RENZO TONIN & ASSOCIATES
inspired to achieve

Acoustics
Vibration
Structural Dynamics

MOOREBANK INTERMODAL TERMINAL

Annual Noise Review - April 2021

21 June 2021

Tactical

TL116-05F11 Annual Review April 2021 (r2)

35 1982-2017 ACOUSTIC ENGINEERING EXCELLENCE

Sydney Melbourne Brisbane Gold Coast Kuwait Singapore
Renzo Tonin & Associates ABN 29 117 462 861
Level 1/418A Elizabeth St SURRY HILLS NSW 2010 | PO Box 877 STRAWBERRY HILLS NSW 2012
P (02) 8218 0500 F (02) 8218 0501 sydney@renzotonin.com.au www.renzotonin.com.au

aaac Association of Australian Acoustical Consultants

Document details

Detail	Reference
Doc reference:	TL116-05F11 Annual Review April 2021 (r2)
Prepared for:	Tactical
Address:	Level 15, 124 Walker Street North Sydney, NSW, 2060
Attention:	Fei Chen

Document control

Date	Revision history	Non-issued revision	Issued revision	Prepared	Instructed	Reviewed / Authorised
29.04.2021	Draft	0	1	C. Weber	-	C. Weber
21.06.2021	Final	-	2	C. Weber	-	C. Weber

File Path: R:\AssocSydProjects\TL101-TL150\TL116 cw Moorebank IMT Temporary Noise Monitoring\Task 5 - cw Operation Compliance Monitoring\1 Docs\Report 11 2021 Annual Review\TL116-05F11 Annual Review April 2021 (r2).docx

Important Disclaimers:

The work presented in this document was carried out in accordance with the Renzo Tonin & Associates Quality Assurance System, which is based on Australian/New Zealand Standard AS/NZS ISO 9001.

This document is issued subject to review and authorisation by the suitably qualified and experienced person named in the last column above. If no name appears, this document shall be considered as preliminary or draft only and no reliance shall be placed upon it other than for information to be verified later.

This document is prepared for the particular requirements of our Client referred to above in the 'Document details' which are based on a specific brief with limitations as agreed to with the Client. It is not intended for and should not be relied upon by a third party and no responsibility is undertaken to any third party without prior consent provided by Renzo Tonin & Associates. The information herein should not be reproduced, presented or reviewed except in full. Prior to passing on to a third party, the Client is to fully inform the third party of the specific brief and limitations associated with the commission.

In preparing this report, we have relied upon, and presumed accurate, any information (or confirmation of the absence thereof) provided by the Client and/or from other sources. Except as otherwise stated in the report, we have not attempted to verify the accuracy or completeness of any such information. If the information is subsequently determined to be false, inaccurate or incomplete then it is possible that our observations and conclusions as expressed in this report may change.

We have derived data in this report from information sourced from the Client (if any) and/or available in the public domain at the time or times outlined in this report. The passage of time, manifestation of latent conditions or impacts of future events may require further examination and re-evaluation of the data, findings, observations and conclusions expressed in this report.

We have prepared this report in accordance with the usual care and thoroughness of the consulting profession, for the sole purpose described above and by reference to applicable standards, guidelines, procedures and practices at the date of issue of this report. For the reasons outlined above, however, no other warranty or guarantee, whether expressed or implied, is made as to the data, observations and findings expressed in this report, to the extent permitted by law.

The information contained herein is for the purpose of acoustics only. No claims are made and no liability is accepted in respect of design and construction issues falling outside of the specialist field of acoustics engineering including and not limited to structural integrity, fire rating, architectural buildability and fit-for-purpose, waterproofing and the like. Supplementary professional advice should be sought in respect of these issues.

External cladding disclaimer: No claims are made and no liability is accepted in respect of any external wall and/or roof systems (eg facade / cladding materials, insulation etc) that are: (a) not compliant with or do not conform to any relevant non-acoustic legislation, regulation, standard, instructions or Building Codes; or (b) installed, applied, specified or utilised in such a manner that is not compliant with or does not conform to any relevant non-acoustic legislation, regulation, standard, instructions or Building Codes.

Contents

1 Introduction 1
1.1 Project overview 1
2 Compliance Matrix 3
3 INP noise monitoring at Casula, Glenfield, Wattle Grove and Wattle Grove North 14
4 Container noise barrier measurements 15
5 Warehouse noise monitoring 17
6 Rail link noise monitoring at residential receivers 19
7 Continuous noise monitoring in residential areas 21
8 Continuous rail link noise monitoring 22
8.1 Year 1 rail operations noise monitoring report 22
9 Rail link angle of attack (AoA) monitoring 26
9.1 Year 1 rail operations AoA monitoring 26
10 Road traffic noise on public roads 28
11 Conclusion 29
APPENDIX A Glossary of terminology 30
APPENDIX B Detailed noise assessment reports 35
B.1 Industrial Noise Policy Measurement Report for Quarter 1 2020 36
B.2 Industrial Noise Policy Measurement Report for Quarter 2 2020 37
B.3 Industrial Noise Policy Measurement Report for Quarter 4 2020 38
B.4 Industrial Noise Policy Measurement Report for Quarter 1 2021 39
B.5 Container Noise Barrier Management Plan Monitoring Report 40
B.6 Warehouse 1 Noise Monitoring Report 41
B.7 Warehouse 3A Noise Monitoring Report 42
B.8 Warehouse 4B Noise Monitoring Report 43
B.9 Warehouse 3B Noise Monitoring Report 44
B.10 Warehouse 4A Noise Monitoring Report 45
B.11 Warehouse 5 Noise Monitoring Report 46
B.12 Existing Levels of Rail Noise and Residential Receivers (2017-2018) 47
B.13 Rail Noise Levels at Glenfield Farm (2020) 48
B.14 Curve Noise Monitoring Report 49
B.15 Operational Road Traffic Noise Assessment - June 2021 50

List of tables

Table 1 Compliance matrix 4
Table 2 Summary of INP noise monitoring 14
Table 3 Summary of container noise barrier management plan noise monitoring 15

Table 4 Predicted noise levels at nearest residential receivers 16
Table 5 Summary of warehouse noise monitoring 17
Table 6 Summary of container noise barrier management plan noise monitoring 19
Table 7 Summary of road traffic noise monitoring 28

List of figures

Figure 1 Measured $L_{Aeq(15hour)}$ daytime noise levels at 30 m from track centreline 24
Figure 2 Measured $L_{Aeq(9hour)}$ night-time noise levels at 30 m from track centreline 24
Figure 3 Measured L_{AFmax} daytime noise levels at 7.5 m from track centreline 25
Figure 4 Measured L_{AFmax} night-time noise levels at 7.5 m from track centreline 25
Figure 5 Maximum AoA value for each train 27

1 Introduction

1.1 Project overview

The Sydney Intermodal Terminal Alliance (SIMTA) received approval for the construction and operation of Stages 1 and 2 of the Moorebank Precinct East (MPE) Project (SSD 6766 and SSD 7628 respectively), which together comprise the two stages of development under the MPE Concept Approval (MP10_0193).

This **Annual Noise Review** report **for Year 1 Operations** has been prepared to address the requirements of Approval Condition G15 of SSD 6766 as follows:

> ***SSD 6766 G15***
> *Within 12 months of the commencement of operation of the project, or as otherwise agreed by the Secretary, the Applicant shall undertake operational noise monitoring to compare actual noise performance of the project against noise performance predicted in the review of noise mitigation measures predicted in documents specified under condition A1 of this approval, and prepare an Operational Noise Report to document this monitoring. The Report shall include, but not necessarily be limited to:*
>
> *a) noise monitoring to assess compliance with the operational noise levels predicted in documents specified under condition A1 of this approval;*
>
> *b) a review of the operational noise levels in terms of criteria and noise goals established in the NSW Road Noise Policy (EPA, 2011);*
>
> *c) sleep disturbance impacts compared to those determined in Condition E25;*
>
> *d) methodology, location and frequency of noise monitoring undertaken, including monitoring sites at which project noise levels are ascertained, with specific reference to locations indicative of impacts on sensitive receivers;*
>
> *e) details of any complaints and enquiries received in relation to operational noise generated by the project between the date of commencement of operation and the date the report was prepared;*
>
> *f) any required recalibrations of the noise model taking into consideration factors such as actual traffic numbers and proportions;*
>
> *g) an assessment of the performance and effectiveness of applied noise mitigation measures together with a review and if necessary, reassessment of all feasible and reasonable mitigation measures; and*
>
> *h) identification of additional feasible and reasonable measures to those predicted in the documents specified under condition A1 of this approval, that would be implemented with the*

> *objective of meeting the criteria outlined in the NSW Road Noise Policy (EPA, 2011), when these measures would be implemented and how their effectiveness would be measured and reported to the Secretary and the EPA.*
>
> *The Applicant shall provide the Secretary and the EPA with a copy of the Operational Noise Report within 60 days of completing the operational noise monitoring referred to in (a) above or as otherwise agreed by the Secretary.*

The above condition refers to range of assessment and noise monitoring requirements that have been completed at various stages during the first 12 months of operations. Table 1 provides a summary of the noise-related Approval Conditions and how these are addressed in this Annual Noise Review.

A separate report has been prepared to address operational noise emissions relating to MPE at 50% site occupancy stage (required as part of SSD 7628 Condition B86). Additional approval conditions from SSD 7628 which are not covered by the 50% site occupancy report are identified in Table 1.

Appendix A contains a glossary of acoustic terms used in this report.

Appendix B contains a copy of the reports referred to in this report that are not publicly available on the SIMTA website.

2 Compliance Matrix

Table 1 provides a summary of the Approval Conditions which relate to operational noise emissions, and a discussion of the operational noise monitoring results. Where required, additional information is provided in later sections of this report or the appendices.

Table 1 Compliance matrix

Condition ID	Condition	Comments on compliance	Reference for further information
SSD 6766			
G15	Within 12 months of the commencement of operation of the project, or as otherwise agreed by the Secretary, the Applicant shall undertake operational noise monitoring to compare actual noise performance of the project against noise performance predicted in the review of noise mitigation measures predicted in documents specified under condition A1 of this approval, and prepare an Operational Noise Report to document this monitoring. The Report shall include, but not necessarily be limited to:	The commencement of operations occurred in May 2020. Operational noise monitoring commitments in the Condition A1 documents include preparation of an Operational Noise and Vibration Management Plan (ONVMP) to identify the proposed industrial noise monitoring requirements; and rail noise monitoring to assess the effectiveness of friction modifiers and freight train noise. These monitoring requirements are captured in the Approval Conditions referred to herein.	Operational Noise and Vibration Management Plan[1]
G15 a)	noise monitoring to assess compliance with the operational noise levels predicted in documents specified under condition A1 of this approval;	These monitoring requirements are captured in the Approval Conditions referred to herein.	n/a
G15 b)	a review of the operational noise levels in terms of criteria and noise goals established in the NSW Road Noise Policy (EPA, 2011);	A review of operational road traffic noise on public roads has been performed. The results are summarised in Section 10 and indicate compliance with the RNP noise goals.	Section 10
G15 c)	sleep disturbance impacts compared to those determined in Condition E25;	The report prepared for Condition E25 predicted compliance with the sleep disturbance screening levels under calm and adverse meteorological conditions. The Industrial Noise Policy (INP) noise monitoring was performed on four occasions (Section 3) and container noise barrier management plan measurements (Section 4) identified that maximum noise level events from operational noise sources were not audible during night-time periods at the nearest residential receivers.	MPE Stage 1 Review of Operational Sleep Disturbance Impacts[2]
G15 d)	methodology, location and frequency of noise monitoring undertaken, including monitoring sites at which project noise levels are ascertained, with specific reference to locations indicative of impacts on sensitive receivers;	A combination of permanent and targeted noise monitoring has been performed. Four permanent noise monitors have been set up in residential areas for the purpose of measuring construction-related noise and targeted operational noise (refer Section 7). Continuous noise monitoring has been performed on the rail link to quantify the noise levels of train passbys (Section 8). Attended noise measurements were performed at nearby residential receivers on four occasions to assess operational noise from MPE (Section 3). Noise compliance monitoring of each warehouse was performed on-site and at the nearest residential receivers (Section 5).	SSD 7628: FCCM2, FCCM3C, B80, B85, B86, B90 SSD 6766: F4, F5, F5B, F5C, G6b, G7, G7A, G7B, G15

[1] Operational Noise and Vibration Management Plan - Moorebank Logistics Park – East Precinct, available https://simta.com.au/wordpress/wp-content/uploads/2020/04/ONVMP_V12_redacted.pdf

[2] MPE Stage 1 Review of Operational Sleep Disturbance Impacts, available https://simta.com.au/wordpress/wp-content/uploads/2019/12/Operational_Sleep_Disturbance_Impacts_E25.pdf

Condition ID	Condition	Comments on compliance	Reference for further information
G15 e)	details of any complaints and enquiries received in relation to operational noise generated by the project between the date of commencement of operation and the date the report was prepared;	No complaints related to operational noise have been received to date	n/a
G15 f)	any required recalibrations of the noise model taking into consideration factors such as actual traffic numbers and proportions;	All noise monitoring undertaken to date has complied with the operational noise limits. On this basis, recalibration of the noise models has not been required.	n/a
G15 g)	an assessment of the performance and effectiveness of applied noise mitigation measures together with a review and if necessary, reassessment of all feasible and reasonable mitigation measures; and	All noise monitoring undertaken to date has complied with the operational noise limits. The effectiveness of the container noise barrier (Section 4) and warehouse noise mitigation measures (Section 5) verified the effectiveness of the noise mitigation and management measures. Additional reassessment of all feasible and reasonable mitigation measures has not been required.	Sections 4 and 5
G15 h)	identification of additional feasible and reasonable measures to those predicted in the documents specified under condition A1 of this approval, that would be implemented with the objective of meeting the criteria outlined in the NSW Road Noise Policy (EPA, 2011), when these measures would be implemented and how their effectiveness would be measured and reported to the Secretary and the EPA.	A review of the current operational road traffic noise on public roads has been performed. The results are summarised in Section 10 and indicate compliance with the RNP noise goals.	Section 10
G15	The Applicant shall provide the Secretary and the EPA with a copy of the Operational Noise Report within 60 days of completing the operational noise monitoring referred to in (a) above or as otherwise agreed by the Secretary.	The completion of the operational noise monitoring associated with the most recent Industrial Noise Policy measurements were completed on 30 March 2021. This report has been prepared within 60 days of the latest monitoring.	n/a

<table>
<tr><th>Condition ID</th><th>Condition</th><th>Comments on compliance</th><th>Reference for further information</th></tr>
<tr><td>F5A b), c) and d)</td><td>b) the measurement of noise from operation of the site and an assessment of compliance with the project specific noise levels and the sleep disturbance trigger levels at the nearest affected residential receivers at the following times:
(i) not less than 3 months and not more than 6 months after commencement of operation, noise surveys shall be conducted on three separate nights for a period of not less than 2 hours whilst train wagons are being loaded with containers;
(ii) thereafter for 6 months on one night per month for a period of not less than 2 hours whilst train wagons are being loaded with containers.
Noise measurements shall be conducted in accordance with the EPA's Industrial Noise Policy.

c) the details of each noise survey shall be documented in a report with a drawing showing the observed location of containers which are subject to the Plan, the measurement equipment used, its calibration status, environmental conditions, receiver locations, methodology, a detailed description of the activities on site, the results obtained and whether or not compliance has been achieved with the project specific noise levels and the sleep disturbance trigger levels at the nearest affected residential receivers.

d) if the report concludes that the project specific noise levels and the sleep disturbance trigger levels for the night-time period at the nearest affected residential receivers are not being complied with, then recommendations shall be made by the acoustic consultant to amend the Plan accordingly and the Applicant shall implement those recommendations as soon as practical provided they are feasible and reasonable.</td><td>The measurement of noise from the operation of the site was performed on four occasions to assess general MPE-related noise (refer Section 3). Additional noise measurements and predictions to assess warehouse-specific noise levels were performed on six occasions (refer Section 5). Measurements to evaluate the noise associated with the loading / unloading of containers from trains and the effectiveness of the container noise barrier was performed on one occasion (refer Section 4).
As noted in Sections 6 and 8, there is an average of 1.5 to 2 night-time train movements per week on the new rail link to and from the Intermodal Terminal. This corresponds to approximately one container loading / unloading event per week, on average, during the night-time period, for current operations. Based on the infrequent nature of night-time container loading / unloading events, that noise levels were not audible at the nearest residential receivers and that the predicted noise levels are 5 dB(A) or more below the noise management levels, these measurements have only been performed on one occasion.
All reports conclude that the operational noise levels comply with the approval noise limits and that no additional mitigation or management measures are required.</td><td>Sections 3, 4 and 5</td></tr>
<tr><td>F5B</td><td>Industrial noise (excluding activities covered by the NSW Rail Infrastructure Noise Guideline) generated by the development is to be measured and evaluated for compliance generally in accordance with the relevant requirements of the NSW Industrial Noise Policy (as may be updated from time to time).
Table A: Noise Criteria dB(A)
<table>
<tr><th>Sensitive Receiver</th><th>Day (LAeq(15min))</th><th>Evening (LAeq(15min)</th><th>Night (LAeq(15min))</th><th>Night (LA1(1min))</th></tr>
<tr><td>Wattle Grove (NCA 1)</td><td>43</td><td>42</td><td>42</td><td>52</td></tr>
<tr><td>Wattle Grove (NCA 2)</td><td>41</td><td>41</td><td>41</td><td>51</td></tr>
<tr><td>Casula (NCA 3)</td><td>45</td><td>42</td><td>38</td><td>47</td></tr>
<tr><td>Glenfield (NCA 4)</td><td>46</td><td>46</td><td>40</td><td>50</td></tr>
</table>
Note: References to sensitive receivers should be read in conjunction with the description of sensitive receivers in the EIS noting that Casula includes Glenfield Farm.</td><td>The measurement of noise from the operation of the site was performed on four occasions to address the requirements of this condition (refer Section 3). These measurements were performed in February 2020, July 2020, December 2020 and March 2021. During each campaign, attended noise measurements were performed at the nearest residential receivers in the suburbs of Casula, Glenfield, Wattle Grove and Wattle Grove North.
In all cases, noise emissions from MLP East operations were not audible at the nearest residential receivers in the presence of ambient noise from other sources. The ambient noise environment was controlled by local and distant road / rail traffic and other natural sources. During night-time periods, no maximum noise events were audible at the nearest residential receivers.
The reports conclude that operational noise levels from MPE were compliant with the noise limits in this condition.</td><td>Section 3</td></tr>
</table>

Condition ID	Condition	Comments on compliance	Reference for further information
F5C	The noise criteria in Table A of condition F5B are to apply under all meteorological conditions except the following: (a) wind speeds greater than 3 m/s at 10 metres above ground level; or (b) stability category F temperature inversion conditions and wind speeds greater than 2 m/s at 10 m above ground level; or (c) stability category G temperature inversion conditions.	The noise compliance measurements referred to in Section 3 and the above comments related to condition F5B were performed under weather conditions compliant with the requirements of this condition.	Section 3
G7	The Applicant shall install and maintain a rail noise monitoring system on the rail link at the commencement of operation to continuously monitor the noise from rail operations on the rail link. The system shall capture the noise from each individual train passby noise generation event, and include information to identify: a) Time and date of freight train passbys; b) Imagery or video to enable identification of the rolling stock during day and night; c) $L_{Aeq(15hour)}$ and $L_{Aeq(9hour)}$ from rail operations; and d) $L_{AF(max)}$ and SEL of individual train passbys, measured in accordance with ISO3095; or e) Other alternative information as agreed with, or required by, the Secretary. The results from the noise monitoring system, shall be publicly accessible from a website maintained by the Applicant. The noise results from each train shall be available on the website within 24 hours of it passing the monitor, unless unforeseen circumstances (i.e a system malfunction) have occurred. The $L_{Aeq(15hour)}$ and $L_{Aeq(9hr)}$ results from each day shall be available on the website within 24 hours of the period ending. Prior to the commencement of operation, the Applicant shall submit for the approval of the Secretary, justification supporting the appropriateness of the location for rail noise monitoring, including details of any alternative options considered and reasons for these being dismissed. The rail noise monitoring system shall not operate until the Secretary has approved the proposed monitoring location. The Applicant shall provide an annual report to the Secretary with the results of monitoring for a period of 5 years, or as otherwise agreed with the Secretary, from the commencement of operation of the IMEX terminal. The Secretary shall consider the need for further reporting following a review of the results for year 5.	The commencement of IMT operations occurred in May 2020. The new rail link was commissioned in November 2019. A description of the noise monitoring systems are provided in Section 8 and capture all information required by this approval. A Functional and Performance Specification for the permanent noise monitoring system and angle of attack monitoring system was prepared for approval by the Secretary before the rail link commissioning. A summary of the noise monitoring results of the first year operations is provided in Section 8.1.	https://simta.com.au/wordpress/wp-content/uploads/2019/12/TJ741-04F04-AoA-and-Functional-Spec-for-Permanent-Noise-Monitor-r9_redacted.pdf https://moorebanknoisemonitor-emsbk.trackiq.net/NoiseMonitor/ http://www.renzotonin.com.au/imt-monitoring/

Condition ID	Condition	Comments on compliance	Reference for further information
G7A	The applicant shall install and maintain a wayside angle of attack monitoring system on the rail link at the commencement of operation to continuously monitor the angle of attack to the rail of rolling stock wheels. The system shall capture the angle of attack from a wheel on each axle of every train, and include information to identify: a) Time and date of each axle passby; and b) The identification number of each item of rolling stock. The results from the angle of attack monitoring system shall be: • accessible by train operators from a website maintained by the Applicant. Angle of attack results from each train shall be available on the website within 24 hours of it passing the monitor, unless unforeseen circumstances have occurred. • included in a six-monthly report to the Secretary. The report should at least identify the number of wagons with wheels that exceed the ASA standard angle of attack and the action taken by operators to improve steering performance. Prior to the commencement of operation, the Applicant shall submit for the approval of the Secretary, justification supporting the appropriateness of the location for angle of attack monitoring, the format of the information to be accessible to operators and the format of the public report. The angle of attack monitoring system shall not operate until the Secretary has approved the proposed monitoring location and reporting arrangements.	An Angle of Attack (AoA) monitoring system was installed on the new rail link in May 2020. The monitoring system captures the AoA of each axle passby and compares the measured values with the acceptable value in the applicable Asset Standards Authority minimum operating standard. The AoA values for each axle are available to operators in accordance with the approval condition. A Functional and Performance Specification for the permanent noise monitoring system and angle of attack monitoring system was prepared for approval by the Secretary before the rail link commissioning. A summary of the AoA noise monitoring results of the first year operations is provided in Section 9.1. The monitoring identified 13 trains where the maximum AoA value exceeded the alarm level. Two of these events resulted in elevated noise levels at the permanent noise monitoring location. These were viewed as one-off instances, occurring irregularly.	Section 8

Condition ID	Condition	Comments on compliance	Reference for further information
G7B	The Applicant shall: (a) not less than three months and not more than twelve months from commencement of operation, engage an appropriately qualified and experienced acoustic engineer to undertake a night-time noise survey at Glenfield Farm (or an equivalent location if access is denied). (b) the noise survey shall be conducted in accordance with the EPA's Rail Infrastructure Noise Guideline 2013 to determine: (i) the contribution of any new rail traffic travelling to and from the development; and, (ii) the increase in the total rail traffic noise level caused by any new rail traffic to and from the development. (c) the noise survey shall be conducted for not less than 12 contiguous days in the winter months (July, August or September). (d) if as a result of the noise survey there is a sustained increase in the total rail traffic noise level due to the noise level from rail traffic travelling to and from the development of more than 2dB(A) for more than 30% of nights surveyed, the Applicant shall: within twelve months, construct a noise barrier along the relevant sections of rail link in accordance with the specifications provided by an appropriately qualified and experienced acoustic engineer so as to limit the increase in the total rail traffic noise level at Glenfield Farm caused by any new rail traffic to and from the development to not exceed 2dB(A). (e) the report of the noise survey including the results and recommendations shall be provided to the Secretary.	The existing level of rail traffic noise prior to construction of the new rail link was performed over a two-week period in August 2017 and a two-week period in November/December 2018. Commissioning of the new rail link occurred in November 2019. The detailed noise survey to assess compliance with this approval condition was performed over 22 contiguous days between 13 August and 4 September 2020 (winter and early spring). Resident permission to perform measurements at the Glenfield Farm was not granted. The measurements were performed at an equivalent location, at the publicly accessible area immediately north of the Glenfield Farm. The measurements were performed in accordance with the requirements of the EPA's Rail Infrastructure Noise Guideline 2013. A summary of the noise measurement results is provided in Section 6. The results identified that there was only a small number of train movements on the rail link during night-time periods (average of two night-time passbys per week). This is less than 30% of the nights surveyed. The measurement survey identified a maximum increase in rail noise levels during the night-time period of 0.1 dB(A), compared with the 2 dB(A) allowance in Approval Condition G7B. Therefore, the construction of a noise barrier along relevant sections of rail link is not required.	Section 9
G8	The following measures must be implemented during operation: a) The use of automatic rail lubrication equipment in accordance with ASA Standard T HR TR 00111 ST Rail Lubrication and top of rail friction modifiers, where required; and b) Measures to ensure the rail cross sectional profile is maintained in accordance with ETN–01-02 Rail Grinding Manual for Plain Track to ensure the correct wheel / rail contact position and hence to encourage proper rolling stock steering.	Two rail friction modifier systems were installed on the rail link on 22 November 2019 per ASA Standard. These are positioned on the MIMT North Track at Chainage 39.840 km and the MIMT South Track at Chainage 39.580 km. These are maintained by Laing O'Rourke (LOR) on behalf of Qube and monthly track inspections are performed to ensure satisfactory operation. Rail grinding has been performed so that the rail profile is within the ARTC standards.	FCCM 3B
SSD 7628			
B79	The permitted hours of warehouse and distribution operation as detailed in Table 4. Table 4: Hours of Operation **Activity** / **Day** / **Time** Operation / Monday to Sunday / 24 hours	MPE operates 24 hours per day, 365 days per year, consistent with the permitted hours of operation.	n/a

Condition ID	Condition	Comments on compliance	Reference for further information
B85	The Applicant must carry out noise monitoring of mechanical plant and other noisy equipment for a minimum period of one week where valid data is collected following occupation of each warehouse. The monitoring program must be carried out by a suitably qualified and experienced person(s) and a Monitoring Report for Mechanical Plan must be submitted to the Secretary within two months of occupation or each tenancy to verify predicted mechanical plant and equipment noise levels.	Noise measurements to confirm the noise levels of each warehouse have been performed for six warehouses. A summary of the noise measurement results and predictions are provided in Section 5. For all warehouses, the predicted $L_{Aeq(15minute)}$ noise levels for the reasonable worst-case operations comply with the noise limits.	Section 5
B88	To ensure the operational noise impacts are appropriately managed, the following measures apply: a) use of best practice plant; and b) preparation of a risk assessment to determine if non-tonal reversing alarms can be fitted as a condition of site entry. Alternatively, site design may include traffic flow that does not require or precludes reversing of vehicles.	All noise monitoring undertaken to date has complied with the operational noise limits. The effectiveness of the container noise barrier (Section 4) and warehouse noise mitigation measures (Section 5) verified the effectiveness of the noise mitigation and management measures. Additional consideration of best practice plant has not been required. The risk assessment relating to the use of non-tonal reversing alarms is addressed in the Table 2-3 of the ONVMP.	ONVMP https://simta.com.au/wordpress/wp-content/uploads/2020/04/ONVMP_V12_redacted.pdf
B90	For the duration of operation, the Applicant must: a) continue to implement all reasonable and feasible best practice noise mitigation measures; b) continue to investigate ways to reduce noise generated by the development, including maximum noise levels which may result in sleep disturbance; and c) report on these investigations and the implementation and effectiveness of these measures in the Annual Review to the satisfaction of the Secretary.	All noise monitoring undertaken to date has complied with the operational noise limits. The effectiveness of the container noise barrier (Section 4) and warehouse noise mitigation measures (Section 5) verified the effectiveness of the noise mitigation and management measures. The permanent rail noise monitoring results (Section 8) will be reviewed at the end of Year 2 to determine if there is any further upward trend in the measured noise levels that requires further review. The AoA monitoring data for train axles is reviewed by operators to identify wagons that may require maintenance to improve steering performance. Ongoing noise compliance measurements associated with new warehouse operations, annual measurements of industrial noise at residential receivers and any measurements performed in response to complaints will be reviewed to determine if any additional reasonable, feasible or best practice noise mitigation measures need to be implemented.	Sections 3, 4, 5, 6, 8 and 9

Condition ID	Condition	Comments on compliance	Reference for further information
Final Compilation of Mitigation Measures (FCMM) for MPE Stage 1 and Stage 2			
Stage 1 3B	Friction modifiers will be installed to sections of the Rail link where rail curve squeal is likely to occur. The effectiveness of their application will be confirmed with short-term noise monitoring during the first 3 months of operation.	Two rail friction modifier systems were installed on the rail link on 22 November 2019. Unattended noise monitoring was performed at six curve locations between 27 September 2019 and 16 December 2019 to quantify the overall noise levels and the number of curve squeal events before and after installation of the friction modifier systems. 13 passbys were analysed for the period before installation and a further 16 passbys were analysed afterwards. Observations of curve squeal, curve flanging and brake squeal were made. The noise levels and occurrence of flanging events were highest, followed by squealing events and then braking. The noise measurement results did not show a significant reduction in noise levels after the implementation of the friction modifiers. The change in median noise levels before and after installation was generally within 2 dB(A). Similarly, the noise levels and occurrence of wheel squeal events did not significantly reduce after the installation of the friction modifiers. The duration of squealing events was found to be reduced after installation of the friction modifiers. Overall, the results identified that wheel squeal was not a dominant source of noise on the curves of the rail link. The measured noise levels and rate of occurrence of squealing events identified that squealing noise did not contribute significantly to the overall L_{Aeq} and L_{AFmax} noise levels. One of the 29 passbys experienced severe squealing. Rail passby noise levels were controlled by wagon wheel-rail noise, locomotive noise and flanging noise.	Renzo Tonin Report TL116-02F02 Curve noise monitoring report (r1) dated 6 March 2020 (Moorebank Intermodal Terminal Rail Link - Curve Noise Monitoring Report)
Stage 1 3C	A Rail Noise Management Plan (RNMP) (or equivalent) will be prepared prior to operation of the Proposal. The RNMP will include procedures for the application of friction modifiers to the Rail link and measurement and reporting of subsequent rail noise levels should be documented in a Rail Noise Management Plan (RNMP) (or equivalent) to be prepared prior to the operation of the Proposal. During preparation of the RNMP, background rail noise monitoring will be undertaken to establish existing levels of rail noise levels in accordance with the RING. The RNMP will prescribe mitigation measures where modelling predicts and /or operational monitoring shows an exceedance attributable to the Proposal that RING prescribes as a trigger level.	The RNMP is described in Section 3.4.5 of the ONVMP. The current reports and noise monitoring results do not identify rail noise as being a significant impact during operations. The measured noise levels in Section 6 indicate compliance with the noise limits at the nearest residential receiver location (Glenfield Farm).	ONVMP https://simta.com.au/wordpress/wp-content/uploads/2020/04/ONVMP_V12_redacted.pdf
Stage 1 3D	Rail grinding will be undertaken in accordance with TfNSW's requirements on the Rail link, or where otherwise identified within the RNMP or other operational management plan for the Proposal.	Rail grinding has been performed so that the rail profile is within the ARTC standards.	n/a

Condition ID	Condition	Comments on compliance	Reference for further information
Stage 2 2D	In the event of any noise or vibration related complaint or adverse comment from the community, noise and ground vibration levels (as relevant) would be investigated. Remedial action would be implemented where feasible and reasonable. The procedures for managing complaints would be provided within the Community Information and Awareness Strategy.	No complaints related to operational noise have been received to date	n/a
Operational Noise and Vibration Management Plan – Section 4.1.1 Summary of Monitoring Requirements			
Table 4.1 Rail noise monitoring	Continuous rail noise monitoring will be undertaken from the commencement of operations of the IMEX terminal. The monitoring system will capture the following information: • Noise from each train passby • Time and date of each train passby • Imagery or video recording to identify rolling stock • $L_{AF(max)}$ and Sound Exposure Level (SEL) of individual train passbys, measured in accordance with ISO 3095:2013 • $L_{Aeq(15hour)}$ and $L_{Aeq(9hour)}$ noise levels for each 24-hour period, which will be calculated based on the number of train passbys during the day and night periods and the corresponding SEL noise levels, consistent with the procedure in Clause 3.4.1.1 of the Rail Infrastructure Noise Guideline (EPA, 2013). • Other information as required by the Secretary	Refer comments related to SSD 6766 G7	SSD 6766 G7
Wayside Angle of Attack Monitoring	Continuous wayside angle of attack monitoring will be undertaken from the commencement of operations of the IMEX terminal. The monitoring system will capture the following information: • Angle of attack from a wheel on each axle of every train • Time and date of each axle passby • Identification number of each item of rolling stock	Refer comments related to SSD 6766 G7A	SSD 6766 G7A
Night Time Rail Noise Monitoring	Between 3 and 12 months, following the commencement of operations of the IMEX terminal, noise surveys will be conducted for minimum of 12 contiguous days during the winter months of July, August or September. The noise survey will be conducted by a qualified and experienced acoustic engineer in accordance with the EPA's Rail Infrastructure Noise Guideline 2013 to determine: • The contribution of any new rail traffic travelling to and from the MLP East Precinct • The increase in the total rail traffic noise level caused by any new rail traffic to and from the MLP East Precinct	Refer comments related to SSD 6766 G7B(a-d)	SSD 6766 G7B(a-d)
Brake Squeal Noise	Continuous (unattended monitoring system) from the commencement of operations of the IMEX terminal – to assess potential noise impacts of rail link at western receivers	Refer comments related to SSD 6766 G7. The permanent noise monitoring system is positioned at a location on the rail link where it can capture noise levels associated with curve brake squeal should this occur.	SSD 6766 G7

Condition ID	Condition	Comments on compliance	Reference for further information
Container Noise Barrier Effectiveness	Between 3 and 6 months after the commencement of operation of the IMEX terminal (3 separate nights for a period of not less than 2 hours whilst train wagons are being loaded with container). Monthly for 6 months after third measurement event (1 night per month for a period of not less than 2 hours whilst train wagons are being loaded containers)	Refer comments related to SSD 6766 F5A	SSD 6766 F5A
Effectiveness of Friction Modifiers	First 3 months of operation of the IMEX terminal	Refer comments related to FCMM 3B	FCMM 3B
Operational Noise Monitoring	Noise monitoring to compare actual noise performance of the MLP East Precinct against the noise management levels will be undertaken as follows: • Regular performance monitoring • Within 12 months of the commencement of operation of the IMEX terminal and Warehouse 1 Precinct • Within 12 months of occupation of the first warehouse, 50% occupation of the site and 100% occupation of the site, or as otherwise agreed by the Secretary • For a minimum of 12 months following occupation of the entire site	Refer comments related to SSD 6766 F4(f)(i) F5A b) to d), F5B, F5C, G7, G7A, G7B, G8 and G15 Refer comments related to SSD 7628 B79, B80, B83, B85, B86, B87 and B90	SSD 6766 F4(f)(i) F5A b) to d), F5B, F5C, G7, G7A, G7B, G8 and G15 SSD 7628 B79, B80, B83, B85, B86, B87 and B90
Operational Noise Monitoring	Attended noise monitoring will be undertaken to determine compliance against the noise management levels upon receipt of a noise complaint	No complaints related to operational noise have been received to date	n/a
Noise Assessment of Mechanical Plant	Conducted for the freight village and each warehouse for a period of 1 week after construction and submitted to secretary within 2 weeks of occupation. Compliance against the noise management levels.	Refer comments related to SSD 7628 B85	SSD 7628 B85
Continuous Unattended Noise Monitoring	Continuous noise monitoring will be conducted at the following locations for a period of twelve months following the occupation of the entire site: • CM1: 26 Woodlake Court, Wattle Grove • CM2: 22 Glenelg Court, Wattle Grove North • CM3: 14 Dunmore Crescent, Casula • CM4: 26 Goodenough Street, Glenfield	Refer comments related to SSD 7628 B64 (refer Section 7)	SSD 7628 B64 Section 7

3 INP noise monitoring at Casula, Glenfield, Wattle Grove and Wattle Grove North

Operational noise monitoring was performed on four occasions in accordance with the requirements of the NSW Industrial Noise Policy (EPA, 2000), to assess the noise emissions of the MPE operations. A summary of the monitoring periods and reports is provided in Table 2.

Table 2 Summary of INP noise monitoring

Noise monitoring period	Report reference
19-21 February 2020	TL116-05F03 Moorebank INP Monitoring Q1 2020 (r2)
2-8 July 2020	TL116-05F04 Moorebank INP Monitoring Q2 2020 (r1)
17-18 December 2020	TL116-05F10 Moorebank INP Monitoring Q4 2020 (r1)
25-30 March 2021	TL116-05F12 Moorebank INP Monitoring Q1 2021 (r3)

During each campaign, attended noise measurements were performed at the nearest residential receivers in the suburbs of Casula, Glenfield, Wattle Grove and Wattle Grove North. Since the MPE facility operates on a 24 hour per day, seven days per week basis, attended measurements were performed during the daytime, evening and night-time periods. The total duration of the attended measurements was between 10 and 18 hours for each measurement campaign.

The aim of the measurements was to quantify the noise contribution from MPE operations during the daytime, evening and night-time periods and compare the $L_{Aeq(15minute)}$ noise contribution with the limits in SSD 6766 and SSD 7628. During night-time periods (10 pm to 7 am), when maximum noise levels have the potential to cause sleep disturbance at residences, maximum noise level events from MPE operations were also reviewed.

In all cases, noise emissions from MLP East operations were not audible at the nearest residential receivers in the presence of ambient noise from other sources. The ambient noise environment was controlled by local and distant road / rail traffic and other natural sources. During night-time periods, no maximum noise events were heard at the nearest residential receivers.

Since noise levels from MLP east operations were not audible, the measurement reports conclude that operational noise levels from MPE were compliant with the noise limits in SSD 6766 F5B & F5C and SSD 7628 B80.

4 Container noise barrier measurements

Operational noise monitoring was performed in September 2020 for the purpose of quantifying the noise levels of containers being loaded / unloaded from trains in the container stacking area. A combination of attended and unattended noise measurements were performed during a night-time period to assess the $L_{Aeq(15minute)}$ and L_{Amax} noise levels at the nearest residential receivers in the suburbs of Casula, Glenfield, Wattle Grove and Wattle Grove North. A summary of the monitoring period and report is provided in Table 3.

Table 3 Summary of container noise barrier management plan noise monitoring

Noise monitoring period	Report reference
4 September 2020	TL116-05F06 Container Noise Barrier Measurements (r1)

The operational noise limits for container stacking operations are consistent with the INP noise limits outlined in Section 1.3; (i.e. the noise limits in SSD 6766 F5B & F5C and SSD 7628 B80).

During container stacking operations, attended noise measurements were performed at the nearest residential receiver locations in Casula and Glenfield. It was confirmed during the attended measurements that the height of the container noise barrier closest to Moorebank Avenue was one 'tier' higher than the inner rows and the stacking of containers on top of the container noise barrier did not occur during the night-time period.

Audio recordings from four permanent noise monitoring devices at representative locations surrounding the facility were also reviewed. At all far-field measurement locations, maximum noise level events from container stacking operations were not audible.

Where the noise levels at the far-field noise measurement locations are not audible and it is not possible to quantify the container stacking noise directly (as was the case in this study), near-field noise measurement results were used in conjunction with noise modelling, to calculate the container noise stacking operational noise levels at the far-field residential receiver locations.

During the night-time period when the container stacking operations occurred, a combination of attended and unattended noise measurements were performed at near-field locations within 55-110 m of the operations. At the near-field measurement locations, reliable source noise levels of maximum (L_{Amax}) and steady (L_{Aeq}) noise sources were determined. The time of maximum noise level events were noted and correlated with the observed noise levels at the far-field measurement locations.

A computer noise model was employed to calculate the container noise stacking operational noise levels at the far-field locations. The source noise levels in the computer noise model were based on the reasonable worst-case attended noise measurement results at the near-field locations. The reasonable worst-case noise modelling scenario includes unloading operations, locomotive idling, Reacher Stacker operations and truck operations. A separate scenario was run for a grabbing / dropping of container maximum noise level event.

The predicted noise levels were evaluated at the property boundary of the nearest residential receivers and are summarised in Table 4.

