a receiver.

With mobile plant it is generally not possible to treat these sources. However, investigations into the machine itself may result in a reduction of noise (i.e., mufflers/attenuators etc).

#### 5.3.3 General Mitigation Measures (Australia Standard 2436-2010)

As well as the above project specific noise mitigation controls, AS 2436-2010 "*Guide to Noise and Vibration Control on Construction, Demolition and Maintenance Sites*" sets out numerous practical recommendations to assist in mitigating construction noise emissions. Examples of strategies that could be implemented on the subject project are listed below, including the typical noise reduction achieved, where applicable.



#### **5.3.4 Adoption of Universal Work Practices**

- Regular reinforcement (such as at toolbox talks) of the need to minimise noise and vibration.
- Regular identification of noisy activities and adoption of improvement techniques.
- Avoiding the use of portable radios, public address systems or other methods of site communication that may unnecessarily impact upon nearby sensitive receivers.
- Where possible, avoiding the use of equipment that generates impulsive noise.
- Minimising the need for vehicle reversing for example (particularly at night), by arranging for one-way site traffic routes.
- Use of broadband audible alarms on vehicles and elevating work platforms used on site.
- Minimising the movement of materials and plant and unnecessary metal-on-metal contact.
- Minimising truck movements.

#### **5.3.5 Plant and Equipment**

The operation of plant and equipment on the site should be undertaken, including the following:

- Choosing quieter plant and equipment based on the optimal power and size to most efficiently perform the required tasks.
- Selecting plant and equipment with low vibration generation characteristics.
- Operating plant and equipment in the quietest and most efficient manner.

#### **5.3.6 Work Scheduling**

- Providing respite periods which could include restricting very noisy activities to time periods that least affect the nearby noise sensitive locations, restricting the number of nights that after-hours work is conducted near residences or by determining any specific requirements.
- Scheduling work to coincide with non-sensitive periods.
- Planning deliveries and access to the site to occur quietly and efficiently and organising parking only within designated areas located away from the sensitive receivers.
- Optimising the number of deliveries to the site by amalgamating loads where possible and scheduling arrivals within designated hours.
- Including contract conditions that include penalties for non-compliance with reasonable instructions by the principal to minimise noise or arrange suitable scheduling.

#### **5.3.7 Source Noise Control Strategies**

Some ways of controlling noise at the source are:

- Where reasonably practical, noisy plant or processes should be replaced by less noisy alternatives.
- Modify existing equipment: Engines and exhausts are typically the dominant noise sources on mobile plant such as cranes, graders, excavators, trucks, etc. In order to minimise noise emissions, residential grade mufflers should be fitted on all mobile plant utilised on site.
- Siting of equipment: locating noisy equipment behind structures that act as barriers, or at the greatest distance from the noise-sensitive area; or orienting the equipment so that noise emissions are directed away from any sensitive areas, to achieve the maximum attenuation of noise.
- Regular and effective maintenance.

#### **5.3.8 Miscellaneous Comments**

Deliveries should be undertaken, where possible, during standard construction hours.

Maximise hammer penetration (and reduce blows) by using sharp hammer tips. Keep stocks of sharp profiles at site and monitor the profiles in use.

It is advised that mobile plant and trucks operating on site for a significant portion of the project are to have reversing alarm noise emissions minimised. This is to be implemented subject to recognising the need to maintain occupational safety standards.

No public address system should be used on site.



The consideration should be given for the short term (3-4 months) rental of office accommodation for nearby work from home residents to use for the excavation phase of the project, so to manage noise complaints and provide local residents with respite from noise and vibration during the highest noise periods of the project including demolition and excavation stages.

## 5.4 Vibration Mitigation Measures

Based on the existing distance separation to receiver's compliance with construction vibration criteria is expected to be achieved without additional mitigations.

## 5.5 Noise and Vibration Monitoring

Noise monitoring is recommended to be undertaken by attended noise measurements at the start of any new phase of works (i.e. excavation or construction works etc.). The statistical parameters to be measured should include the following noise descriptors: LAmin, LA90, LA10, LA1, LAmax and LAeq. Unattended noise measurements should be conducted over consecutive 15 minute periods.

The survey methodology and any equipment should comply with the requirements discussed in Standard AS 1055.1-1997.

As part of the management of noise and vibration from the proposed construction activities to be undertaken on the site the following noise and vibration measurements are recommended to be undertaken:

1. Noise –
  - a. Attended noise level measurements of typical excavation activities should be undertaken at site.

Attended construction noise surveys of the site and surrounding impacts on neighbours should be undertaken during the following as a minimum:

- i. Commencement of any rock breaking or sawing on the site.
- ii. In response to any ongoing complaints received from neighbours.

2. Vibration –

Vibration monitoring, if required, should be undertaken continuously at the nearest most affected structures to the north and west of the site.

The monitoring location would be on a stiff part of the structure (at the foundation) on the side of the structure adjacent to the subject demolition and construction works.

The vibration monitoring system will be configured to record the peak vibration levels and to trigger an alarm when predetermined vibration thresholds are exceeded. The thresholds correspond to an "Operator Warning Level" and an "Operator Halt Level", where the Warning Level is 75% of the Halt Level. The Halt Level should be determined based on the vibration criteria for building contents and structure (refer to Section 3.3).

Exceedance of the "Operator Warning Level" would not require excavation or demolition work to cease, but rather, alerts the site manager to proceed with caution at a reduced force or load.

An exceedance of the "Operator Halt Level" would require the contractor to implement an alternative excavation technique pending further analysis of the vibration frequency content in order to determine any potential exceedance of the criteria.

The vibration monitoring equipment would be downloaded and analysed by the acoustical consultant.

Reports of the measured vibration levels and their likely impacts would be prepared by the acoustical consultant and issued to the contractor.



## 6 COMMUNITY ENGAGEMENT AND CONSULTATION

Active community consultation and the maintenance of positive relations with local residents and businesses would assist in alleviating concerns and thereby minimising complaint. It is common for construction projects to provide community consultation if an exceedance of noise goals has been predicted. This communication is commonly conducted in the form of a letter box drop or more active engagement with more highly impacted receivers.

This form of notification should provide specific notification of the duration and timing of the construction activities so that residents are informed about the proposed works ahead of time. The letter should also provide the community with a hotline number for a community liaison officer available to adequately respond to all project related enquiries.

Ideally the hotline number should provide concerned locals an opportunity to raise any concerns with the project proponent and provide an opportunity to determine the best method to satisfy all requirements.

Prior to the works onsite being undertaken, it is recommended that community consultation with the neighbouring affected parties be undertaken. Community engagement and consultation should not be limited to the beginning of the onsite works but throughout, providing the community with constant updates on the progress and upcoming works. In our experience these could include:

- Site noticeboard;
- Email notifications; and
- Letterbox drops.

During the proposed construction of the project (including excavation and construction) the building contractor is required to engage in community interaction. The community interaction and notification is required to include the following:

1. Notification of the proposed works to be undertaken on the site and the periods when works will be conducted, including information regarding the programme of works such as excavation activities. This should include the expected period when activities such as hydraulic hammering, rock breaking, concrete or rock sawing is required to be undertaken.
2. Details of the relevant site representative where complaints can be registered.
3. Details of the methodology to respond to complaints raised from the surrounding receivers.
4. A register of complaints, to be kept on site including record of time and nature of the complaint as well as the outcomes and comments regarding investigations resulting from the complaint.



## 6.1 Complaints Management System

Should complaints arise they must be dealt with in a responsible and uniform manner, therefore, a management system to deal with complaints is detailed below:

Local residents and land owners should be informed by direct mail of a direct 24-hour telephone line where any noise complaints related to the construction will be recorded. The 24-hour telephone line number will be made available on the construction site signage.

All complaints should be investigated by the Contractor in accordance with the procedures outlined in Australia Standard 2436-2010. Consequently, a complaint response procedure should be implemented. Information to be gathered as part of this process should include:

- location of complainant
- time/s of occurrence of alleged noise or vibration impacts
- nature of impact particularly with respect to vibration
- Perceived source
- Prevailing weather conditions and similar details that could be utilised to assist in the investigation of the complaint.

All resident complaints will be responded to in the required timeframe and action taken recorded.

Post receiving a noise and or vibration complaint, the process outlined in the *Contingency Plans* below should be undertaken.

## 6.2 Contingency Plans

Contingency plans are required to address noise or vibration problems if excessive levels are measured at surrounding sensitive receivers and/or if justified complaints occur. Such plans include:

- Stop the onsite works.
- Identify the source of the main equipment within specific areas of the site which is producing the most construction noise and vibration at the sensitive receivers; and
- Review the identified equipment and determine if an alternate piece of equipment can be used or the process can be altered.
- In the event an alternate piece of equipment or process can be used, works can re-commence.
- In the event an alternate piece of equipment or process cannot be determined implement a construction assessment to be performed by a suitably qualified acoustic consultant.

The Superintendent shall have access to view the Contractor's noise measurement records on request. The Superintendent may undertake noise monitoring if and when required.



## 7 CONCLUSION

This report details the construction noise and vibration assessment of the proposed construction activities to be undertaken as part of the St Leonards residential project.

An assessment of noise and vibration impacts from the required processes to be undertaken during the construction period of the project has been undertaken and suitable treatments, management controls, perioding measurements and community engagement has been detailed in this report.

The assessment has been undertaken in conjunction with the requirements of the EPA's *Interim Construction Noise Guideline* and detail the recommended noise and vibration mitigations and management which construction should be undertaken in accordance with.

This report includes the recommended noise and vibration mitigations and management controls for the operation of construction activities on the site to ensure impacts to surrounding receivers are minimised as required by the EPA's *Interim Construction Noise Guideline*.