Table 4 Predicted noise levels at nearest residential receivers

Location	Distance (m)	$L_{Aeq(15minute)}$ noise management criteria, dB(A)	$L_{A1, 1minute}$ noise management criteria, dB(A)	Predicted noise levels, dB(A)	
				$L_{Aeq(15minute)}$	L_{AFmax} / $L_{A1, 1minute}$
M1 - Wattle Grove	770	35	52	30	44
M2 - Wattle Grove North	1,050	35	51	21	29
M3 - Casula	960	35	47	26	39
M4 - Glenfield	1,250	35	50	14	28
Glenfield Farm	1,500	35	47	22	36

The noise level calculations in Table 4 verify that the predicted noise levels comply with the $L_{Aeq(15\ minute)}$ and $L_{A1(1\ minute)}$ noise management criteria at the nearest sensitive receivers.

As noted in Section 6, there are approximately two night-time train movements per week on the new rail link to and from the Intermodal Terminal. This corresponds to one container loading / unloading event per week, on average, during the night-time period, for current operations. Based on the infrequent nature of night-time container loading / unloading events, that noise levels were not audible at the nearest residential receivers and that the predicted noise levels are 5 dB(A) or more below the noise management levels, these measurements have only been performed on one occasion.

5 Warehouse noise monitoring

Operational noise monitoring was performed on six occasions in accordance with the requirements of the NSW Industrial Noise Policy (EPA, 2000) and Approval Condition SSD 7628 B85, to assess the operational noise of mechanical plant and other noisy equipment associated with each warehouse. A summary of the monitoring periods and reports is provided in Table 5.

Table 5 Summary of warehouse noise monitoring

Noise monitoring period	Warehouse	Report reference
2-16 September 2020	WH1 – Target	TL116-05.4F07 Target Warehouse Operational Compliance (r2)
2-16 September 2020	WH3A – Caesarstone	TL116-05.4F08 Caesarstone Warehouse Ops (r2)
2-16 September 2020	WH4B – ATS	TL116-05.4F09 ATS Warehouse Operational Compliance (r2)
2-16 March 2021	WH3B	TL116-09F01 Warehouse 3B Ops (r2)
2-16 March 2021	WH4A	TL116-09F02 Warehouse 4A Ops (r1)
2-16 March 2021	WH5	TL116-09F03 Warehouse 5 Ops (r1)

During each measurement campaign, a combination of on-site noise measurements, unattended noise monitoring and video recordings were made to quantify the source noise levels associated with reasonable worst-case operations. Noise measurement results from the permanent noise monitoring systems in residential areas (refer Section 7) were also reviewed.

For warehouse operations, the $L_{Aeq(15minute)}$ operational noise limit during the daytime, evening and night-time periods is 35 dB(A) at the nearest residential receivers. This level of $L_{Aeq(15minute)}$ 35 dB(A) is below the ambient noise levels in the nearby residential areas, which are controlled by road traffic noise, rail traffic noise and other natural sources.

The noise compliance monitoring performed in February 2020, July 2020, December 2020 and March 2021 at the nearest residential receivers in the suburbs of Casula, Glenfield, Wattle Grove and Wattle Grove North (refer Section 3), confirmed that MPE noise was not audible in the presence of other ambient noise sources.

As it was not possible to quantify the noise contribution from industrial noise sources at the nearest residential receivers, the procedure in the Noise Policy for Industry (NPfI) was followed to assess compliance.

Section 7.1.1, the NPfI provides guidance as to how to review noise emissions of a site where the existing ambient noise levels are already high, resulting in the direct quantification of the noise under investigation not being possible via noise measurements at the receiver location. Additionally, the NPfI provides guidance about using noise modelling to review the performance of an industrial operation that is co-located with separate but noise-generating industrial sites impacting the same receiver. To satisfy the requirements of Approval Condition SSD 7628 B85, the following noise monitoring and assessment steps were undertaken:

1. Review of permanent noise monitoring at nearby residential receivers during periods when noise intensive activities were taking place at the warehouse facility to determine if noise levels would allow for quantification of operational noise emissions, by checking if operational noise emissions are audible, distinguishable and quantifiable at the receiver locations during periods of noise intensive on-site activities.

2. On-site attended monitoring of noise-generating activities to quantify noise emission levels of mechanical plant and other noise-generating activities as part of typical warehouse operations.

3. Unattended noise monitoring at the warehouse facility for a period of 1-2 weeks, with concurrent video, to identify the reasonable worst-case operational scenarios and periods for each major noise generating area.

4. A calibrated noise model of the reasonable worst-case operating scenarios was prepared to predict the warehouse noise level contributions at the nearest residential receivers in each noise catchment area. The modelling incorporated the worst-case prevailing meteorological conditions, as required by SSD 6766 F5C and SSD 7628 B80.

For all warehouses, the predicted $L_{Aeq(15minute)}$ noise levels for the reasonable worst-case operations demonstrated compliance with the noise limits in the approval conditions.

6 Rail link noise monitoring at residential receivers

The MLP includes a new rail link, connecting the Intermodal Terminal to the Southern Sydney Freight Line (SSFL).

The existing level of rail traffic noise prior to construction of the new rail link was performed over a two-week period in August 2017 and a two-week period in November/December 2018. These surveys quantified the noise levels associated with passenger and freight train operations on the existing SSFL, Main South Line and East Hills Line. The measurements were performed at Glenfield Farm (88 Leacocks Lane Casula), 15 Slessor Road Casula, 11 Goodenough Street Glenfield and near 19 Wallcliffe Court Wattle Grove.

Commissioning of the new rail link occurred in November 2019 (spring). Noise compliance measurement were performed in winter 2020 (22 contiguous days between 13 August and 4 September), consistent with the requirements of Approval Condition G7B in SSD 6766. The measurements were performed at a publicly accessible area immediately north of the Glenfield Farm (with equivalent noise exposure to the rail link). The purpose of the measurements was to determine:

i) The noise contribution of any new rail traffic travelling to and from the development.

ii) The increase in the total rail traffic noise level caused by any new rail traffic to and from the development.

A summary of the monitoring periods and reports is provided in Table 6.

Table 6 Summary of container noise barrier management plan noise monitoring

Noise monitoring period	Report reference
August 2017 and November/December 2018	TJ741-04F03 Existing Levels of Rail Noise (r3)
August/September 2020	TL116-05F05 Rail Link Noise Monitoring (r1)

The key findings of the measurements in August/September 2020 are:

- There was only a small number of train movements on the rail link during night-time periods. Therefore, the noise monitoring was extended beyond the minimum requirement of 12 contiguous days in winter and included four days in spring.
- The highest number of night-time passbys per week since the commencement of operations was seven. This occurred during week 46 of 2019 (week ending Sunday 3 November).
- The average number of night-time passbys since the commencement of operations was two per week.
- There were eleven weeks (out of 44), where no night-time rail movements occurred to or from the Intermodal Terminal.

- During the 22 day survey period, there was a total of five train movements to or from the Intermodal Terminal. This corresponds to an average of less than two train movements per week and is representative of the average number of train movements during the winter period.
- The measured $L_{Aeq(9hour)}$ (night-time) noise levels from train operations on the new rail link, at the Glenfield Farm location were between 28-36 dB(A), compared with an existing $L_{Aeq(9hour)}$ noise level of 52 dB(A). For current rail link operations, the maximum increase in rail noise levels during the night-time period was calculated to be 0.1 dB(A), compared with the 2 dB(A) allowance in Approval Condition G7B.
- The approval conditions require the construction of a noise barrier along relevant sections of the rail link if there is a sustained increase in the total rail traffic noise at the Glenfield Farm of more than 2 dB(A). Since the measured noise increase was 0.1 dB(A) and well below the 2 dB(A) increase allowance, the measured noise levels comply with the requirements in the Approval Condition and the construction of a noise barrier along relevant sections of rail link is not required.

7 Continuous noise monitoring in residential areas

Continuous noise monitoring at sensitive receivers is required to be undertaken at sensitive receivers in accordance with the approval conditions for MPE Stage 2 (SSD 7628 Condition B64). Whilst this condition relates to construction noise, the noise monitoring results can also be utilised to measure operational noise and to investigate noise complaints (if required).

Details of the continuous noise monitoring and measurement locations (CM1 to CM4) are provided in Section 4.1.2 and Figure 3-1 of the CNVMP. The measurement systems comprise four Envirosuite permanent noise monitors.

The primary purpose of the permanent noise monitoring systems is to measure construction-related noise in accordance with the requirements of SSD 7628 Condition B64. The measurement results have also been utilised to assist with the operational noise measurements discussed in Section 3 and the container noise barrier management plan measurements discussed in Section 4.

8 Continuous rail link noise monitoring

The commencement of Intermodal Terminal operations occurred in May 2020. The new rail link was commissioned earlier in November 2019. In conjunction with the rail link commissioning, a temporary rail noise monitoring system (RNMS) was established to quantify the passby noise levels in accordance with the requirements of SSD6766 Condition G7.

The temporary RNMS was positioned at a location near one of the small radius curves and where freight trains are likely to be braking. The microphone of the RNMS monitoring system was positioned on the western side of rail link at a distance of 10.5 m from the near track centreline (Up track) and 15.5 m from the far track centreline (Down track).

The temporary RNMS was operational between 1 November 2019 and 8 July 2020. A summary of the measurement systems and results is provided here[3]. During this period, procurement of a permanent noise monitoring system occurred, compliant with the requirements of the *Functional and Performance Specification for Permanent Noise Monitor and Proposed Noise and AoA Monitoring Locations*[4]. This functional specification provided justification supporting the appropriateness of the proposed monitoring location and was approved by the Secretary.

The permanent noise monitoring system was commissioned on 9 July 2020 at the same location as the temporary RNMS. The permanent system incorporates two microphones, one adjacent to each track, at a distance of 7.5 m from the track centreline. Noise measurement results of all passbys are provided here[5].

Below is a summary of the noise monitoring results for Year 1 operations.

8.1 Year 1 rail operations noise monitoring report

This report covers rail movements between 1 November 2019 and 8 April 2021. A summary of the key statistics are provided below:

- Number of days in monitoring period - 524 days.
- Number of valid train passby events – 462 (day), 151 (night), 613 (day + night)
- Number of days that included one or more train events – 230, representing 44% of days (3.1 days per week)

[3] http://www.renzotonin.com.au/imt-monitoring/

[4] Renzo Tonin & Associates Report TJ741-04F04 AoA and Functional Spec for Permanent Noise Monitor (r8) – available https://simta.com.au/wordpress/wp-content/uploads/2019/12/TJ741-04F04-AoA-and-Functional-Spec-for-Permanent-Noise-Monitor-r9_redacted.pdf

[5] Available https://moorebanknoisemonitor-emsbk.trackiq.net/NoiseMonitor/

- Number of nights that included one or more train events – 110, representing 21% of nights (1.5 nights per week)

For each train passby, the noise monitoring system recorded the L_{AFmax} and SEL[6] noise levels at a measurement distance of 7.5 m from the track centreline. The SEL noise levels are utilised to calculate the $L_{Aeq(15hour)}$ daytime and $L_{Aeq(9hour)}$ noise levels each day.

A summary of the measured $L_{Aeq(15hour)}$ daytime noise levels, normalised to a measurement distance of 30 m is provided in Figure 1. The corresponding noise levels for the night-time period are provided in Figure 2.

It is noted that the nearest residential receiver (Glenfield Farm) is approximately 400 m from the rail link at the closest point and approximately 850 m from the noise monitoring system. The noise levels at Glenfield Farm are estimated to be approximately 14 dB(A) or more below the values in Figure 1 and Figure 2.

Based on the results in Figure 1 and Figure 2, there appears to be a general upward trend in the measured $L_{Aeq(15hour)}$ and $L_{Aeq(9hour)}$ noise levels during the monitoring period. As this report forms part of the first year of operation, this data will be referred to in subsequent periods to evaluate any long-term trends in the measurement results and if any further mitigation or management measures are required.

There are two measurement periods where the calculated $L_{Aeq(9hour)}$ noise levels were above 60 dB(A):

- The first period was at 4:00am on 19 June 2020. A maximum noise level of 112 dB(A) was recorded for this event at a distance of 7.5 m from the track centreline and was responsible for the elevated noise level. The maximum event was associated with curve or brake squeal. The Angle of Attack monitoring system was not fully commissioned at the time of this passby. The worst Angle of Attack value measured for this passby was 28 mrad.
- The second period was on 25 February 2021 (three separate passbys at 11:06pm, 2:35am and 3:53am). Maximum noise levels of 91-106 dB(A) were recorded for these events at a distance of 7.5 m from the track centreline. The measured Angle of Attack value for the passby at 11:06pm was 27 mrad.

[6] SEL represents the single-event Sound Exposure Level of the train passby. This represents the total noise energy of the train passby event, normalised to a measurement interval of one second. The SEL is expressed as a dB(A) noise level.

Figure 1 Measured $L_{Aeq(15hour)}$ daytime noise levels at 30 m from track centreline

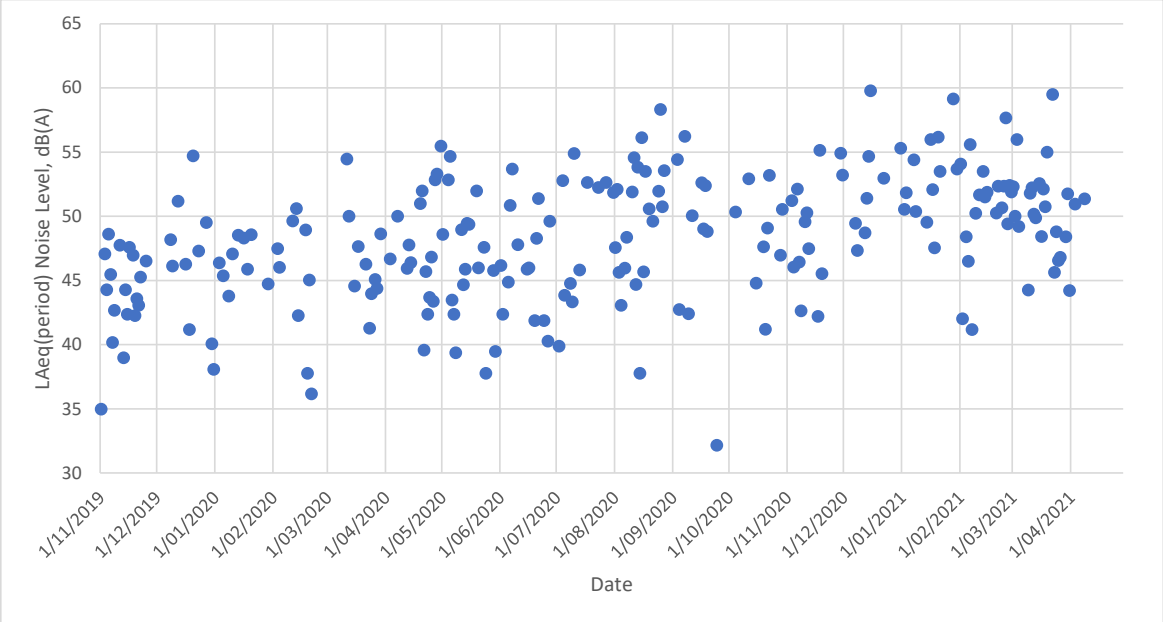
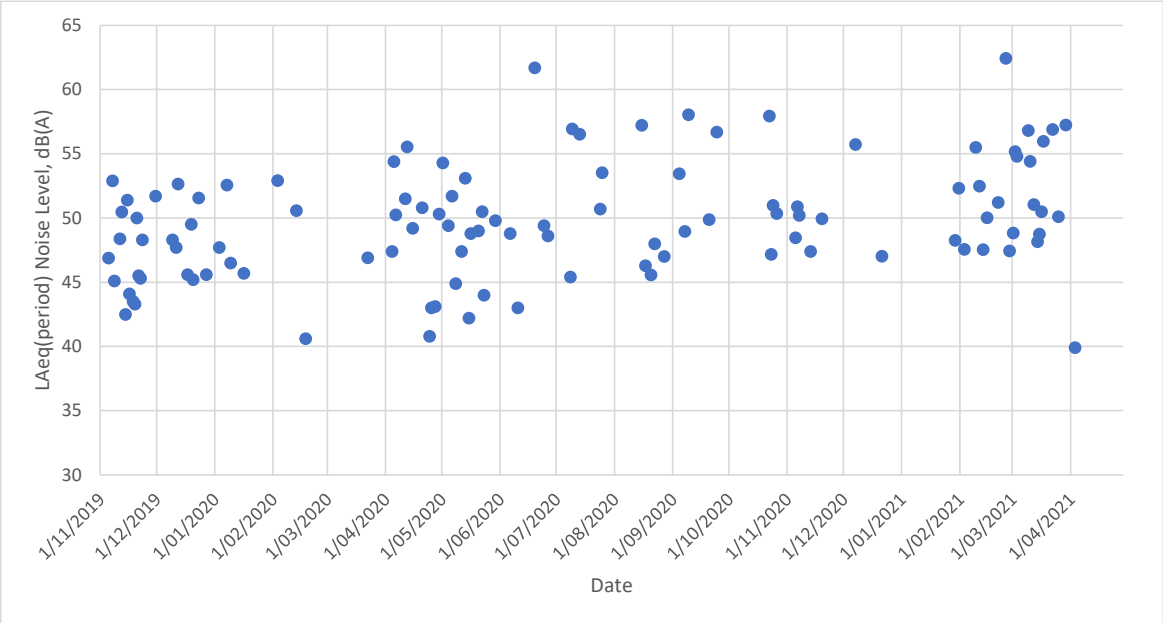


Figure 2 Measured $L_{Aeq(9hour)}$ night-time noise levels at 30 m from track centreline



A summary of the measured L_{AFmax} daytime noise levels at a measurement distance of 7.5 m is provided in Figure 3. The corresponding noise levels for the night-time period are provided in Figure 4.

Figure 3 Measured L_{AFmax} daytime noise levels at 7.5 m from track centreline

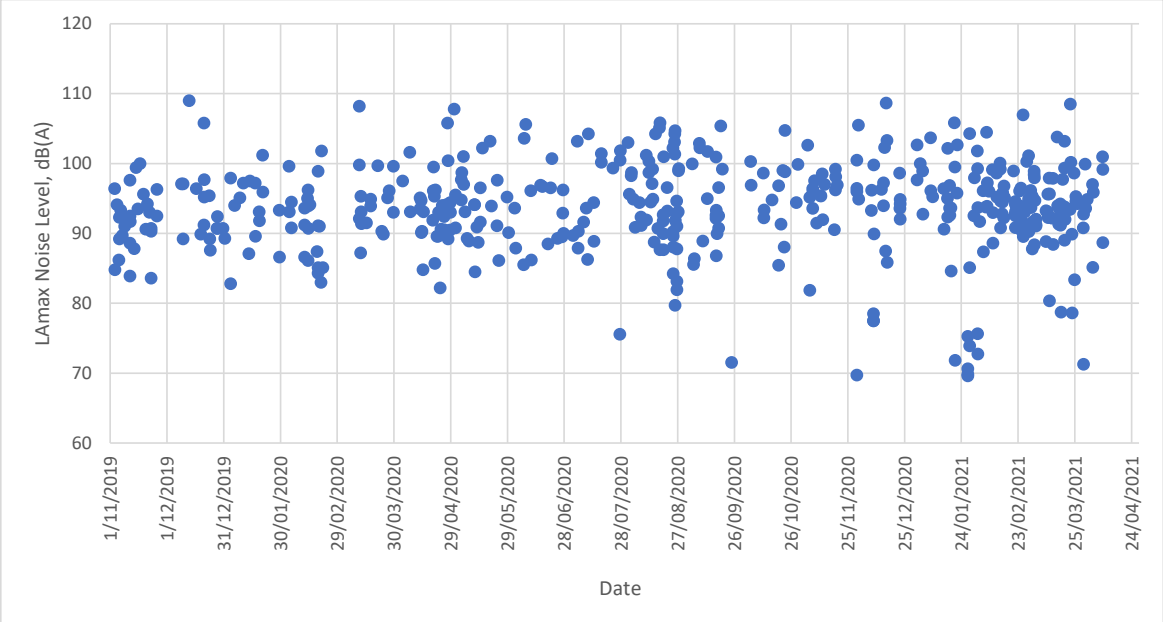
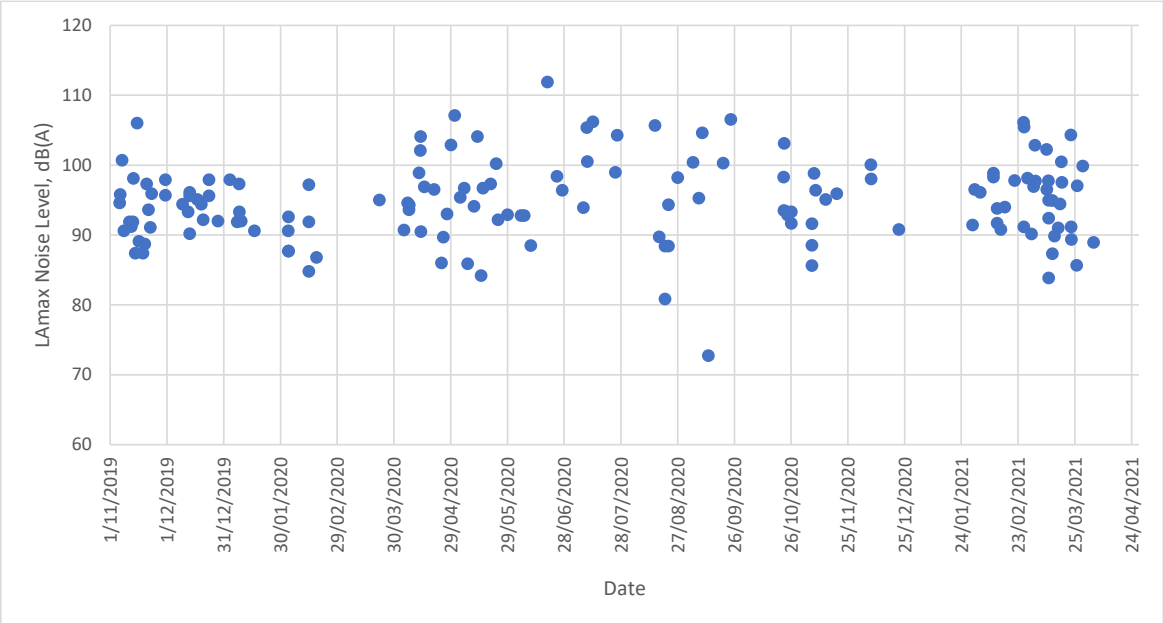


Figure 4 Measured L_{AFmax} night-time noise levels at 7.5 m from track centreline



Based on the results in Figure 1 and Figure 2, there does not appear to be any obvious trend in the measured L_{AFmax} noise levels during the monitoring period.

9 Rail link angle of attack (AoA) monitoring

The performance of wagon bogies and their ability to negotiate small radius curves without generating curve squeal, is assessed in terms of the angle of attack (AoA) of the wheelset. Acceptable AoA values are defined in Section 2.7.1 of Asset Standards Authority Standard T HR RS 00400 ST[7] and are a function of the curve radius and wheel base.

An AoA measurement system was installed on the rail link and partially commissioned on 13 May 2020. The system was fully commissioned on 9 July 2020 at the same time as the permanent noise monitoring system. The AoA system is installed on the eastern track.

Justification supporting the appropriateness of the proposed monitoring location is provided in the *Functional and Performance Specification for Permanent Noise Monitor and Proposed Noise and AoA Monitoring Locations*[8], and was approved by the Secretary.

AoA measurement data is available for the period between 13 May 2020 and 8 April 2021. In accordance with the requirements of the SSD 6766 Condition G7A, the AoA of a wheel of each axle of each train is captured by the measurement system. This data is accessible by train operators on a website maintained by QUBE.

Below is a summary of the noise monitoring results for Year 1 operations.

9.1 Year 1 rail operations AoA monitoring

This report covers rail movements between 13 May 2020 and 8 April 2021. A summary of the key statistics are provided below:

- Number of valid train passby events – 225
- Number of train passby events where the measure AoA values on one or more axles were above the acceptable level defined in Section 2.7.1 of Asset Standards Authority Standard T HR RS 00400 ST – 13, representing 6% of passbys.

A summary of the maximum AoA value measured for each train is provided in Figure 5. The results show that the maximum AoA value is typically less than 10 mrad. 13 train passbys had maximum AoA values greater than the established alarm level of approximately 19 mrad.

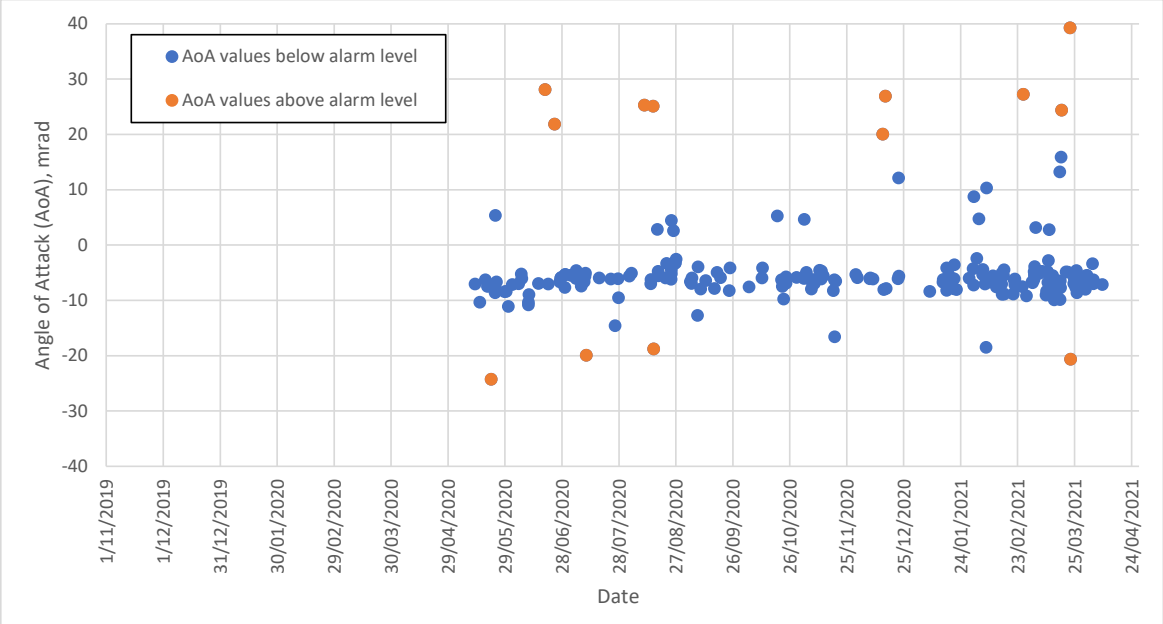
Two of these AoA alarm events resulted in elevated noise levels at the permanent noise monitoring location (refer Section 8.1). These were viewed as one-off instances, occurring irregularly.

---

[7] Transport for NSW Asset Standards Authority T HR RS 00400 ST *RSU 400 Series – Minimum Operating Standards for Rolling Stock – Freight Vehicle Specific Interface Requirements* Version 2.0 dated 24 August 2017

[8] Renzo Tonin & Associates Report TJ741-04F04 AoA and Functional Spec for Permanent Noise Monitor (r8) – available https://simta.com.au/wordpress/wp-content/uploads/2019/12/TJ741-04F04-AoA-and-Functional-Spec-for-Permanent-Noise-Monitor-r9_redacted.pdf

Figure 5 Maximum AoA value for each train



10 Road traffic noise on public roads

A road traffic noise assessment was undertaken in June 2021 to assess the potential noise impact associated with project-related road traffic travelling to and from MPE, in accordance with the approval conditions. This assessment included attended noise measurements on Moorebank Avenue (north and south of the M5 Motorway), unattended noise monitoring at a representative residential receiver location on Moorebank Avenue (north of the M5 Motorway) and a review of traffic counting results. A summary of the monitoring period and report is provided in Table 7.

Table 7 Summary of road traffic noise monitoring

Noise monitoring period	Report reference
June 2021	TL116-05F14 Moorebank IMT Road Traffic (r1)

The assessment was conducted to address the requirements of Approval Condition B86 of SSD 7628 and Approval Condition G15 of SSD 6766, and assesses the operational road traffic noise levels associated with MPE at the point in time when the subject site is 50% occupied.

Operational noise objectives were established in accordance with the requirements of the NSW 'Road Noise Policy' (RNP). The measured and calculated increase in project-related road traffic noise at representative residential receiver locations along public roads were compared with the 2 dB(A) allowance, derived from the NSW RNP. This criterion is consistent with the road traffic noise objectives in the EIS.

Validation of the operational road traffic prediction model was performed via concurrent road traffic noise monitoring and road traffic counting at a representative residential receiver on Moorebank Avenue, north of the M5 interchange. The difference between the measured and predicted noise levels was less than the acceptable tolerance of ± 1.0 dB(A).

This validated noise model was subsequently utilised in conjunction with the Biannual Trip Origin and Destination Report, to understand the distribution of MPE traffic on the surrounding road network, and to predict the project-related increase in road traffic noise levels.

The project-related increase in road traffic noise levels from MPE was calculated to be 0.1 dB(A) or less at the nearest residential receivers. The highest calculated increase of 0.3 dB(A) occurs in the area between the MPE site entry and M5 interchange where there are no residential receivers in this area.

Attended noise measurements were performed in conjunction with visual observations of trucks entering / exiting MPE to directly measure the noise increase of MPE trucks over a two-hour period in the residential area on Moorebank Avenue, north of the M5 interchange. The measured noise level increase from MPE trucks was 0.1 dB(A), consistent with the noise model calculations.

It is concluded that the project-related increase in road traffic noise levels related to MPE is less than the 2 dB(A) allowance in the NSW RNP. Therefore, no re-calibration of the road traffic noise model and/or consideration of additional mitigation measures are required at this stage.

11 Conclusion

This **Annual Noise Review** report **for Year 1 Operations** has been prepared to address the requirements of Approval Condition G15 of SSD 6766.

The following operational noise monitoring has been performed in accordance the Approval Conditions in SSD 6766 and 7628:

- Industrial noise policy measurements at the nearest sensitive receivers in residential areas. This monitoring was undertaken on four occasions.
- Container noise barrier management plan measurements and predictions were performed on one occasion.
- Warehouse noise monitoring and predictions were performed for six warehouses.
- Noise measurements were performed at a location adjacent to the Glenfield farm to quantify noise levels from the new rail link and assess compliance.
- Continuous rail noise and angle of attack (AoA) monitoring systems were installed on the rail link to monitoring rail traffic noise and to assist in identifying potential high noise events (e.g. excessive locomotive noise, brake squeal or curve squeal).
- Road traffic noise predictions were performed to determine if the current controls and management actions are effective in minimising traffic noise within the MPE facility and on public roads.

In all cases, noise levels from MPE operations, inclusive of warehouse noise, mechanical plant noise, and container loading/unloading noise, were not audible at the nearest residential receiver locations.

At the noise monitoring location near Glenfield Farm, the measured noise increase was 0.1 dB(A) and well below the 2 dB(A) increase allowance.

No exceedances of the planning approval noise limits were measured during Year 1 operations.

APPENDIX A Glossary of terminology

The following is a brief description of the technical terms used to describe noise to assist in understanding the technical issues presented.

Absorption Coefficient α	The absorption coefficient of a material, usually measured for each octave or third-octave band and ranging between zero and one. For example, a value of 0.85 for an octave band means that 85% of the sound energy within that octave band is absorbed on coming into contact with the material. Conversely, a low value below about 0.1 means the material is acoustically reflective.
Adverse weather	Weather effects that enhance noise (particularly wind and temperature inversions) occurring at a site for a significant period of time. In the NSW INP this occurs when wind occurs for more than 30% of the time in any assessment period in any season and/or temperature inversions occurring more than 30% of nights in winter.
Air-borne noise	Noise which is fundamentally transmitted by way of the air and can be attenuated by the use of barriers and walls placed physically between the noise source and receiver.
Ambient noise	The all-encompassing noise associated within a given environment at a given time, usually composed of sound from all sources near and far.
AoA	Angle of Attack - As the wheels on a bogie negotiate a tight curve, the leading wheelset typically presents an Angle-of-Attack (AoA) to the rail. The AoA of a leading wheelset with good steering performance can be calculated from AoA = wheelbase (m) / curve radius (m). AoA is normally measured in milliradian (mrad).
Amenity	A desirable or useful feature or facility of a building or place.
AS	Australian Standard
ASA	Asset Standards Authority
Assessment period	The time period in which an assessment is made. e.g. Day 7am-10pm & Night 10pm-7am.
Assessment Point	A location at which a noise or vibration measurement is taken or estimated.
Attenuation	The reduction in the level of sound or vibration.
Audible Range	The limits of frequency which are audible or heard as sound. The normal hearing in young adults detects ranges from 20 Hz to 20 kHz, although some people can detect sound with frequencies outside these limits.
A-weighting	A filter applied to the sound recording made by a microphone to approximate the response of the human ear.
Background noise	Background noise is the term used to describe the underlying level of noise present in the ambient noise, measured in the absence of the noise under investigation. It is described as the average of the minimum noise levels measured on a sound level meter and is measured statistically as the A-weighted noise level exceeded for ninety percent of a sample period. This is represented as the LA90 noise level if measured as an overall level or an L90 noise level when measured in octave or third-octave bands.
Barrier (Noise)	A natural or constructed physical barrier which impedes the propagation of sound and includes fences, walls, earth mounds or berms and buildings.
Berm	Earth or overburden mound.
Buffer	An area of land between a source and a noise-sensitive receiver and may be an open space or a noise-tolerant land use.
Bund	A bund is an embankment or wall of brick, stone, concrete or other impervious material, which may form part or all of the perimeter of a compound.
BS	British Standard

CoRTN	United Kingdom Department of Environment entitled "Calculation of Road Traffic Noise (1988)"		
Decibel [dB]	The units that sound is measured in. The following are examples of the decibel readings of common sounds in our environment:		
	threshold of hearing	0 dB	The faintest sound we can hear, defined as 20 micro Pascal
		10 dB	Human breathing
	almost silent	20 dB	
		30 dB	Quiet bedroom or in a quiet national park location
	generally quiet	40 dB	Library
		50 dB	Typical office space or ambience in the city at night
	moderately loud	60 dB	CBD mall at lunch time
		70 dB	The sound of a car passing on the street
	loud	80 dB	Loud music played at home
		90 dB	The sound of a truck passing on the street
	very loud	100 dB	Indoor rock band concert
		110 dB	Operating a chainsaw or jackhammer
	extremely loud	120 dB	Jet plane take-off at 100m away
	threshold of pain	130 dB	
		140 dB	Military jet take-off at 25m away
dB(A)	A-weighted decibel. The A- weighting noise filter simulates the response of the human ear at relatively low levels, where the ear is not as effective in hearing low frequency sounds as it is in 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 is denoted as dB(A). Practically all noise is measured using the A filter.		
dB(C)	C-weighted decibels. The C-weighting noise filter simulates the response of the human ear at relatively high levels, where the human ear is nearly equally effective at hearing from mid-low frequency (63Hz) to mid-high frequency (4kHz), but is less effective outside these frequencies. The dB(C) level is not widely used but has some applications.		
Diffraction	The distortion of sound waves caused when passing tangentially around solid objects.		
DIN	German Standard		
ECRTN	Environmental Criteria for Road Traffic Noise, NSW, 1999		
ENMM	Environmental Noise Management Manual, Roads and Maritime Services (Transport for NSW)		
EPA	Environment Protection Authority		
Field Test	A test of the sound insulation performance in-situ. See also 'Laboratory Test' The sound insulation performance between building spaces can be measured by conducting a field test, for example, early during the construction stage or on completion. A field test is conducted in a non-ideal acoustic environment. It is generally not possible to measure the performance of an individual building element accurately as the results can be affected by numerous field conditions.		
Fluctuating Noise	Noise that varies continuously to an appreciable extent over the period of observation.		
Free-field	An environment in which there are no acoustic reflective surfaces. Free field noise measurements are carried out outdoors at least 3.5m from any acoustic reflecting structures other than the ground.		
Frequency	Frequency is synonymous to pitch. 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.		

Ground-borne noise	Vibration propagated through the ground and then radiated as noise by vibrating building elements such as wall and floor surfaces. This noise is more noticeable in rooms that are well insulated from other airborne noise. An example would be vibration transmitted from an underground rail line radiating as sound in a bedroom of a building located above.
Habitable Area	Includes a bedroom, living room, lounge room, music room, television room, kitchen, dining room, sewing room, study, playroom, family room, home theatre and sunroom. Excludes a bathroom, laundry, water closet, pantry, walk-in wardrobe, corridor, hallway, lobby, photographic darkroom, clothes drying room, and other spaces of a specialised nature occupied neither frequently nor for extended periods.
Heavy Vehicle	A truck, transporter or other vehicle with a gross weight above a specified level (for example: over 8 tonnes).
IGANRIP	Interim Guideline for the Assessment of Noise from Rail Infrastructure Projects, NSW DEC 2007
Impulsive noise	Having a high peak of short duration or a sequence of such peaks. A sequence of impulses in rapid succession is termed repetitive impulsive noise.
INP	NSW Industrial Noise Policy, EPA 1999
Intermittent noise	The level suddenly drops to that of the background noise several times during the period of observation. The time during which the noise remains at levels different from that of the ambient is one second or more.
Intrusive noise	Refers to noise that intrudes above the background level by more than 5 dB(A).
ISEPP	State Environmental Planning Policy (Infrastructure), NSW, 2007
ISEPP Guideline	Development Near Rail Corridors and Busy Roads - Interim Guideline, NSW Department of Planning, December 2008
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.
L10(1hr)	The L10 level measured over a 1 hour period.
L10(18hr)	The arithmetic average of the L10(1hr) levels for the 18 hour period between 6am and 12 midnight on a normal working day.
L90	The level of noise exceeded for 90% of the time. The bottom 10% of the sample is the L90 noise level expressed in units of dB(A).
LAeq or Leq	The "equivalent noise level" is the summation of noise events and integrated over a selected period of time, which would produce the same energy as a fluctuating sound level. When A-weighted, this is written as the LAeq.
LAeq(1hr)	The LAeq noise level for a one-hour period. In the context of the NSW EPA's Road Noise Policy it represents the highest tenth percentile hourly A-weighted Leq during the period 7am to 10pm, or 10pm to 7am (whichever is relevant).
LAeq(8hr)	The LAeq noise level for the period 10pm to 6am.
LAeq(9hr)	The LAeq noise level for the period 10pm to 7am.
LAeq(15hr)	The LAeq noise level for the period 7am to 10pm.
LAeq (24hr)	The LAeq noise level during a 24 hour period, usually from midnight to midnight.
Lmax	The maximum sound pressure level measured over a given period. When A-weighted, this is usually written as the LAmax.
Lmin	The minimum sound pressure level measured over a given period. When A-weighted, this is usually written as the LAmin.
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. That is, the sound of 85 dB is four times or 400% the loudness of a sound of 65 dB.

Microphone	An electro-acoustic transducer which receives an acoustic signal and delivers a corresponding electric signal.
MPE	Moorebank Precinct East
NCA	Noise Catchment Area. An area of study within which the noise environment is substantially constant.
NCG	Noise Criteria Guideline, Roads and Maritime Services (Transport for NSW)
NMG	Noise Mitigation Guideline, Roads and Maritime Services (Transport for NSW)
Noise	Unwanted sound
Pre-construction	Work in respect of the proposed project that includes design, survey, acquisitions, fencing, investigative drilling or excavation, building/road dilapidation surveys, minor clearing (except where threatened species, populations or ecological communities would be affected), establishing ancillary facilities such as site compounds, or other relevant activities determined to have minimal environmental impact (e.g. minor access roads).
Reflection	Sound wave reflected from a solid object obscuring its path.
RING	Rail Infrastructure Noise Guideline, NSW, May 2013
RMS	Root Mean Square value representing the average value of a signal.
Rw	Weighted Sound Reduction Index A measure of the sound insulation performance of a building element. It is measured in very controlled conditions in a laboratory. The term supersedes the value STC which was used in older versions of the Building Code of Australia. Rw is measured and calculated using the procedure in ISO 717-1. The related field measurement is the DnT,w. The higher the value the better the acoustic performance of the building element.
R'w	Weighted Apparent Sound Reduction Index. As for Rw but measured in-situ and therefore subject to the inherent accuracies involved in such a measurement. The higher the value the better the acoustic performance of the building element.
RNP	Road Noise Policy, NSW, March 2011
Sabine	A measure of the total acoustic absorption provided by a material. It is the product of the Absorption Coefficient (alpha) and the surface area of the material (m2). For example, a material with alpha = 0.65 and a surface area of 8.2m2 would have 0.65 x 8.2 = 5.33 Sabine. Sabine is usually calculated for each individual octave band (or third-octave).
SEL	Sound Exposure Level (SEL) is the constant sound level which, if maintained for a period of 1 second would have the same acoustic energy as the measured noise event. SEL noise measurements are useful as they can be converted to obtain Leq sound levels over any period of time and can be used for predicting noise at various locations.
Sound	A fluctuation of air pressure which is propagated as a wave through air.
Sound absorption	The ability of a material to absorb sound energy by conversion to thermal energy.
Sound Insulation	Sound insulation refers to the ability of a construction or building element to limit noise transmission through the building element. The sound insulation of a material can be described by the Rw and the sound insulation between two rooms can be described by the DnT,w.
Sound level meter	An instrument consisting of a microphone, amplifier and indicating device, having a declared performance and designed to measure sound pressure levels.
Sound power level	Ten times the logarithm to the base 10 of the ratio of the sound power of the source to the reference sound power of 1 pico watt.
Sound pressure level	The level of noise, usually expressed in decibels, as measured by a standard sound level meter with a microphone referenced to 20 mico Pascal.
Spoil	Soil or materials arising from excavation activities.

SSFL	Southern Sydney Freight Line
STC	Sound Transmission Class A measure of the sound insulation performance of a building element. It is measured in controlled conditions in a laboratory. The term has been superseded by Rw.
Structure-borne Noise	Audible noise generated by vibration induced in the ground and/or a structure. Vibration can be generated by impact or by solid contact with a vibrating machine. Structure-borne noise cannot be attenuated by barriers or walls but requires the isolation of the vibration source itself. This can be achieved using a resilient element placed between the vibration source and its support such as rubber, neoprene or springs or by physical separation (using an air gap for example). Examples of structure-borne noise include the noise of trains in underground tunnels heard to a listener above the ground, the sound of footsteps on the floor above a listener and the sound of a lift car passing in a shaft. See also 'Impact Noise'.
Tonal Noise	Sound containing a prominent frequency and characterised by a definite pitch.
Transmission Loss	The sound level difference between one room or area and another, usually of sound transmitted through an intervening partition or wall. Also the vibration level difference between one point and another. For example, if the sound level on one side of a wall is 100dB and 65dB on the other side, it is said that the transmission loss of the wall is 35dB. If the transmission loss is normalised or standardised, it then becomes the Rw or R'w or DnT,w.
Wheelbase	The wheelbase is the distance between the centres of the front and rear wheels on a 2-axle bogie.

APPENDIX B Detailed noise assessment reports

B.1 Industrial Noise Policy Measurement Report for Quarter 1 2020

Renzo Tonin & Associates Report TL116-05F03 Moorebank INP Monitoring Q1 2020 (r2)

RENZO TONIN & ASSOCIATES
inspired to achieve

Acoustics
Vibration
Structural Dynamics

MOOREBANK LOGISTIC PARK - PRECINCT EAST

Operational Noise Monitoring for Moorebank Logistic Park - Q1 2020

17 April 2020

Tactical

TL116-05F03 Moorebank INP Monitoring Q1 2020 (r2).docx

35 1982-2017 ACOUSTIC ENGINEERING EXCELLENCE

Sydney Melbourne Brisbane Gold Coast Kuwait Singapore
Renzo Tonin & Associates ABN 29 117 462 861
Level 1/418A Elizabeth St SURRY HILLS NSW 2010 | PO Box 877 STRAWBERRY HILLS NSW 2012
P (02) 8218 0500 F (02) 8218 0501 sydney@renzotonin.com.au www.renzotonin.com.au

aaac Association of Australian Acoustical Consultants

Document details

Detail	Reference
Doc reference:	TL116-05F03 Moorebank INP Monitoring Q1 2020 (r2).docx
Prepared for:	Tactical
Address:	Level 15, 124 Walker Street North Sydney NSW 2060
Attention:	Fei Chen

Document control

Date	Revision history	Non-issued revision	Issued revision	Prepared	Instructed	Authorised
19.03.2020	Draft	0	1	J. Liang	C. Weber	C. Weber
17.04.2020	Final	-	2	J. Liang	C. Weber	C. Weber

Important Disclaimer:

The work presented in this document was carried out in accordance with the Renzo Tonin & Associates Quality Assurance System, which is based on Australian Standard / NZS ISO 9001.

This document is issued subject to review and authorisation by the Team Leader noted by the initials printed in the last column above. If no initials appear, this document shall be considered as preliminary or draft only and no reliance shall be placed upon it other than for information to be verified later.

This document is prepared for the particular requirements of our Client referred to above in the 'Document details' which are based on a specific brief with limitations as agreed to with the Client. It is not intended for and should not be relied upon by a third party and no responsibility is undertaken to any third party without prior consent provided by Renzo Tonin & Associates. The information herein should not be reproduced, presented or reviewed except in full. Prior to passing on to a third party, the Client is to fully inform the third party of the specific brief and limitations associated with the commission.

In preparing this report, we have relied upon, and presumed accurate, any information (or confirmation of the absence thereof) provided by the Client and/or from other sources. Except as otherwise stated in the report, we have not attempted to verify the accuracy or completeness of any such information. If the information is subsequently determined to be false, inaccurate or incomplete then it is possible that our observations and conclusions as expressed in this report may change.

We have derived data in this report from information sourced from the Client (if any) and/or available in the public domain at the time or times outlined in this report. The passage of time, manifestation of latent conditions or impacts of future events may require further examination and re-evaluation of the data, findings, observations and conclusions expressed in this report.

We have prepared this report in accordance with the usual care and thoroughness of the consulting profession, for the sole purpose described above and by reference to applicable standards, guidelines, procedures and practices at the date of issue of this report. For the reasons outlined above, however, no other warranty or guarantee, whether expressed or implied, is made as to the data, observations and findings expressed in this report, to the extent permitted by law.

The information contained herein is for the purpose of acoustics only. No claims are made and no liability is accepted in respect of design and construction issues falling outside of the specialist field of acoustics engineering including and not limited to structural integrity, fire rating, architectural buildability and fit-for-purpose, waterproofing and the like. Supplementary professional advice should be sought in respect of these issues.

Contents

1 Introduction 1
1.1 Project overview 1
1.2 Scope of assessment 1
2 Summary of noise objectives 3
3 Measurement methodology and equipment 4
4 Measurement results 5
4.1 Measurement locations and time periods 5
4.2 Measurement results 6
5 Discussion 9
6 Conclusion 10
APPENDIX A Description of technical terms 11
APPENDIX B Detailed measurement location descriptions 12
B.1 M1 – Wattle Grove measurement location 12
B.2 M2 - Wattle Grove North measurement location 14
B.3 M3 – Casula measurement location 16
B.4 M4 - Glenfield measurement location 18

List of tables

Table 1 MPE Stage 1 and 2 noise limits, dB(A) 3
Table 2 Measurement equipment 4
Table 3 Sensitive receivers and approximate distance from MLP East Precinct 5
Table 4 Attended measurement periods 5
Table 5 Attended noise measurement results 7

List of figures

Figure 1 MLP East Precinct and nearest sensitive receivers 1

1 Introduction

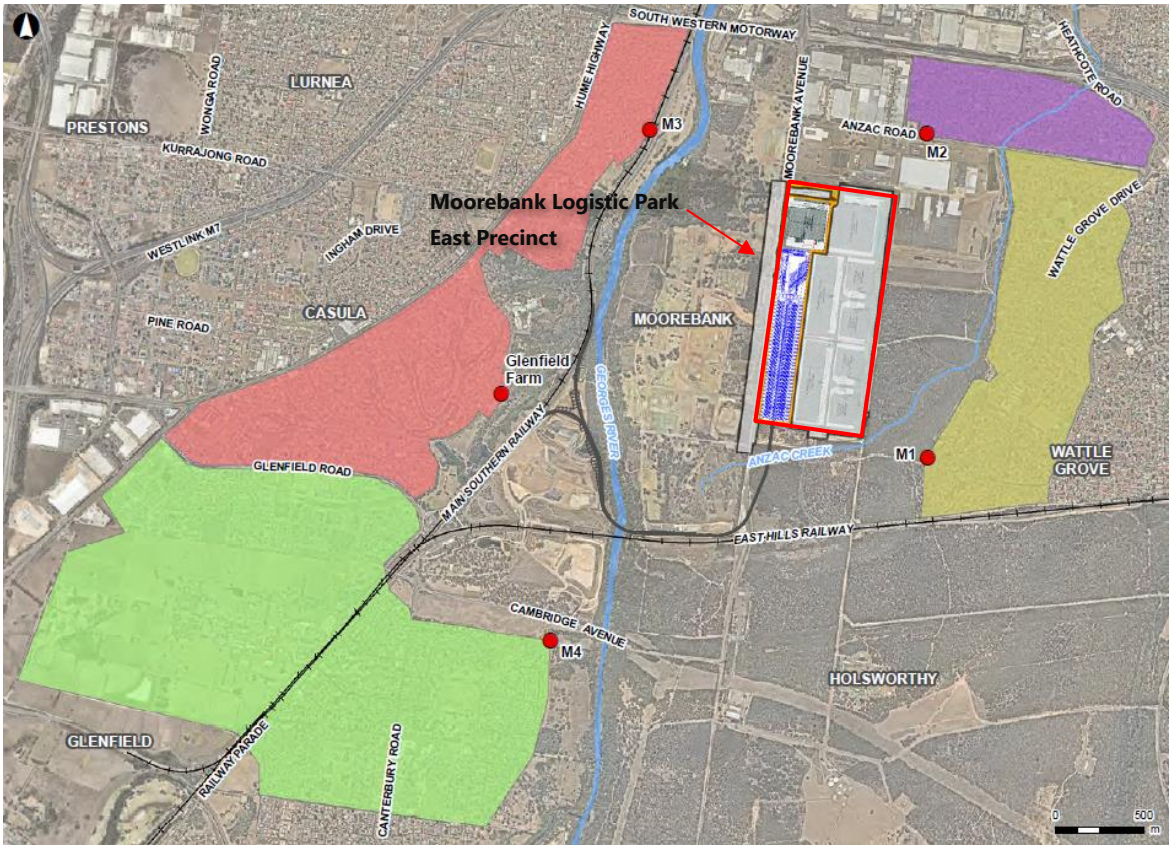
1.1 Project overview

The Sydney Intermodal Terminal Alliance (SIMTA) received approval for the construction and operation of Stages 1 and 2 of the Moorebank Precinct East (MPE) Project (SSD 6766 and SSD 7628 respectively), which together comprise the two stages of development under the MPE Concept Approval (MP10_0193).

This operational noise monitoring has been conducted to assess noise impacts during operation of the east precinct for the first quarter in 2020.

The location of the Moorebank Logistics Park (MLP) East Precinct in relation to the nearest representative receivers (M1 to M4 and Glenfield Farm) is illustrated in Figure 1.

Figure 1 MLP East Precinct and nearest sensitive receivers



1.2 Scope of assessment

Renzo Tonin & Associates (NSW) Pty Ltd has been engaged by Tactical to perform attended noise measurements for the purpose of assessing compliance with the approval conditions. These

measurements have been performed, consistent with the requirements of the NSW *Industrial Noise Policy* (EPA, 2000) and the Operational Noise and Vibration Management Plan[1].

Airborne noise measurements were performed at the four potentially most affected residential receivers in the vicinity of the MLP. The representative receivers are located in the suburbs of Casula, Glenfield, Wattle Grove and Wattle Grove North (see Figure 1).

Daytime construction noise is currently occurring at the MLP site. Construction noise has been excluded from the assessment.

A description of technical terms used within this report is provided in Appendix A.

[1] OPERATIONAL NOISE AND VIBRATION MANAGEMENT PLAN - Moorebank Logistics Park – East Precinct (Revision 010 dated 24/9/2019)

2 Summary of noise objectives

Stages 1 and 2 of the MPE Project was approved under State Significant Development (SSD) Approvals 6766 and 7628, respectively.

The noise assessments for Stage 1 and 2 were prepared and assessed in accordance with the requirements of the NSW *Industrial Noise Policy* (EPA, 2000). However, the Determination Report for MPE Stage 2[2] identified that the recommended noise limits at Wattle Grove be amended to reflect the recently adopted *Noise Policy for Industry* (EPA, 2017).

A summary of the MPE Stage 1 and 2 noise limits from SSD 7628 is provided in Table 1.

Table 1 MPE Stage 1 and 2 noise limits, dB(A)

Sensitive receiver	Day [1] $L_{Aeq,\ 15\ minute}$	Evening [1] $L_{Aeq,\ 15\ minute}$	Night [1] $L_{Aeq,\ 15\ minute}$	Night [1] $L_{A1,\ 1\ minute}$
Casula	35	35	35	52
Glenfield	35	35	35	52
Wattle Grove	35	35	35	52
Casula	35	35	35	52
Wattle Grove North [2]	35	35	35	52

Notes:

To determine compliance with the $L_{Aeq,15\ minute}$ noise limits, noise from the development is to be measured at the most affected point within the residential boundary, or at the most affected point within 30 metres of a dwelling where the dwelling is more than 30 metres from the boundary. Where it can be demonstrated that direct measurement of noise from the project is impractical, the EPA may accept alternative means of determining compliance (see Chapter 11 of the NSW Industrial Noise Policy). The modification factors in Section 4 of the NSW Industrial Noise Policy must also be applied to the measured noise levels where applicable.

To determine compliance with the $L_{A1,1\ minute}$ noise limits, noise from the project is to be measured at 1 metre from the dwelling façade. Where it can be demonstrated that direct measurement of noise from the project is impractical, the EPA may accept alternative means of determining compliance (see Chapter 11 of the NSW Industrial Noise Policy).

The noise emission limits identified above apply under meteorological conditions of:

(i) wind speeds of up to 3 m/s at 10 metres above ground level; or

(ii) 'F' atmospheric stability class.

Note 1: In accordance with the INP, day is the period from 7:00 am to 6:00 pm Monday to Saturday; or 8:00 am to 6:00 pm on Sundays and public holidays; evening is the period from 6:00 pm to 10:00 pm; and night is the remaining periods.

Note 2: Wattle Grove North receiver is not included in SSD 7628, but is listed as a sensitive receiver in the Operational Noise and Vibration Management Plan (Section 3.3).

[2] NSW Planning Assessment Commission Determination Report – Moorebank Intermodal Terminal, Stage 2, Moorebank Precinct East (SSD 7628).

3 Measurement methodology and equipment

All noise measurements were performed with a Type 1 sound level meter and Type 1 microphone calibrator. The measurement equipment calibration certificates were current at the time of the measurements. Before and after each series of measurements, the calibration of the sound level meter was verified using a reference calibration of 94 dB at 1 kHz. The difference between pre- and post-calibration levels was within 0.5 dB for all measurements.

Airborne noise measurements were performed in accordance with the requirements of the *NSW Industrial Noise Policy (EPA 2000)*.

A summary of measurement equipment is provided in Table 2.

Table 2 Measurement equipment

Description	Make	Model	Serial No	Last Date Calibrated
Type 1 sound level meter	NTi	XL2	A2A-12693-E0	01/05/2019
Sound level meter calibrator	Bruel & Kjaer	4231	3017534	27/07/2018

4 Measurement results

4.1 Measurement locations and time periods

15-hours of on-site measurements were performed between 19-21 February 2020, during the daytime (7am to 6pm), evening (6pm to 10pm) and night-time (10pm to 7am) periods, to capture a representative period of 24-hour operations.

Prior to the measurements, it was confirmed that the MLP site was operational to ensure that the measurements were representative of current options. It is understood that the facility is not currently operating at full capacity.

A summary of the attended measurement locations and the approximate distances to the MLP East Precinct is provided in Table 3. Additional details are provided in Appendix B.

A summary of the attended measurement periods is provided in Table 4.

Table 3 Sensitive receivers and approximate distance from MLP East Precinct

Measurement locations	Approximate distance (m) from MLP East Precinct
M1 - Wattle Grove	770
M2 - Wattle Grove North	1,050
M3 - Casula	960
M4 - Glenfield	1,250

Table 4 Attended measurement periods

Location	Measurement period 1	Measurement period 2
Measurements during 7am to 6pm daytime period – 19 February 2020		
M1 - Wattle Grove	11:52pm to 12:37pm (Note 1)	3:42pm to 4:14pm (Note 2)
M2 - Wattle Grove North	1:58pm to 2:28pm (Note 3)	4:31pm to 5:01pm (Note 3)
M3 - Casula	12:50pm to 1:26pm (Note 4)	5:18pm to 5:46pm (Note 4)
M4 - Glenfield	2:49pm to 3:20pm (Note 5)	6:27pm to 6:42pm (Note 5)
Measurements during 6pm to 10pm evening period – 20 February 2020		
M1 - Wattle Grove	6:46pm to 7:01pm (Note 2)	7:06pm to 7:21pm (Note 1)
M2 - Wattle Grove North	7:38pm to 8:09 pm (Note 3)	9:57pm to 10:27 (Note 3)
M3 - Casula	8:23pm to 8:53pm (Note 4)	10:38pm to 10:53 (Note 4)
M4 - Glenfield	6:12pm to 6:42pm (Note 5)	-
Measurements during 10pm to 1am night-time period – 20-21 February 2020		
M1 - Wattle Grove	11:36pm to 11:51pm (Note 2)	2:35am to 3:06 am (Note 1)
M2 - Wattle Grove North	9:57pm to 11:25pm (Note 3)	1:39am to 2:11am (Note 3)
M3 - Casula	10:38pm to 10:53pm (Note 4)	1:04am to 1:19am (Note 4)
M4 - Glenfield	12:12am to 12:44am (Note 5)	00:12 pm to 00:44 (Note 5)

Location	Measurement period 1	Measurement period 2

Note 1: Measurements performed at 18 Corryton Ct
Note 2: Measurements performed at 25 Yallum Ct
Note 3: Measurements performed at 39 Anzac Rd
Note 4: Measurements performed at St Andrews Park
Note 5: Measurements performed at 26 Goodenough St

4.2 Measurement results

Results from the attended noise measurements at all measurement locations is provided in Table 5. All noise measurements were performed over 15-minute measurement durations in accordance with the requirements of the approval conditions and the INP.

Table 5 Attended noise measurement results

ID	Address	Assessment period	$L_{Aeq,\ 15minute}$ noise limit, dB(A)	$L_{A1,\ 1\ minute}$ noise limit, dB(A)	Measurement period	Measured noise levels, dB(A)		Estimated MLP noise contribution, dB(A)		Comments and measured L_{AFmax} noise levels from typical events	MLP Noise Levels Comply?
						$L_{Aeq,\ 15minute}$	$L_{AF,90\%}$	$L_{Aeq,\ 15minute}$.	L_{AFmax}		
M1 - Wattle Grove											
1	18 Corryton Ct.	Day	35	-	19/02/20 11:52 12:07	56	44	Note 1	Note 1	Background noise nominated by noise from the nature: Insects 56-61 dBA, Dog barking 61-62 dBA, Birds 47-77 dBA, Road traffic 52-55dBA, Rail Traffic 50-53 dBA, Construction noise 45-49 dBA	Yes
2	18 Corryton Ct.	Day	35	-	19/02/20 12:22 12:37	58	43	Note 1	Note 1	Background noise nominated by noise from the nature: Insects 50-64 dBA, Dog barking 61-72 dBA, Birds 47-77 dBA, Road traffic 52-55 dBA, Rail Traffic 50-60 dBA, Construction noise 41-46 dBA	Yes
3	25 Yallum Ct.	Day	35	-	19/02/20 15:42 15:57	48	41	Note 1	Note 1	Background noise nominated by noise from the nature: Insects 56-59 dBA, Birds40-70 dBA, Air Traffic 40-57 dBA, Rail Traffic 50-61 dBA	Yes
4	25 Yallum Ct.	Day	35	-	19/02/20 15:59 16:14	49	42	Note 1	Note 1	Background noise nominated by noise from the nature: Insects 43-46 dBA, Birds 50-53 dBA, Air Traffic 40-57 dBA, Rail Traffic 46-50 dBA, Air Traffic 50-72 dBA	Yes
5	25 Yallum Ct.	Evening	35	-	20/02/20 18:46 19:01	43	38	Note 1	Note 1	Background noise nominated by noise from the nature: Dog barking 40-46 dBA, Birds 45-60 dBA, Lawn mowing 40-43 dBA, Air Traffic 40-55 dBA	Yes
6	18 Corryton Ct.	Evening	35	-	20/02/20 19:06 19:21	44	37	Note 1	Note 1	Background noise nominated by noise from the nature: Dog barking 45-56 dBA, Birds 38-43 dBA, Rial Traffic 45-47 dBA, Road traffic 40-45 dBA, Lawn mowing 40-43 dBA, Air Traffic 40-56	Yes
7	25 Yallum Ct.	Night	35	52	20/02/20 23:36 23:51	42	36	Note 1	Note 1	Background noise nominated by noise from the nature: Animal 41-66 dBA, Road traffic 52-55 dBA, Rail Traffic 44-46 dBA, TV 45 dBA	Yes
8	18 Corryton Ct.	Night	35	52	21/02/20 02:35 02:50	32	30	Note 1	Note 1	Background noise nominated by noise from the nature: Insects 40-43 dBA, Road Traffic 36-38 dBA, Rail Traffic 34-35 dBA	Yes
9	18 Corryton Ct.	Night	35	52	21/02/20 02:51 03:06	32	30	Note 1	Note 1	Background noise nominated by noise from the nature: Insects 40-43 dBA, Rail Traffic 34-35 dBA	Yes
M2 - Wattle Grove North											
10	39 Anzac Rd (East to West side)	Day	35	-	19/02/20 13:58 14:13	65	51	Note 1	Note 1	Background noise nominated by noise from the Anzac Rd: Road Traffic 55-90 dBA, Truck loading noise 50-60 dBA	Yes
11	39 Anzac Rd (East to West side)	Day	35	-	19/02/20 14:13 14:28	60	51	Note 1	Note 1	Background noise nominated by noise from the Anzac Rd: Road Traffic 55-72 dBA, Truck loading noise 50-60 dBA, Truck 60-62 dBA	Yes
12	39 Anzac Rd (East to West side)	Day	35	-	19/02/20 16:31 16:46	61	51	Note 1	Note 1	Background noise nominated by noise from the Anzac Rd: Road Traffic 55-75 dBA, Air Traffic 55-58 dBA	Yes
13	39 Anzac Rd (East to West side)	Day	35	-	19/02/20 16:46 17:01	62	52	Note 1	Note 1	Background noise nominated by noise from the Anzac Rd: Road Traffic 60-73 dBA	Yes
14	39 Anzac Rd (East to West side)	Evening	35	-	20/02/20 19:38 19:53	60	46	Note 1	Note 1	Background noise nominated by noise from the Anzac Rd: Road Traffic 55-73 dBA, Birds 50-54 dBA, Air Traffic 47-51 dBA	Yes
15	39 Anzac Rd (East to West side)	Evening	35	-	20/02/20 19:54 20:09	62	46	Note 1	Note 1	Background noise nominated by noise from the Anzac Rd: Road Traffic 60-79 dBA, Air Traffic 49-52 dBA	Yes
16	39 Anzac Rd (West to East side)	Night	35	52	20/02/20 21:57 22:12	64	39	Note 1	Note 1	Background noise nominated by noise from the Anzac Rd: Road Traffic 70-82 dBA, Air Traffic 48-56 dBA	Yes
17	39 Anzac Rd (West to East side)	Night	35	52	20/02/20 22:12 22:27	62	38	Note 1	Note 1	Background noise nominated by noise from the Anzac Rd: Road Traffic 55-79 dBA	Yes
18	39 Anzac Rd (West to East side)	Night	35	52	20/02/20 23:10 23:25	61	35	Note 1	Note 1	Background noise nominated by noise from the Anzac Rd: Road Traffic 55-80 dBA, Substation 33 -34 dBA, Air Traffic 40-49 dBA	Yes
19	39 Anzac Rd (West to East side)	Night	35	52	21/02/20 01:39 01:54	38	34	Note 1	Note 1	Background noise nominated by noise from the Anzac Rd: Substation 35-36 dBA, Truck 37-42 dBA	Yes
20	39 Anzac Rd (East to West side)	Night	35	52	21/02/20 01:56 02:11	37	35	Note 1	Note 1	Background noise nominated by noise from the Anzac Rd: Road Traffic 55-90 dBA	Yes
M3 - Casula											
21	St Andrews Park	Day	35	-	19/02/20 12:50 13:05	58	42	Note 1	Note 1	Background noise nominated by noise from the M5 Motorway: Road Traffic 40-45 dBA, Dog barking 61-72 dBA, Birds 54-48 dBA, Rail Traffic 75-80 dBA, Air Traffic 47 dBA, Playground 41-45 dBA	Yes
22	St Andrews Park	Day	35	-	19/02/20 13:11 13:26	47	42	Note 1	Note 1	Background noise nominated by noise from the M5 Motorway: Road Traffic 44-53 dBA, Dog barking 61-72 dBA, Birds 54-48 dBA, Rail Traffic 60-64 dBA, Air Traffic 55 dBA, Playground 44 -53 dBA, Construction noise 42-45 dBA	Yes
23	St Andrews Park	Day	35	-	19/02/20 17:18 17:33	57	45	Note 1	Note 1	Background noise nominated by noise from the M5 Motorway: Road Traffic 40-47 dBA, Birds 55-66 dBA, Playground 50-56 dBA, Air Traffic 60-73 dBA, Truck 55- 57 dBA	Yes
24	St Andrews Park	Day	35	-	19/02/20 17:31 17:46	53	44	Note 1	Note 1	Background noise nominated by noise from the M5 Motorway: Road Traffic 40-58 dBA, Birds 50-57 dBA, Dog barking 46-61 dBA, Air Traffic 50-55 dBA, Truck 55- 57 dBA, Rail Traffic 60-67 dBA	Yes
25	St Andrews Park	Evening	35	-	20/02/20 20:23 20:38	57	45	Note 1	Note 1	Background noise nominated by noise from the M5 Motorway: Road Traffic 45-55 dBA, Birds 50-57 dBA, Air Traffic 50-55 dBA, Rail Traffic 70-74 dBA	Yes
26	St Andrews Park	Evening	35	-	20/02/20 20:38 20:53	57	44	Note 1	Note 1	Background noise nominated by noise from the M5 Motorway: Road Traffic 40-58 dBA, Birds 50-57 dBA, Air Traffic 50-55 dBA, Rail Traffic 60-72 dBA	Yes
27	St Andrews Park	Night	35	52	20/02/20 22:38 22:53	44	39	Note 1	Note 1	Background noise nominated by noise from the M5 Motorway: Road Traffic 40-49 dBA, Birds 42-42 dBA, Air Traffic 40-52 dBA, Car passing 60-63 dBA	Yes
28	St Andrews Park	Night	35	52	21/02/20 01:04 01:19	37	33	Note 1	Note 1	Background noise nominated by noise from the M5 Motorway: Road Traffic 35-39 dBA, Truck 39-40 dBA	Yes
M4 - Glenfield											
29	26 Goodenough St	Day	35	-	19/02/20 14:49 15:04	49	46	Note 1	Note 1	Background noise nominated by noise from the Cambridge Ave: Road Traffic 48-51 dBA, Insects 50-52 dBA, Birds 48-49 dBA, Dog barking 55-65 dBA	Yes
30	26 Goodenough St	Day	35	-	19/02/20 15:05 15:20	50	46	Note 1	Note 1	Background noise nominated by noise from the Cambridge Ave: Road Traffic 48-61 dBA, Insects 50-52 dBA, Birds 48-50 dBA, Dog barking 55-65 dBA, Lawn mowing 50-56 dBA	Yes

ID	Address	Assessment period	$L_{Aeq,\ 15minute}$ noise limit, dB(A)	$L_{A1,\ 1\ minute}$ noise limit, dB(A)	Measurement period		Measured noise levels, dB(A)		Estimated MLP noise contribution, dB(A)		Comments and measured L_{AFmax} noise levels from typical events	MLP Noise Levels Comply?
							$L_{Aeq,\ 15minute}$	$L_{AF,90\%}$	$L_{Aeq,\ 15minute}$	L_{AFmax}		
31	26 Goodenough St	Evening	35	-	19/02/20	18:12 18:27	51	49	Note 1	Note 1	Background noise nominated by road noise from the Cambridge Ave: Road Traffic 45-48 dBA, Birds 50-56 dBA, Dog barking 50-59 dBA, Air Traffic 45- 64 dBA, Lawn Mowing 50-56 dBA	Yes
32	26 Goodenough St	Evening	35	-	19/02/20	18:27 18:42	51	48	Note 1	Note 1	Background noise nominated by road noise from the Cambridge Ave: Road Traffic 45-48 dBA, Birds 50-64 dBA, Dog barking 50-59 dBA, Air Traffic 45- 64 dBA, Lawn mowing 50-51 dBA	Yes
33	26 Goodenough St	Night	35	52	21/02/20	00:12 00:27	45	42	Note 1	Note 1	Background noise nominated by noise from the Cambridge Ave: Road Traffic 43-48 dBA, Birds 48-58 dBA, Dog barking 43 -44 dBA	Yes
34	26 Goodenough St	Night	35	52	21/02/20	00:29 00:44	44	41	Note 1	Note 1	Background noise nominated by noise from the Cambridge Ave: Road Traffic 48-53 dBA, Insects 42-43 dBA, Rail Traffic 42-43 dBA	Yes

Note 1: Since noise levels from the MLP were not audible during the measurement period, it was not possible to estimate the MLP noise contribution

5 Discussion

Based on the attended measurement results in Section 4, it can be seen that the measured $L_{Aeq(15minute)}$ noise levels at all locations during most measurement periods were above the 35 dB(A) noise limit.

At Location M1 (Wattle Grove), the closest measurement location to the MLP, the measured $L_{Aeq(15minutre)}$ noise levels were 32 dB(A) between 2:35am and 3:05am. During this quietest period, MLP noise emissions were not audible.

In all cases, the measured $L_{Aeq(15minute)}$ noise levels were dominated by extraneous noise sources apart from the MLP operations. MLP noise sources were not audible during any of the measurement periods at all four representative measurement locations. Since MLP noise emissions were not audible, it was not possible to estimate the industrial noise contribution from the MLP facility.

Based on the results of the attended noise measurements performed during the day, evening and night-time periods between 19-22 February 2020, it is concluded that the current noise levels comply with the operational noise limits in SSD 7628.

6 Conclusion

This report presents the results of airborne noise measurements at four representative receivers in proximity to the Moorebank Logistics Park (MLP). The measurements were performed in accordance with the requirements of the NSW *Industrial Noise Policy* (INP) the Operational noise and vibration management plan to verify compliance with the noise limits in SSD approval 7628. The measurements were performed during the daytime, evening and night-time periods between 19-22 February 2020.

At all measurement locations, the measured $L_{Aeq(15minute)}$ noise levels were dominated by extraneous noise sources apart from the MLP operations. MLP noise sources were not audible during any of the measurement periods. Since MLP noise emissions were not audible, it was not possible to estimate the industrial noise contribution from the MLP facility.

Based on the results of the attended noise measurements, and given that MLP noise levels were not audible at any of the measurement locations, it is concluded that the current noise levels comply with the operational noise limits in SSD 7628.

APPENDIX A Description of technical terms

The following is a brief description of the technical terms used to describe noise to assist in understanding the technical issues presented.

Adverse weather	Weather effects that enhance noise (that is, wind and temperature inversions) that occur at a site for a significant period of time (that is, wind occurring more than 30% of the time in any assessment period in any season and/or temperature inversions occurring more than 30% of the nights in winter).
Ambient noise	The all-encompassing noise associated within a given environment at a given time, usually composed of sound from all sources near and far.
Assessment period	The period in a day over which assessments are made.
Assessment point	A point at which noise measurements are taken or estimated. A point at which noise measurements are taken or estimated.
Background noise	Background noise is the term used to describe the underlying level of noise present in the ambient noise, measured in the absence of the noise under investigation, when extraneous noise is removed. It is described as the average of the minimum noise levels measured on a sound level meter and is measured statistically as the A-weighted noise level exceeded for ninety percent of a sample period. This is represented as the L90 noise level (see below).
Decibel [dB]	The units that sound is measured in. The following are examples of the decibel readings of every day sounds: 0dB The faintest sound we can hear 30dB A quiet library or in a quiet location in the country 45dB Typical office space. Ambience in the city at night 60dB CBD mall at lunch time 70dB The sound of a car passing on the street 80dB Loud music played at home 90dB The sound of a truck passing on the street 100dB The sound of a rock band 115dB Limit of sound permitted in industry 120dB Deafening
dB(A)	A-weighted decibels. The A- weighting noise filter simulates the response of the human ear at relatively low levels, where the ear is not as effective in hearing low frequency sounds as it is in 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.
dB(C)	C-weighted decibels. The C-weighting noise filter simulates the response of the human ear at relatively high levels, where the human ear is nearly equally effective at hearing from mid-low frequency (63Hz) to mid-high frequency (4kHz), but is less effective outside these frequencies.
Frequency	Frequency is synonymous to pitch. 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.
Impulsive noise	Having a high peak of short duration or a sequence of such peaks. A sequence of impulses in rapid succession is termed repetitive impulsive noise.
Intermittent noise	The level suddenly drops to that of the background noise several times during the period of observation. The time during which the noise remains at levels different from that of the ambient is one second or more.
LMax	The maximum sound pressure level measured over a given period.
LMin	The minimum sound pressure level measured over a given period.

APPENDIX B Detailed measurement location descriptions

B.1 M1 – Wattle Grove measurement location

An aerial photo of Wattle Grove measurement location is provided in Figure B1.

Figure B1 Wattle Grove measurement location

At the Wattle Grove location, noise measurements were performed at a free field measurement positions near the fence facing the facility. Two measurement positions were selected near Corryton Ct and Yallum Ct. At both positions, the microphone was positioned at a height of 1.5 m above ground level. The measurement locations are approximately 770 metres from the MLP. A picture of the measurement setup near Corryton Ct is provided in Figure B2.

Figure B2 18 Corryton Ct measurement location

B.2 M2 - Wattle Grove North measurement location

An aerial photo of the Wattle Grove North measurement location is provided in Figure B3.

Figure B3 Wattle Grove North measurement location

At Wattle Grove North, noise measurements were performed at a free field measurement locations on both sides of Anzac Road. At both positions, the microphone was positioned at a height of 1.5 m above ground level. The measurement location is approximately 1050 meters from MLP. Pictures of the measurements setup near Anzac Rd are provided in Figure B4.

Figure B4 Anzac Road measurement locations

B.3 M3 – Casula measurement location

An aerial photo of the Casula measurement locations is provided in B5.

Figure B5 Casula measurement location

At Casula, noise measurements were performed at a free field measurement location within St Andrews Park. The microphone was positioned at a height of 1.5 m above ground level. Measurements were performed at two locations due to safety considerations during the night-time measurements. The measurement location is approximately 960 meters from MLP. A picture of the measurement setup is provided in Figure B6.

Figure B6 St Andrews Park measurement locations

B.4 M4 - Glenfield measurement location

An aerial photo of the Glenfield measurement locations is provided in Figure B7.

Figure B7 Glenfield measurement location

At Glenfield, noise measurements were performed at a free field measurement location at the eastern end of Goodenough St. At this position, the microphone was positioned at a height of 1.5 m above ground level. The measurement location is approximately 1250 meters from MLP. Pictures of the measurement setup are provided in Figure B8.

Figure B8 26 Goodenough Road measurement location

B.2 Industrial Noise Policy Measurement Report for Quarter 2 2020

Renzo Tonin & Associates Report TL116-05F04 Moorebank INP Monitoring Q2 2020 (r1)

RENZO TONIN & ASSOCIATES
inspired to achieve

Acoustics
Vibration
Structural Dynamics

MOOREBANK LOGISTIC PARK - PRECINCT EAST

Operational Noise Monitoring for Moorebank Logistic Park - Q2 2020

22 July 2020

Tactical

TL116-05F04 Moorebank INP Monitoring Q2 2020 (r1).docx

35 1982-2017 ACOUSTIC ENGINEERING EXCELLENCE

Sydney Melbourne Brisbane Gold Coast Kuwait Singapore
Renzo Tonin & Associates ABN 29 117 462 861
Level 1/418A Elizabeth St SURRY HILLS NSW 2010 | PO Box 877 STRAWBERRY HILLS NSW 2012
P (02) 8218 0500 F (02) 8218 0501 sydney@renzotonin.com.au www.renzotonin.com.au

aaac Association of Australian Acoustical Consultants

Document details

Detail	Reference
Doc reference:	TL116-05F04 Moorebank INP Monitoring Q2 2020 (r1).docx
Prepared for:	Tactical
Address:	Level 15, 124 Walker Street North Sydney NSW 2060
Attention:	Richard Mason

Document control

Date	Revision history	Non-issued revision	Issued revision	Prepared	Instructed	Reviewed / Authorised
22.07.2020	Final	0	1	J. Liang	C. Weber	C. Weber

Important Disclaimers:

The work presented in this document was carried out in accordance with the Renzo Tonin & Associates Quality Assurance System, which is based on Australian/New Zealand Standard AS/NZS ISO 9001.

This document is issued subject to review and authorisation by the suitably qualified and experienced person named in the last column above. If no name appears, this document shall be considered as preliminary or draft only and no reliance shall be placed upon it other than for information to be verified later.

This document is prepared for the particular requirements of our Client referred to above in the 'Document details' which are based on a specific brief with limitations as agreed to with the Client. It is not intended for and should not be relied upon by a third party and no responsibility is undertaken to any third party without prior consent provided by Renzo Tonin & Associates. The information herein should not be reproduced, presented or reviewed except in full. Prior to passing on to a third party, the Client is to fully inform the third party of the specific brief and limitations associated with the commission.

In preparing this report, we have relied upon, and presumed accurate, any information (or confirmation of the absence thereof) provided by the Client and/or from other sources. Except as otherwise stated in the report, we have not attempted to verify the accuracy or completeness of any such information. If the information is subsequently determined to be false, inaccurate or incomplete then it is possible that our observations and conclusions as expressed in this report may change.

We have derived data in this report from information sourced from the Client (if any) and/or available in the public domain at the time or times outlined in this report. The passage of time, manifestation of latent conditions or impacts of future events may require further examination and re-evaluation of the data, findings, observations and conclusions expressed in this report.

We have prepared this report in accordance with the usual care and thoroughness of the consulting profession, for the sole purpose described above and by reference to applicable standards, guidelines, procedures and practices at the date of issue of this report. For the reasons outlined above, however, no other warranty or guarantee, whether expressed or implied, is made as to the data, observations and findings expressed in this report, to the extent permitted by law.

The information contained herein is for the purpose of acoustics only. No claims are made and no liability is accepted in respect of design and construction issues falling outside of the specialist field of acoustics engineering including and not limited to structural integrity, fire rating, architectural buildability and fit-for-purpose, waterproofing and the like. Supplementary professional advice should be sought in respect of these issues.

External cladding disclaimer: No claims are made and no liability is accepted in respect of any external wall and/or roof systems (eg facade / cladding materials, insulation etc) that are: (a) not compliant with or do not conform to any relevant non-acoustic legislation, regulation, standard, instructions or Building Codes; or (b) installed, applied, specified or utilised in such a manner that is not compliant with or does not conform to any relevant non-acoustic legislation, regulation, standard, instructions or Building Codes.