## 8 APPENDIX A: ACOUSTIC GLOSSARY

The following is a brief description of the acoustic terminology used in this report:

|                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|-----------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Ambient Sound               | The totally encompassing sound in a given situation at a given time, usually composed of sound from all sources near and far.                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Audible Range               | The limits of frequency which are audible or heard as sound. The normal ear in young adults detects sound having frequencies in the region 20 Hz to 20 kHz, although it is possible for some people to detect frequencies outside these limits.                                                                                                                                                                                                                                                                                                                                                   |
| Character, acoustic         | The total of the qualities making up the individuality of the noise. The pitch or shape of a sound's frequency content (spectrum) dictate a sound's character.                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Decibel [dB]                | The level of noise is measured objectively using a Sound Level Meter. The following are examples of the decibel readings of every day sounds;<br>0dB the faintest sound we can hear<br>30dB a quiet library or in a quiet location in the country<br>45dB typical office space. Ambience in the city at night<br>60dB Martin Place at lunch time<br>70dB the sound of a car passing on the street<br>80dB loud music played at home<br>90dB the sound of a truck passing on the street<br>100dB the sound of a rock band<br>115dB limit of sound permitted in industry<br>120dB deafening         |
| dB(A)                       | <i>A-weighted decibels</i> The ear is not as effective in hearing low frequency sounds as it is hearing high frequency sounds. That is, low frequency sounds of the same dB level are not heard as loud as high frequency sounds. The sound level meter replicates the human response of the ear by using an electronic filter which is called the "A" filter. A sound level measured with this filter switched on is denoted as dB(A). Practically all noise is measured using the A filter. The sound pressure level in dB(A) gives a close indication of the subjective loudness of the noise. |
| Frequency                   | Frequency is synonymous to <i>pitch</i> . Sounds have a pitch which is peculiar to the nature of the sound generator. For example, the sound of a tiny bell has a high pitch and the sound of a bass drum has a low pitch. Frequency or pitch can be measured on a scale in units of Hertz or Hz.                                                                                                                                                                                                                                                                                                 |
| Loudness                    | A rise of 10 dB in sound level corresponds approximately to a doubling of subjective loudness. That is, a sound of 85 dB is twice as loud as a sound of 75 dB which is twice as loud as a sound of 65 dB and so on                                                                                                                                                                                                                                                                                                                                                                                |
| LMax                        | The maximum sound pressure level measured over a given period.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| LMin                        | The minimum sound pressure level measured over a given period.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| L1                          | The sound pressure level that is exceeded for 1% of the time for which the given sound is measured.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| L10                         | The sound pressure level that is exceeded for 10% of the time for which the given sound is measured.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| L90                         | The level of noise exceeded for 90% of the time. The bottom 10% of the sample is the L <sub>90</sub> noise level expressed in units of dB(A).                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Leq                         | The "equivalent noise level" is the summation of noise events and integrated over a selected period of time.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| dB (A)                      | 'A' Weighted overall sound pressure level                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Sound Pressure Level, LP dB | A measurement obtained directly using a microphone and sound level meter. Sound pressure level varies with distance from a source and with changes to the measuring environment. Sound pressure level equals 20 times the logarithm to the base 10 of the ratio of the rms sound pressure to the reference sound pressure of 20 micro Pascals.                                                                                                                                                                                                                                                    |
| Sound Power Level, Lw dB    | Sound power level is a measure of the sound energy emitted by a source, does not change with distance, and cannot be directly measured. Sound power level of a machine may vary depending on the actual operating load and is calculated from sound pressure level measurements with appropriate corrections for distance and/or environmental conditions. Sound power levels is equal to 10 times the logarithm to the base 10 of the ratio of the sound power of the source to the reference sound power of 1 picoWatt                                                                          |