Contents

1 Introduction 1
1.1 Project overview 1
1.2 Scope of assessment 1
2 Summary of noise objectives 3
3 Measurement methodology and equipment 4
4 Measurement results 5
4.1 Measurement locations and time periods 5
4.2 Measurement results 6
5 Discussion 9
6 Conclusion 10
APPENDIX A Description of technical terms 11
APPENDIX B Detailed measurement location descriptions 12
B.1 M1 – Wattle Grove measurement location 12
B.2 M2 - Wattle Grove North measurement location 14
B.3 M3 – Casula measurement location 16
B.4 M4 - Glenfield measurement location 18

List of tables

Table 1 MPE Stage 1 and 2 noise limits, dB(A) 3
Table 2 Measurement equipment 4
Table 3 Sensitive receivers and approximate distance from MLP East Precinct 5
Table 4 Attended measurement periods 5
Table 5 Attended noise measurement results 7

List of figures

Figure 1 MLP East Precinct and nearest sensitive receivers 1

1 Introduction

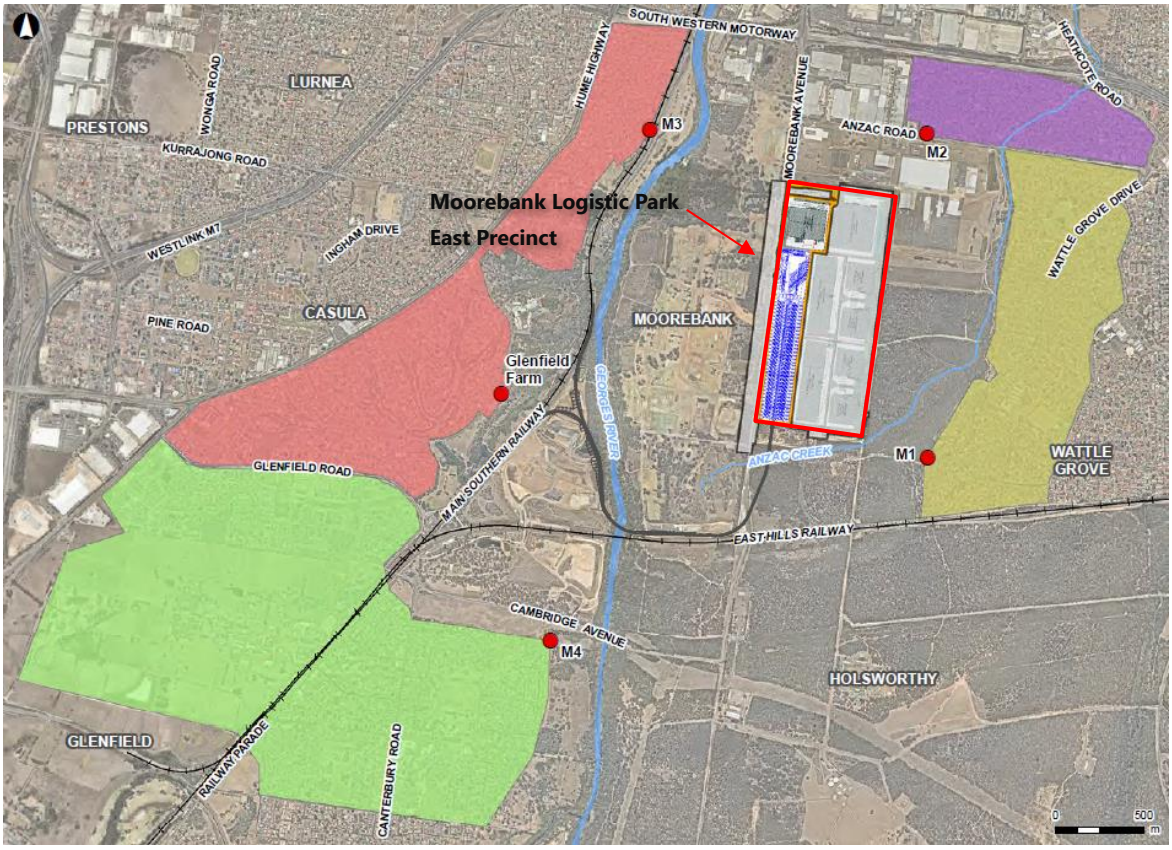
1.1 Project overview

The Sydney Intermodal Terminal Alliance (SIMTA) received approval for the construction and operation of Stages 1 and 2 of the Moorebank Precinct East (MPE) Project (SSD 6766 and SSD 7628 respectively), which together comprise the two stages of development under the MPE Concept Approval (MP10_0193).

This operational noise monitoring has been conducted to assess noise impacts during operation of the east precinct for the second quarter in 2020.

The location of the Moorebank Logistics Park (MLP) East Precinct in relation to the nearest representative receivers (M1 to M4 and Glenfield Farm) is illustrated in Figure 1.

Figure 1 MLP East Precinct and nearest sensitive receivers



1.2 Scope of assessment

Renzo Tonin & Associates (NSW) Pty Ltd has been engaged by Tactical to perform attended noise measurements for the purpose of assessing compliance with the approval conditions. These

measurements have been performed, consistent with the requirements of the NSW *Industrial Noise Policy* (EPA, 2000) and the Operational Noise and Vibration Management Plan[1].

Airborne noise measurements were performed at the four potentially most affected residential receivers in the vicinity of the MLP. The representative receivers are located in the suburbs of Casula, Glenfield, Wattle Grove and Wattle Grove North (see Figure 1).

Daytime construction noise is currently occurring at the MLP site. Construction noise has been excluded from the assessment.

A description of technical terms used within this report is provided in Appendix A.

[1] OPERATIONAL NOISE AND VIBRATION MANAGEMENT PLAN - Moorebank Logistics Park – East Precinct (Revision 010 dated 24/9/2019)

2 Summary of noise objectives

Stages 1 and 2 of the MPE Project was approved under State Significant Development (SSD) Approvals 6766 and 7628, respectively.

The noise assessments for Stage 1 and 2 were prepared and assessed in accordance with the requirements of the NSW *Industrial Noise Policy* (EPA, 2000). However, the Determination Report for MPE Stage 2[2] identified that the recommended noise limits at Wattle Grove be amended to reflect the values derived in accordance with the *Noise Policy for Industry* (EPA, 2017).

A summary of the MPE Stage 1 and 2 noise limits from SSD 7628 is provided in Table 1.

Table 1 MPE Stage 1 and 2 noise limits, dB(A)

Sensitive receiver	Day [1] $L_{Aeq,\ 15\ minute}$	Evening [1] $L_{Aeq,\ 15\ minute}$	Night [1] $L_{Aeq,\ 15\ minute}$	Night [1] $L_{A1,\ 1\ minute}$
Casula	35	35	35	52
Glenfield	35	35	35	52
Wattle Grove	35	35	35	52
Casula	35	35	35	52
Wattle Grove North [2]	35	35	35	52

Notes:

To determine compliance with the $L_{Aeq,15\ minute}$ noise limits, noise from the development is to be measured at the most affected point within the residential boundary, or at the most affected point within 30 metres of a dwelling where the dwelling is more than 30 metres from the boundary. Where it can be demonstrated that direct measurement of noise from the project is impractical, the EPA may accept alternative means of determining compliance (see Chapter 11 of the NSW Industrial Noise Policy). The modification factors in Section 4 of the NSW Industrial Noise Policy must also be applied to the measured noise levels where applicable.

To determine compliance with the $L_{A1,1\ minute}$ noise limits, noise from the project is to be measured at 1 metre from the dwelling façade. Where it can be demonstrated that direct measurement of noise from the project is impractical, the EPA may accept alternative means of determining compliance (see Chapter 11 of the NSW Industrial Noise Policy).

The noise emission limits identified above apply under meteorological conditions of:

(i) wind speeds of up to 3 m/s at 10 metres above ground level; or

(ii) 'F' atmospheric stability class.

Note 1: In accordance with the INP, day is the period from 7:00 am to 6:00 pm Monday to Saturday; or 8:00 am to 6:00 pm on Sundays and public holidays; evening is the period from 6:00 pm to 10:00 pm; and night is the remaining periods.

Note 2: Wattle Grove North receiver is not included in SSD 7628, but is listed as a sensitive receiver in the Operational Noise and Vibration Management Plan (Section 3.3).

[2] NSW Planning Assessment Commission Determination Report – Moorebank Intermodal Terminal, Stage 2, Moorebank Precinct East (SSD 7628).

3 Measurement methodology and equipment

All noise measurements were performed with a Type 1 sound level meter and Type 1 microphone calibrator. The measurement equipment calibration certificates were current at the time of the measurements. Before and after each series of measurements, the calibration of the sound level meter was verified using a reference calibration of 94 dB at 1 kHz. The difference between pre- and post-calibration levels was within 0.5 dB for all measurements.

Airborne noise measurements were performed in accordance with the requirements of the *NSW Industrial Noise Policy (EPA 2000)*.

A summary of measurement equipment is provided in Table 2.

Table 2 Measurement equipment

Description	Make	Model	Serial No	Last Date Calibrated
Type 1 sound level meter	NTi	XL2	A2A-07815-E0	09/11/2018
Sound level meter calibrator	Bruel & Kjaer	4231	3017534	24/02/2020

4 Measurement results

4.1 Measurement locations and time periods

15-hours of on-site attended measurements were performed between 2 July and 8 July 2020. The measurements were performed during representative daytime (7am to 6pm), evening (6pm to 10pm) and night-time (10pm to 7am) periods, consistent with the approved 24-hour operations.

Prior to the measurements, it was confirmed that the MLP site was operational to ensure that the measurements were representative of current options. It is understood that the facility is not currently operating at full capacity.

A summary of the attended measurement locations and the approximate distances to the MLP East Precinct is provided in Table 3. Additional details are provided in Appendix B.

A summary of the attended measurement periods is provided in Table 4.

Table 3 Sensitive receivers and approximate distance from MLP East Precinct

Measurement locations	Approximate distance (m) from MLP East Precinct
M1 - Wattle Grove	770
M2 - Wattle Grove North	1,050
M3 - Casula	960
M4 - Glenfield	1,250

Table 4 Attended measurement periods

Location	Measurement period 1	Measurement period 2
Measurements during 7am to 6pm daytime period – 2 July 2020		
M1 - Wattle Grove	10:52am to 11:24am (Note 2)	2:21pm to 2:51pm (Note 2)
M2 - Wattle Grove North	11:40am to 12:11pm (Note 3)	3:03pm to 3:35pm (Note 3)
M3 - Casula	12:25pm to 12:56pm (Note 4)	3:45pm to 4:17pm (Note 4)
M4 - Glenfield	1:27pm to 1:59pm (Note 5)	4:38pm to 5:09pm (Note 5)
Measurements during 6pm to 10pm evening period – 6 July 2020		
M1 - Wattle Grove	7:18pm to 7:49pm (Note 2)	-
M2 - Wattle Grove North	7:59pm to 8:29pm (Note 3)	-
M3 - Casula	8:39pm to 9:10pm (Note 4)	-
M4 - Glenfield	9:28pm to 9:59pm (Note 5)	-
Measurements during 10pm to 7am night-time period – 6-8 July 2020		
M1 - Wattle Grove	10:53pm to 11:25pm (Note 1)	5:16am to 5:51am (Note 1)
M2 - Wattle Grove North	11:34pm to 12:04pm (Note 3)	6:00am to 6:31am (Note 3)
M3 - Casula	12:13pm to 12:44pm (Note 4)	6:39am to 6:54am (Note 4)
M4 - Glenfield	10:00pm to 10:30pm (Note 5)	-

Location	Measurement period 1	Measurement period 2

Note 1: Measurements performed at 18 Corryton Ct
Note 2: Measurements performed at 25 Yallum Ct
Note 3: Measurements performed at 39 Anzac Rd
Note 4: Measurements performed at St Andrews Park
Note 5: Measurements performed at 26 Goodenough St

4.2 Measurement results

Results from the attended noise measurements at all measurement locations is provided in Table 5. All noise measurements were performed over 15-minute measurement durations in accordance with the requirements of the approval conditions and the INP.

Table 5 Attended noise measurement results

ID	Address	Assessment period	$L_{Aeq,\ 15minute}$ noise limit, dB(A)	$L_{A1,\ 1\text{-}minute}$ noise limit, dB(A)	Measurement period	Measured noise levels, dB(A)		Estimated MLP noise contribution, dB(A)		Comments and measured L_{AFmax} noise levels from typical events	MLP Noise Levels Comply?
						$L_{Aeq,\ 15minute}$	$L_{AF,90\%}$	$L_{Aeq,\ 15minute.}$	L_{AFmax}		
M1 - Wattle Grove											
1	25 Yallum Ct.	Day	35	-	2/07/2020 10:52 11:08	51	47	Note 1	Note 1	Background noise dominated by noise from MLP East precinct construction activities: Construction 49-52dBA, bird 61-72dBA, Aircraft 54-60dBA, road traffic 51-52dBA, Nature 50-52dBA	Yes
2	25 Yallum Ct.	Day	35	-	2/07/2020 11:08 11:24	49	46	Note 1	Note 1	Background noise dominated by noise from MLP East precinct construction activities: Construction 49-52dBA, bird 65-69dBA, dog 50-55.5dBA, rail traffic 49-52dBA, Nature 47-51dBA	Yes
3	25 Yallum Ct.	Day	35	-	2/07/2020 14:21 14:36	51	48	Note 1	Note 1	Background noise dominated by noise from MLP East precinct construction activities: Construction 49-55dBA, bird 62-66dBA, rail traffic 51-52dBA, Nature 55-58dBA	Yes
4	25 Yallum Ct.	Day	35	-	2/07/2020 14:36 14:51	49	46	Note 1	Note 1	Background noise dominated by noise from MLP East precinct construction activities: Construction 49-54dBA, bird 57-60dBA, Aircraft 54-56dBA, rail traffic 51-52dBA	Yes
5	25 Yallum Ct.	Evening	35	-	6/07/2020 19:18 19:34	44	38	Note 1	Note 1	Background noise dominated by noise from road traffic on Wattle Grove Dr: Road traffic 41-48dBA, Rail traffic 49-52.8dBA, Dog 39-45dBA, Resident 40-43dBA, Nature 38-39dBA	Yes
6	25 Yallum Ct.	Evening	35	-	6/07/2020 19:34 19:49	44	38	Note 1	Note 1	Background noise dominated by noise from road traffic on Wattle Grove Dr: Road traffic 45-48dBA, Rail traffic 50-55dBA, Dog 39-45dBA, Resident 40-41dBA, Nature 38-39dBA	Yes
7	25 Yallum Ct.	Night	35	52	6/07/2020 22:53 23:08	40	34	Note 1	Note 1	Background noise dominated by noise from MLP East precinct construction activities: Construction 38-39dBA, Rail traffic 50-53dBA, Aircraft 40-42dBA, Nature 35-37dBA, Wattle Grove Dr: 40-41dBA	Yes
8	18 Corryton Ct.	Night	35	52	6/07/2020 23:10 23:25	40	34	Note 1	Note 1	Background noise dominated by noise from MLP East precinct construction activities: Construction 38-46dBA, Rail traffic 50-53dBA, Nature 35-38dBA, Road traffic Wattle Grove Dr: 40-42dBA	Yes
9	18 Corryton Ct.	Night	35	52	8/07/2020 05:16 05:32	37	35	Note 1	Note 1	Background noise dominated by noise from MLP East precinct construction activities: Construction 35-45dBA, Rail traffic 46-47dBA, Nature 35-36dBA	Yes
10	18 Corryton Ct.	Night	35	52	8/07/2020 05:33 05:51	42	37	Note 1	Note 1	Background noise dominated by noise from MLP East precinct construction activities: Construction 38-62dBA, Rail traffic 46-47dBA, Nature 35-36dBA	Yes
M2 - Wattle Grove North											
11	39 Anzac Rd	Day	35	-	2/07/2020 11:40 11:55	69	55	Note 1	Note 1	Background noise dominated by noise from Anzac Rd: Road traffic 75-82dBA, Residential 60-62dBA, Bird 62-64dBA	Yes
12	39 Anzac Rd	Day	35	-	2/07/2020 11:56 12:11	69	56	Note 1	Note 1	Background noise dominated by noise from Anzac Rd: Road traffic 75-82dBA	Yes
13	39 Anzac Rd	Day	35	-	2/07/2020 15:03 15:20	72	59	Note 1	Note 1	Background noise dominated by noise from Anzac Rd: Road traffic 80-86dBA, Truck loading 60-62dBA, Siren 80-88dBA, Bird 65-62dBA	Yes
14	39 Anzac Rd	Day	35	-	2/07/2020 15:20 15:35	71	58	Note 1	Note 1	Background noise dominated by noise from Anzac Rd: Road traffic 77-85dBA, Bird 62-60dBA	Yes
15	39 Anzac Rd	Evening	35	-	6/07/2020 19:59 19:14	67	50	Note 1	Note 1	Background noise dominated by noise from Anzac Rd" Road traffic 81-82dBA	Yes
16	39 Anzac Rd	Evening	35	-	6/07/2020 20:14 20:29	66	48	Note 1	Note 1	Background noise dominated by noise from Anzac Rd: Road traffic 78-83dBA, Aircraft 47-51dBA	Yes
17	39 Anzac Rd	Night	35	52	6/07/2020 23:34 23:49	62	42	Note 1	Note 1	Background noise dominated by noise from Anzac Rd: Road traffic 80-81dBA, Bird 60-62dBA	Yes
18	39 Anzac Rd	Night	35	52	6/07/2020 23:49 00:04	62	40	Note 1	Note 1	Background noise dominated by noise from Anzac Rd: Road traffic 78-83dBA, Moorebank Ave traffic 47-48dBA	Yes
19	39 Anzac Rd	Night	35	52	8/07/2020 06:00 06:15	70	50	Note 1	Note 1	Background noise dominated by noise from Anzac Rd: Road traffic 78-88dBA, Moorebank Ave traffic 47-50dBA	Yes
20	39 Anzac Rd	Night	35	52	8/07/2020 06:16 06:31	70	52	Note 1	Note 1	Background noise dominated by noise from Anzac Rd: Road traffic 78-83dBA, Moorebank Ave traffic 47-49dBA	Yes
M3 – Casula											
21	St Andrews Park	Day	35	-	2/07/2020 12:25 12:40	61	53	Note 1	Note 1	Background noise dominated by noise from M5 Motorway: Road traffic 53-55dBA, Loco 78-79dBA, Rail traffic 72-73dBA, Children playing 51-56dBA, Residential 56-56dBA	Yes
22	St Andrews Park	Day	35	-	2/07/2020 12:41 12:56	60	53	Note 1	Note 1	Background noise dominated by noise from M5 Motorway: Road traffic 54-55dBA, Loco 79-70dBA, Rail traffic 68-69dBA, Residential 54-57dBA	Yes
23	St Andrews Park	Day	35	-	2/07/2020 15:45 16:00	60	49	Note 1	Note 1	Background noise dominated by noise from M5 Motorway: Road traffic 51-56dBA, Loco 70-73dBA, Rail traffic 67-75dBA, Residential 60-64dBA	Yes
24	St Andrews Park	Day	35	-	2/07/2020 16:01 16:17	59	50	Note 1	Note 1	Background noise dominated by noise from M5 Motorway: Road traffic 50-55dBA, Rail traffic 75-77dBA, Children playing 62-63dBA	Yes
25	St Andrews Park	Evening	35	-	6/07/2020 20:39 20:54	59	47	Note 1	Note 1	Background noise dominated by noise from M5 Motorway: Road traffic 51-53dBA, Rail traffic 58-70dBA	Yes
26	St Andrews Park	Evening	35	-	6/07/2020 20:55 21:10	56	44	Note 1	Note 1	Background noise dominated by noise from M5 Motorway: Road traffic 52-54dBA, Rail traffic 67-70dBA	Yes
27	St Andrews Park	Night	35	52	7/07/2020 00:13 00:28	47	41	Note 1	Note 1	Background noise dominated by noise from M5 Motorway: Road traffic 44-45dBA, Rail traffic 70-72dBA, Aircraft 41-42dBA	Yes
28	St Andrews Park	Night	35	52	7/07/2020 00:29 00:44	57	48	Note 1	Note 1	Background noise dominated by noise from M5 Motorway: Road traffic 52-54dBA, Rail traffic 67-70dBA, Construction 45-46dBA	Yes
29	St Andrews Park	Night	35	52	8/07/2020 06:39 06:54	57	47	Note 1	Note 1	Background noise dominated by noise from M5 Motorway: Road traffic 47-55dBA, Rail traffic 73-74dBA	

ID	Address	Assessment period	$L_{Aeq,\ 15minute}$ noise limit, dB(A)	$L_{A1,\ 1\text{-}minute}$ noise limit, dB(A)	Measurement period	Measured noise levels, dB(A)		Estimated MLP noise contribution, dB(A)		Comments and measured L_{AFmax} noise levels from typical events	MLP Noise Levels Comply?
						$L_{Aeq,\ 15minute}$	$L_{AF,90\%}$	$L_{Aeq,\ 15minute.}$	L_{AFmax}		
M4 – Glenfield											
30	26 Goodenough St	Day	35	-	2/07/2020 13:27 13:42	52	48	Note 1	Note 1	Background noise dominated by noise from Cambridge Ave: Road traffic 53-54dBA, Bird 55-64dBA, High Voltage power line buzzing 54-55dBA	Yes
31	26 Goodenough St	Day	35	-	2/07/2020 13:44 13:59	55	51	Note 1	Note 1	Background noise dominated by noise from Cambridge Ave: Road traffic 53-55dBA, Bird 54-69dBA, Rail traffic 53-54dBA, High Voltage power line buzzing 54-55dBA	Yes
32	26 Goodenough St	Day	35	-	2/07/2020 16:38 16:53	53	50	Note 1	Note 1	Background noise dominated by noise from Cambridge Ave: Road traffic 53-54dBA, Bird 53-64dBA, Aircraft 54-55dBA, High Voltage line buzzing 54-55dBA	Yes
33	26 Goodenough St	Day	35	-	2/07/2020 16:54 17:09	53	50	Note 1	Note 1	Background noise dominated by noise from Cambridge Ave: Road traffic 53-55dBA, Bird 55-60dBA, High Voltage power line buzzing 54-55dBA	Yes
34	26 Goodenough St	Evening	35	52	6/07/2020 21:28 21:43	52	47	Note 1	Note 1	Background noise dominated by noise from Cambridge Ave: Road traffic 55-60dBA, Rail traffic 45-47, Dog 48-49dBA	Yes
35	26 Goodenough St	Evening	35	52	6/07/2020 21:44 21:59	50	45	Note 1	Note 1	Background noise dominated by noise from Cambridge Ave: Road traffic 56-60dBA, Rail traffic 45-47dBA	Yes
36	26 Goodenough St	Night	35	52	6/07/2020 22:00 22:15	49	45	Note 1	Note 1	Background noise dominated by noise from Cambridge Ave: Road traffic 52-57dBA, Rail traffic 45-46dBA, Dog 45-52dBA	Yes
37	26 Goodenough St	Night	35	52	6/07/2020 22:15 22:30	49	45	Note 1	Note 1	Background noise dominated by noise from Cambridge Ave: Road traffic 52-62dBA, Rail traffic 46-50dBA	Yes

Note 1: Since noise levels from the MLP were not audible during the measurement period, it was not possible to estimate the MLP noise contribution

5 Discussion

Based on the attended measurement results in Section 4, it can be seen that the measured $L_{Aeq(15minute)}$ noise levels at all locations and during all measurement periods were above the 35 dB(A) noise limit.

At Location M1 (Wattle Grove), the closest measurement location to the MLP, the measured $L_{Aeq(15minutre)}$ noise level was 37 dB(A) between 5:16am and 5:32am. During this quietest period, MLP noise emissions were not audible.

In all cases, the measured $L_{Aeq(15minute)}$ noise levels were dominated by extraneous noise sources apart from the MLP operations. Noise sources from MLP operations were not audible during any of the measurement periods at all four representative measurement locations. Since MLP noise emissions were not audible, it was not possible to estimate the industrial noise contribution from the MLP facility.

Based on the results of the attended noise measurements performed during the day, evening and night-time periods between 2 July and -7 July 2020, it is concluded that the current noise levels comply with the operational noise limits in SSD 7628.

6 Conclusion

This report presents the results of airborne noise measurements at four representative receivers in proximity to the Moorebank Logistics Park (MLP). The measurements were performed in accordance with the requirements of the NSW *Industrial Noise Policy* (INP) the Operational noise and vibration management plan to verify compliance with the noise limits in SSD approval 7628. The measurements were performed during the daytime, evening and night-time periods between 2 July and -7 July 2020.

At all measurement locations, the measured $L_{Aeq(15minute)}$ noise levels were dominated by extraneous noise sources apart from the MLP operations. Noise sources from MLP operations were not audible during any of the measurement periods. Since MLP noise emissions were not audible, it was not possible to estimate the industrial noise contribution from the MLP facility.

Based on the results of the attended noise measurements, and given that MLP noise levels were not audible at any of the measurement locations, it is concluded that the current noise levels comply with the operational noise limits in SSD 7628.

APPENDIX A Description of technical terms

The following is a brief description of the technical terms used to describe noise to assist in understanding the technical issues presented.

Adverse weather	Weather effects that enhance noise (that is, wind and temperature inversions) that occur at a site for a significant period of time (that is, wind occurring more than 30% of the time in any assessment period in any season and/or temperature inversions occurring more than 30% of the nights in winter).
Ambient noise	The all-encompassing noise associated within a given environment at a given time, usually composed of sound from all sources near and far.
Assessment period	The period in a day over which assessments are made.
Assessment point	A point at which noise measurements are taken or estimated. A point at which noise measurements are taken or estimated.
Background noise	Background noise is the term used to describe the underlying level of noise present in the ambient noise, measured in the absence of the noise under investigation, when extraneous noise is removed. It is described as the average of the minimum noise levels measured on a sound level meter and is measured statistically as the A-weighted noise level exceeded for ninety percent of a sample period. This is represented as the L90 noise level (see below).
Decibel [dB]	The units that sound is measured in. The following are examples of the decibel readings of every day sounds: 0dB The faintest sound we can hear 30dB A quiet library or in a quiet location in the country 45dB Typical office space. Ambience in the city at night 60dB CBD mall at lunch time 70dB The sound of a car passing on the street 80dB Loud music played at home 90dB The sound of a truck passing on the street 100dB The sound of a rock band 115dB Limit of sound permitted in industry 120dB Deafening
dB(A)	A-weighted decibels. The A- weighting noise filter simulates the response of the human ear at relatively low levels, where the ear is not as effective in hearing low frequency sounds as it is in 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.
dB(C)	C-weighted decibels. The C-weighting noise filter simulates the response of the human ear at relatively high levels, where the human ear is nearly equally effective at hearing from mid-low frequency (63Hz) to mid-high frequency (4kHz), but is less effective outside these frequencies.
Frequency	Frequency is synonymous to pitch. 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.
Impulsive noise	Having a high peak of short duration or a sequence of such peaks. A sequence of impulses in rapid succession is termed repetitive impulsive noise.
Intermittent noise	The level suddenly drops to that of the background noise several times during the period of observation. The time during which the noise remains at levels different from that of the ambient is one second or more.
LMax	The maximum sound pressure level measured over a given period.
LMin	The minimum sound pressure level measured over a given period.

APPENDIX B Detailed measurement location descriptions

B.1 M1 – Wattle Grove measurement location

An aerial photo of Wattle Grove measurement location is provided in Figure B1.

Figure B1 Wattle Grove measurement location

At the Wattle Grove location, noise measurements were performed at a free field measurement positions near the fence facing the facility. Two measurement positions were selected near Corryton Ct and Yallum Ct. At both positions, the microphone was positioned at a height of 1.5 m above ground level. The measurement locations are approximately 770 metres from the MLP. A picture of the measurement setup near Yallum Ct is provided in Figure B2.

Figure B2 25 Yallum Ct measurement location

B.2 M2 - Wattle Grove North measurement location

An aerial photo of the Wattle Grove North measurement location is provided in Figure B3.

Figure B3 Wattle Grove North measurement location

At Wattle Grove North, noise measurements were performed at a free field measurement locations on both sides of Anzac Road. At both positions, the microphone was positioned at a height of 1.5 m above ground level. The measurement location is approximately 1050 meters from MLP. Pictures of the measurements setup near Anzac Rd are provided in Figure B4.

Figure B4 Anzac Road measurement locations

B.3 M3 – Casula measurement location

An aerial photo of the Casula measurement locations is provided in B5.

Figure B5 Casula measurement location

At Casula, noise measurements were performed at a free field measurement location within St Andrews Park. The microphone was positioned at a height of 1.5 m above ground level. Measurements were performed at two locations due to safety considerations during the night-time measurements. The measurement location is approximately 960 meters from MLP. A picture of the measurement setup is provided in Figure B6.

Figure B6 St Andrews Park measurement locations

B.4 M4 - Glenfield measurement location

An aerial photo of the Glenfield measurement locations is provided in Figure B7.

Figure B7 Glenfield measurement location

At Glenfield, noise measurements were performed at a free field measurement location at the eastern end of Goodenough St. At this position, the microphone was positioned at a height of 1.5 m above ground level. The measurement location is approximately 1250 meters from MLP. Pictures of the measurement setup are provided in Figure B8.

Figure B8 26 Goodenough Road measurement location

B.3 Industrial Noise Policy Measurement Report for Quarter 4 2020

Renzo Tonin & Associates Report TL116-05F10 Moorebank INP Monitoring Q4 2020 (r1)

RENZO TONIN & ASSOCIATES
inspired to achieve

Acoustics
Vibration
Structural Dynamics

MOOREBANK LOGISTIC PARK - PRECINCT EAST

Operational Noise Monitoring for Moorebank Logistic Park - Q4 2020

15 February 2021

Qube Property Management Services Pty Ltd c/- Tactical Group

TL116-05F10 Moorebank INP Monitoring Q4 2020 (r1)

Sydney Melbourne Brisbane Gold Coast Kuwait Singapore
Renzo Tonin & Associates ABN 29 117 462 861
Level 1/418A Elizabeth St SURRY HILLS NSW 2010 | PO Box 877 STRAWBERRY HILLS NSW 2012
P (02) 8218 0500 F (02) 8218 0501 sydney@renzotonin.com.au www.renzotonin.com.au

Document details

Detail	Reference
Doc reference:	TL116-05F10 Moorebank INP Monitoring Q4 2020 (r1)
Prepared for:	Qube Property Management Services Pty Ltd c/- Tactical Group
Address:	Level 15, 124 Walker Street North Sydney NSW 2060
Attention:	Cathal McGann

Document control

Date	Revision history	Non-issued revision	Issued revision	Prepared	Instructed	Reviewed / Authorised
15.02.2021	Final	0	1	J. Liang	C. Weber	C. Weber

Important Disclaimers:

The work presented in this document was carried out in accordance with the Renzo Tonin & Associates Quality Assurance System, which is based on Australian/New Zealand Standard AS/NZS ISO 9001.

This document is issued subject to review and authorisation by the suitably qualified and experienced person named in the last column above. If no name appears, this document shall be considered as preliminary or draft only and no reliance shall be placed upon it other than for information to be verified later.

This document is prepared for the particular requirements of our Client referred to above in the 'Document details' which are based on a specific brief with limitations as agreed to with the Client. It is not intended for and should not be relied upon by a third party and no responsibility is undertaken to any third party without prior consent provided by Renzo Tonin & Associates. The information herein should not be reproduced, presented or reviewed except in full. Prior to passing on to a third party, the Client is to fully inform the third party of the specific brief and limitations associated with the commission.

In preparing this report, we have relied upon, and presumed accurate, any information (or confirmation of the absence thereof) provided by the Client and/or from other sources. Except as otherwise stated in the report, we have not attempted to verify the accuracy or completeness of any such information. If the information is subsequently determined to be false, inaccurate or incomplete then it is possible that our observations and conclusions as expressed in this report may change.

We have derived data in this report from information sourced from the Client (if any) and/or available in the public domain at the time or times outlined in this report. The passage of time, manifestation of latent conditions or impacts of future events may require further examination and re-evaluation of the data, findings, observations and conclusions expressed in this report.

We have prepared this report in accordance with the usual care and thoroughness of the consulting profession, for the sole purpose described above and by reference to applicable standards, guidelines, procedures and practices at the date of issue of this report. For the reasons outlined above, however, no other warranty or guarantee, whether expressed or implied, is made as to the data, observations and findings expressed in this report, to the extent permitted by law.

The information contained herein is for the purpose of acoustics only. No claims are made and no liability is accepted in respect of design and construction issues falling outside of the specialist field of acoustics engineering including and not limited to structural integrity, fire rating, architectural buildability and fit-for-purpose, waterproofing and the like. Supplementary professional advice should be sought in respect of these issues.

External cladding disclaimer: No claims are made and no liability is accepted in respect of any external wall and/or roof systems (eg facade / cladding materials, insulation etc) that are: (a) not compliant with or do not conform to any relevant non-acoustic legislation, regulation, standard, instructions or Building Codes; or (b) installed, applied, specified or utilised in such a manner that is not compliant with or does not conform to any relevant non-acoustic legislation, regulation, standard, instructions or Building Codes.

Contents

1 Introduction 1
1.1 Project overview 1
1.2 Scope of assessment 1
2 Summary of noise objectives 3
3 Measurement methodology and equipment 4
4 Measurement results 5
4.1 Measurement locations and time periods 5
4.2 Measurement results 6
5 Discussion 9
6 Conclusion 10
APPENDIX A Description of technical terms 11
APPENDIX B Detailed measurement location descriptions 12
B.1 M1 – Wattle Grove measurement location 12
B.2 M2 - Wattle Grove North measurement location 14
B.3 M3 – Casula measurement location 16
B.4 M4 - Glenfield measurement location 18

List of tables

Table 1 MPE Stage 1 and 2 noise limits, dB(A) 3
Table 2 Measurement equipment 4
Table 3 Sensitive receivers and approximate distance from MLP East Precinct 5
Table 4 Attended measurement periods 5
Table 5 Attended noise measurement results 7

List of figures

Figure 1 MLP East Precinct and nearest sensitive receivers 1

1 Introduction

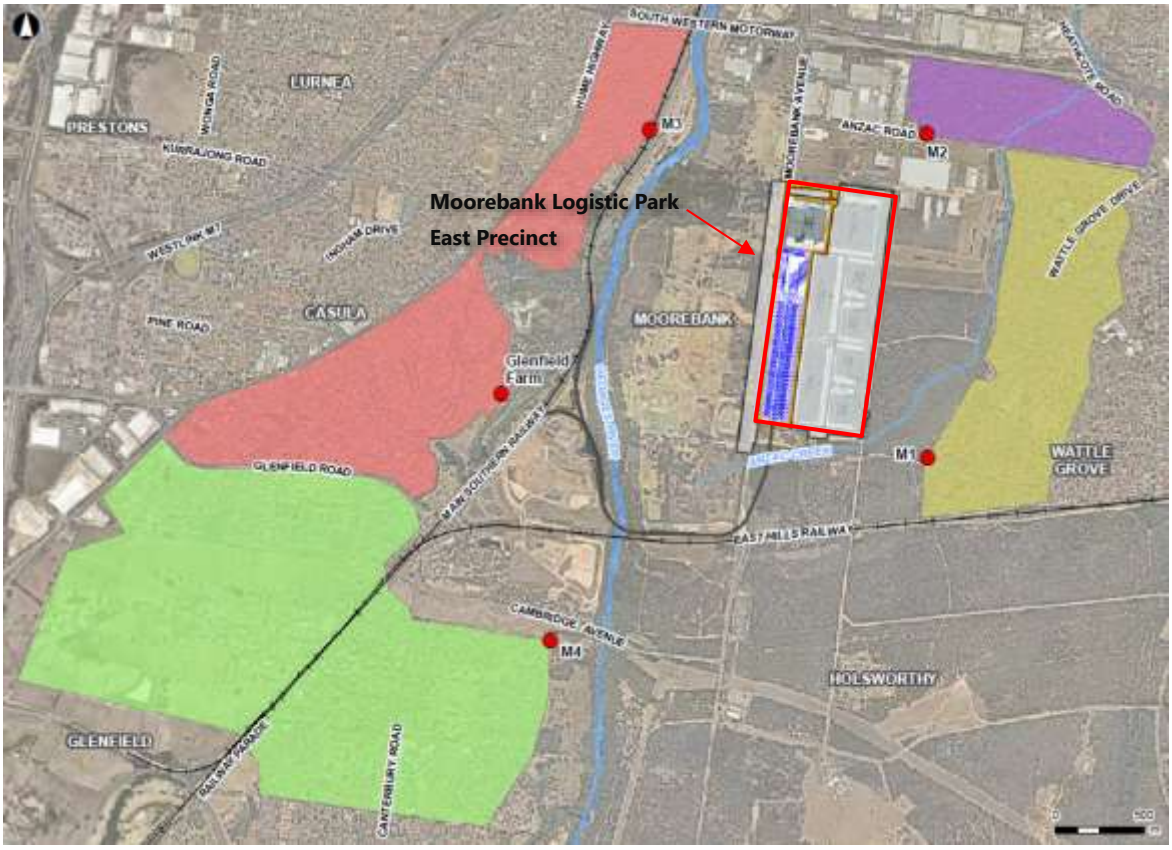
1.1 Project overview

The Sydney Intermodal Terminal Alliance (SIMTA) received approval for the construction and operation of Stages 1 and 2 of the Moorebank Precinct East (MPE) Project (SSD 6766 and SSD 7628 respectively), which together comprise the two stages of development under the MPE Concept Approval (MP10_0193).

This operational noise monitoring has been conducted to assess noise impacts during operation of the east precinct for the fourth quarter in 2020.

The location of the Moorebank Logistics Park (MLP) East Precinct in relation to the nearest representative receivers (M1 to M4 and Glenfield Farm) is illustrated in Figure 1.

Figure 1 MLP East Precinct and nearest sensitive receivers



1.2 Scope of assessment

Renzo Tonin & Associates (NSW) Pty Ltd has been engaged by Tactical to perform attended noise measurements for the purpose of assessing compliance with the approval conditions. These

measurements have been performed, consistent with the requirements of the NSW *Industrial Noise Policy* (EPA, 2000) and the Operational Noise and Vibration Management Plan[1].

Airborne noise measurements were performed at the four potentially most affected residential receivers in the vicinity of the MLP. The representative receivers are located in the suburbs of Casula, Glenfield, Wattle Grove and Wattle Grove North (see Figure 1).

Daytime construction noise is currently occurring at the MLP site. Construction noise has been excluded from the assessment.

A description of technical terms used within this report is provided in Appendix A.

[1] OPERATIONAL NOISE AND VIBRATION MANAGEMENT PLAN - Moorebank Logistics Park – East Precinct (Revision 010 dated 24/9/2019)

2 Summary of noise objectives

Stages 1 and 2 of the MPE Project was approved under State Significant Development (SSD) Approvals 6766 and 7628, respectively.

The noise assessments for Stage 1 and 2 were prepared and assessed in accordance with the requirements of the NSW *Industrial Noise Policy* (EPA, 2000). However, the Determination Report for MPE Stage 2[2] identified that the recommended noise limits at Wattle Grove be amended to reflect the values derived in accordance with the *Noise Policy for Industry* (EPA, 2017).

A summary of the MPE Stage 1 and 2 noise limits from SSD 7628 is provided in Table 1.

Table 1 MPE Stage 1 and 2 noise limits, dB(A)

Sensitive receiver	Day [1] $L_{Aeq,\ 15\ minute}$	Evening [1] $L_{Aeq,\ 15\ minute}$	Night [1] $L_{Aeq,\ 15\ minute}$	Night [1] $L_{A1,\ 1\ minute}$
Casula	35	35	35	52
Glenfield	35	35	35	52
Wattle Grove	35	35	35	52
Casula	35	35	35	52
Wattle Grove North [2]	35	35	35	52

Notes:

To determine compliance with the $L_{Aeq,15\ minute}$ noise limits, noise from the development is to be measured at the most affected point within the residential boundary, or at the most affected point within 30 metres of a dwelling where the dwelling is more than 30 metres from the boundary. Where it can be demonstrated that direct measurement of noise from the project is impractical, the EPA may accept alternative means of determining compliance (see Chapter 11 of the NSW Industrial Noise Policy). The modification factors in Section 4 of the NSW Industrial Noise Policy must also be applied to the measured noise levels where applicable.

To determine compliance with the $L_{A1,1\ minute}$ noise limits, noise from the project is to be measured at 1 metre from the dwelling façade. Where it can be demonstrated that direct measurement of noise from the project is impractical, the EPA may accept alternative means of determining compliance (see Chapter 11 of the NSW Industrial Noise Policy).

The noise emission limits identified above apply under meteorological conditions of:

(i) wind speeds of up to 3 m/s at 10 metres above ground level; or

(ii) 'F' atmospheric stability class.

Note 1: In accordance with the INP, day is the period from 7:00 am to 6:00 pm Monday to Saturday; or 8:00 am to 6:00 pm on Sundays and public holidays; evening is the period from 6:00 pm to 10:00 pm; and night is the remaining periods.

Note 2: Wattle Grove North receiver is not included in SSD 7628, but is listed as a sensitive receiver in the Operational Noise and Vibration Management Plan (Section 3.3).

[2] NSW Planning Assessment Commission Determination Report – Moorebank Intermodal Terminal, Stage 2, Moorebank Precinct East (SSD 7628).

3 Measurement methodology and equipment

All noise measurements were performed with a Type 1 sound level meter and Type 1 microphone calibrator. The measurement equipment calibration certificates were current at the time of the measurements. Before and after each series of measurements, the calibration of the sound level meter was verified using a reference calibration of 94 dB at 1 kHz. The difference between pre- and post-calibration levels was within 0.5 dB for all measurements.

Airborne noise measurements were performed in accordance with the requirements of the *NSW Industrial Noise Policy (EPA 2000)*.

A summary of measurement equipment is provided in Table 2.

Table 2 Measurement equipment

Description	Make	Model	Serial No	Last Date Calibrated
Type 1 sound level meter	NTi	XL2	A2A-02386-D2	08/07/2019
Sound level meter calibrator	Bruel & Kjaer	4231	2677710	16/03/2020

4 Measurement results

4.1 Measurement locations and time periods

10-hours of on-site attended measurements were performed between 17 December and 18 December 2020. The measurements were performed during representative daytime (7am to 6pm), evening (6pm to 10pm) and night-time (10pm to 7am) periods, consistent with the approved 24-hour operations.

Prior to the measurements, it was confirmed that the MLP site was operational to ensure that the measurements were representative of current options. It is understood that the facility is not currently operating at full capacity.

A summary of the attended measurement locations and the approximate distances to the MLP East Precinct is provided in Table 3. Additional details are provided in Appendix B.

A summary of the attended measurement periods is provided in Table 4.

Table 3 Sensitive receivers and approximate distance from MLP East Precinct

Measurement locations	Approximate distance (m) from MLP East Precinct
M1 - Wattle Grove	770
M2 - Wattle Grove North	1,050
M3 - Casula	960
M4 - Glenfield	1,250

Table 4 Attended measurement periods

Location	Measurement period 1	Measurement period 2
Measurements during 7am to 6pm daytime period – 18 December 2020		
M1 - Wattle Grove	1:08pm to 1:40pm (Note 1)	5:45pm to 6:00pm (Note 1)
M2 - Wattle Grove North	1:48pm to 2:19pm (Note 2)	2:19pm to 2:49pm (Note 2)
M3 - Casula	3:03pm to 3:34pm (Note 3)	3:38pm to 4:08pm (Note 3)
M4 - Glenfield	4:29pm to 4:59pm (Note 4)	4:59pm to 5:29pm (Note 4)
Measurements during 6pm to 10pm evening period – 17 December 2020		
M1 - Wattle Grove	7:44pm to 8:16pm (Note 1)	-
M2 - Wattle Grove North	8:25pm to 8:55pm (Note 2)	-
M3 - Casula	9:04pm to 9:34pm (Note 3)	-
M4 - Glenfield	9:52pm to 10:07pm (Note 4)	
Measurements during 10pm to 7am night-time period – 17 December 2020		
M1 - Wattle Grove	11:47pm to 12:17am (Note 1)	12:17am to 12:32am (Note 1)
M2 - Wattle Grove North	10:51pm to 11:21pm (Note 2)	11:21pm to 11:36pm (Note 2)
M3 - Casula	12:55am to 1:25am (Note 3)	1:25am to 1:40am (Note 3)
M4 - Glenfield	10:08pm to 10:39pm (Note 4)	-

Location	Measurement period 1	Measurement period 2

Note 1: Measurements performed at 25 Yallum Ct
Note 2: Measurements performed at 39 Anzac Rd
Note 3: Measurements performed at St Andrews Park
Note 4: Measurements performed at 26 Goodenough St

4.2 Measurement results

Results from the attended noise measurements at all measurement locations is provided in Table 5. All noise measurements were performed over 15-minute measurement durations in accordance with the requirements of the approval conditions and the INP.

Table 5 Attended noise measurement results

ID	Address	Assessment period	$L_{Aeq,\ 15minute}$ noise limit, dB(A)	$L_{A1,\ 1\ minute}$ noise limit, dB(A)	Measurement period	Measured noise levels, dB(A)		Estimated MLP noise contribution, dB(A)		Comments and measured L_{AFmax} noise levels from typical events	MLP Noise Levels Comply?
						$L_{Aeq,\ 15minute}$	$L_{AF,90\%}$	$L_{Aeq,\ 15minute}$	L_{AFmax}		
M1 - Wattle Grove											
1	25 Yallum Ct.	Day	35	-	18/12/20 13:08 13:23	55	52	Note 1	Note 1	Background noise dominated by construction activities: Construction noise 52-53 dBA, Dog barking 61-62 dBA, Birds 70-71 dBA, Cricket 45-50 dBA, Rail Traffic 48-50 dBA	Yes
2	25 Yallum Ct.	Day	35	-	18/12/20 13:25 13:40	57	53	Note 1	Note 1	Background noise dominated by construction activities: Construction noise 55-58 dBA, Air Traffic 60-61dBA, Birds 60-65 dBA, Road Traffic 62-63 dBA, Rail Traffic 49-50 dBA	Yes
3	25 Yallum Ct.	Day	35	-	18/12/20 17:45 18:00	49	43	Note 1	Note 1	Background noise dominated by crickets: Cricket 49-50 dBA, Birds 61-62 dBA, Rail Traffic 46-49 dBA	Yes
4	25 Yallum Ct.	Evening	35	-	17/12/20 19:44 19:59	46	44	Note 1	Note 1	Background noise dominated by Moorebank Ave traffic: Birds 59-64 dBA, Moorebank Ave traffic 43-44 dBA, Rail Traffic 46-50 dBA, Construction MPE 44-45dBA	Yes
5	25 Yallum Ct.	Evening	35	-	17/12/20 20:01 20:16	49	44	Note 1	Note 1	Background noise dominated by Moorebank Ave traffic: Birds 69-70 dBA, Moorebank Ave traffic 45-46 dBA, Rail Traffic 49-50 dBA, Construction MPE 44-45dBA	Yes
6	25 Yallum Ct.	Night	35	52	17/12/20 23:47 00:02	47	44	Note 1	Note 1	Background noise dominated by construction activities of MPE: Construction 47-48 dBA, Cricket49-50 dBA, Rail Traffic 49-50 dBA	Yes
7	25 Yallum Ct.	Night	35	52	18/12/20 00:02 00:17	45	41	Note 1	Note 1	Background noise dominated by construction activities of MPE: Construction 48-49 dBA, Cricket48-49 dBA, Rail Traffic 48-50 dBA	Yes
8	25 Yallum Ct.	Night	35	52	18/12/20 00:17 00:32	44	41	Note 1	Note 1	Background noise dominated by construction activities of MPE: Construction 47-48 dBA, Cricket49-50 dBA, Rail Traffic 49-50 dBA	Yes
M2 - Wattle Grove North											
9	39 Anzac Rd	Day	35	-	18/12/20 13:48 14:04	71	53	Note 1	Note 1	Background noise dominated by noise from Anzac Rd traffic: Road Traffic 85-94 dBA, Cricket 56-57 dBA	Yes
10	39 Anzac Rd	Day	35	-	18/12/20 14:04 14:19	69	54	Note 1	Note 1	Background noise dominated by noise from Anzac Rd traffic: Road Traffic 70-75 dBA, Cricket 54-56 dBA	Yes
11	39 Anzac Rd	Day	35	-	18/12/20 14:19 14:34	69	54	Note 1	Note 1	Background noise dominated by noise from Anzac Rd traffic: Road Traffic 86-87 dBA, Cricket 55-56 dBA	Yes
12	39 Anzac Rd	Day	35	-	18/12/20 14:34 14:49	72	54	Note 1	Note 1	Background noise dominated by noise from Anzac Rd traffic: Road Traffic 88-89 dBA, Cricket 54-56 dBA	Yes
13	39 Anzac Rd	Evening	35	-	17/12/20 20:25 20:40	68	53	Note 1	Note 1	Background noise dominated by noise from Anzac Rd traffic: Road Traffic 87-88 dBA, Cricket 63-65 dBA, Moorebank Ave traffic 47-48dBA	Yes
14	39 Anzac Rd	Evening	35	-	17/12/20 20:40 20:55	66	52	Note 1	Note 1	Background noise dominated by noise from Anzac Rd traffic: Road Traffic 88-89 dBA, Cricket 50-54 dBA, Moorebank Ave traffic 46-47dBA, Air Traffic 47-51 dBA	Yes
15	39 Anzac Rd	Night	35	52	17/12/20 22:51 23:06	64	45	Note 1	Note 1	Background noise dominated by noise from Anzac Rd traffic: Road Traffic 70-82 dBA, Cricket 51-53 dBA	Yes
16	39 Anzac Rd	Night	35	52	17/12/20 23:06 23:21	66	46	Note 1	Note 1	Background noise dominated by noise from Anzac Rd traffic: Road Traffic 85-86 dBA, Cricket 50-52 dBA	Yes
17	39 Anzac Rd	Night	35	52	17/12/20 23:21 23:36	62	46	Note 1	Note 1	Background noise dominated by noise from Anzac Rd traffic: Road Traffic 80-81 dBA, Moorebank Ave traffic 51-52dBA	Yes
M3 - Casula											
18	St Andrews Park	Day	35	-	18/12/20 15:03 15:18	57	49	Note 1	Note 1	Background noise dominated by noise from M5 Motorway traffic: M5 41-45 dBA, Birds 60-65 dBA, Rail Traffic 70-71 dBA, Construction 51-52 dBA	Yes
19	St Andrews Park	Day	35	-	18/12/20 15:19 15:34	58	48	Note 1	Note 1	Background noise dominated by noise from M5 Motorway traffic: M5 42-44 dBA, Construction 56-57 dBA, Birds 60-65 dBA, Rail Traffic 70-75 dBA, Children Playing 55-56 dBA	Yes
20	St Andrews Park	Day	35	-	18/12/20 15:38 15:53	58	50	Note 1	Note 1	Background noise dominated by noise from M5 Motorway traffic: M5 40-45 dBA, Construction 54-55 dBA, Rail Traffic 71-74 dBA	Yes
21	St Andrews Park	Day	35	-	18/12/20 15:53 16:08	60	51	Note 1	Note 1	Background noise dominated by noise from M5 Motorway traffic: M5 42-46 dBA, Rail Traffic 71-73 dBA, Rain fall 58-59 dBA	Yes
22	St Andrews Park	Evening	35	-	17/12/20 21:04 21:19	54	45	Note 1	Note 1	Background noise dominated by crickets: M5 Traffic 45-47 dBA, Birds 50-57 dBA, Air Traffic 50-55 dBA, Rail Traffic 73-74 dBA, Cricket 65-66	Yes
23	St Andrews Park	Evening	35	-	17/12/20 21:19 21:34	59	43	Note 1	Note 1	Background noise dominated by crickets: M5 Traffic 45-47 dBA, Air Traffic 50-55 dBA, Rail Traffic 72-73 dBA, Cricket 65-66 dBA, Air Traffic 53-54	Yes
24	St Andrews Park	Night	35	52	18/12/20 00:55 01:10	48	38	Note 1	Note 1	Background noise dominated by crickets: M5 Traffic 45-46 dBA, Rail Traffic 68-70 dBA, Cricket 64-65 dBA	Yes
25	St Andrews Park	Night	35	52	18/12/20 01:10 01:25	50	38	Note 1	Note 1	Background noise dominated by crickets: M5 Traffic 46-47 dBA, Rail Traffic 70-72 dBA, Cricket 65-66 dBA	Yes
26	St Andrews Park	Night	35	52	18/12/20 01:25 01:40	44	39	Note 1	Note 1	Background noise dominated by crickets: M5 Traffic 46-47 dBA, Rail Traffic 70-72 dBA, Cricket 64-65 dBA	Yes
M4 - Glenfield											
27	26 Goodenough St	Day	35	-	18/12/20 16:29 16:44	52	48	Note 1	Note 1	Background noise dominated by road noise from the Cambridge Ave: Road Traffic 55-58 dBA, Rail traffic 45-46dBA, High Voltage Power Line 50-51 dBA	Yes
28	26 Goodenough St	Day	35	-	18/12/20 16:44 16:59	51	47	Note 1	Note 1	Background noise dominated by road noise from Cambridge Ave: Road Traffic 54-59 dBA, Rail traffic 45-46dBA, High Voltage Power Line 50-51 dBA	Yes
29	26 Goodenough St	Day	35	-	18/12/20 16:59 17:14	55	48	Note 1	Note 1	Background noise dominated by road noise from Cambridge Ave: Road Traffic 54-58 dBA, Rail traffic 45-46dBA, Dog Barking 67-68 dBA, High Voltage Power Line 50-51 dBA, Children Playing 55-56 dBA	Yes
30	26 Goodenough St	Day	35	-	18/12/20 17:14 17:29	50	47	Note 1	Note 1	Background noise dominated by road noise from Cambridge Ave: Road Traffic 59-51 dBA, Rail traffic 45-46dBA, High Voltage Power Line 50-51 dBA, Children Playing 60-61 dBA	Yes
31	26 Goodenough St	Evening	35	-	17/12/20 21:52 21:52	58	54	Note 1	Note 1	Background noise dominated by road noise from Cambridge Ave: Road Traffic 58-59 dBA, Dog barking 61-62 dBA, Rail traffic 45-46dBA, Cricket 57-58 dBA	Yes
32	26 Goodenough St	Night	35	52	17/12/20 22:08 22:23	49	45	Note 1	Note 1	Background noise dominated by road noise from Cambridge Ave: Road Traffic 58-59 dBA, Cricket 45-46 dBA	Yes
33	26 Goodenough St	Night	35	52	17/12/20 22:24 22:39	54	45	Note 1	Note 1	Background noise dominated by road noise from Cambridge Ave: Road Traffic 58-59 dBA, Cricket 47-48 dBA	Yes

Note 1: Since noise levels from the MLP were not audible during the measurement period, it was not possible to estimate the MLP noise contribution

5 Discussion

Based on the attended measurement results in Section 4, it can be seen that the measured $L_{Aeq(15minute)}$ noise levels at all locations and during all measurement periods were above the 35 dB(A) noise limit.

At Location M1 (Wattle Grove), the closest measurement location to the MLP, the measured $L_{Aeq(15minutre)}$ noise level was 44 dB(A) between 00:17am and 00:32am. During this quietest period, MLP noise emissions were not audible.

In all cases, the measured $L_{Aeq(15minute)}$ noise levels were dominated by extraneous noise sources apart from the MLP operations. Noise sources from MLP operations were not audible during any of the measurement periods at all four representative measurement locations. Since MLP noise emissions were not audible, it was not possible to estimate the industrial noise contribution from the MLP facility.

Based on the results of the attended noise measurements performed during the day, evening and night-time periods between 17 December and 18 December 2020, it is concluded that the current noise levels comply with the operational noise limits in SSD 7628.

6 Conclusion

This report presents the results of airborne noise measurements at four representative receivers in proximity to the Moorebank Logistics Park (MLP). The measurements were performed in accordance with the requirements of the NSW *Industrial Noise Policy* (INP) the Operational noise and vibration management plan to verify compliance with the noise limits in SSD approval 7628. The measurements were performed during the daytime, evening and night-time periods between 17 December and 18 December 2020.

At all measurement locations, the measured $L_{Aeq(15minute)}$ noise levels were dominated by extraneous noise sources apart from the MLP operations. Noise sources from MLP operations were not audible during any of the measurement periods. Since MLP noise emissions were not audible, it was not possible to estimate the industrial noise contribution from the MLP facility.

Based on the results of the attended noise measurements, and given that MLP noise levels were not audible at any of the measurement locations, it is concluded that the current noise levels comply with the operational noise limits in SSD 7628.

APPENDIX A Description of technical terms

The following is a brief description of the technical terms used to describe noise to assist in understanding the technical issues presented.

Adverse weather	Weather effects that enhance noise (that is, wind and temperature inversions) that occur at a site for a significant period of time (that is, wind occurring more than 30% of the time in any assessment period in any season and/or temperature inversions occurring more than 30% of the nights in winter).
Ambient noise	The all-encompassing noise associated within a given environment at a given time, usually composed of sound from all sources near and far.
Assessment period	The period in a day over which assessments are made.
Assessment point	A point at which noise measurements are taken or estimated. A point at which noise measurements are taken or estimated.
Background noise	Background noise is the term used to describe the underlying level of noise present in the ambient noise, measured in the absence of the noise under investigation, when extraneous noise is removed. It is described as the average of the minimum noise levels measured on a sound level meter and is measured statistically as the A-weighted noise level exceeded for ninety percent of a sample period. This is represented as the L90 noise level (see below).
Decibel [dB]	The units that sound is measured in. The following are examples of the decibel readings of every day sounds: 0dB The faintest sound we can hear 30dB A quiet library or in a quiet location in the country 45dB Typical office space. Ambience in the city at night 60dB CBD mall at lunch time 70dB The sound of a car passing on the street 80dB Loud music played at home 90dB The sound of a truck passing on the street 100dB The sound of a rock band 115dB Limit of sound permitted in industry 120dB Deafening
dB(A)	A-weighted decibels. The A- weighting noise filter simulates the response of the human ear at relatively low levels, where the ear is not as effective in hearing low frequency sounds as it is in 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.
dB(C)	C-weighted decibels. The C-weighting noise filter simulates the response of the human ear at relatively high levels, where the human ear is nearly equally effective at hearing from mid-low frequency (63Hz) to mid-high frequency (4kHz), but is less effective outside these frequencies.
Frequency	Frequency is synonymous to pitch. 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.
Impulsive noise	Having a high peak of short duration or a sequence of such peaks. A sequence of impulses in rapid succession is termed repetitive impulsive noise.
Intermittent noise	The level suddenly drops to that of the background noise several times during the period of observation. The time during which the noise remains at levels different from that of the ambient is one second or more.
LMax	The maximum sound pressure level measured over a given period.
LMin	The minimum sound pressure level measured over a given period.

APPENDIX B Detailed measurement location descriptions

B.1 M1 – Wattle Grove measurement location

An aerial photo of Wattle Grove measurement location is provided in Figure B1.

Figure B1 Wattle Grove measurement location

At the Wattle Grove location, noise measurements were performed at a free field measurement positions near the fence facing the facility. Two measurement positions were selected near Corryton Ct and Yallum Ct. At both positions, the microphone was positioned at a height of 1.5 m above ground level. The measurement locations are approximately 770 metres from the MLP. A picture of the measurement setup near Yallum Ct is provided in Figure B2.

Figure B2 25 Yallum Ct measurement location

B.2 M2 - Wattle Grove North measurement location

An aerial photo of the Wattle Grove North measurement location is provided in Figure B3.

Figure B3 Wattle Grove North measurement location

At Wattle Grove North, noise measurements were performed at a free field measurement locations on both sides of Anzac Road. At both positions, the microphone was positioned at a height of 1.5 m above ground level. The measurement location is approximately 1050 meters from MLP. Pictures of the measurements setup near Anzac Rd are provided in Figure B4.

Figure B4 Anzac Road measurement locations

B.3 M3 – Casula measurement location

An aerial photo of the Casula measurement locations is provided in B5.

Figure B5 Casula measurement location

At Casula, noise measurements were performed at a free field measurement location within St Andrews Park. The microphone was positioned at a height of 1.5 m above ground level. Measurements were performed at two locations due to safety considerations during the night-time measurements. The measurement location is approximately 960 meters from MLP. A picture of the measurement setup is provided in Figure B6.

Figure B6 St Andrews Park measurement locations

B.4 M4 - Glenfield measurement location

An aerial photo of the Glenfield measurement locations is provided in Figure B7.

Figure B7 Glenfield measurement location

At Glenfield, noise measurements were performed at a free field measurement location at the eastern end of Goodenough St. At this position, the microphone was positioned at a height of 1.5 m above ground level. The measurement location is approximately 1250 meters from MLP. Pictures of the measurement setup are provided in Figure B8.

Figure B8 26 Goodenough Road measurement location

B.4 Industrial Noise Policy Measurement Report for Quarter 1 2021

Renzo Tonin & Associates Report TL116-05F12 Moorebank INP Monitoring Q1 2021 (r3)

RENZO TONIN & ASSOCIATES
inspired to achieve

Acoustics
Vibration
Structural Dynamics

MOOREBANK LOGISTIC PARK - PRECINCT EAST

Operational Noise Monitoring for Moorebank Logistic Park - Q1 2021

21 June 2021

Qube Property Management Services Pty Ltd c/- Tactical Group

TL116-05F12 Moorebank INP Monitoring Q1 2021 (r3)

35 1982-2017 ACOUSTIC ENGINEERING EXCELLENCE

Sydney Melbourne Brisbane Gold Coast Kuwait Singapore
Renzo Tonin & Associates ABN 29 117 462 861
Level 1/418A Elizabeth St SURRY HILLS NSW 2010 | PO Box 877 STRAWBERRY HILLS NSW 2012
P (02) 8218 0500 F (02) 8218 0501 sydney@renzotonin.com.au www.renzotonin.com.au

aaac Association of Australian Acoustical Consultants

Document details

Detail	Reference
Doc reference:	TL116-05F12 Moorebank INP Monitoring Q1 2021 (r3)
Prepared for:	Qube Property Management Services Pty Ltd c/- Tactical Group
Address:	Level 15, 124 Walker Street North Sydney NSW 2060
Attention:	Cathal McGann

Document control

Date	Revision history	Non-issued revision	Issued revision	Prepared	Instructed	Reviewed / Authorised
22.04.2021	Final	0	1	J. Liang	C. Weber	C. Weber
08.06.2021	Minor update to reflect 50% occupation status of site	-	2	C. Weber	-	C. Weber
21.06.2021	Update to address DPIE comments	-	3	C. Weber	-	C. Weber

Important Disclaimers:

The work presented in this document was carried out in accordance with the Renzo Tonin & Associates Quality Assurance System, which is based on Australian/New Zealand Standard AS/NZS ISO 9001.

This document is issued subject to review and authorisation by the suitably qualified and experienced person named in the last column above. If no name appears, this document shall be considered as preliminary or draft only and no reliance shall be placed upon it other than for information to be verified later.

This document is prepared for the particular requirements of our Client referred to above in the 'Document details' which are based on a specific brief with limitations as agreed to with the Client. It is not intended for and should not be relied upon by a third party and no responsibility is undertaken to any third party without prior consent provided by Renzo Tonin & Associates. The information herein should not be reproduced, presented or reviewed except in full. Prior to passing on to a third party, the Client is to fully inform the third party of the specific brief and limitations associated with the commission.

In preparing this report, we have relied upon, and presumed accurate, any information (or confirmation of the absence thereof) provided by the Client and/or from other sources. Except as otherwise stated in the report, we have not attempted to verify the accuracy or completeness of any such information. If the information is subsequently determined to be false, inaccurate or incomplete then it is possible that our observations and conclusions as expressed in this report may change.

We have derived data in this report from information sourced from the Client (if any) and/or available in the public domain at the time or times outlined in this report. The passage of time, manifestation of latent conditions or impacts of future events may require further examination and re-evaluation of the data, findings, observations and conclusions expressed in this report.

We have prepared this report in accordance with the usual care and thoroughness of the consulting profession, for the sole purpose described above and by reference to applicable standards, guidelines, procedures and practices at the date of issue of this report. For the reasons outlined above, however, no other warranty or guarantee, whether expressed or implied, is made as to the data, observations and findings expressed in this report, to the extent permitted by law.

The information contained herein is for the purpose of acoustics only. No claims are made and no liability is accepted in respect of design and construction issues falling outside of the specialist field of acoustics engineering including and not limited to structural integrity, fire rating, architectural buildability and fit-for-purpose, waterproofing and the like. Supplementary professional advice should be sought in respect of these issues.

External cladding disclaimer: No claims are made and no liability is accepted in respect of any external wall and/or roof systems (eg facade / cladding materials, insulation etc) that are: (a) not compliant with or do not conform to any relevant non-acoustic legislation, regulation, standard, instructions or Building Codes; or (b) installed, applied, specified or utilised in such a manner that is not compliant with or does not conform to any relevant non-acoustic legislation, regulation, standard, instructions or Building Codes.

Contents

1 Introduction 1
1.1 Project overview 1
1.2 Scope of assessment 2
2 Compliance Matrix 3
3 Summary of noise objectives 5
4 Measurement methodology and equipment 6
5 Measurement results 7
5.1 Measurement locations and time periods 7
5.2 Measurement results 8
6 Discussion 11
7 Conclusion 12
APPENDIX A Description of technical terms 13
APPENDIX B Detailed measurement location descriptions 14
B.1 M1 – Wattle Grove measurement location 14
B.2 M2 - Wattle Grove North measurement location 16
B.3 M3 – Casula measurement location 18
B.4 M4 - Glenfield measurement location 20
APPENDIX C Operational road traffic noise assessment – 50% occupancy stage 22

List of tables

Table 1 Compliance matrix 3
Table 2 MPE Stage 1 and 2 noise limits, dB(A) 5
Table 3 Measurement equipment 6
Table 4 Sensitive receivers and approximate distance from MLP East Precinct 7
Table 5 Attended measurement periods 8
Table 6 Attended noise measurement results 9

List of figures

Figure 1 MLP East Precinct and nearest sensitive receivers 2

1 Introduction

1.1 Project overview

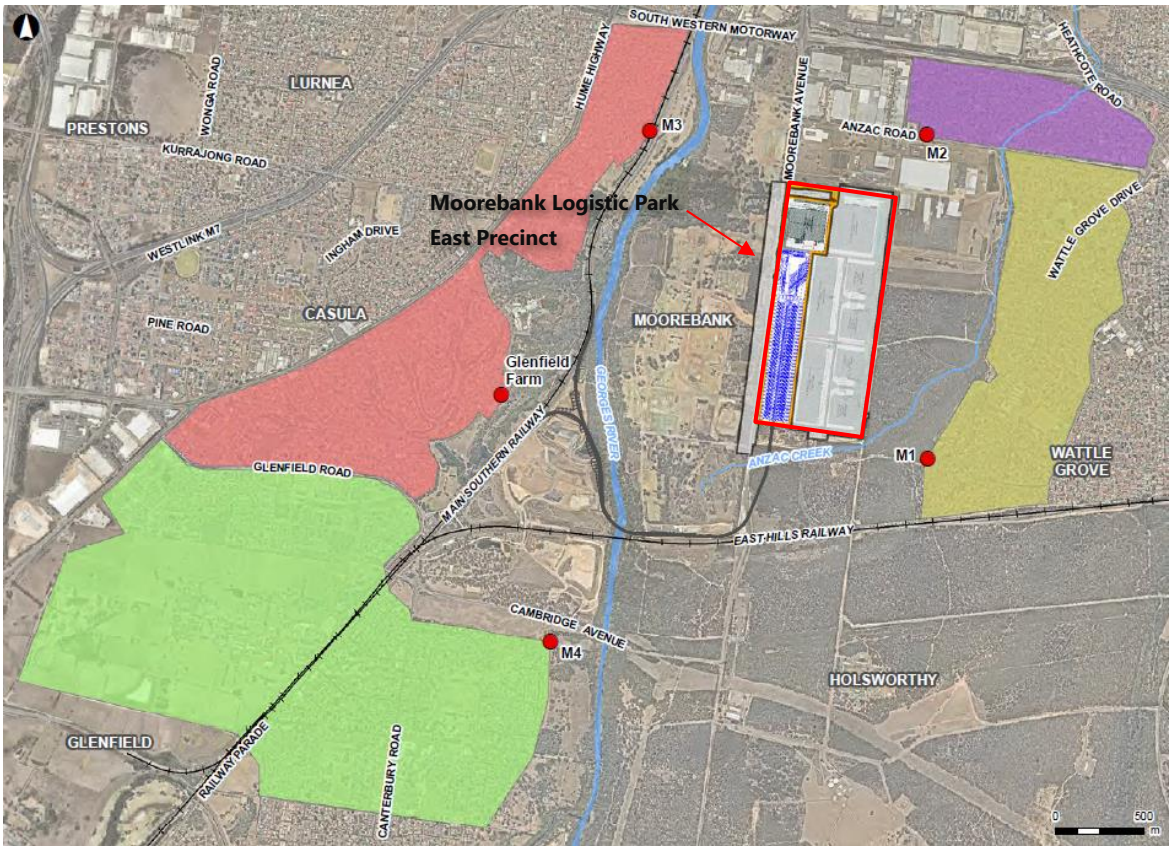
The Sydney Intermodal Terminal Alliance (SIMTA) received approval for the construction and operation of Stages 1 and 2 of the Moorebank Precinct East (MPE) Project (SSD 6766 and SSD 7628 respectively), which together comprise the two stages of development under the MPE Concept Approval (MP10_0193).

This operational noise monitoring has been conducted to assess noise impacts during operation of the east precinct for the first quarter in 2021. This report forms part of the evidence in addressing the following Approval Conditions. Additional details are provided in the compliance matrix (Table 1):

- SSD 7628
    - Condition B80 – Monitoring of industrial noise to assess compliance with the noise criteria.
    - Condition B86 – Monitoring of industrial noise to assess compliance with the noise criteria at a point in time when the site is 50% occupied.
    - Condition B90 - Monitoring of industrial noise to identify if any additional reasonable and feasible best practice noise mitigation measures are required to minimise noise impacts, including maximum noise levels that may result in sleep disturbance.
    - Condition FCMM2E - Regular monitoring performed as part of the Operational Noise and Vibration Management Plan to assess noise levels generated by the project.

The location of the Moorebank Logistics Park (MLP) East Precinct in relation to the nearest representative receivers (M1 to M4 and Glenfield Farm) is illustrated in Figure 1.

Figure 1 MLP East Precinct and nearest sensitive receivers



1.2 Scope of assessment

Renzo Tonin & Associates (NSW) Pty Ltd has been engaged by Tactical to perform attended noise measurements for the purpose of assessing compliance with the approval conditions. These measurements have been performed, consistent with the requirements of the NSW *Industrial Noise Policy* (EPA, 2000) and the Operational Noise and Vibration Management Plan[1].

Airborne noise measurements were performed at the four potentially most affected residential receivers in the vicinity of the MLP. The representative receivers are located in the suburbs of Casula, Glenfield, Wattle Grove and Wattle Grove North (see Figure 1).

Daytime construction noise is currently occurring at the MLP site. Construction noise has been excluded from the assessment.

A description of technical terms used within this report is provided in Appendix A.

[1] OPERATIONAL NOISE AND VIBRATION MANAGEMENT PLAN - Moorebank Logistics Park – East Precinct (Revision 010 dated 24/9/2019)

2 Compliance Matrix

Table 1 provides a summary of the Approval Conditions which relate to operational noise emissions when the site is 50% occupied.

Table 1 Compliance matrix

Condition ID	Condition	Comments on compliance	Reference for further information
SSD 7628			
B86	Within 12 months of occupation of the first warehouse, 50% occupation of the site and 100% occupation of the site, or as otherwise agreed by the Secretary, the Applicant must undertake operational noise monitoring to compare actual noise performance of the project against predicted noise performance, and prepare an Operational Noise Report to document this monitoring. The Report must include, but not necessarily be limited to:	This report has been prepared at 50% site occupancy stage. Noise monitoring results at the nearest residential receivers are presented in Section 5.	Sections 5 and 6
B86 a)	noise monitoring to assess compliance with the predicted operational noise levels and the noise limits specified in Table 5;	The operational noise limits in Table 5 are summarised in Section 3 and refer to industrial noise, assessed in accordance with the requirements of the NSW Industrial Noise Policy, 2000. The measurement of noise from the operation of the site at 50% occupancy stage was performed in March 2021. The results are presented in Sections 5 and 6.	Sections 3, 5 and 6
B86 b)	a validation by predictive modelling of the operational noise levels in terms of criteria and noise goals established in the NSW RNP (EPA, 2011);	Assessment of road traffic noise at 50% occupancy stage is provided in Appendix C.	Refer Appendix C
B86 c)	sleep disturbance impacts compared to those determined in documents specified under condition A2;	Per Section 5 and 6, noise levels at residential receivers from MLP East were not audible and therefore compliant with the sleep disturbance noise criterion in Section 3.	Refer also Annual Review required for SSD 6766 Condition G7; and MPE Stage 1 Review of Operational Sleep Disturbance Impacts[2]
B86 d)	impacts associated with annoying characteristics such as prominent tonal components, impulsiveness, intermittency, irregularity and dominant low-frequency content;	Per Section 5 and 6, noise levels at residential receivers from MLP East were not audible. No annoying characteristics were therefore observed.	Sections 5 and 6

[2] MPE Stage 1 Review of Operational Sleep Disturbance Impacts, available https://simta.com.au/wordpress/wp-content/uploads/2019/12/Operational_Sleep_Disturbance_Impacts_E25.pdf

Condition ID	Condition	Comments on compliance	Reference for further information
B86 e)	methodology, location and frequency of noise monitoring undertaken, including monitoring sites at which project noise levels are ascertained, with specific reference to locations indicative of impacts on sensitive receivers;	Refer ONVMP	Operational Noise and Vibration Management Plan[3]
B86 f)	details of any complaints and enquiries received in relation to operational noise generated by the project between the date of commencement of operation and the date the report was prepared;	No complaints related to operational noise have been received to date	n/a
B86 g)	any required recalibrations of the noise model taking into consideration factors such as actual traffic numbers and heavy vehicle proportions; and	All noise monitoring undertaken to date has complied with the operational noise limits. On this basis, recalibration of the noise models has not been required. Assessment of road traffic noise at 50% occupancy stage is provided in Appendix C.	For road traffic noise, Refer Appendix C
B86 h)	an assessment of the performance and effectiveness of applied noise mitigation measures together with a review and if necessary, reassessment of all feasible and reasonable mitigation measures.	All noise monitoring undertaken to date has complied with the operational noise limits. Additional reassessment of all feasible and reasonable mitigation measures has not been required.	Sections 5 and 6

[3] Operational Noise and Vibration Management Plan - Moorebank Logistics Park – East Precinct, available https://simta.com.au/wordpress/wp-content/uploads/2020/04/ONVMP_V12_redacted.pdf

3 Summary of noise objectives

Stages 1 and 2 of the MPE Project was approved under State Significant Development (SSD) Approvals 6766 and 7628, respectively.

The noise assessments for Stage 1 and 2 were prepared and assessed in accordance with the requirements of the NSW *Industrial Noise Policy* (EPA, 2000). However, the Determination Report for MPE Stage 2[4] identified that the recommended noise limits at Wattle Grove be amended to reflect the values derived in accordance with the *Noise Policy for Industry* (EPA, 2017).

A summary of the MPE Stage 1 and 2 noise limits from SSD 7628 (Condition B80) is provided in Table 2. These levels are more stringent than the operational noise limits in SSD 6766.

Table 2 MPE Stage 1 and 2 noise limits, dB(A)

Sensitive receiver	Day [1] $L_{Aeq,\ 15\ minute}$	Evening [1] $L_{Aeq,\ 15\ minute}$	Night [1] $L_{Aeq,\ 15\ minute}$	Night [1] $L_{A1,\ 1\ minute}$
Casula	35	35	35	52
Glenfield	35	35	35	52
Wattle Grove	35	35	35	52
Casula	35	35	35	52
Wattle Grove North [2]	35	35	35	52

Notes:

To determine compliance with the $L_{Aeq,15\ minute}$ noise limits, noise from the development is to be measured at the most affected point within the residential boundary, or at the most affected point within 30 metres of a dwelling where the dwelling is more than 30 metres from the boundary. Where it can be demonstrated that direct measurement of noise from the project is impractical, the EPA may accept alternative means of determining compliance (see Chapter 11 of the NSW Industrial Noise Policy). The modification factors in Section 4 of the NSW Industrial Noise Policy must also be applied to the measured noise levels where applicable.

To determine compliance with the $L_{A1,1\ minute}$ noise limits, noise from the project is to be measured at 1 metre from the dwelling façade. Where it can be demonstrated that direct measurement of noise from the project is impractical, the EPA may accept alternative means of determining compliance (see Chapter 11 of the NSW Industrial Noise Policy).

The noise emission limits identified above apply under meteorological conditions of:

(i) wind speeds of up to 3 m/s at 10 metres above ground level; or

(ii) 'F' atmospheric stability class.

Note 1: In accordance with the INP, day is the period from 7:00 am to 6:00 pm Monday to Saturday; or 8:00 am to 6:00 pm on Sundays and public holidays; evening is the period from 6:00 pm to 10:00 pm; and night is the remaining periods.

Note 2: Wattle Grove North receiver is not included in SSD 7628, but is listed as a sensitive receiver in the Operational Noise and Vibration Management Plan (Section 3.3).

[4] NSW Planning Assessment Commission Determination Report – Moorebank Intermodal Terminal, Stage 2, Moorebank Precinct East (SSD 7628).

4 Measurement methodology and equipment

All noise measurements were performed with a Type 1 sound level meter and Type 1 microphone calibrator. The measurement equipment calibration certificates were current at the time of the measurements. Before and after each series of measurements, the calibration of the sound level meter was verified using a reference calibration of 94 dB at 1 kHz. The difference between pre- and post-calibration levels was within 0.5 dB for all measurements.

Airborne noise measurements were performed in accordance with the requirements of the *NSW Industrial Noise Policy (EPA 2000)*.

A summary of measurement equipment is provided in Table 3.

Table 3 Measurement equipment

Description	Make	Model	Serial No	Last Date Calibrated
Type 1 sound level meter	NTi	XL2	A2A-05320-D2	24/11/2020
Type 1 sound level meter	NTi	XL2	A2A-09356-E0	1/5/2019
Sound level meter calibrator	Bruel & Kjaer	4231	2677710	3/12/2020

5 Measurement results

5.1 Measurement locations and time periods

18-hours of on-site attended measurements were performed between 25 March and 30 March 2021. The measurements were performed during representative daytime (7am to 6pm), evening (6pm to 10pm) and night-time (10pm to 7am) periods, consistent with the approved 24-hour operations.

Prior to the measurements, it was confirmed that the MLP site was operational to ensure that the measurements were representative of current options. It is understood that the facility is not currently operating at full capacity.

A summary of the attended measurement locations and the approximate distances to the MLP East Precinct is provided in Table 4. Additional details are provided in Appendix B.

A summary of the attended measurement periods is provided in Table 5.

Table 4 Sensitive receivers and approximate distance from MLP East Precinct

Measurement locations	Approximate distance (m) from MLP East Precinct
M1 - Wattle Grove	770
M2 - Wattle Grove North	1,050
M3 - Casula	960
M4 - Glenfield	1,250

Table 5 Attended measurement periods

Location	Measurement period 1	Measurement period 2
Measurements during 7am to 6pm daytime period – 25 March 2021		
M1 - Wattle Grove	9:45am to 10:50am (Note 1)	12:48pm to 1:35pm (Note 1)
M2 - Wattle Grove North	9:58am to 10:46am (Note 2)	1:12pm to 1:58pm (Note 2)
M3 - Casula	11:26am to 12:15pm (Note 3)	-
M4 - Glenfield	11:12am to 12:18pm (Note 4)	-
Measurements during 6pm to 10pm evening period – 29 and 30 March 2021		
M1 - Wattle Grove	30 March 6:49pm to 7:19pm (Note 1)	30 March 9:37pm to 9:52pm (Note 1)
M2 - Wattle Grove North	29 March 9:20pm to 9:50pm (Note 2)	30 March 7:27pm to 7:57pm (Note 2)
M3 - Casula	29 March 7:49pm to 8:19pm (Note 3)	30 March 8:10pm to 8:40pm (Note 3)
M4 - Glenfield	29 March 8:36pm to 9:06pm (Note 4)	30 March 8:53pm to 9:23pm (Note 4)
Measurements during 10pm to 7am night-time period – 29 and 30 March 2021		
M1 - Wattle Grove	29 March 10:00pm to 10:30pm (Note 1)	30 March 12:52am to 1:07am (Note 1)
M2 - Wattle Grove North	29 March 10:38pm to 11:08pm (Note 2)	30 March 1:32am to 2:02am (Note 2)
M3 - Casula	29 March 11:18pm to 11:48pm (Note 3)	30 March 10:43pm to11:13pm (Note 3)
M4 - Glenfield	30 March 12:06am to 12:36am (Note 4)	30 March 11:27pm to 11:57pm (Note 4)

Note 1: Measurements performed at 25 Yallum Ct

Note 2: Measurements performed at 39 Anzac Rd

Note 3: Measurements performed at St Andrews Park

Note 4: Measurements performed at 26 Goodenough St

5.2 Measurement results

Results from the attended noise measurements at all measurement locations is provided in Table 6. All noise measurements were performed over 15-minute measurement durations in accordance with the requirements of the approval conditions and the INP.