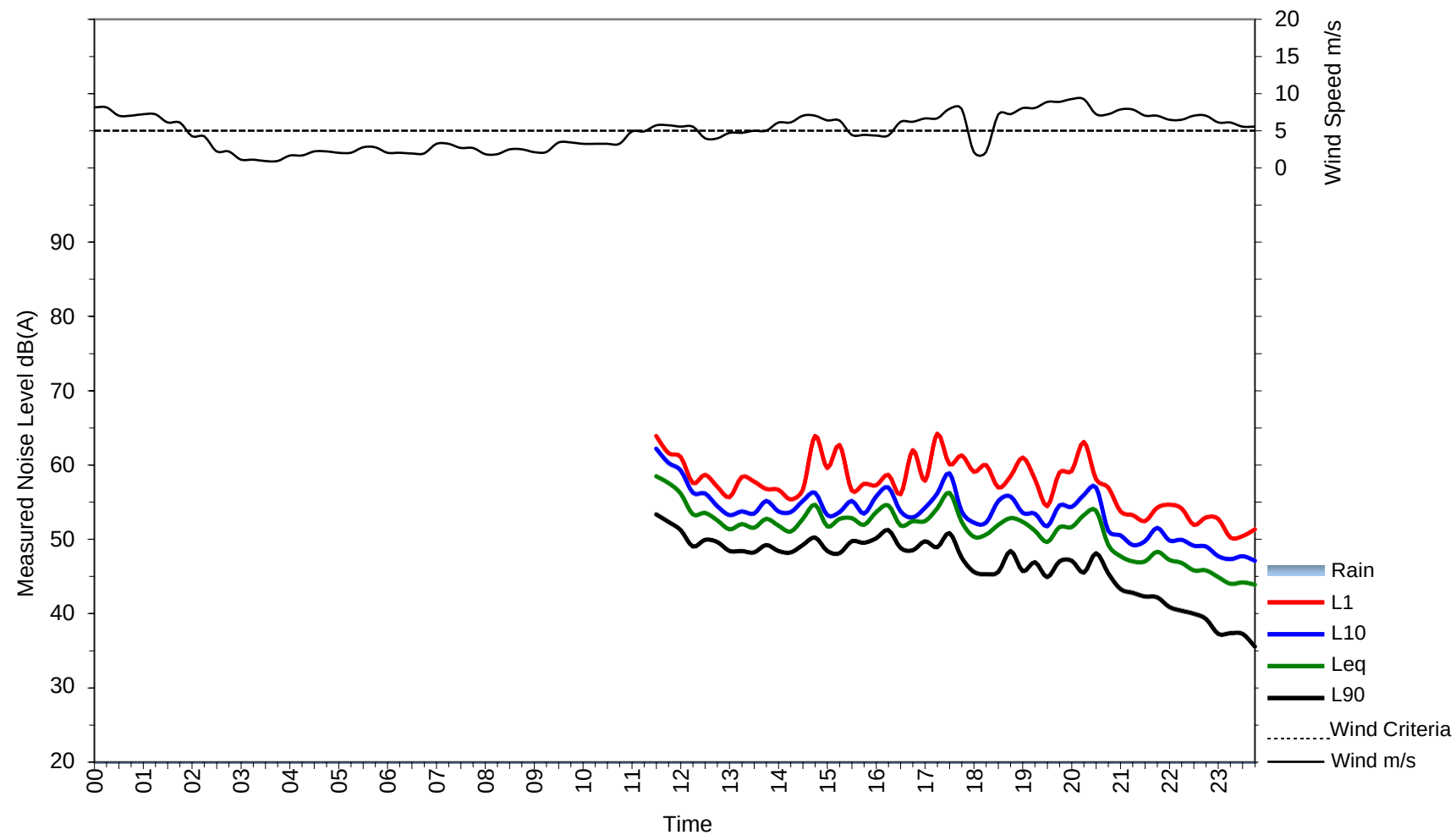
---

## **9 APPENDIX B – NOISE LOGGING RESULTS**



## 37 Canberra Avenue, St Leonards

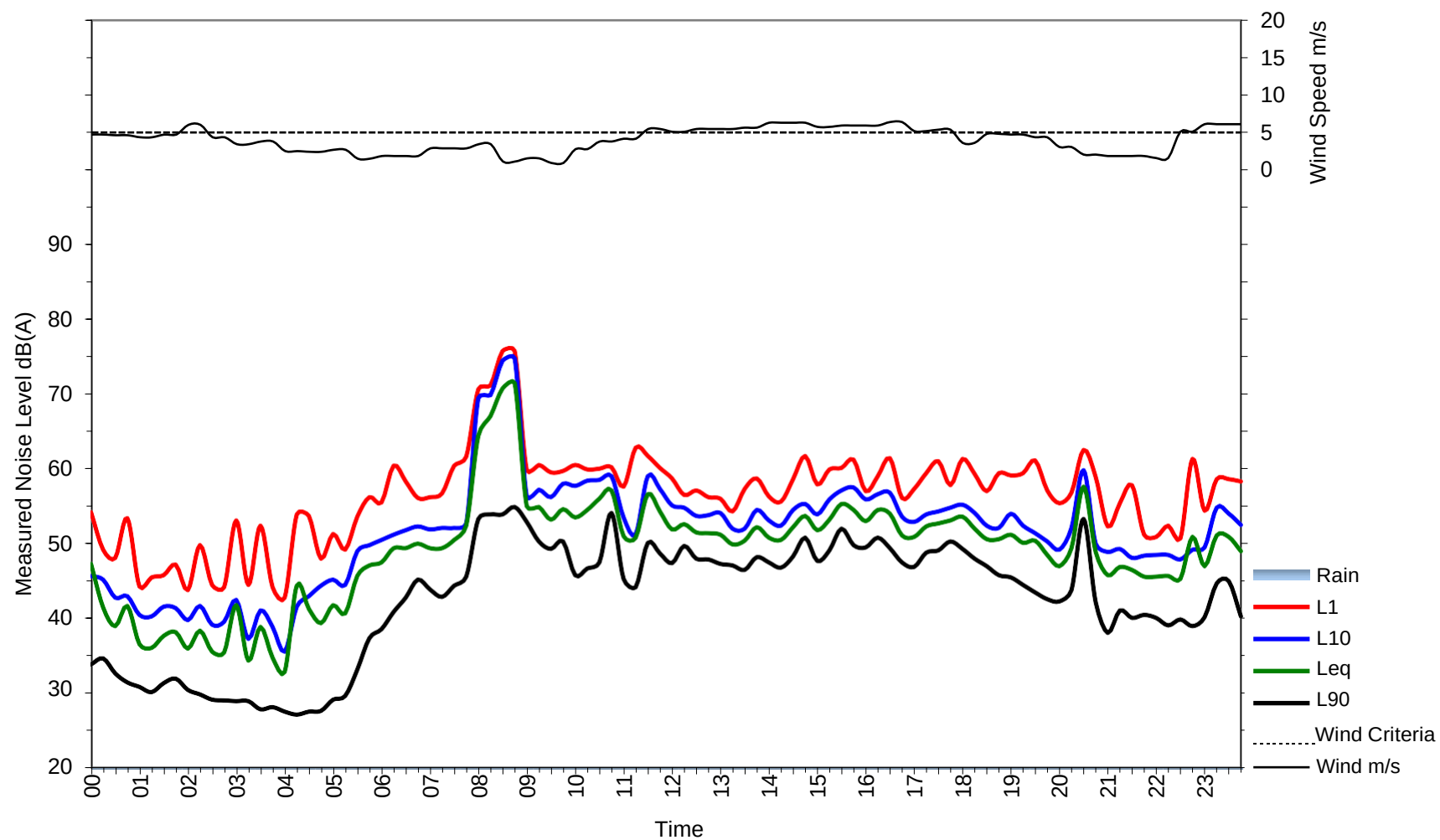