Table 6 Attended noise measurement results

ID	Address	Assessment period	$L_{Aeq,\ 15minute}$ noise limit, dB(A)	$L_{A1,\ 1\ minute}$ noise limit, dB(A)	Measurement period	Measured noise levels, dB(A)		Estimated MLP noise contribution, dB(A)		Comments and measured L_{AFmax} noise levels from typical events	MLP Noise Levels Comply?
						$L_{Aeq,\ 15minute}$	$L_{AF,90\%}$	$L_{Aeq,\ 15minute}$	L_{AFmax}		
M1 - Wattle Grove											
1	25 Yallum Ct.	Day	35	-	25/03/21 09:45 10:00	49	39	Note 1	Note 1	Background noise dominated by Moorebank Ave traffic: Moorebank traffic 48-50dBA, Lawn mower 56-57 dBA, Birds 70-71 dBA, Rail Traffic 49-50 dBA, Construction 50-53 dBA, Air traffic 58-60 dBA	Yes
2	25 Yallum Ct.	Day	35	-	25/03/21 10:05 10:20	49	39	Note 1	Note 1	Background noise dominated by Moorebank Ave traffic: Moorebank traffic 48-50dBA, Rail Traffic 49-51 dBA, Construction 52-54 dBA, Air Traffic 58-60 dBA	Yes
3	25 Yallum Ct.	Day	35	-	25/03/21 10:20 10:35	47	40	Note 1	Note 1	Background noise dominated by Moorebank Ave traffic: Moorebank traffic 48-50dBA, Rail Traffic 49-51 dBA, Air traffic 58-60 dBA	Yes
4	25 Yallum Ct.	Day	35	-	25/03/21 10:35 10:50	52	38	Note 1	Note 1	Background noise dominated by Moorebank Ave traffic: Moorebank traffic 49-53dBA, Rail Traffic 50-52 dBA, Air traffic 58-62 dBA, Bird 62-65 dBA	Yes
5	25 Yallum Ct.	Day	35	-	25/03/21 12:48 13:03	48	40	Note 1	Note 1	Background noise dominated by Moorebank Ave traffic: Moorebank traffic 46-49dBA, Rail Traffic 50-52 dBA, Air traffic 59-60 dBA, Bird 65-67 dBA	Yes
6	25 Yallum Ct.	Day	35	-	25/03/21 13:05 13:20	44	38	Note 1	Note 1	Background noise dominated by noise from MLP East precinct construction activities: Construction 41-45dBA, Rail traffic 47-49 dBA	Yes
7	25 Yallum Ct.	Day	35	-	25/03/21 13:20 13:35	44	38	Note 1	Note 1	Background noise dominated by noise from MLP East precinct construction activities: Construction 44-47dBA, Rail traffic 46-48 dBA	Yes
8	25 Yallum Ct.	Evening	35	-	30/03/21 18:49 19:04	44	35	Note 1	Note 1	Background noise dominated by Moorebank Ave Traffic: Moorebank Traffic 41-45dBA, Rail Traffic 49-51 dBA, Bird 65-67 dBA, Air Traffic 60-62 dBA	Yes
9	25 Yallum Ct.	Evening	35	-	30/03/21 19:04 19:19	46	37	Note 1	Note 1	Background noise dominated by Moorebank Ave Traffic: Moorebank Traffic 46-47dBA, Rail Traffic 48-50 dBA	Yes
10	25 Yallum Ct.	Evening	35	-	30/03/21 21:37 21:52	46	43	Note 1	Note 1	Background noise dominated by noise from Air Traffic: Rail Traffic 49-51 dBA, Air Traffic 60-63 dBA	Yes
11	25 Yallum Ct.	Night	35	52	29/03/21 21:59 22:14	47	41	Note 1	Note 1	Background noise dominated by noise from Air Traffic: Rail Traffic 50-52 dBA, Bird 51-52 dBA, Air Traffic 60-66 dBA	Yes
12	25 Yallum Ct.	Night	35	52	29/03/21 22:14 22:29	50	41	Note 1	Note 1	Background noise dominated by noise from Rail Traffic: Moorebank Traffic 41-43dBA, Rail Traffic 50-52 dBA, Air Traffic 60-65 dBA	Yes
13	25 Yallum Ct.	Night	35	52	30/03/21 00:52 01:07	41	39	Note 1	Note 1	Background noise dominated by noise from Nature: Rail Traffic 50-51 dBA, Birds 50-51 dBA	Yes
14	25 Yallum Ct.	Night	35	52	30/03/21 01:07 01:22	40	39	Note 1	Note 1	Background noise dominated by noise from Nature: Birds 50-56 dBA, Rail Traffic 49-50 dBA	Yes
M2 - Wattle Grove North											
15	39 Anzac Rd	Day	35	-	25/03/21 09:58 10:13	67	51	Note 1	Note 1	Background noise dominated by Anzac Rd: Road Traffic 85-94 dBA, Moorebank Ave Traffic 50-53 dBA	Yes
16	39 Anzac Rd	Day	35	-	25/03/21 10:14 10:29	68	54	Note 1	Note 1	Background noise dominated by Anzac Rd: Road Traffic 70-75 dBA, Moorebank Ave Traffic 52-55 dBA	Yes
17	39 Anzac Rd	Day	35	-	25/03/21 10:31 10:46	68	53	Note 1	Note 1	Background noise dominated by Anzac Rd: Road Traffic 86-87 dBA, Moorebank Ave Traffic 52-55 dBA	Yes
18	39 Anzac Rd	Day	35	-	25/03/21 13:12 13:27	68	53	Note 1	Note 1	Background noise dominated by Anzac Rd: Road Traffic 88-89 dBA, Moorebank Ave Traffic 50-51 dBA	Yes
19	39 Anzac Rd	Day	35	-	25/03/21 13:27 13:42	67	52	Note 1	Note 1	Background noise dominated by Anzac Rd: Road Traffic 87-88 dBA, Moorebank Ave Traffic 47-50 dBA	Yes
20	39 Anzac Rd	Day	35	-	25/03/21 13:43 13:58	68	50	Note 1	Note 1	Background noise dominated by Anzac Rd: Road Traffic 88-89 dBA, Moorebank Ave Traffic 48-50 dBA	Yes
21	39 Anzac Rd	Evening	35	-	30/03/21 19:27 19:42	68	51	Note 1	Note 1	Background noise dominated by Anzac Rd: Road Traffic 88-89 dBA, Moorebank Ave Traffic 46-47 dBA, Air Traffic 50-55 dBA	Yes
22	39 Anzac Rd	Evening	35	-	30/03/21 19:42 19:57	68	52	Note 1	Note 1	Background noise dominated by Anzac Rd: Road Traffic 88-89 dBA, Moorebank Ave Traffic 46-47 dBA, Air Traffic 50-55 dBA	Yes
23	39 Anzac Rd	Evening	35	-	29/03/21 21:20 21:35	59	48	Note 1	Note 1	Background noise dominated by Anzac Rd: Road Traffic 80-83 dBA, Moorebank Ave Traffic 50-51 dBA	Yes
24	39 Anzac Rd	Evening	35	-	29/03/21 21:35 21:50	66	45	Note 1	Note 1	Background noise dominated by Anzac Rd: Road Traffic 81-82 dBA, Moorebank Ave Traffic 50-52 dBA	Yes
25	39 Anzac Rd	Night	35	52	29/03/21 22:38 22:53	62	38	Note 1	Note 1	Background noise dominated by Anzac Rd: Road Traffic 80-81 dBA, Moorebank Ave Traffic 47-48 dBA	Yes
26	39 Anzac Rd	Night	35	52	29/03/21 22:53 23:08	64	37	Note 1	Note 1	Background noise dominated by Anzac Rd: Road Traffic 81-82 dBA, Moorebank Ave Traffic 47-50 dBA	Yes
27	39 Anzac Rd	Night	35	52	30/03/21 01:32 01:47	54	34	Note 1	Note 1	Background noise dominated by Anzac Rd: Road Traffic 80-83 dBA, Moorebank Ave Traffic 45-47 dBA	Yes
28	39 Anzac Rd	Night	35	52	30/03/21 01:47 02:02	53	34	Note 1	Note 1	Background noise dominated by Anzac Rd: Road Traffic 80-83 dBA, Moorebank Ave Traffic 38-41 dBA	Yes
M3 – Casula											
29	St Andrews Park	Day	35	-	25/03/21 11:26 11:41	55	42	Note 1	Note 1	Background noise dominated by the M5 Motorway: M5 Traffic 50-51 dBA, Rail Traffic 71-72 dBA, Construction 50-52 dBA	Yes
30	St Andrews Park	Day	35	-	25/03/21 11:43 11:58	62	41	Note 1	Note 1	Background noise dominated by the M5 Motorway: M5 Traffic 54-55 dBA, Construction 50-52 dBA, Birds 60-62 dBA, Rail Traffic 79-80 dBA, Children Playing 55-56 dBA	Yes
31	St Andrews Park	Day	35	-	25/03/21 12:00 12:15	55	42	Note 1	Note 1	Background noise dominated by the M5 Motorway: M5 Traffic 53-54 dBA, Construction 51-52 dBA, Rail Traffic 73-74 dBA	Yes
33	St Andrews Park	Evening	35	-	29/03/21 19:49 20:04	57	48	Note 1	Note 1	Background noise dominated by the M5 Motorway: M5 Traffic 52-53 dBA, Construction 47-50 dBA, Rail Traffic 72-74 dBA	Yes
34	St Andrews Park	Evening	35	-	29/03/21 20:04 20:19	59	49	Note 1	Note 1	Background noise dominated by the M5 Motorway: M5 Traffic 55-56 dBA, Construction 50-52 dBA, Rail Traffic 70-75 dBA	Yes
34	St Andrews Park	Evening	35	-	30/03/21 20:10 20:25	59	42	Note 1	Note 1	Background noise dominated by the M5 Motorway: M5 Traffic 51-54 dBA, Rail Traffic 70-72 dBA	Yes

35	St Andrews Park	Evening	35	-	30/03/21 20:25 20:40	56	42	Note 1	Note 1	Background noise dominated by the M5 Motorway: M5 Traffic 53-55 dBA, Rail Traffic 72-73 dBA	Yes
36	St Andrews Park	Night	35	52	29/03/21 23:18 23:33	57	39	Note 1	Note 1	Background noise dominated by the M5 Motorway: M5 Traffic 42-45 dBA, Rail Traffic 71-72 dBA	Yes
37	St Andrews Park	Night	35	52	29/03/21 23:33 23:48	52	38	Note 1	Note 1	Background noise dominated by the M5 Motorway: M5 Traffic 41-43 dBA, Rail Traffic 75-76 dBA	Yes
38	St Andrews Park	Night	35	52	30/03/21 22:43 22:58	56	41	Note 1	Note 1	Background noise dominated by the M5 Motorway: M5 Traffic 40-43 dBA, Rail Traffic 70-72 dBA	Yes
39	St Andrews Park	Night	35	52	30/03/21 22:58 23:13	54	41	Note 1	Note 1	Background noise dominated by the M5 Motorway: M5 Traffic 41-45 dBA, Rail Traffic 70-73 dBA, Near By Road Traffic 64-65 dBA	Yes
M4 - Glenfield											
40	26 Goodenough St	Day	35	-	25/03/21 11:12 11:27	62	49	Note 1	Note 1	Background noise dominated by Cambridge Ave: Road Traffic 55-58 dBA, Rail traffic 45-46dBA, Lawn mower 69-72 dBA	Yes
41	26 Goodenough St	Day	35	-	25/03/21 11:28 11:43	49	44	Note 1	Note 1	Background noise dominated by Cambridge Ave: Road Traffic 49-56 dBA, Rail traffic 45-46dBA, Bird 54-55dBA	Yes
42	26 Goodenough St	Day	35	-	25/03/21 11:44 11:59	49	43	Note 1	Note 1	Background noise dominated by Cambridge Ave: Road Traffic 47-55 dBA, Rail traffic 45-46dBA, Dog Barking 66-67 dBA	Yes
43	26 Goodenough St	Day	35	-	25/03/21 12:03 12:18	51	43	Note 1	Note 1	Background noise dominated by Cambridge Ave: Road Traffic 51-53 dBA, Rail Traffic 45-46dBA, Car Passby 65-67 dBA	Yes
44	26 Goodenough St	Evening	35	-	29/03/21 20:36 20:51	52	50	Note 1	Note 1	Background noise dominated by Cambridge Ave: Road Traffic 54-55 dBA, Air Traffic 62-65 dBA, Cricket 55-56 dBA	Yes
45	26 Goodenough St	Evening	35	-	29/03/21 20:51 21:06	51	50	Note 1	Note 1	Background noise dominated by Cambridge Ave: Road Traffic 55-56 dBA	Yes
46	26 Goodenough St	Evening	35	-	30/03/21 20:53 21:08	52	49	Note 1	Note 1	Background noise dominated by Cambridge Ave: Road Traffic 55-56 dBA, Animal 55-60 dBA	Yes
47	26 Goodenough St	Evening	35	-	30/03/21 21:08 21:23	53	53	Note 1	Note 1	Background noise dominated by Cambridge Ave: Road Traffic 55-57 dBA, Cricket 55-56 dBA	Yes
48	26 Goodenough St	Night	35	52	30/03/21 00:06 00:21	47	41	Note 1	Note 1	Background noise dominated by Cambridge Ave: Road Traffic 54-56 dBA, Cricket 55-56 dBA	Yes
49	26 Goodenough St	Night	35	52	30/03/21 00:21 00:36	48	44	Note 1	Note 1	Background noise dominated by noise from Nature: Road Traffic 54-56 dBA, Cricket 54-55 dBA	Yes
50	26 Goodenough St	Night	35	52	30/03/21 23:27 23:42	48	45	Note 1	Note 1	Background noise dominated by noise from Nature: Cricket 54-55 dBA	Yes
51	26 Goodenough St	Night	35	52	30/03/21 23:42 23:57	49	45	Note 1	Note 1	Background noise dominated by noise from Nature: Cricket 54-55 dBA	Yes

Note 1: Since noise levels from the MLP were not audible during the measurement period, it was not possible to estimate the MLP noise contribution

6 Discussion

Based on the attended measurement results in Section 5, it can be seen that the measured $L_{Aeq(15minute)}$ noise levels at all locations and during all measurement periods were above the 35 dB(A) noise limit.

At Location M1 (Wattle Grove), the closest measurement location to the MLP, the measured $L_{Aeq(15minutre)}$ noise level was 40 dB(A) between 01:07am and 01:22am on 30 March. During this period with the quietest ambient noise levels, MLP noise emissions were not audible.

In all cases, the measured $L_{Aeq(15minute)}$ noise levels were dominated by extraneous noise sources apart from the MLP operations. Noise sources from MLP operations were not audible during any of the measurement periods at all four representative measurement locations. Since MLP noise emissions were not audible, it was not possible to estimate the industrial noise contribution from the MLP facility.

Based on the results of the attended noise measurements performed during the day, evening and night-time periods between 25 March and 30 March 2021, it is concluded that the current noise levels comply with the operational noise limits in SSD 7628, at a point in time when the site is 50% occupied.

7 Conclusion

This report presents the results of airborne noise measurements at four representative receivers in proximity to the Moorebank Logistics Park (MLP). The measurements were performed in accordance with the requirements of the NSW *Industrial Noise Policy* (INP) the Operational noise and vibration management plan to verify compliance with the noise limits in SSD approval 7628. The measurements were performed during the daytime, evening and night-time periods between 25 March and 30 March 2021.

At all measurement locations, the measured $L_{Aeq(15minute)}$ noise levels were dominated by extraneous noise sources apart from the MLP operations. Noise sources from MLP operations were not audible during any of the measurement periods. Since MLP noise emissions were not audible, it was not possible to estimate the industrial noise contribution from the MLP facility.

Based on the results of the attended noise measurements, and given that MLP noise levels were not audible at any of the measurement locations, it is concluded that the current noise levels comply with the operational noise limits in SSD 7628, at a point in time when the site is 50% occupied.

APPENDIX A Description of technical terms

The following is a brief description of the technical terms used to describe noise to assist in understanding the technical issues presented.

Adverse weather	Weather effects that enhance noise (that is, wind and temperature inversions) that occur at a site for a significant period of time (that is, wind occurring more than 30% of the time in any assessment period in any season and/or temperature inversions occurring more than 30% of the nights in winter).
Ambient noise	The all-encompassing noise associated within a given environment at a given time, usually composed of sound from all sources near and far.
Assessment period	The period in a day over which assessments are made.
Assessment point	A point at which noise measurements are taken or estimated. A point at which noise measurements are taken or estimated.
Background noise	Background noise is the term used to describe the underlying level of noise present in the ambient noise, measured in the absence of the noise under investigation, when extraneous noise is removed. It is described as the average of the minimum noise levels measured on a sound level meter and is measured statistically as the A-weighted noise level exceeded for ninety percent of a sample period. This is represented as the L90 noise level (see below).
Decibel [dB]	The units that sound is measured in. The following are examples of the decibel readings of every day sounds: 0dB The faintest sound we can hear 30dB A quiet library or in a quiet location in the country 45dB Typical office space. Ambience in the city at night 60dB CBD mall at lunch time 70dB The sound of a car passing on the street 80dB Loud music played at home 90dB The sound of a truck passing on the street 100dB The sound of a rock band 115dB Limit of sound permitted in industry 120dB Deafening
dB(A)	A-weighted decibels. The A- weighting noise filter simulates the response of the human ear at relatively low levels, where the ear is not as effective in hearing low frequency sounds as it is in 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.
dB(C)	C-weighted decibels. The C-weighting noise filter simulates the response of the human ear at relatively high levels, where the human ear is nearly equally effective at hearing from mid-low frequency (63Hz) to mid-high frequency (4kHz), but is less effective outside these frequencies.
Frequency	Frequency is synonymous to pitch. 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.
Impulsive noise	Having a high peak of short duration or a sequence of such peaks. A sequence of impulses in rapid succession is termed repetitive impulsive noise.
Intermittent noise	The level suddenly drops to that of the background noise several times during the period of observation. The time during which the noise remains at levels different from that of the ambient is one second or more.
LMax	The maximum sound pressure level measured over a given period.
LMin	The minimum sound pressure level measured over a given period.

APPENDIX B Detailed measurement location descriptions

B.1 M1 – Wattle Grove measurement location

An aerial photo of Wattle Grove measurement location is provided in Figure B1.

Figure B1 Wattle Grove measurement location

At the Wattle Grove location, noise measurements were performed at a free field measurement positions near the fence facing the facility. Two measurement positions were selected near Corryton Ct and Yallum Ct. At both positions, the microphone was positioned at a height of 1.5 m above ground level. The measurement locations are approximately 770 metres from the MLP. A picture of the measurement setup near Yallum Ct is provided in Figure B2.

Figure B2 25 Yallum Ct measurement location

B.2 M2 - Wattle Grove North measurement location

An aerial photo of the Wattle Grove North measurement location is provided in Figure B3.

Figure B3 Wattle Grove North measurement location

At Wattle Grove North, noise measurements were performed at a free field measurement locations on both sides of Anzac Road. At both positions, the microphone was positioned at a height of 1.5 m above ground level. The measurement location is approximately 1050 meters from MLP. Pictures of the measurements setup near Anzac Rd are provided in Figure B4.

Figure B4 Anzac Road measurement locations

B.3 M3 – Casula measurement location

An aerial photo of the Casula measurement locations is provided in B5.

Figure B5 Casula measurement location

At Casula, noise measurements were performed at a free field measurement location within St Andrews Park. The microphone was positioned at a height of 1.5 m above ground level. Measurements were performed at two locations due to safety considerations during the night-time measurements. The measurement location is approximately 960 meters from MLP. A picture of the measurement setup is provided in Figure B6.

Figure B6 St Andrews Park measurement locations

B.4 M4 - Glenfield measurement location

An aerial photo of the Glenfield measurement locations is provided in Figure B7.

Figure B7 Glenfield measurement location

At Glenfield, noise measurements were performed at a free field measurement location at the eastern end of Goodenough St. At this position, the microphone was positioned at a height of 1.5 m above ground level. The measurement location is approximately 1250 meters from MLP. Pictures of the measurement setup are provided in Figure B8.

Figure B8 26 Goodenough Road measurement location

APPENDIX C Operational road traffic noise assessment – 50% occupancy stage

Refer Appendix B.15

B.5 Container Noise Barrier Management Plan Monitoring Report

Renzo Tonin & Associates Report TL116-05F06 Container Noise Barrier Measurements (r1)

RENZO TONIN & ASSOCIATES
inspired to achieve

Acoustics
Vibration
Structural Dynamics

MOOREBANK LOGISTIC PARK - PRECINCT EAST

Container Noise Barrier Management Plan Measurements – September 2020

20 October 2020

Tactical Group

TL116-05F06 Container Noise Barrier Measurements (r1).docx

35 1982-2017 ACOUSTIC ENGINEERING EXCELLENCE

Sydney Melbourne Brisbane Gold Coast Kuwait Singapore
Renzo Tonin & Associates ABN 29 117 462 861
Level 1/418A Elizabeth St SURRY HILLS NSW 2010 | PO Box 877 STRAWBERRY HILLS NSW 2012
P (02) 8218 0500 F (02) 8218 0501 sydney@renzotonin.com.au www.renzotonin.com.au

aaac Association of Australian Acoustical Consultants

Document details

Detail	Reference
Doc reference:	TL116-05F06 Container Noise Barrier Measurements (r1).docx
Prepared for:	Tactical Group
Attention:	Richard Mason

Document control

Date	Revision history	Non-issued revision	Issued revision	Prepared	Instructed	Reviewed / Authorised
16.10.2020	First Issue	0	1	J. Liang	H.Puckeridge	C. Weber

File Path: R:\AssocSydProjects\TL101-TL150\TL116 cw Moorebank IMT Temporary Noise Monitoring\Task 5 - cw Operation Compliance Monitoring\1 Docs\Report 6 Container Noise Barrier Q3 2020\TL116-05F06 Container Noise Barrier Measurements (r1).docx

Important Disclaimers:

The work presented in this document was carried out in accordance with the Renzo Tonin & Associates Quality Assurance System, which is based on Australian/New Zealand Standard AS/NZS ISO 9001.

This document is issued subject to review and authorisation by the suitably qualified and experienced person named in the last column above. If no name appears, this document shall be considered as preliminary or draft only and no reliance shall be placed upon it other than for information to be verified later.

This document is prepared for the particular requirements of our Client referred to above in the 'Document details' which are based on a specific brief with limitations as agreed to with the Client. It is not intended for and should not be relied upon by a third party and no responsibility is undertaken to any third party without prior consent provided by Renzo Tonin & Associates. The information herein should not be reproduced, presented or reviewed except in full. Prior to passing on to a third party, the Client is to fully inform the third party of the specific brief and limitations associated with the commission.

In preparing this report, we have relied upon, and presumed accurate, any information (or confirmation of the absence thereof) provided by the Client and/or from other sources. Except as otherwise stated in the report, we have not attempted to verify the accuracy or completeness of any such information. If the information is subsequently determined to be false, inaccurate or incomplete then it is possible that our observations and conclusions as expressed in this report may change.

We have derived data in this report from information sourced from the Client (if any) and/or available in the public domain at the time or times outlined in this report. The passage of time, manifestation of latent conditions or impacts of future events may require further examination and re-evaluation of the data, findings, observations and conclusions expressed in this report.

We have prepared this report in accordance with the usual care and thoroughness of the consulting profession, for the sole purpose described above and by reference to applicable standards, guidelines, procedures and practices at the date of issue of this report. For the reasons outlined above, however, no other warranty or guarantee, whether expressed or implied, is made as to the data, observations and findings expressed in this report, to the extent permitted by law.

The information contained herein is for the purpose of acoustics only. No claims are made and no liability is accepted in respect of design and construction issues falling outside of the specialist field of acoustics engineering including and not limited to structural integrity, fire rating, architectural buildability and fit-for-purpose, waterproofing and the like. Supplementary professional advice should be sought in respect of these issues.

External cladding disclaimer: No claims are made and no liability is accepted in respect of any external wall and/or roof systems (eg facade / cladding materials, insulation etc) that are: (a) not compliant with or do not conform to any relevant non-acoustic legislation, regulation, standard, instructions or Building Codes; or (b) installed, applied, specified or utilised in such a manner that is not compliant with or does not conform to any relevant non-acoustic legislation, regulation, standard, instructions or Building Codes.

Contents

1 Introduction 1
1.1 Project overview 1
2 Summary of noise objectives 3
2.1 Sensitive Receivers 3
2.2 Noise management criteria 3
3 Container noise barrier arrangement 6
4 Noise measurements 7
4.1 Noise measurement approach 7
4.2 Measurement equipment 7
4.3 Measurement methodology 8
5 Noise measurement results 10
5.1 Near-field locations 10
5.2 Far-field attended measurements at sensitive residential receivers 10
5.3 Far-field unattended noise measurements 11
5.4 Weather conditions 11
6 Noise modelling results 14
6.1 Overview of noise modelling 14
6.2 General modelling assumptions 14
6.3 Noise model predictions 14
7 Discussion 16
8 Conclusion 17
APPENDIX A Glossary of terminology 18

List of tables

Table 1 Sensitive receivers and approximate distance from MPE container stacking area 3
Table 2 Noise management criteria, dB(A) 4
Table 3 Container noise barriers arrangement 6
Table 4 Measurement equipment 8
Table 5 Summary of near-field noise measurement results 10
Table 6 Far-field unattended noise measurement results 11
Table 7 Summary of attended and unattended noise measurement results at the nearest sensitive residential receivers (far field) 12
Table 8 Predicted noise level at nearest residential receivers 15

List of figures

Figure 1 MPE East Precinct, container noise barrier stacking area and nearest sensitive residential receivers 5

Figure 2 Near-field measurement location 9
Figure 3 Near-field measurement setup 9

1 Introduction

1.1 Project overview

The Sydney Intermodal Terminal Alliance (SIMTA) received approval for the construction and operation of Stages 1 and 2 of the Moorebank Precinct East (MPE) Project (SSD 6766 and SSD 7628 respectively), which together comprise the two stages of development under the MPE Concept Approval (MP10_0193).

This report has been prepared to address the requirements of Approval Condition F5A in State Significant Development (SSD) 6766. Specifically, this report includes noise measurement results performed to meet the requirements in clauses b), c) and d). The requirements of Condition F5A are copied verbatim below.

> *F5A. The Applicant shall prepare and implement (following approval) a Container Noise Barrier Management Plan (CNBMP) [1]. The plan shall be prepared by a suitably experienced and qualified acoustics consultant and shall outline the management practices and procedures that are to be followed during night-time operation of the site and for the stacking of containers to be used as noise barriers. The plan shall include, but not necessarily be limited to:*
>
> *a) the preparation of a specification for the stacking of containers to achieve the required level of noise reduction so as to comply with the project specific noise levels** and the sleep disturbance trigger levels*** for the night-time period* at the nearest affected residential receivers and which is to include such details as the minimum numbers of containers, their locations, stacking heights, orientation and maximum gap between containers. The Plan shall include any restrictions on stacking of containers above two high if this is found necessary.*
>
> *b) the measurement of noise from operation of the site and an assessment of compliance with the project specific noise levels and the sleep disturbance trigger levels at the nearest affected residential receivers at the following times:*
>
> *(i) not less than 3 months and not more than 6 months after commencement of operation, noise surveys shall be conducted on three separate nights for a period of not less than 2 hours whilst train wagons are being loaded with containers;*
>
> *(ii) thereafter for 6 months on one night per month for a period of not less than 2 hours whilst train wagons are being loaded with containers. Noise*

[1] Arcadis & Renzo Tonin & Associates, *Operational Noise and Vibration Management Plan for Moorebank Logistics Park – East Precinct*, Revision 012, dated 27/3/2020, available https://simta.com.au/wordpress/wp-content/uploads/2020/04/ONVMP_V12_redacted.pdf, accessed 8/10/2020

measurements shall be conducted in accordance with the EPA's Industrial Noise Policy.

c) the details of each noise survey shall be documented in a report with a drawing showing the observed location of containers which are subject to the Plan, the measurement equipment used, its calibration status, environmental conditions, receiver locations, methodology, a detailed description of the activities on site, the results obtained and whether or not compliance has been achieved with the project specific noise levels and the sleep disturbance trigger levels at the nearest affected residential receivers.

d) if the report concludes that the project specific noise levels and the sleep disturbance trigger levels for the night-time period at the nearest affected residential receivers are not being complied with, then recommendations shall be made by the acoustic consultant to amend the Plan accordingly and the Applicant shall implement those recommendations as soon as practical provided they are feasible and reasonable.

e) the Plan shall include a description of the roles and responsibilities for relevant employees involved in the operation of the CNBMP, including relevant training and induction provisions for ensuring that employees are aware of their environmental and compliance obligations under the Plan.

The Plan shall be submitted for the approval of the Secretary no later than one month prior to the commencement of operation. Copies of the detailed reports and the Plan (as amended) shall be provided to the Secretary and made available on the Project Website.

The work documented in this report was carried out in accordance with the Renzo Tonin & Associates Quality Assurance System, which is based on the Australian Standard / NZS ISO 9001. Appendix A contains a glossary of acoustic terms used in this report.

2 Summary of noise objectives

2.1 Sensitive Receivers

The potentially most affected residential receivers in the vicinity of the container stacking area (where trains are loaded / unloaded), are located in the suburbs of Casula, Glenfield, Wattle Grove and Wattle Grove North. A summary of the monitoring locations and the approximate distance to the container stacking area is provided in Table 1. The locations and noise catchment areas (NCAs), in relation to the container stacking area are illustrated in Figure 1

Table 1 Sensitive receivers and approximate distance from MPE container stacking area

Noise Catchment Area (NCA)	Monitoring location ID	Approximate distance (m) from MPE Precinct
NCA 1: Wattle Grove	M1	770
NCA 2: Wattle Grove North	M2	1050
NCA 3: Casula	M3	960
NCA 4: Glenfield	M4	1250
NCA 3: Glenfield Farm	n/a	1400

2.2 Noise management criteria

The operational noise management criteria, consistent with the approval conditions are outlined in Section 3.4 of the Container Noise Barrier Management Plan (CNBMP[1]) and summarised in Table 2. The $L_{Aeq(period)}$ criteria are applicable during the day, evening and night-time periods and the L_{Amax} sleep disturbance screening criteria are applicable during night-time periods.

The meteorological conditions under which the criteria are appliable are summarised in the table notes and are consistent with the requirements outlined in Approval Condition FC5. An additional receiver location (Glenfield Farm) has been included in the assessment, as described in Section 3.5 of the CNBMP.

Table 2 Noise management criteria, dB(A)

Sensitive receiver	Day [1] $L_{Aeq,\ 15\ minute}$	Evening [1] $L_{Aeq,\ 15\ minute}$	Night [1] $L_{Aeq,\ 15\ minute}$	Night [1] $L_{A1\ (1\ min)}$/L_{Amax}
Wattle Grove (NCA 1)	35	35	35	52
Wattle Grove North (NCA 2)	35	35	35	51
Casula (NCA 3)	35	35	35	47
Glenfield (NCA 4)	35	35	35	50
Glenfield Farm (NCA3)	35	35	35	47

Notes:

To determine compliance with the $L_{Aeq,15\ minute}$ noise limits, noise from the development is to be measured at the most affected point within the residential boundary, or at the most affected point within 30 metres of a dwelling where the dwelling is more than 30 metres from the boundary. Where it can be demonstrated that direct measurement of noise from the project is impractical, the EPA may accept alternative means of determining compliance (see Chapter 11 of the NSW Industrial Noise Policy - INP). The modification factors in Section 4 of the INP must also be applied to the measured noise levels where applicable.

To determine compliance with the L_{A1} noise limits, noise from the project is to be measured at 1 metre from the dwelling façade. Where it can be demonstrated that direct measurement of noise from the project is impractical, the EPA may accept alternative means of determining compliance (see Chapter 11 of the INP).

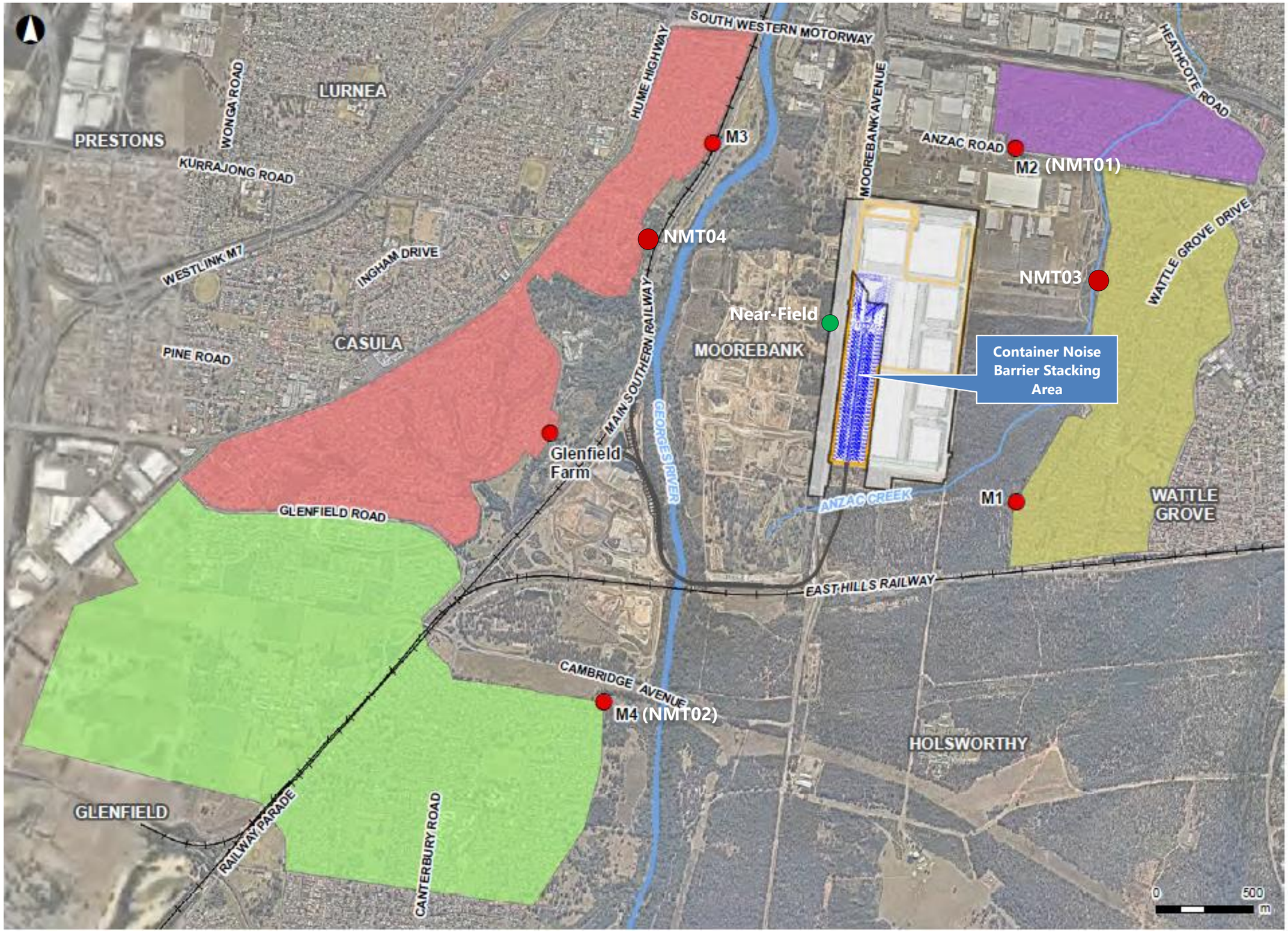
The noise emission limits identified above apply under meteorological conditions of:

(i) wind speeds of up to 3 m/s at 10 metres above ground level; or

(ii) 'F' atmospheric stability class.

Note 1: In accordance with the INP, day is the period from 7:00 am to 6:00 pm Monday to Saturday; or 8:00 am to 6:00 pm on Sundays and public holidays; evening is the period from 6:00 pm to 10:00 pm; and night is the remaining periods.

Figure 1 MPE East Precinct, container noise barrier stacking area and nearest sensitive residential receivers



3 Container noise barrier arrangement

During the night-time measurements, container stacks were located adjacent to the western boundary of the MPE (See Figure 2 and Figure 3). Table 3 provides a summary of the container noise barrier arrangements.

Section 3.6.2 of the CNBMP provides a summary of the approved container noise barrier stacking arrangements. It was confirmed during the attended measurements that the height of the container noise barrier closest to Moorebank Avenue was one 'tier' higher than the inner rows and the stacking of containers on top of the container noise barrier did not occur during the night-time period.

Table 3 Container noise barriers arrangement

Location	MPE
Dimensions of container stacks	52m (length) x 14m (width) x 2.6m(Height)
Gap between container stacks	7m & 2m
Stacking height	3 containers high
Orientation	Stacked parallel to the rail link

4 Noise measurements

4.1 Noise measurement approach

The objective of the noise measurements is to evaluate the noise levels associated with container unloading and stacking during a night-time period at the nearest sensitive receivers, and determine if the noise measurement results comply with the noise management criteria in Table 2.

Approval Condition F5A requires noise measurements to be performed on three separate nights for a period of not less than 2 hours, whilst train wagons are being loaded with containers. Based on current operations, the loading and unloading of wagons during night-time periods is infrequent. On average, there is one loading/unloading event per week during night-time periods.

During the night-time period when container stacking operations are taking place, the measurement approach includes performing attended noise measurements at near-field locations within approximately 100 m of the operations. At the near-field measurement locations, it is possible to observe the container stacking operations and reliably measure the source noise levels of maximum (L_{Amax}) and steady (L_{Aeq}) noise sources. The time of these events can also be noted.

At the far-field noise measurement locations (refer Table 1 and Figure 1), a combination of attended and unattended noise measurements are performed to evaluate if noise emissions from the container stacking operations are audible at the nearest sensitive residential receivers. This is achieved by listening to the noise recordings at the far-field locations during the same time periods when noise emissions were audible at the near-field measurement locations.

Where the noise levels at the far-field noise measurement locations are not audible and it is not possible to quantify the container stacking operations directly (as was the case in this study), the near-field noise measurement results can be used in conjunction with noise modelling, to calculate the container noise stacking operational noise levels at the far-field locations.

4.2 Measurement equipment

The measurement equipment included two NTi XL2 sound level meters and four Envirosuite permanent noise monitors. The XL2 sound level meters were utilised for the attended noise measurements in the near- and far-fields. Four Envirosuite permanent noise monitors are set up at representative locations in the community, and are labelled NMT01 to NMT04 in Figure 1.

All of the noise monitoring equipment are Class 1 instruments, with calibration certificates current at the time of the measurements. Before and after each series of attended measurements, the calibration of the XL2 sound level meters were verified using a reference calibration of 94 dB at 1 kHz. The difference between pre- and post-calibration levels was within 0.5 dB for all measurements.

A summary of measurement equipment and calibration dates is provided in Table 4.

Table 4 Measurement equipment

Location	Description	Make	Model	Serial No	Last Date Calibrated
Far Field attended	Class 1 sound level meter	NTi	XL2	A2A-02386-D2	08/07/2019
Near Field attended	Class 1 sound level meter	NTi	XL2	A2A-13500-E0	22/01/2020
Near and Far field attended	Class 1 sound level meter calibrator	B&K	4231	2677710	16/03/2020
NMT01	Permanent noise monitor	B&K	2250	3025394	12/03/2019
NMT02	Permanent noise monitor	B&K	2250	3025271	12/03/2019
NMT03	Permanent noise monitor	B&K	2250	3025351	12/03/2019
NMT04	Permanent noise monitor	B&K	2250	3025317	12/03/2019

4.3 Measurement methodology

Attended noise measurements were performed at near-field locations on Moorebank Avenue to capture the freight train unloading events. The measurement were performed between 4:30 am and 7:30 am on 4 September 2020. The position of the near-field measurement location is shown in Figure 2. The near-field measurement setup is shown in Figure 3.

Concurrent with the near-field measurements, a combination of attended and unattended noise measurements were performed at the property boundary of the nearest sensitive residential receivers.