Thursday 14 January 2021





## 37 Canberra Avenue, St Leonards

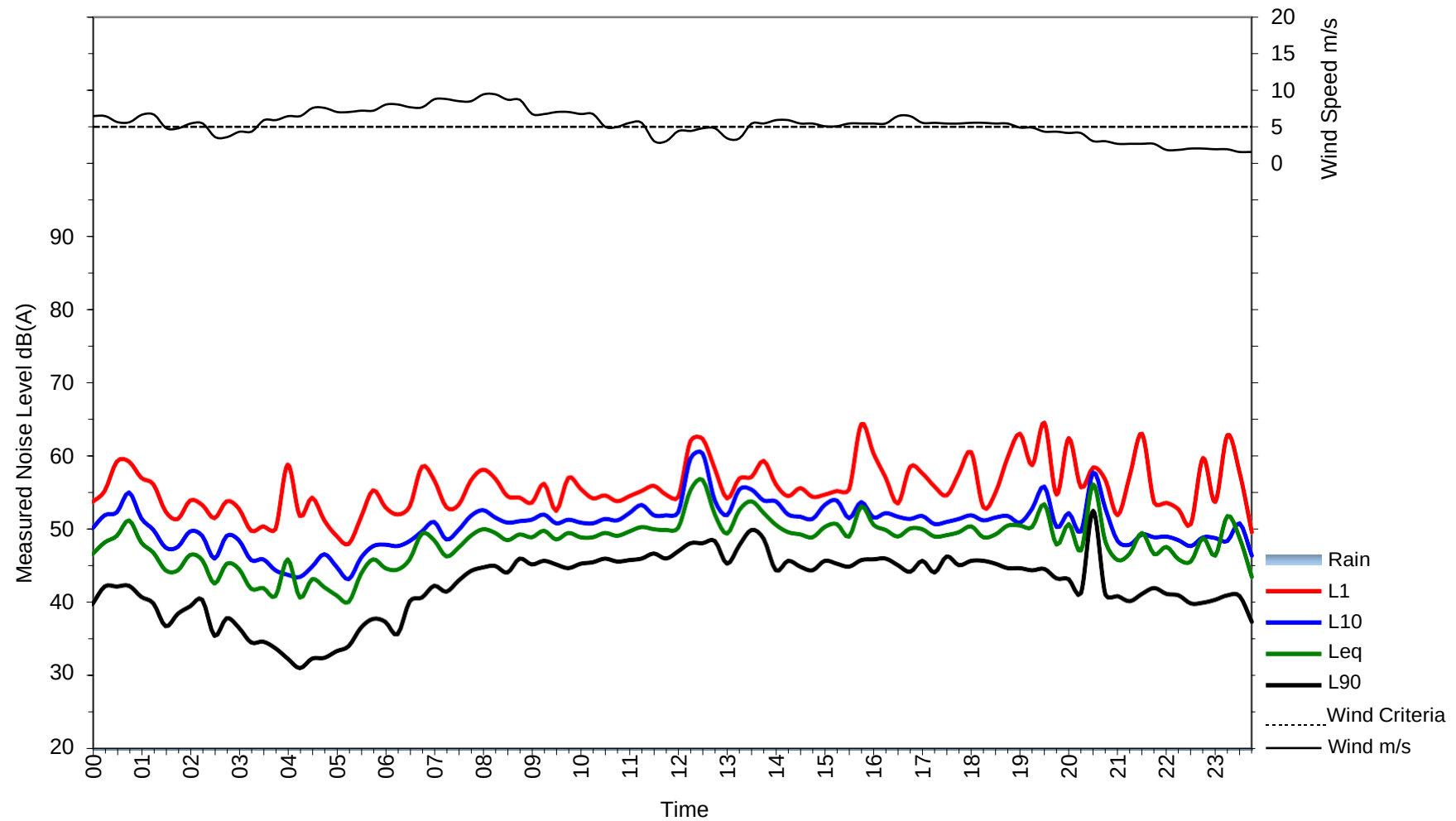
Friday 15 January 2021





## 37 Canberra Avenue, St Leonards