Figure 2 Near-field measurement location

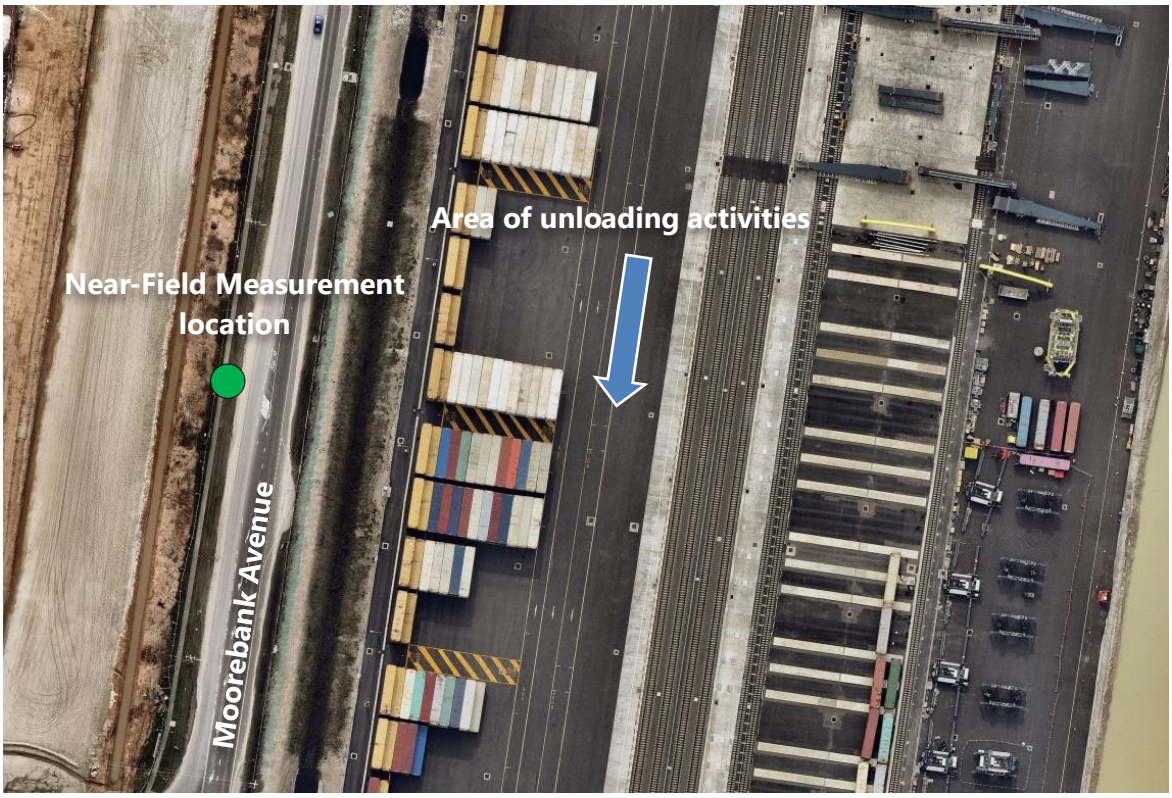
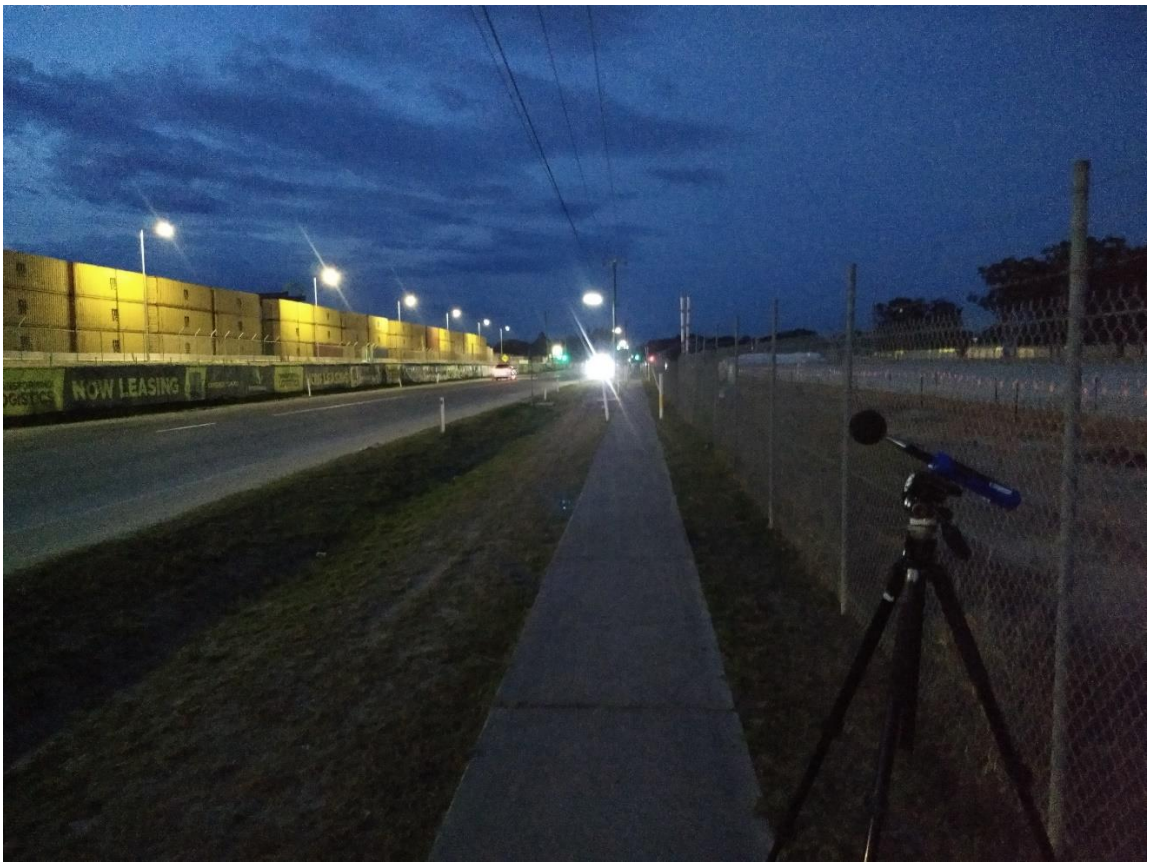


Figure 3 Near-field measurement setup



5 Noise measurement results

5.1 Near-field locations

Attended noise measurements were performed at a representative near-field measurement location approximately 50 m from the western boundary of the container noise barrier.

Several on-site activities were recorded during the attended noise measurements. These included Reacher Stackers unloading containers from the freight train onto trucks, Reacher Stackers unloading containers from the freight train and stacking them behind the container noise barriers at the eastern boundary, and locomotive idling noise.

The typical worst-case $L_{Aeq(15\ minute)}$ noise level is related to the above activities and was considered in the modelling described in Section 6.

A summary of the near-field noise measurement results is provided in Table 5. The reported noise levels represent the typical worst-case noise events observed during the measurement survey.

Table 5 Summary of near-field noise measurement results

Activity noise sources	Time	Measurement Duration, t (sec)	Measurement Distance, m	Measured noise levels, dB(A)	
				$L_{Aeq(t)}$	L_{AFmax}
Freight train					
Engine Idling	5:25 am	12	110	52	54
Reacher Stacker					
Grabbing & Dropping Sound	5:14 am	3	95	59	68
Engine revving	5:17 am	11	60	57	58
Engine Idling	5:17 am	17	55	57	57
Reverse Beeping	5:16 am	11	60	62	64

Note: After 5:30am, it was not possible to quantify the noise contribution from site activities in the presence of high ambient noise from continuous road traffic on Moorebank Avenue.

5.2 Far-field attended measurements at sensitive residential receivers

Attended noise measurements were performed at the residential boundary of the nearest residential receivers at locations M3, M4 and NMT 04 (refer Figure 1). Results from the attended noise measurements are provided in Table 7.

At the three far-field noise measurement locations, noise emissions from the container unloading activities were not audible in the presence of the ambient noise environment. At measurement location M3, this included the time period when the loudest grabbing / dropping sound was observed at the near-field location (5:14am).

5.3 Far-field unattended noise measurements

Continuous noise monitoring is currently being performed at four noise-sensitive locations in accordance with Approval Condition B64 (SSD 7628) (see Section 4.1.2 of ONVMP).

During the attended noise measurements, the permanent noise monitors were configured to perform audio recordings and short-term statistical noise measurements. This setup allowed the unattended measurement results to be post-processed to determine if the container unloading operations are audible at the sensitive receiver locations.

Following the attended measurements, the noise measurements results were downloaded and analysed. It was confirmed that the container unloading activities were not audible in the presence of the ambient noise environment, including the time period when the loudest grabbing / dropping sound was observed at the near-field location (5:14am).

A summary of the noise measurement results during the time period when the loudest grabbing / dropping sound was audible at the near-field location is provided in Table 6. During this period, the grabbing / dropping noise was not audible in the sound recordings.

A summary of the measured $L_{Aeq(15minute)}$ noise levels during the 4:30 am to 7:30 am period is provided in Table 7.

Table 6 Far-field unattended noise measurement results

Monitoring station	Approximate distance (m) from MPE East Precinct	Time period	Measured $L_{A,1min}$ Noise Level, dB(A)	Audibility
NMT 01	550	5:14 am to 5:15 am	53	Site activities not audible
NMT 02	1250	5:14 am to 5:15 am	53	Site activities not audible
NMT 03	700	5:14 am to 5:15 am	50	Site activities not audible
NMT 04	1000	5:14 am to 5:15 am	47	Site activities not audible

5.4 Weather conditions

Observations of the weather conditions were made using a hand-held MS6252B digital anemometer. The air temperature during the survey was 17°C, relative humidity 50%, average wind speed 0.5 m/s (SW) and 40% cloud cover. There was no precipitation.

The weather conditions during the survey were conducive for measuring noise under typical environmental conditions.

Table 7 Summary of attended and unattended noise measurement results at the nearest sensitive residential receivers (far field)

ID	Address	Measurement Method	Assessment period	$L_{Aeq,\ 15minute}$ noise criterion, dB(A)	$L_{A1,\ 1\ minute}$ noise criterion, dB(A)	Measurement period	Measured noise levels, dB(A)		Estimated MPE noise contribution, dB(A)		Comments and measured L_{Amax} noise levels from typical events	MPE Noise Levels Comply?
							$L_{Aeq,\ 15minute}$	$L_{AF,90\%}$	$L_{Aeq,\ 15minute}$-	L_{AFmax}		
M3 – Casula												
1	St Andrews Park	Attended	Night	35	47	04/09/20 05:13 - 05:28	57	47	Note 1	Note 1	Background noise dominated by noise from the M5 traffic noise: M5 49-50dBA, Animal 49-50dBA, Rail Traffic 75-78 dBA	Yes
2	St Andrews Park	Attended	Night	35	47	04/09/20 05:33 - 05:48	62	55	Note 1	Note 1	Background noise dominated by noise from the M5 traffic noise: M5 49-50dBA, Animal 59-60dBA, Rail Traffic 80-81 dBA, Road traffic 57-59dBA	Yes
3	St Andrews Park	Attended	Night	35	47	04/09/20 05:57 - 06:12	60	59	Note 1	Note 1	Background noise dominated by noise from the M5 traffic noise: M5 49-51dBA, Animal 59-60dBA, Rail Traffic 79-80 dBA, Road traffic 52-53dBA, Distance Construction noise 54-55	Yes
14 Dunmore Crescent												
4	14 Dunmore Crescent	Attended	Night	35	50	04/09/20 04:47 - 05:02	48	46	Note 1	Note 1	Background noise dominated by noise from the Hume Highway: Road Traffic 49-51dBA, Rail Traffic 51-52dBA, Animal noise 47-48 dBA	Yes
5	14 Dunmore Crescent	Attended	Night/Day	35	50	04/09/20 06:55 - 07:10	51	50	Note 1	Note 1	Background noise dominated by noise from the Hume Highway: Road Traffic 49-51dBA, Rail Traffic 51-52dBA, Animal noise 47-48 dBA	Yes
6	14 Dunmore Crescent	Attended	Day	35	-	19/02/20 07:10 - 07:25	61	51	Note 1	Note 1	Background noise dominated by noise from the Hume Highway: Road Traffic 50-51dBA, Rail Traffic 50-51dBA	Yes
7	14 Dunmore Crescent	Attended	Day	35	-	19/02/20 07:26 - 07:41	55	53	Note 1	Note 1	Background noise dominated by noise from the Hume Highway: Road Traffic 50-51dBA, Rail Traffic 50-51dBA, Freight Train 56-57dBA	Yes
M4 – Glenfield												
8	26 Goodenough Street	Attended	Night	35	51	04/09/20 06:26 - 06:41	56	54	Note 1	Note 1	Background noise dominated by noise from the Cambridge Ave: Road Traffic 58-59 dBA, Animal 58-59dBA	Yes
NMT 01 - Wattle Grove North												
9	22 Glenelg Court	Unattended	Night	35	52	04/09/20 04:30- 04:45	55	52	-	-	Refer Table 6	Yes
			Night	35	52	04/09/20 04:45- 05:00	52	49	-	-	Refer Table 6	Yes
			Night	35	52	04/09/20 05:00- 05:15	52	47	-	-	Refer Table 6	Yes
			Night	35	52	04/09/20 05:15- 05:30	54	49	-	-	Refer Table 6	Yes
			Night	35	52	04/09/20 05:30- 05:45	56	54	-	-	Refer Table 6	Yes
			Night	35	52	04/09/20 05:45- 06:00	56	54	-	-	Refer Table 6	Yes
			Night	35	52	04/09/20 06:00- 06:15	57	54	-	-	Refer Table 6	Yes
			Night	35	52	04/09/20 06:15- 06:30	57	53	-	-	Refer Table 6	Yes
			Night	35	52	04/09/20 06:30- 06:45	57	53	-	-	Refer Table 6	Yes
			Night	35	52	04/09/20 06:45- 07:00	57	53	-	-	Refer Table 6	Yes
			Day	35	-	04/09/20 07:00- 07:15	58	55	-	-	Refer Table 6	Yes
			Day	35	-	04/09/20 07:15- 07:30	57	54	-	-	Refer Table 6	Yes
NMT 02 – Glenfield												
10	26 Goodenough Street	Unattended	Night	35	51	04/09/20 04:30- 04:45	50	46	-	-	Refer Table 6	Yes
			Night	35	51	04/09/20 04:45- 05:00	50	46	-	-	Refer Table 6	Yes
			Night	35	51	04/09/20 05:00- 05:15	53	50	-	-	Refer Table 6	Yes
			Night	35	51	04/09/20 05:15- 05:30	52	48	-	-	Refer Table 6	Yes
			Night	35	51	04/09/20 05:30- 05:45	54	52	-	-	Refer Table 6	Yes
			Night	35	51	04/09/20 05:45- 06:00	55	53	-	-	Refer Table 6	Yes
			Night	35	51	04/09/20 06:00- 06:15	56	53	-	-	Refer Table 6	Yes
			Night	35	51	04/09/20 06:15- 06:30	55	54	-	-	Refer Table 6	Yes
			Night	35	51	04/09/20 06:30- 06:45	59	54	-	-	Refer Table 6	Yes
			Night	35	51	04/09/20 06:45- 07:00	55	54	-	-	Refer Table 6	Yes
			Day	35	-	04/09/20 07:00- 07:15	57	54	-	-	Refer Table 6	Yes
			Day	35	-	04/09/20 07:15- 07:30	56	54	-	-	Refer Table 6	Yes

ID	Address	Measurement Method	Assessment period	$L_{Aeq,\ 15minute}$ noise criterion, dB(A)	$L_{A1,\ 1\ minute}$ noise criterion, dB(A)	Measurement period	Measured noise levels, dB(A)		Estimated MPE noise contribution, dB(A)		Comments and measured L_{Amax} noise levels from typical events	MPE Noise Levels Comply?
							$L_{Aeq,\ 15minute}$	$L_{AF,90\%}$	$L_{Aeq,\ 15minute}$.	L_{AFmax}		
NMT 03 – Wattle Grove												
11	31 Martindale Court	Unattended	Night	35	47	04/09/20 04:30- 04:45	50	48	-	-	Refer Table 6	Yes
			Night	35	47	04/09/20 04:45- 05:00	51	50	-	-	Refer Table 6	Yes
			Night	35	47	04/09/20 05:00- 05:15	50	48	-	-	Refer Table 6	Yes
			Night	35	47	04/09/20 05:15- 05:30	56	48	-	-	Refer Table 6	Yes
			Night	35	47	04/09/20 05:30- 05:45	53	52	-	-	Refer Table 6	Yes
			Night	35	47	04/09/20 05:45- 06:00	55	52	-	-	Refer Table 6	Yes
			Night	35	47	04/09/20 06:00- 06:15	52	52	-	-	Refer Table 6	Yes
			Night	35	47	04/09/20 06:15- 06:30	51	50	-	-	Refer Table 6	Yes
			Night	35	47	04/09/20 06:30- 06:45	53	50	-	-	Refer Table 6	Yes
			Night	35	47	04/09/20 06:45- 07:00	57	51	-	-	Refer Table 6	Yes
			Day	35	-	04/09/20 07:00- 07:15	54	51	-	-	Refer Table 6	Yes
			Day	35	-	04/09/20 07:15- 07:30	55	53	-	-	Refer Table 6	Yes
NMT 04 – Casula												
12	14 Dunmore Crescent	Unattended	Night	35	50	04/09/20 04:30- 04:45	57	44	-	-	Refer Table 6	Yes
			Night	35	50	04/09/20 04:45- 05:00	51	41	-	-	Refer Table 6	Yes
			Night	35	50	04/09/20 05:00- 05:15	50	42	-	-	Refer Table 6	Yes
			Night	35	50	04/09/20 05:15- 05:30	51	46	-	-	Refer Table 6	Yes
			Night	35	50	04/09/20 05:30- 05:45	52	49	-	-	Refer Table 6	Yes
			Night	35	50	04/09/20 05:45- 06:00	53	48	-	-	Refer Table 6	Yes
			Night	35	50	04/09/20 06:00- 06:15	51	49	-	-	Refer Table 6	Yes
			Night	35	50	04/09/20 06:15- 06:30	55	50	-	-	Refer Table 6	Yes
			Night	35	50	04/09/20 06:30- 06:45	57	52	-	-	Refer Table 6	Yes
			Night	35	50	04/09/20 06:45- 07:00	56	54	-	-	Refer Table 6	Yes
			Day	35	-	04/09/20 07:00- 07:15	55	52	-	-	Refer Table 6	Yes
			Day	35	-	04/09/20 07:15- 07:30	61	54	-	-	Refer Table 6	Yes

Note 1: Since noise levels from the MPE were not audible during the measurement period, it was not possible to estimate the MPE noise contribution

6 Noise modelling results

6.1 Overview of noise modelling

Since noise levels from the container unloading operations were not audible at the nearest residential receivers, and it was not possible to measure the MLE noise contribution directly, computer noise modelling was employed to calculate the container noise stacking operational noise levels at the far-field locations. The source noise levels in the computer noise model are based on the typical worst-case attended noise measurement results at the near-field location (see Table 5).

6.2 General modelling assumptions

The CadnaA (version 2020) noise model has been utilised to predict the far-field noise levels at the nearest residential receivers. The noise predictions are based on the CONCAWE noise prediction algorithms.

The CONCAWE method was originally developed for predicting the long-distance propagation of noise from petrochemical complexes. It is especially suited to predicting noise propagation over large distances because it accounts for a range of atmospheric conditions that can significantly influence the propagation of noise over large distances.

Noting that the nearest residential receiver is in the vicinity of MPE Facility is at least 770 m from the site, the CONCAWE environmental noise prediction method is an appropriate method for predicting the noise propagation. The noise modelling calculations account for the following:

- Ground topography;
- Buildings and structures (including the container noise barrier);
- All sources behave as point, or moving point sources;
- Ground absorption;
- Representative operational noise sources as required; and
- Meteorological conditions.

6.3 Noise model predictions

A summary of the predicted noise levels at the nearest residential receiver locations are compared with the project specified noise criteria in Table 8. The noise predictions are based on the typical worst-case noise measurements at the near-field measurement location and represent unloading operations which include locomotive idling, Reacher Stacker operations and truck operations. The predicted noise levels are evaluated at the property boundary of the nearest residential receivers.

A separate noise modelling scenario was run for the L_{AFmax} grabbing / dropping sound in order to evaluate the potential sleep disturbance impacts.

Table 8 Predicted noise levels at nearest residential receivers

Location	Distance (m)	$L_{Aeq(15minute)}$ noise management criteria, dB(A)	$L_{A1, 1minute}$ noise management criteria, dB(A)	Predicted noise levels, dB(A)	
				$L_{Aeq(15minute)}$	L_{AFmax} / $L_{A1, 1minute}$
M1 - Wattle Grove	770	35	52	30	44
M2 - Wattle Grove North	1,050	35	51	21	29
M3 - Casula	960	35	47	26	39
M4 - Glenfield	1,250	35	50	14	28
Glenfield Farm	1,500	35	47	22	36

7 Discussion

Attended noise measurements at near-field distances of up to 100 m have been used to quantify the source noise levels of typical operations associated with container unloading and stacking operations. The highest noise levels occurred at 5:14 am, generating a L_{Amax} noise level of 57 dB(A) at a distance of 95 m (container grabbing / dropping sound).

At the far-field noise measurement locations, noise emissions from the container unloading and stacking operations were not audible during the night-time measurement period in the presence of other ambient noise sources. The noise recordings at the permanent noise monitoring sites were reviewed during the time period when the highest container grabbing / dropping sound was observed at the near-field measurement locations. This L_{Amax} noise event was not audible at the permanent noise monitoring locations or at the attended far-field noise measurement location (M3).

Since the airborne noise levels from container unloading operations were not audible, computer noise modelling was performed, based on the near-field noise measurement results, to quantify the noise contribution from typical worst-case site activities. The noise level calculations in Table 8 verify that the predicted noise levels comply with the $L_{Aeq(15\ minute)}$ and $L_{A1(1\ minute)}$ noise management criteria at the nearest sensitive receivers.

8 Conclusion

This report presents the results of container noise barrier measurements representative near-and far-field locations in proximity to Moorebank Precinct East (MPE). The measurements were performed in accordance with the requirements of the NSW *Industrial Noise Policy* (INP) and the Container Noise Barrier Management Plan to verify compliance with the noise limits in SSD Approval 6766. The measurements were performed during the night-time period on 4 September 2020 during container unloading and stacking operations.

At the nearest residential receivers, the measured $L_{Aeq(15minute)}$ noise levels were dominated by extraneous noise sources apart from the MPE activities. MPE noise sources were not audible during any of the measurement periods at the nearest residential receivers. On this basis, near-field measurement data was utilised in conjunction with computer noise modelling to quantify the typical worst-case noise contribution from the facility.

Based on the calculated noise levels in Table 8, it is concluded that the current noise levels comply with the project-specific noise management criteria and sleep disturbance screening levels in Approval Condition F5A of SSD 6766.

APPENDIX A Glossary of terminology

The following is a brief description of the technical terms used to describe noise to assist in understanding the technical issues presented.

Adverse weather	Weather effects that enhance noise (that is, wind and temperature inversions) that occur at a site for a significant period of time (that is, wind occurring more than 30% of the time in any assessment period in any season and/or temperature inversions occurring more than 30% of the nights in winter).
Ambient noise	The all-encompassing noise associated within a given environment at a given time, usually composed of sound from all sources near and far.
Assessment period	The period in a day over which assessments are made.
Assessment Point	A point at which noise measurements are taken or estimated. A point at which noise measurements are taken or estimated.
Background noise	Background noise is the term used to describe the underlying level of noise present in the ambient noise, measured in the absence of the noise under investigation, when extraneous noise is removed. It is described as the average of the minimum noise levels measured on a sound level meter and is measured statistically as the A-weighted noise level exceeded for ninety percent of a sample period. This is represented as the L90 noise level (see below).
Decibel [dB]	The units that sound is measured in. The following are examples of the decibel readings of common sounds in our daytime environment:

threshold of hearing	0 dB	The faintest sound we can hear
	10 dB	Human breathing
almost silent	20 dB	
	30 dB	Quiet bedroom or in a quiet national park location
generally quiet	40 dB	Library
	50 dB	Typical office space or ambience in the city at night
moderately loud	60 dB	CBD mall at lunch time
	70 dB	The sound of a car passing on the street
loud	80 dB	Loud music played at home
	90 dB	The sound of a truck passing on the street
very loud	100 dB	Indoor rock band concert
	110 dB	Operating a chainsaw or jackhammer
extremely loud	120 dB	Jet plane take-off at 100m away
threshold of pain	130 dB	
	140 dB	Military jet take-off at 25m away

dB(A)	A-weighted decibels. The A- weighting noise filter simulates the response of the human ear at relatively low levels, where the ear is not as effective in hearing low frequency sounds as it is in 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.
dB(C)	C-weighted decibels. The C-weighting noise filter simulates the response of the human ear at relatively high levels, where the human ear is nearly equally effective at hearing from mid-low frequency (63Hz) to mid-high frequency (4kHz), but is less effective outside these frequencies.

Frequency	Frequency is synonymous to pitch. 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.
Impulsive noise	Having a high peak of short duration or a sequence of such peaks. A sequence of impulses in rapid succession is termed repetitive impulsive noise.
Intermittent noise	The level suddenly drops to that of the background noise several times during the period of observation. The time during which the noise remains at levels different from that of the ambient is one second or more.
L_{Max}	The maximum sound pressure level measured over a given period.
L_{Min}	The minimum sound pressure level measured over a given period.
L_1	The sound pressure level that is exceeded for 1% of the time for which the given sound is measured.
L_{10}	The sound pressure level that is exceeded for 10% of the time for which the given sound is measured.
L_{90}	The level of noise exceeded for 90% of the time. The bottom 10% of the sample is the L90 noise level expressed in units of dB(A).
L_{eq}	The "equivalent noise level" is the summation of noise events and integrated over a selected period of time.
Reflection	Sound wave changed in direction of propagation due to a solid object obscuring its path.
SEL	Sound Exposure Level (SEL) is the constant sound level which, if maintained for a period of 1 second would have the same acoustic energy as the measured noise event. SEL noise measurements are useful as they can be converted to obtain Leq sound levels over any period of time and can be used for predicting noise at various locations.
Sound	A fluctuation of air pressure which is propagated as a wave through air.
Sound absorption	The ability of a material to absorb sound energy through its conversion into thermal energy.
Sound level meter	An instrument consisting of a microphone, amplifier and indicating device, having a declared performance and designed to measure sound pressure levels.
Sound pressure level	The level of noise, usually expressed in decibels, as measured by a standard sound level meter with a microphone.
Sound power level	Ten times the logarithm to the base 10 of the ratio of the sound power of the source to the reference sound power.
Tonal noise	Containing a prominent frequency and characterised by a definite pitch.

B.6 Warehouse 1 Noise Monitoring Report

Renzo Tonin & Associates Report TL116-05.4F07 Target Warehouse Operational Compliance (r2)

RENZO TONIN & ASSOCIATES
inspired to achieve

Acoustics
Vibration
Structural Dynamics

MOOREBANK LOGISTIC PARK - PRECINCT EAST

Target Warehouse Operational Compliance Measurements

1 December 2020

Qube Property Management Services Pty Ltd c/- Tactical Group

TL116-05.4F07 Target Warehouse Operational Compliance (r2).docx

35 1982-2017 ACOUSTIC ENGINEERING EXCELLENCE

Sydney Melbourne Brisbane Gold Coast Kuwait Singapore
Renzo Tonin & Associates ABN 29 117 462 861
Level 1/418A Elizabeth St SURRY HILLS NSW 2010 | PO Box 877 STRAWBERRY HILLS NSW 2012
P (02) 8218 0500 F (02) 8218 0501 sydney@renzotonin.com.au www.renzotonin.com.au

aaac Association of Australian Acoustical Consultants

Document details

Detail	Reference
Doc reference:	TL116-05.4F07 Target Warehouse Operational Compliance (r2).docx
Prepared for:	Qube Property Management Services Pty Ltd c/- Tactical Group
Attention:	Cathal McGann

Document control

Date	Revision history	Non-issued revision	Issued revision	Prepared	Instructed	Reviewed / Authorised
30.10.2020	Initial issue (draft)	0	1	J.Liang/ A.Leslie	A.Leslie	C. Weber
1.12.2020	Final	-	2	J.Liang/ A.Leslie	A.Leslie	C. Weber

File Path: R:\AssocSydProjects\TL101-TL150\TL116 cw Moorebank IMT Temporary Noise Monitoring\Task 5 - cw Operation Compliance Monitoring\1 Docs\Report 7 Target Warehouse\TL116-05.4F07 Target Warehouse Operational Compliance (r2).docx

Important Disclaimers:

The work presented in this document was carried out in accordance with the Renzo Tonin & Associates Quality Assurance System, which is based on Australian/New Zealand Standard AS/NZS ISO 9001.

This document is issued subject to review and authorisation by the suitably qualified and experienced person named in the last column above. If no name appears, this document shall be considered as preliminary or draft only and no reliance shall be placed upon it other than for information to be verified later.

This document is prepared for the particular requirements of our Client referred to above in the 'Document details' which are based on a specific brief with limitations as agreed to with the Client. It is not intended for and should not be relied upon by a third party and no responsibility is undertaken to any third party without prior consent provided by Renzo Tonin & Associates. The information herein should not be reproduced, presented or reviewed except in full. Prior to passing on to a third party, the Client is to fully inform the third party of the specific brief and limitations associated with the commission.

In preparing this report, we have relied upon, and presumed accurate, any information (or confirmation of the absence thereof) provided by the Client and/or from other sources. Except as otherwise stated in the report, we have not attempted to verify the accuracy or completeness of any such information. If the information is subsequently determined to be false, inaccurate or incomplete then it is possible that our observations and conclusions as expressed in this report may change.

We have derived data in this report from information sourced from the Client (if any) and/or available in the public domain at the time or times outlined in this report. The passage of time, manifestation of latent conditions or impacts of future events may require further examination and re-evaluation of the data, findings, observations and conclusions expressed in this report.

We have prepared this report in accordance with the usual care and thoroughness of the consulting profession, for the sole purpose described above and by reference to applicable standards, guidelines, procedures and practices at the date of issue of this report. For the reasons outlined above, however, no other warranty or guarantee, whether expressed or implied, is made as to the data, observations and findings expressed in this report, to the extent permitted by law.

The information contained herein is for the purpose of acoustics only. No claims are made and no liability is accepted in respect of design and construction issues falling outside of the specialist field of acoustics engineering including and not limited to structural integrity, fire rating, architectural buildability and fit-for-purpose, waterproofing and the like. Supplementary professional advice should be sought in respect of these issues.

External cladding disclaimer: No claims are made and no liability is accepted in respect of any external wall and/or roof systems (eg facade / cladding materials, insulation etc) that are: (a) not compliant with or do not conform to any relevant non-acoustic legislation, regulation, standard, instructions or Building Codes; or (b) installed, applied, specified or utilised in such a manner that is not compliant with or does not conform to any relevant non-acoustic legislation, regulation, standard, instructions or Building Codes.

Contents

1 Introduction 5
1.1 Warehouse operations description – Target 6
1.1.1 Location 6
1.1.2 Operational activities and facilities and hours of operation 6
1.2 Nearby sensitive receivers 6
2 Summary of noise objectives 9
2.1 Compliance assessment noise requirements 9
2.2 Operational noise limits 9
2.3 Discussion of assessment noise limits 10
3 Measurement methodology and results 12
3.1 Compliance measurement methodology 12
3.2 Instrumentation 13
3.3 Receiver attended noise measurement results 13
3.3.1 Meteorological conditions 14
3.4 On-site attended operational activity noise measurement results 17
3.5 Unattended noise measurements 18
3.6 Modelled operational scenarios 19
3.6.1 Observed operations for modelling 19
3.6.1.1 Truck and despatching operations (Target north and south) 20
3.6.1.2 Unloading operations at Target south 20
3.6.1.3 Qube container handling operational area 20
3.6.2 Assessment noise source levels 21
3.6.3 Reasonable worst-case intrusiveness scenarios (15-minute period) 22
3.7 Modelling methodology 24
3.7.1 Overview of noise modelling 24
3.7.2 General modelling assumptions 24
3.7.3 Model validation 25
3.8 Noise compliance assessment 25
4 Conclusion 27
APPENDIX A Glossary of terminology 29
APPENDIX B Logger location 1 – Target - North side 31
APPENDIX C Logger location 2 – Target – South side 32

List of tables

Table 1 Noise sensitive receivers and approximate distance from MPE warehouse (Target) 7
Table 2 SSD 7628 CoC B80 noise limits, dB(A) 10

Table 3 Noise measurement equipment 13
Table 4 Receiver attended noise monitoring locations 14
Table 5 Summary of attended noise measurement results at the nearest sensitive residential receivers 16
Table 6 On-site attended measurement results (7 September 2020) 17
Table 7 Assessment noise source levels 21
Table 8 Representative 'reasonable' worst-case 15-minute intrusive assessment scenarios 23
Table 9 Comparison between measured and modelled noise levels 25
Table 10 Predicted noise levels - Reasonable worst-case scenarios for warehouse (Target) 26

List of figures

Figure 1 Warehouse location (Target), MPE precinct and the nearest residential receivers 8
Figure 2 Attended residential receiver noise monitoring locations 15
Figure 3 Unattended noise logger locations and main noise generation areas (imagery: Nearmap, 2020) 19

1 Introduction

Renzo Tonin & Associates was engaged by Tactical on behalf of Qube Property Management Services Pty Ltd (QUBE) to undertake an operational noise compliance assessment of the warehouse operations carried out by Target (Warehouse 1 (WH1)) within the Moorebank Precent East (MPE), located within the Moorebank Logistics Park (MLP) at Moorebank, NSW.

The Sydney Intermodal Terminal Alliance (SIMTA) received approval for the construction and operation of Stages 1 and 2 of the MPE Project (SSD 6766 and SSD 7628 respectively), which together comprise the two stages of development under the MPE Concept Approval (MP10_0193). Warehouse operations, including the site that is operated by Target (WH1), fall under the area and activities approved as part of SSD 7628.

This report has been prepared to address the operational noise monitoring requirements outlined in the MPE Operational Noise and Vibration Management Plan[1] (MPE ONVMP) required for the warehouse operations carried out by Target. Specifically, this report has been prepared to address the requirements of Condition of Consent (CoC) B85 in State Significant Development (SSD) 7628, as detailed in Section 3.2.2 of the MPE ONVMP.

Appendix A contains a glossary of acoustic terms used in this report.

1 Arcadis & Renzo Tonin & Associates, Operational Noise and Vibration Management Plan for Moorebank Logistics Park – East Precinct, Revision 012, dated 27/3/2020, available https://simta.com.au/wordpress/wp-content/uploads/2020/04/ONVMP_V12_redacted.pdf, accessed 8/10/2020

1.1 Warehouse operations description – Target

1.1.1 Location

The MLP is located approximately 27 kilometres south-west of the Sydney Central Business District and approximately 26 kilometres west of Port Botany, within the Liverpool Local Government Area. The MLP is divided into an East Precinct and a West Precinct, located east and west of Moorebank Avenue respectively, as shown in Figure 1.

1.1.2 Operational activities and facilities and hours of operation

Target undertakes warehouse and distribution activities from the warehouse designated WH1 within the MPE. The day to day activities include:

- Receipt and despatch of goods from and to the IMEX terminal
- Packing and unpacking of containers
- Storage of goods
- Despatching and receiving truck movements in and out of the facility
- Forklift operations
- General office administrative and support functions.

Target's warehouse and distribution activities operate 24 hours, 7 days per week.

The despatch activities mostly occur from the north side of the Target warehouse, typically between the hours of 5:00am and 3:00pm, with the busiest period around 5:00am to 7:00am. The receiving activities mostly occur from the southern side of the warehouse, typically between the hours of 5:00am and 12:00pm, with the busiest period ramping up from around 6:00am. Additionally, there is a designated area on the southern side of the warehouse where containers from the IMEX terminal are transported to and stored for unloading within the warehouse. These three main areas are shown in Figure 3.

1.2 Nearby sensitive receivers

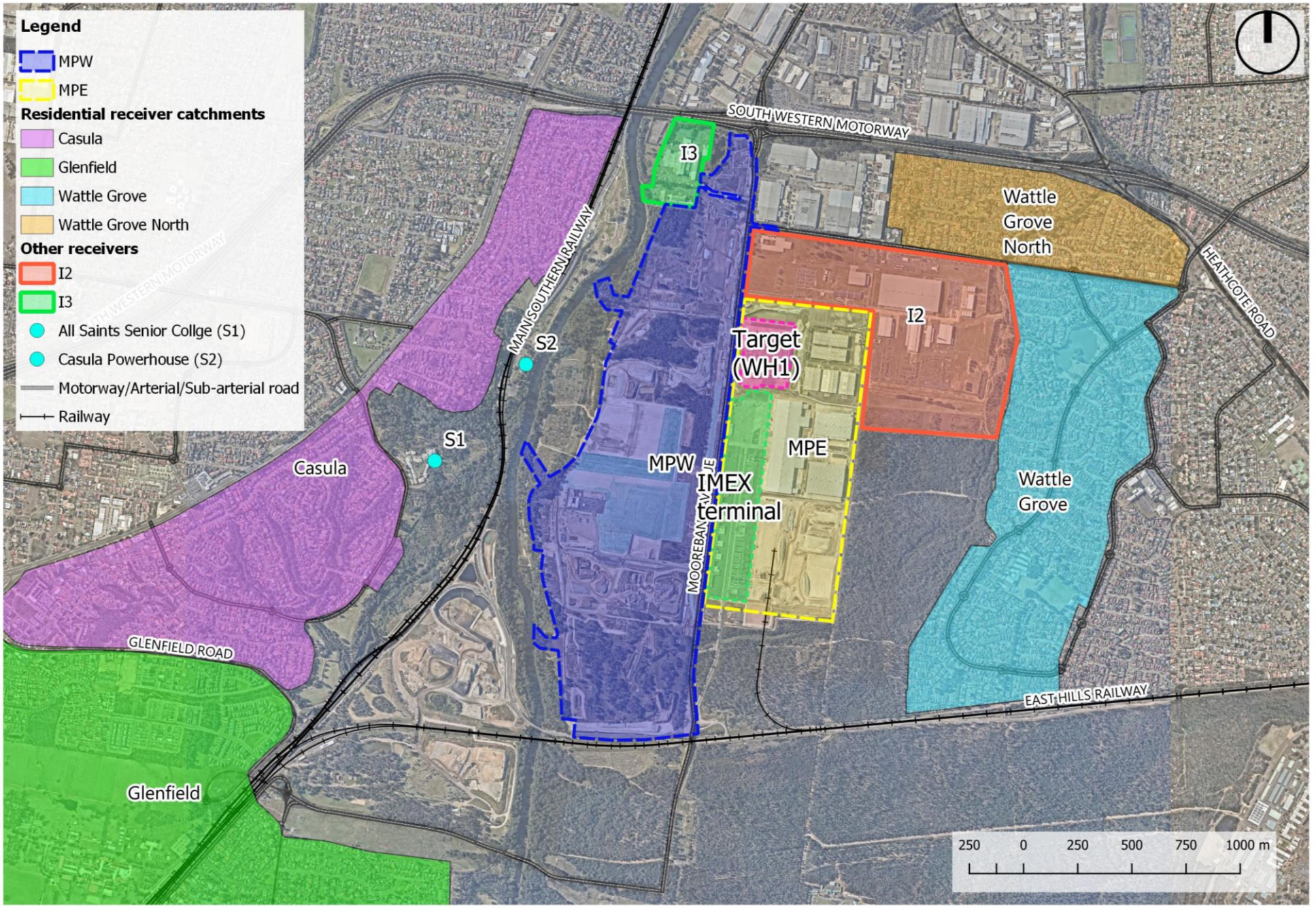
The potentially most affected residential receivers in the vicinity of the MPE (where loading / unloading at Target north and south occur), are located in the suburbs of Casula, Glenfield, Wattle Grove and Wattle Grove North. A summary of the approximate distance to the nearest residential receiver in the surround noise catchment areas (NCAs) is provided in Table 1. The locations of the NCAs or receivers, are shown in Figure 1.

Table 1 Noise sensitive receivers and approximate distance from MPE warehouse (Target)

Sensitive receiver (Noise Catchment Area (NCA) or Receiver ID)	Receiver type	Approximate distance from MPE precinct warehouse (Target), metres
Wattle Grove (NCA 1)	Residential	770
Wattle Grove North (NCA 2)		1,050
Casula (NCA 3)		960
Glenfield (NCA 4)		1,250
All Saints Senior College (S1)	Educational	1,700
Casula Powerhouse (S2)		1,100
Defence Joint Logistics Unit (DJLU) (I2)	Industrial	100
ABB (I3)		600

Notes: 1. Moorebank Precinct West (MPW) has not been assessed as the final receiver locations have not been confirmed or constructed.

Figure 1 Warehouse location (Target), MPE precinct and the nearest residential receivers



2 Summary of noise objectives

2.1 Compliance assessment noise requirements

The management of operational noise emission from warehouse activities within MPE Stage 2 is outlined in the MPE ONVMP. Specifically, this report has been prepared to address the requirements of CoC B85 in SSD 7628, as detailed in Section 4.1.1 of the MPE ONVMP.

This report includes noise monitoring performed to address the requirements in CoC B85, as detailed in Table 4-1 in Section 4.1.1 of the MPE ONVMP.

The requirements of CoC B85 state:

> *B85 The Applicant must carry out noise monitoring of mechanical plant and other noisy equipment for a minimum period of one week where valid data is collected following occupation of each warehouse. The monitoring program must be carried out by a suitably qualified and experienced person(s) and a Monitoring Report for Mechanical Plant must be submitted to the Secretary within two months of occupation or each tenancy to verify predicted mechanical plant and equipment noise levels.*

CoC B85 requires that the monitored noise levels be compared against the predicted levels reviewed in accordance with CoC B84. Mechanical plant and equipment noise levels were reviewed prior to construction to satisfy CoC B84. This is detail in the Acoustic Logic Report (reference 20180664.1/1405A/R0/TT, dated 14 May 2018). This report did not provide predicted noise levels for all nearby noise sensitive receivers, for verification under CoC B85, as the review concluded that due to the distance from the warehouse operations to the nearest residential receivers the mechanical plant noise levels would achieve the noise limits presented in Table 5 of CoC B80.