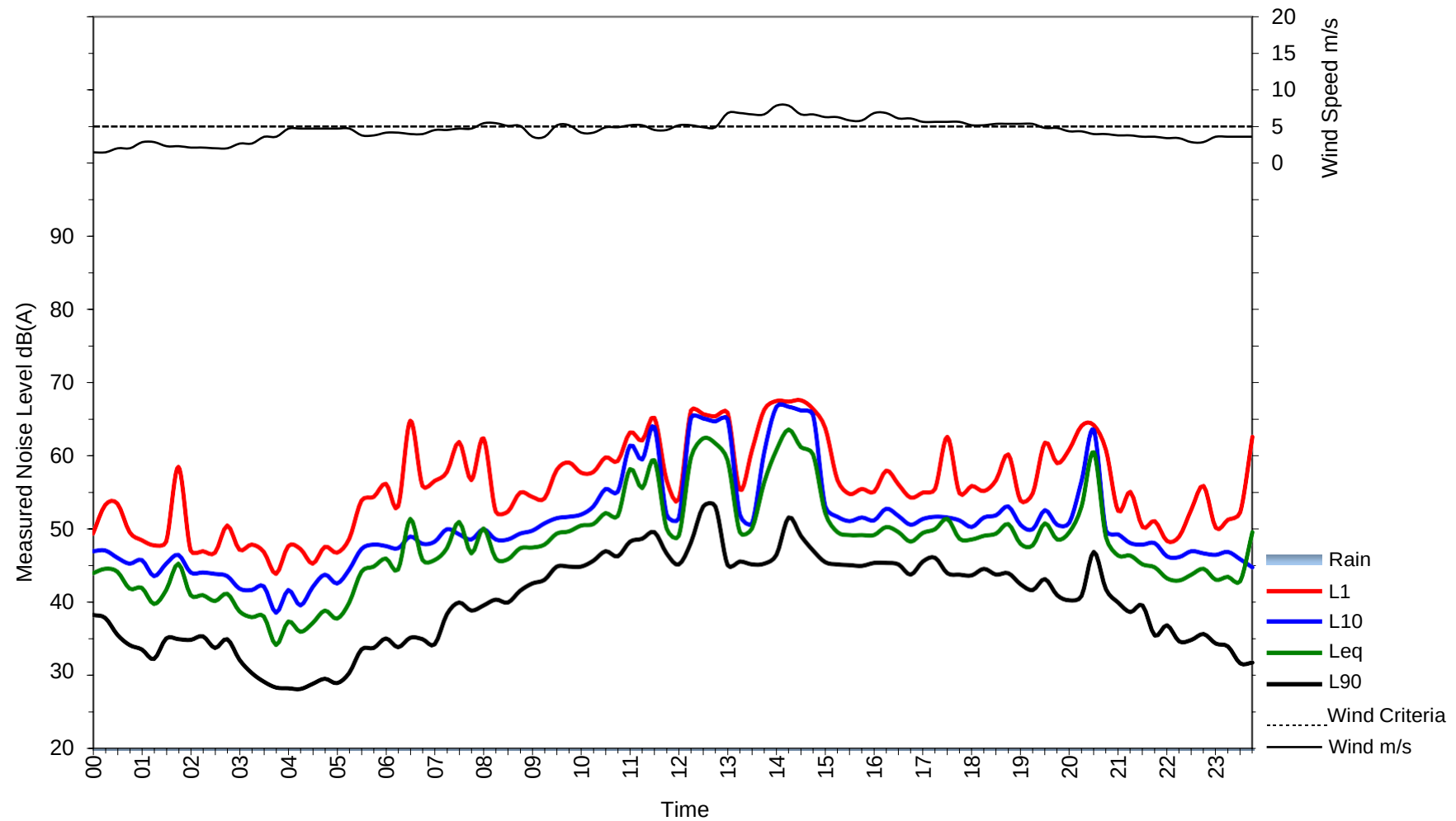
Saturday 16 January 2021





## 37 Canberra Avenue, St Leonards

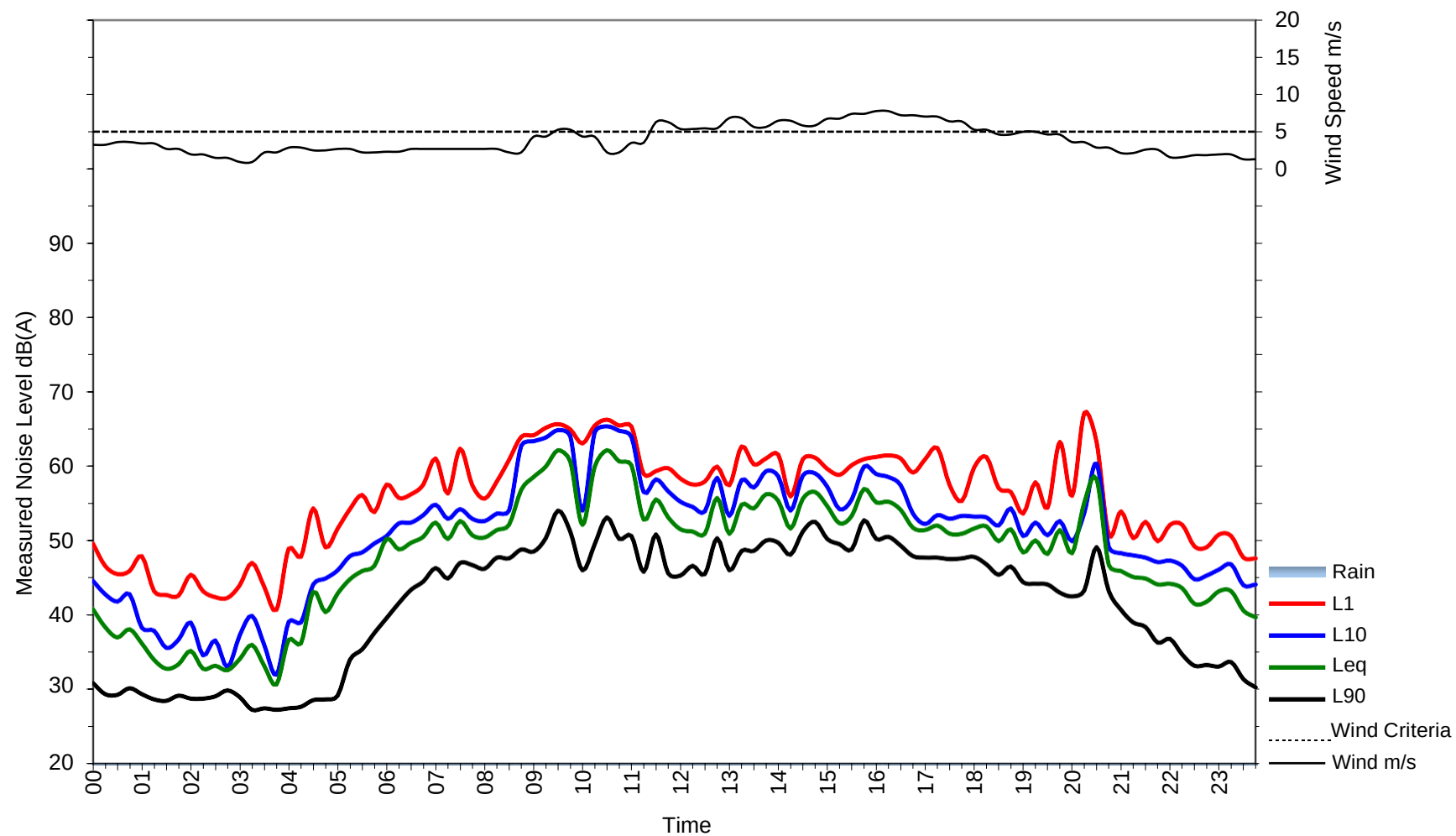
Sunday 17 January 2021





## 37 Canberra Avenue, St Leonards

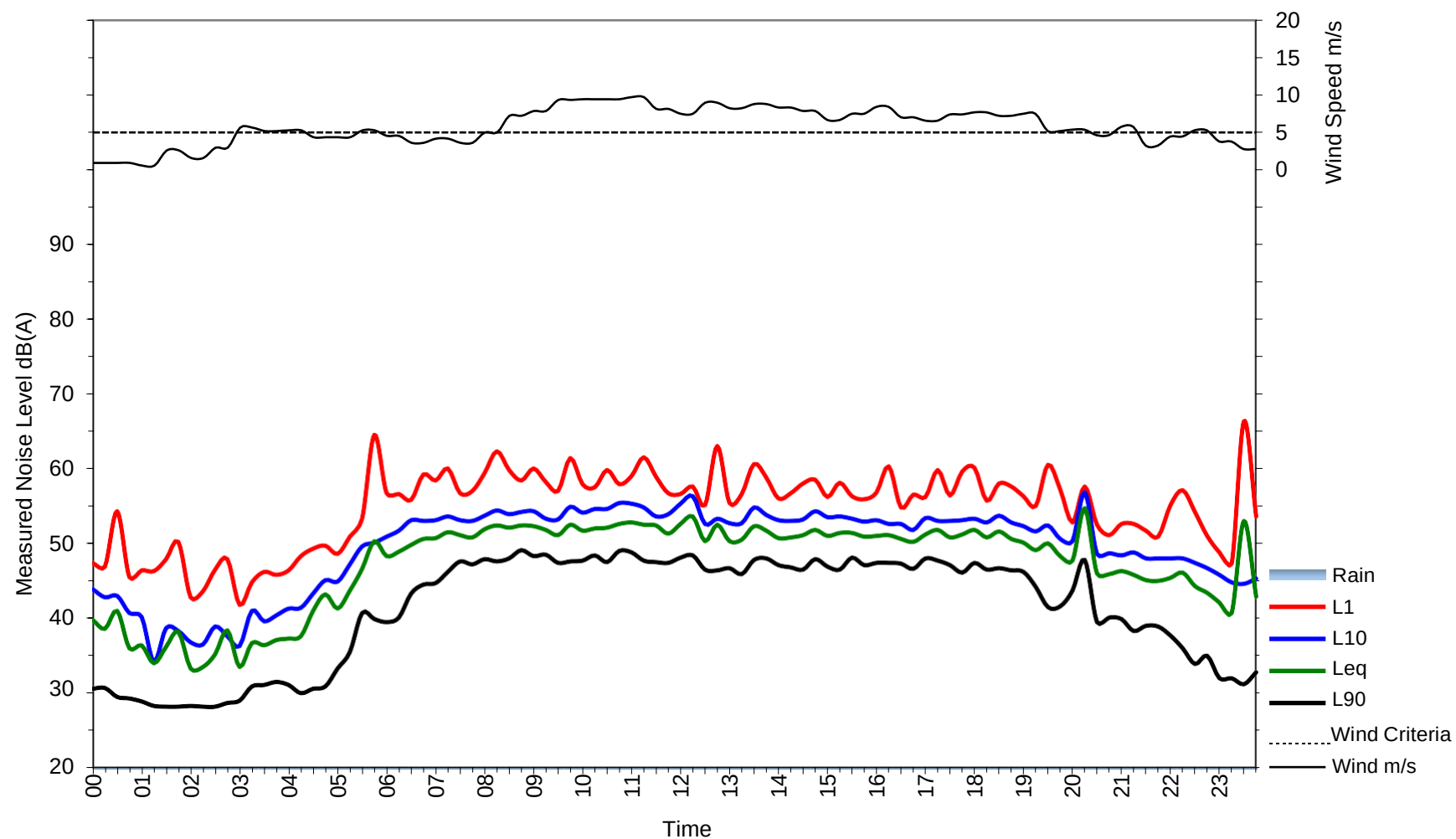
Monday 18 January 2021





## 37 Canberra Avenue, St Leonards

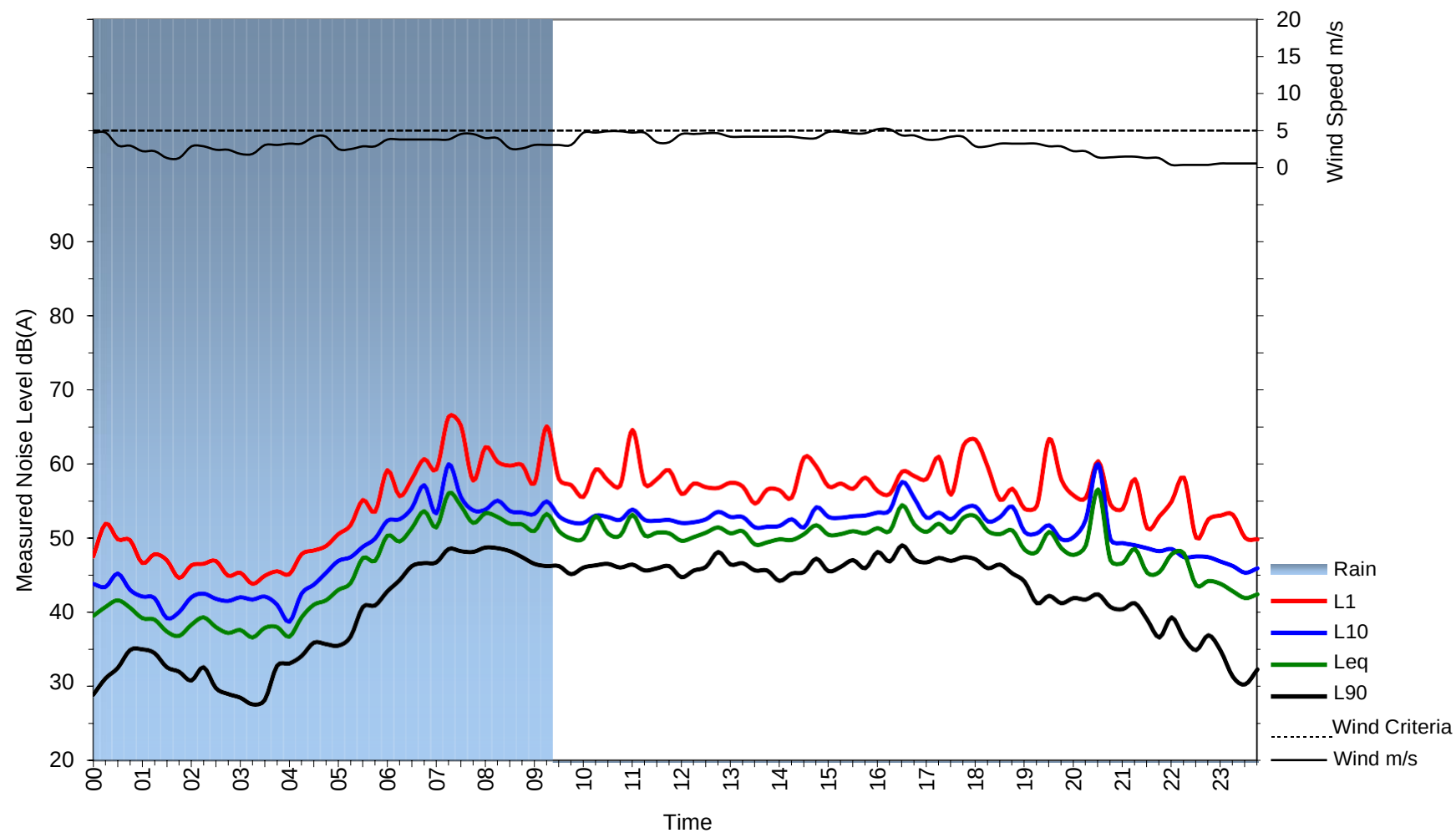
Tuesday 19 January 2021





## 37 Canberra Avenue, St Leonards

Wednesday 20 January 2021





## 37 Canberra Avenue, St Leonards

Thursday 21 January 2021