As per Table 4-1 in Section 4.1.1 of the MPE ONVMP, Table 3-20 and Table 3-21 of the MPE ONVMP detail the predicted $L_{Aeq\ 15\ minute}$ intrusiveness and L_{Amax} sleep disturbance noise levels respectively for the overall MPE operations, and not for an individual warehouse.

As such, for the purposes of addressing CoC B85, instead of comparing the facility noise emission against the noise level predicted in accordance with condition B84, this report is aims to assess the noise levels from the mechanical plant and other noisy equipment that operate within the facility directly against the noise limits presented in Table 5 of condition B80.

2.2 Operational noise limits

The operational noise limits applicable for the warehouse operations within MPE are presented in Table 5 of SSD 7628 CoC B80 and are reproduced in Table 2 below. These noise limits are as per Table 3-

5 of the MPE ONVMP. The noise limits are applicable not only to all operational noise sources approved under SSD 7628, but are inclusive of operations as part of MPE Stage 1, approval SSD 6766.

The $L_{Aeq(15\ minute)}$ criteria are applicable during the day, evening and night-time periods and the $L_{A1\ (1\ minute)}$ sleep disturbance noise limits are applicable during the night-time period.

The noise limits are applicable under prevailing meteorological conditions of wind speeds of up to 3 m/s at 10 metres above ground level or stability category 'F' temperature inversion conditions.

Table 2 SSD 7628 CoC B80 noise limits, dB(A)

Sensitive receiver	Day [1] $L_{Aeq,\ 15\ minute}$	Evening [1] $L_{Aeq,\ 15\ minute}$	Night [1] $L_{Aeq,\ 15\ minute}$	Night [1] $L_{A1\ (1\ min)}$
Wattle Grove (NCA 1)	35	35	35	52
Wattle Grove North (NCA 2)	35	35	35	52
Casula (NCA 3)	35	35	35	52
Glenfield (NCA 4)	35	35	35	52

Notes:

1. In accordance with the INP, day is the period from 7:00 am to 6:00 pm Monday to Saturday; or 8:00 am to 6:00 pm on Sundays and public holidays; evening is the period from 6:00 pm to 10:00 pm; and night is the remaining periods.
2. To determine compliance with the $L_{Aeq,15\ minute}$ noise limits, noise from the development is to be measured at the most affected point within the residential boundary, or at the most affected point within 30 metres of a dwelling where the dwelling is more than 30 metres from the boundary. Where it can be demonstrated that direct measurement of noise from the project is impractical, the EPA may accept alternative means of determining compliance (see Chapter 7 Noise Policy for Industry - NPfI) The modification factors in Section 4 of the INP must also be applied to the measured noise levels where applicable.
3. To determine compliance with the L_{A1} noise limits, noise from the project is to be measured at 1 metre from the dwelling façade. Where it can be demonstrated that direct measurement of noise from the project is impractical, the EPA may accept alternative means of determining compliance (see Chapter 7 of the NPfI).
4. The noise emission limits identified above apply under meteorological conditions of:

   (i) wind speeds of up to 3 m/s at 10 metres above ground level; or

   (ii) 'F' atmospheric stability class.

2.3 Discussion of assessment noise limits

As noted in Section 2.2, the noise limits detailed in SSD 7628 CoC B80 are applicable not only to all operational noise sources approved under SSD 7628, but are also inclusive of operations as part of the MPE Stage 1 approval for SSD 6766. Importantly, when assessing compliance with these noise limits, the most affected residential receiver for any individual operations will not necessarily be at the same location. Additionally, it is unlikely that the reasonable worst-case noise levels from any individual operations would also occur in the same 15-minute period.

As part of the recent modification application for SSD 7709 Moorebank Precinct West (MPW) – Stage 2, MOD 1 - Building height increase (July 2020), a review of the applicable operational noise requirements across Moorebank Precinct West (MPW) and Moorebank Precinct East (MPE) was undertaken (Renzo Tonin and Associates document reference TJ741-11F05 (r4), dated 30 June 2020). The review identified that there are number of approval conditions that are applicable across both the MPW and MPE sites for operational noise, and that in the application of these approvals to the site activities it became apparent that the operational noise requirements were not consistent across the MPE and MPW sites.

Additionally, the review identified that the operational noise limits across MPE and MPW were set substantially below both the noise criteria and the predicted noise levels (even with feasible and reasonable mitigation measures) established during the environmental assessment stages considering the cumulative operational noise levels from all MPE and MPW operations.

As such, the review recommended that an overall approach for cumulative operational noise management of the Moorebank intermodal terminal precinct (for East and West precinct) for a "whole of complex" approach be adopted, and that consistent noise management objectives for the Moorebank intermodal terminal precinct's operational noise be adopted to cover all operations within MPE and MPW. Appropriate and achievable noise management objectives consistent with EPA's noise policies were also developed in the review.

Following the modification application for SSD 7709 (MOD 1), the submission received from the NSW Environment Protection Authority (NSW EPA) noted the following:

However, the current noise limits are set below the predicted noise levels and are not based on the Project Specific Noise Levels (PSNL) derived under the then-applicable Industrial Noise Policy 2000 (now superseded by the Noise Policy for Industry 2017)…. The EPA considers that the resulting noise limits are not achievable for MPW, nor are they achievable for the cumulative MPW and MPE sites.

Also Liverpool City Council included in their submission:

Council considers that site regulation in regard to noise management may be assisted by adopting a precinct approach consistent with the NSW EPA's Noise Policy for Industry (2017)…. Whilst it is acknowledged that current criteria in the Approval may be impracticable, it will be necessary for the Department to consider applying suitable noise limits that are achievable and capable of protecting the amenity and wellbeing of sensitive receivers.

As such, this operational compliance assessment does not include further quantification of cumulative noise levels, and demonstrates that warehouse operations can achieve the noise limits set out in SSD 7628 CoC B80 in isolation during reasonable worst-case operations.

It is recommended that noise levels from this assessment achieve the required noise limits set out in Table 5 of SSD 7628 CoC B80, and that the site specific noise levels should be considered as part of the operational noise management applicable to the overall Moorebank intermodal terminal precinct.

3 Measurement methodology and results

3.1 Compliance measurement methodology

The Noise Policy for Industry (NPfI) provides guidance in Chapter 7 for monitoring the performance of a noise-generating industrial facility. In Section 7.1.1, the NPfI provides guidance as to how to review noise emissions of a site where the existing ambient noise levels are already high, resulting in the direct quantification of the noise under investigation not being possible via noise measurements at the receiver location. Additionally, it provides guidance about using noise modelling to review the performance of an industrial operation that is co-located with separate but noise-generating industrial sites impacting the same receiver.

Noise measurements undertaken as part of this compliance monitoring established that the existing ambient noise levels at the nearby receiver locations meant that the direct quantification or estimation of operational noise emissions from the warehouse operations was not possible.

As such, because of existing high ambient noise levels at the nearest receivers, in addition to a number of industrial noise-generating facilities being co-located, the noise emissions from the warehouse facility (Target) have been evaluated using a combination of on-site attended and unattended noise monitoring, combined with noise modelling, in order to quantify the industrial noise emissions from Target operations. To satisfy the requirements of CoC B85, the following noise monitoring and assessment steps have been undertaken:

1. attended noise monitoring at nearby residential receivers to review existing noise levels and to determine if operational noise emissions are quantifiable (Section 3.3)
2. on-site attended monitoring of noise-generating activities to quantify noise emission levels of mechanical plant and other noise-generating activities as part of typical warehouse operations (Section 3.4)
3. unattended noise monitoring for a period of two weeks, with concurrent video, to identify the reasonable worst-case operational scenarios for each major noise-generating area (Section 3.5).

Following the noise monitoring, the following steps were undertaken to assess the noise level contributions at the nearby sensitive receivers:

4. review observations of warehouse operations, in addition to the noise monitoring results and associated video, to then determine the reasonable worst-case operational scenarios
5. setup and calibrate the noise model for the reasonable worst-case operational scenarios
6. calculate the operational noise levels from the warehouse operations to all nearby receivers and determine the noise level contribution at the property with the highest noise levels within each NCA.

3.2 Instrumentation

A range of noise monitoring equipment was used to undertake the compliance noise monitoring. A summary of measurement equipment and calibration dates is provided in Table 3.

All of the noise monitoring equipment are Class 1 instruments, with calibration certificates current at the time of the measurements. Before and after each series of attended measurements, the calibration of the sound level meters were verified using a reference calibration of 94 dB at 1 kHz. The difference between pre- and post-calibration levels was within 0.5 dB for all measurements.

Table 3 Noise measurement equipment

Monitoring location/ purpose	Equipment	Serial No	Last date calibrated
Receiver attended noise measurements	NTi XL2	A2A-13500-E0	17/01/2020
On-site attended noise measurements	NTi XL2	A2A-02386-D2	08/07/2019
Unattended on-site noise measurements (Target North)	NTi XL2	A2A-16821-E0	25/11/2019
Unattended on-site noise measurements (Target South)	NTi XL2	A2A-08004-E0	01/11/2018
Field calibration	B&K 4231	2677710	16/03/2020

3.3 Receiver attended noise measurement results

As detailed in Section 1.2, the nearest residential receivers to the Target warehouse site are located in the suburbs of Casula, Glenfield, Wattle Grove and Wattle Grove North.

As the most intensive period of operational activities at the WH1 (Target) was during the morning period from 5:00 am, attended noise measurements were performed at the nearest residential receiver locations between 5:30 am and 8:00 am on 7 September 2020. These measurements were undertaken concurrently with on-site noise measurements (see Section 3.4) to confirm that noise intensive activities were occurring on-site during the receiver noise measurements.

Attended noise measurements were undertaken at six potentially noise affected residential receivers in the surrounding residential noise catchment areas. These included nearby residential receiver locations and the locations of the permanent noise monitoring terminals that are established in the suburbs surrounding MLP.

A summary of the monitoring locations and the approximate distance to the warehouse (Target) is provided in Table 4. The locations and noise catchment areas (NCAs) are presented in Figure 2.

The results of the attended measurements conducted on 7 September 2020 are presented in Table 5.

Table 4 Receiver attended noise monitoring locations

Monitoring location ID	Monitoring location (applicable NCA) (see Figure 2)	Approximate distance (m) from warehouse (Target)
M1	25 Yallum Ct, Wattle Grove (Wattle Grove – NCA1)	1,350
M2	39 Glenelg Court, Wattle Grove (Wattle Grove North – NCA2)	620
M3	St Andrews Park, Casula (Casula – NCA3)	900
M4	26 Goodenough St, Glenfield Glenfield – NCA4)	2,650
M5	31 Martindale Court, Wattle Grove (Wattle Grove – NCA1)	1,020
M6	14 Dunmore Crescent, Casula (Casula – NCA3)	1,100

In all cases, the measured $L_{Aeq(15minute)}$ noise levels at the residential receivers, noise from the direction of the Target warehouse on-site activities was not audible and/or distinguishable. The noise measurements at each residential receiver location was dominated by noise from sources outside of the MPE operations, mainly dominated by traffic noise levels from nearby arterial roads.

Since the Target noise emissions were not audible, it was not possible to estimate the industrial noise contribution from the facility at the nearest residential receivers from these measurements.

3.3.1 Meteorological conditions

Meteorological conditions during the period of the receiver attended noise measurements has been reviewed to determine the prevailing wind and temperature inversion conditions. Data from the meteorological data monitoring station adjacent to Moorebank Avenue, within the MPE site, established in accordance with CoC A54 SSD 7709 has been reviewed. It was determined from the review that the attended noise measurements were undertaken under periods with worst-case prevailing meteorological conditions in accordance with SSD7628 B80.

The meteorological conditions experienced during receiver attended noise measurement on 7 September 2020 are summarised as:

- During the measurement period, the temperature inversion conditions between the period of 5:30 am 2 September 2020 and 7:30 am 2 September 2020 were generally Class F temperature inversion (> 95% of the measurement period), based upon calculations using the sigma-theta method referred to in Fact Sheet D of the NPfI;

- During the measurement period at the facility, the equivalent average wind speed was 0.5-1 m/s and generally from the SSW, varying from SE to W. The measurements were not impacted by excessive wind during any of the measurement periods;

- No rain occurred during any of the measurement periods; and

- The temperature during the measurement period ranged between 12˚C and 16˚C, and the cloud conditions were generally clear skies with a few scattered clouds.

Figure 2 Attended residential receiver noise monitoring locations

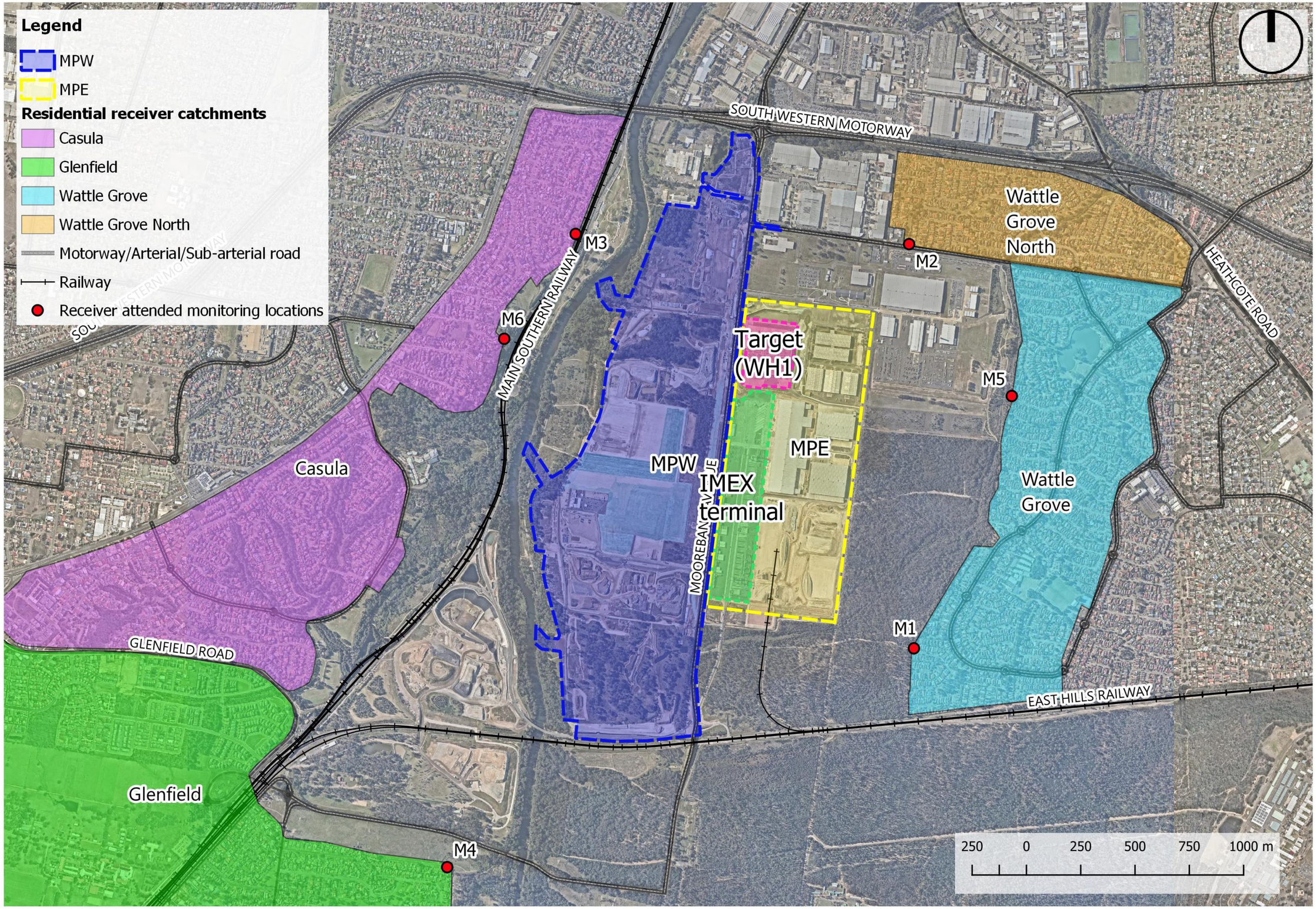


Table 5 Summary of attended noise measurement results at the nearest sensitive residential receivers

ID	Address	Noise limit, dB(A)		Measurement period	Measured noise level (15 minute), dB(A)				Estimated MPE operational noise contribution, dB(A)		Comments and measured noise levels from typical events	Target Noise Audible?
		$L_{A1,\ 1\ minute}$	$L_{Aeq,\ 15minute}$		L_{Amax}	L_{A1}	L_{Aeq}	L_{A90}	$L_{A1,\ 1\ minute}$	$L_{Aeq,\ 15minute}$		
M1 - Wattle Grove												
1	25 Yallum Ct, Wattle Grove	52	35	07/09/2020 7:23 am to 7:38am	78	62	54	48	Note 1	Note 1	Ambient noise environment dominated by noise from road traffic at north west: Construction 54-57dB(A), bird 65-69dB(A), dog 50-56dB(A), rail traffic 49-52dB(A).	No
M2 - Wattle Grove North												
2	39 Glenelg Court, Wattle Grove North	52	35	07/09/2020 6:53 am 7:08 am	79	76	68	54	Note 1	Note 1	Ambient noise environment dominated by noise from Anzac Rd: Road traffic 79-80dB(A), Bird 60-62dB(A), Moorebank Ave traffic 54-55dB(A)	No
M3 – Casula												
3	St Andrews Park, Casula	52	35	07/09/2020 5:28 am 05:45 am	78	75	60	50	Note 1	Note 1	Ambient noise environment dominated by noise from M5 Motorway: Road traffic 50-51, Rail traffic 75-78dB(A), Bird 66-67dB(A)	No
M4 – Glenfield												
4	26 Goodenough St, Glenfield	52	35	07/09/2020 6:23 am to 6:38 am	67	59	56	54	Note 1	Note 1	Ambient noise environment dominated by noise from Cambridge Ave: Road traffic 53-55dB(A), Bird 55-67dB(A), Dog barking 59-60dB(A), Rail traffic 59-60dB(A)	No
NMT 03 – Wattle Grove												
5	31 Martindale Court, Wattle Grove	52	35	07/09/2020 7:17 am to 7:31 am	69	61	54	52	Note 1	Note 1	Ambient noise environment dominated by noise from Road traffic from north west: Road traffic 54-55dB(A), Dog barking 64-69dB(A)	No
NMT 04 – Casula												
6	14 Dunmore Crescent, Casula	52	35	07/09/2020 5:53am to 6:09 am	69	56	51	49	Note 1	Note 1	Ambient noise environment dominated by noise from M5 Motorway: Road traffic 49-50dB(A), Rail traffic 53-54dB(A), Birds 68-69dBA	No

Notes: 1: Since noise levels from the MLP were not audible during the measurement period, it was not possible to estimate the MLP noise contribution

3.4 On-site attended operational activity noise measurement results

Attended noise measurements of individual operational items and typical operations were undertaken at Target on the 7 September 2020, in order to quantify the noise emissions from noise-generating operational activities. These noise levels have been used to assist in establishing the source noise levels in the noise model.

During all measurements, the specific noise source being measured was the dominant noise source. Observations were made of the on-site operations, which have then been reviewed in conjunction with the video data to model 'reasonable' worst-case operational scenarios over the assessment periods. Critical on-site attended measurement results are summarised in Table 6.

Table 6 On-site attended measurement results (7 September 2020)

Activity noise sources	Time	Measurement duration (t), sec	Measurement distance, m	Measured noise levels, dB(A)	
				$L_{Aeq(t)}$	L_{AFmax}
Truck					
Truck pass-by	6:02 am	16	10	65	67
Truck Idling	5:44 am	30	13	59	59
Truck reversing beeper	6:48 am	5	7	76	80
Air brake release	6:20 am	2	9.5	79	83
Combi-lift					
Grabbing & dropping sound	7:19 am	2	44	67	71
Engine revving	7:19 am	10	23	75	76
Engine	7:20 am	20	38	60	61
Reverse beeper	7:19 am	12	23	71	74
Loading					
Loading activity	5:27 am	13	28	62	70
Forklift					
Forklift horn	8:03 am	1	7	89	84
Internal warehouse noise levels (noise breakout)					
Internal noise sources at loading dock door (radio, internal conveyors)	8:30 am	60	At loading dock doorway	65	75
Mechanical plant					
Warehouse smoke exhaust fan[1]	7:51 am	15	11	62	62
Air condenser unit	11:30 am	60	1	77	77

Notes: 1. Internal noise levels within the Target warehouse meant that fan noise levels were not audible or quantifiable from accessible locations, and so fan noise levels are based upon Internal noise measurement undertaken at ATS Building Products warehouse, 16 September 2020, as similar model fans are installed within that warehouse.

3.5 Unattended noise measurements

Unattended noise measurements were undertaken over the period between 2 September and 15 September 2020 at a location adjacent to the Target office building on both side of the warehouse. Three main areas of noise-generating operations were identified across the warehouse site, one on the northern side of the warehouse and two on the southern side. These are shown in Figure 3.

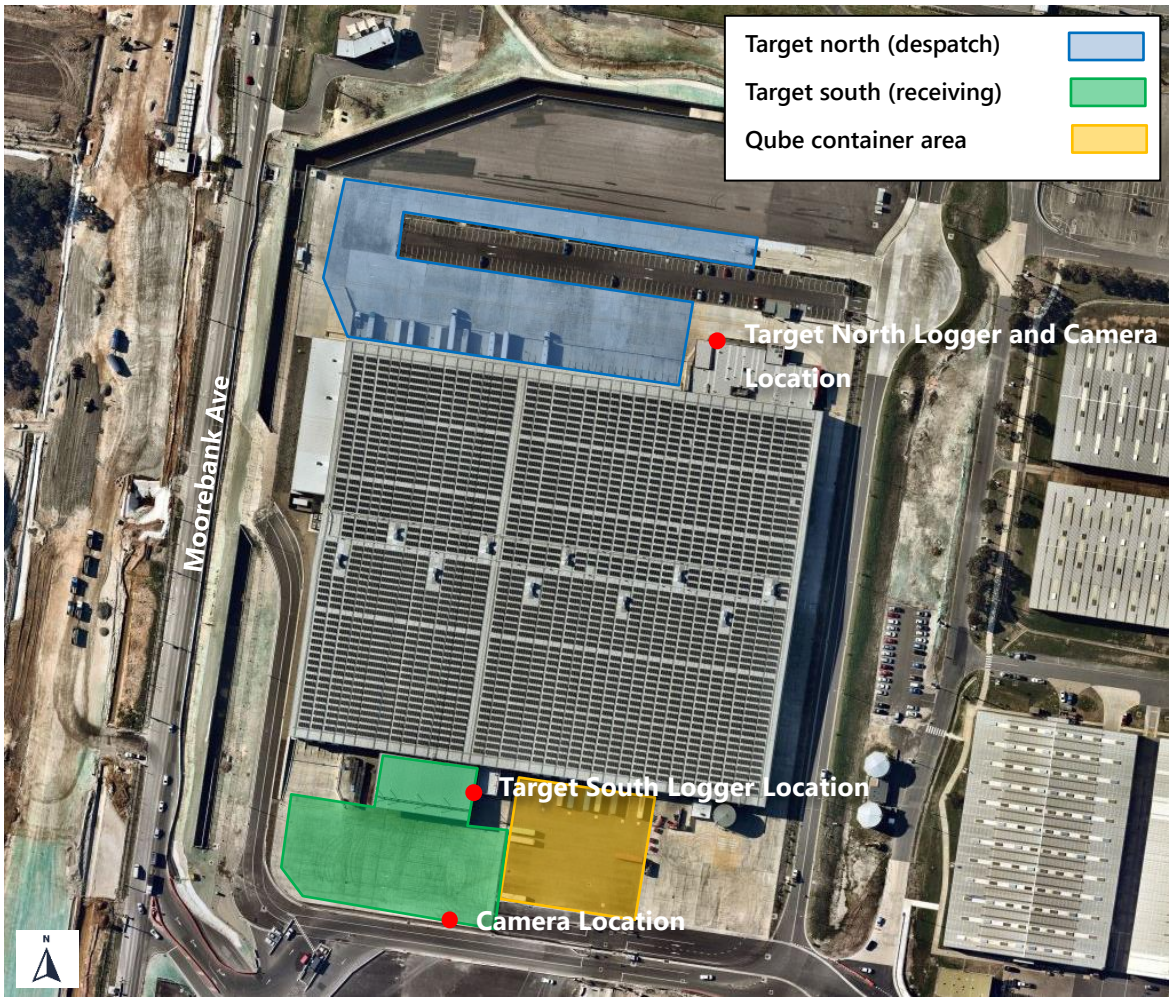
The location of the unattended noise loggers is shown in Figure 3. These were selected so that they would capture noise from the main noise-generating areas as part of the typical warehouse operations. Camera units were setup at the noise logger location at Target north and the southern boundary fence at Target south to assist the engineers in gaining a comprehensive understanding of the site operations and truck movements.

The purpose of the noise logging at the selected locations was for the following:

- Determine the noise emissions from the facility at a fixed location close enough to quantify on-site sources;
- Determine the long-term background noise levels when operations were not taking place at the site;
- A source for analysis to determine duration and nature of the different on-site activities through correlation with the Facility activity data; and
- Source of validation for the noise model calibration process.

Detailed unattended noise monitoring results are provided in APPENDIX B for Target North and APPENDIX C for Target South. The noise model was validated using the unattended noise logger results, refer to refer to Section 3.7 for noise model calibration.

Figure 3 Unattended noise logger locations and main noise generation areas (imagery: Nearmap, 2020)



It is noted that MLP operates four continuous noise monitoring stations located in the surrounding residential noise catchment areas, as per Section 4.1.2 of the MPE ONVMP. Following the attended noise measurements presented in Section 3.3, which found that the warehouse noise emissions were not audible at the nearby residential receivers locations, and as such further analysis of the data from the continuous noise monitoring stations were not undertaken.

3.6 Modelled operational scenarios

3.6.1 Observed operations for modelling

Based upon the on-site attended measurements presented in Section 3.4, the video recording for the facility over the unattended monitoring period presented in Section 3.5, and discussions with Target personnel, 'reasonable' worst-case operational scenarios were established and modelled to satisfy the assessment periods under SSD 7628.

The following section describes the details the key observations of each of the noise-generating activities that take place across the warehouse operations.

3.6.1.1 Truck and despatching operations (Target north and south)

The following data on truck operations was obtained from the site observations during the attended and unattended noise measurements, and from the video data recoded between 2 September and 15 September 2020.

- It was observed and confirmed by video movement data, that truck operations were typically B-Double trucks, and that a typical 'in-and-out' cycle time in the facility was on median 20 minutes, with each loading and unloading cycle taking approximately 5-10 minutes;

- Based upon the attended noise measurement, trucks going to the Target south area pass through the Target north despatching area with a relative low speed of less than 10km/h.

- The maximum number of trucks using the loading dock were observed to be two simultaneously, which was confirmed for all periods through analysis of the video data and unattended noise logger. As such, the reasonable worst-case would be 2 loading events concurrently.

- Air-brake releases would occur when the trucks arrived on site and stopped at the gate, and also when they stopped after moving into the docks. Reversing beepers are used when each truck arrives on site. The use of the reversing beepers has been considered within the CadnaA modelling process.

- Truck loading activities typically commence between 5:00am and 5:30am at Target north, however, individual truck movements can occur prior to this (4:00am to 5:00am), however this is not typical and the majority of trucks arrive from 5:00am.

3.6.1.2 Unloading operations at Target south

- It was observed and confirmed by video data, that one unloading activity occurs at a time for each truck upon arrival.

- Based on the video recordings, one or two forklifts are used for unloading operations. In addition, it was noted that unloading operations happen concurrently with truck arrivals.

- Unloading operations from Target south typically commence from 6:00am and are undertaken during the morning period.

3.6.1.3 Qube container handling operational area

- It was observed that one combi-lift is in use to move containers "in and out" of the Target terminal at the Qube operational area. During on-site measurements it was observed that the combi-lift operate could operate continuously throughout a 15-minute period when handling containers.

- Impact noise events associated with grabbing and dropping would occur when the combi-lift gripper contact individual containers as part of handling operations. This sound power level is adopted in the modelling for the sleep disturbance calculations.

- Tonal reversing beepers is used when a combi-lift is undertaking container handling activities.

- Movements of containers within the Qube area can occur throughout the day, evening and night depending upon train arrivals. However, it was observed movements typically started from approximately 6:00am and continued throughout the rest of the morning period.

3.6.2 Assessment noise source levels

Source levels for the key noise-generating activities on-site have been established based upon the attended noise measurements (Section 3.4) and unattended noise measurements (Section 3.5) during periods of typical operation. The sound power level inputs presented in Table 7 were used in the operational noise compliance modelling, and adjusted for the duration and frequency of operations in accordance with the operations described in Section 3.6.3.

Table 7 Assessment noise source levels

Site items / operation	Individual activity sound power level (SWL) (L_{Aeq}), dB(A)
Target North	
Trucks accelerating on site[1]	107
Trucks idling on site/no engine load movement	98
Trucks reversing beeper	105
Truck airbrake event (L_{Amax})	117[4]
Loading activity[3]	92
Target South	
Forklift horn (L_{Amax})	109
Container combi-lift (moving container activity)	103
Container gripping & drop (L_{Amax})	114
Internal noise breakout	
Internal noise breakout via Target South loading dock door	79
Mechanical Plant	
Warehouse air smoke exhaust fan[2]	90
Air condenser unit (warehouse façade west)	85

Notes:

1. The source level for truck have been categorised into two separate sound power levels due to trucks accelerate after passing speed bumps
2. Loading is intermittent activity typically 2 minutes out of 15 minutes of noise-generating activities
3. Based upon internal measurement
4. The airbrakes levels of the fleet were often lower than this measured level, typically SWL 111dB(A).

3.6.3 Reasonable worst-case intrusiveness scenarios (15-minute period)

As the noise limits in CoC B80 are set at 35 dB(A) $L_{Aeq\ 15\ minute}$ for each of the day, evening and night periods, specific separation of noise intensive periods for each of these time periods has not been undertaken. Instead, it is noted that there are three main areas of noise generation as part of typical warehouse operations, as presented in Figure 3.

In order to assess the operational noise emissions from the warehouse, the 'reasonable' worst-case operations for each of the three main areas of noise generation have been developed, along with the corresponding activities in the other noise-generating areas, in order to review a representative snapshot of activities from the warehouse operations. Each of the assessment scenarios have been developed from an analysis of the video movement data over during the two-week period, in addition to the information detailed in Section 3.6.1.

As activities at Target North can occur prior to 6:00am, a representative scenario has been selected to assess a 'reasonable' worst-case scenario prior to 6:00am. The most noise-intensive period for Target North can occur concurrently with noise intensive activities within the Qube container area in the morning period at 7:00am. The Target south activities commence from 6:00am, and are most noise-intensive around the 8:00am period. As such, these three periods representing the 'reasonable' worst-case operations have been used to assess operational noise emissions.

Table 8 details the three 'reasonable' worst-case scenarios (15-minute period), covering the noise intensive periods for the three main areas of noise generation across the site.

All significant noise-generating equipment has been included the assessment modelling, in addition to the key noise-generating mechanical plant as required by CoC B85. It is noted that the noise contribution from the mechanical plant items serving the warehouse and office area are included in the modelling, however, they generate minimal contribution to the overall noise levels from site operations , which are controlled by other on-site activities such as truck departures, arrivals and loading activities.

Table 8 Representative 'reasonable' worst-case 15-minute intrusive assessment scenarios

Activity	Target North 15-minute assessment period	Target South 15-minute assessment period	Qube Container Area
Target north noise intensive period (Prior to 6:00 am)			
Departure	One truck moves out from despatch area at the 15-minute assessment period, internal movement speed approximately 10km/h and stop at Target entry gate.	No activity	No activity
Arrival	One truck move into the loading area during the 15-mintute assessment period, truck movement speed approximately 10km/h, stop with air brake release, and idle for 1 minute at loading dock.	No activity	No activity
Operations	Two docks are loading concurrently at Target north. a) Dock 15 b) Dock 10	No activity	No activity
Target south noise intensive period (Morning peak – 6:00am to 9:00am)			
Departure	Two trucks departure from Target south receiving area at 15-minute assessment period.	One truck departure from south Target during 15-minute assessment period.	No activity
Arrival	No activity	Two trucks movement were observed during 15-minute assessment period. Trucks movement speed approximately 10km/h, stop with air brake release and average 1-minute reversing beeper.	No activity
Operations	One dock is loading at 15-minute assessment period.	One unloading activity at receiving dock and Internal warehouse noise breakout.	No activity
Qube container area noise intensive period (Morning peak – 6:00am to 9:00am)			
Departure	Two trucks departure form Target south passing Target north approaching entrance gate at approximately 10km/h.	One truck departure from south Target during 15-minute assessment period.	No activity
Arrival	Two truck arriving at the loading dock.	One truck arrives at dock R1	No activity
Operation	One dock is loading at Target north. a) Dock 10	One unloading activity at receiving dock and Internal warehouse noise breakout	One Combi-lift operating for the period of 15 minute. a) Transferring containers in and out of the site at 10km/h. b) Gripping and dropping containers at Target south terminal.
Mechanical plant			
a) Roof top exhaust fan (10 fans) b) Office condenser (4 units) c) Warehouse air condenser (4 units)			

3.7 Modelling methodology

3.7.1 Overview of noise modelling

Since noise levels from the warehouse operations were not audible at the nearest residential receivers, and it was not possible to directly measure or estimate the warehouse noise contribution directly, computer noise modelling was used to calculate the operational noise levels from warehouse operations at the nearby noise sensitive receivers.

3.7.2 General modelling assumptions

Modelling and assessment of warehouse noise emissions was determined by modelling the noise sources, receiver locations, existing built structures and topographical features, using CadnaA (version 2020).

The modelling incorporated the worst-case prevailing meteorological conditions, as required by CoC B80, which are wind speeds of up to 3 m/s at 10 metres above ground level or stability category 'F' temperature inversion conditions.

The noise predictions are based on the CONCAWE noise prediction algorithms, noting that the nearby noise sensitive receivers are greater 100 metres from the site (except for MPW). The CONCAWE environmental noise prediction method is an appropriate method for predicting the noise propagation in these circumstances.

The noise prediction model considers:

- Location of noise sources on-site sensitive receiver locations
- Height of sources and receivers referenced to digital ground contours within the site and outside the site area
- Noise source levels of individual plant, equipment and internal building noise levels, modelled as either point, line or area noise sources. All noise sources associated with the Target operations within the MPE boundary have been included in the noise modelling, including the truck movements outside of the WH1 Target warehouse footprint, along internal MPE roads.
- Separation distances between sources and receivers
- Ground type between sources and receivers (mixed soft/ hard)
- Attenuation from buildings and built structures and topography (natural and purpose built)
- Atmospheric losses and assessment meteorological conditions.

The modelled activities and assumptions for the to the equipment operating and the duration and frequency of operation as part of the 'reasonable' worst-case operational scenarios are described in Section 3.6.3.

3.7.3 Model validation

Following the development of each of the modelling scenarios, the noise model outputs were compared with unattended noise measurement results for the period equivalent to the reasonable' worst-case operational scenario. Validation of the reasonable worst-case on-site activities was undertaken to check the final modelling inputs against the representative period, with the results of this process presented in Table 9.

Table 9 Comparison between measured and modelled noise levels

Time period	Logger	Measured noise levels $L_{Aeq,15minute}$ (dB(A))	Predicted noise levels $L_{Aeq,15minute}$ (dB(A))	Difference, dB(A)
5:20 am – 5:35 am 07 September 2020	North Target	56	56	< 1
8:00 am – 8:15 am 03 September 2020	South Target	67	65	2
7:20 am – 7:35 am 7 September 2020	Qube Area	69	68	1

The differences between the modelled and the measured noise levels are the result of the following:

- Noise levels at the logger location are dependent upon the specific location of loading activities and which dock is being used by a truck at Target North. Differences in modelled levels compared with measured noise levels will likely depend upon variations in the specifically used dock.

- Modelled levels for unloading activities were based upon a worst-case average sound power level for a range of measured unloading activities. In addition at Target south, noise contribution from forklift operations, which varied in duration and location compared to the logger location throughout the activity, which would result in minor differences in measured noise levels.

The results from the validation of the model demonstrates that it is suitable for determining the compliance noise levels for this assessment.

3.8 Noise compliance assessment

Predicted operational compliance noise levels are presented in Table 10 for each of the three compliance assessment scenarios. The noise levels have been predicted to each of the surrounding residential receiver noise catchments, and the highest residential receiver noise level in each catchment area is the reported level in Table 10. It should be noted that this is not necessarily the same receiver location for each assessment scenario.

These noise levels represent the reasonable worst-case intrusiveness operational scenarios (15-minute period) from typical operations of the warehouse. The results in Table 10 show that the predicted noise

levels for both the $L_{Aeq\ (15\text{-}minute)}$ and $L_{A1\ (1\text{-}minute)}$ assessments comply with the overall operational noise limits presented in Table 2.

Table 10 Predicted noise levels - Reasonable worst-case scenarios for warehouse (Target)

Noise catchment area/ receiver location	$L_{Aeq\ (15\text{-}minute)}$		Compliance	$L_{A1\ (1\text{-}minute)}$		Compliance
	Noise limits	Predicted noise levels		Noise limits	Predicted noise levels	
Target north noise intensive period (Prior to 6:00 am)						
Wattle Grove (NCA 1)	35	24	Yes	52	32	Yes
Wattle Grove North (NCA 2)	35	29	Yes	52	34	Yes
Casula (NCA 3)	35	30	Yes	52	36	Yes
Glenfield (NCA 4)	35	< 20	Yes	52	18	Yes
All Saints Senior College (S1)	45[1]	22	Yes	-	N/A	N/A
Casula Powerhouse (S2)	45[1]	30	Yes	-	N/A	N/A
Defence Joint Logistics Unit (DJLU) (I2)	70[1]	43	Yes	-	N/A	N/A
ABB (I3)	70[1]	34	Yes	-	N/A	N/A
Target south noise intensive period (Morning peak – 6:00am to 9:00am)						
Wattle Grove (NCA 1)	35	24	Yes	52	32	Yes
Wattle Grove North (NCA 2)	35	26	Yes	52	34	Yes
Casula (NCA 3)	35	29	Yes	52	38	Yes
Glenfield (NCA 4)	35	< 20	Yes	52	23	Yes
All Saints Senior College (S1)	45[1]	24	Yes	-	N/A	N/A
Casula Powerhouse (S2)	45[1]	31	Yes	-	N/A	N/A
Defence Joint Logistics Unit (DJLU) (I2)	70[1]	42	Yes	-	N/A	N/A
ABB (I3)	70[1]	33	Yes	-	N/A	N/A
Qube container area noise intensive period (Morning peak – 6:00am to 9:00am)						
Wattle Grove (NCA 1)	35	26	Yes	52	32	Yes
Wattle Grove North (NCA 2)	35	27	Yes	52	34	Yes
Casula (NCA 3)	35	31	Yes	52	38	Yes
Glenfield (NCA 4)	35	< 20	Yes	52	23	Yes
All Saints Senior College (S1)	45[1]	26	Yes	-	N/A	N/A
Casula Powerhouse (S2)	45[1]	32	Yes	-	N/A	N/A
Defence Joint Logistics Unit (DJLU) (I2)	70[1]	46	Yes	-	N/A	N/A
ABB (I3)	70[1]	35	Yes	-	N/A	N/A

Notes; 2. Noise limits for these receivers are only applicable when the receiver is in use

4 Conclusion

The noise assessment has been undertaken to address the operational noise requirements for the Target warehouse (WH1) within the Moorebank Precent East in accordance with the *Operational Noise and Vibration Management Plan, Moorebank Logistics Park – East Precinct* (dated 27 March 2019, Revision 12) (MPE ONVMP), more specifically to address the requirements of Condition of Consent (CoC) B85 in State Significant Development (SSD) 7628.

As part of the compliance noise assessment, a series of noise measurements were undertaken over a two week period. Unattended noise monitoring was undertaken at two locations within the Target warehouse over a period of two weeks between 2 September and 15 September 2020. In addition, attended noise measurements were also undertaken on the 7 September at the nearest residential receivers and as well as within the Target warehouse site. The aim of the measurements was to quantify operational noise levels at both the nearby residential receivers and confirm operational noise levels on site.

The attended noise measurements were undertaken on 7 September 2020 as part of this compliance monitoring established if noise levels from warehouse operations were quantifiable at nearby receivers. These measurements determined that the existing ambient noise levels at the nearby receiver locations were too high for direct quantification or estimation of operational noise emissions from the warehouse operations.

As such, the noise compliance assessment has been demonstrated compliance in accordance with the guidance in the NSW EPA Noise Policy for Industry (NPfI) Chapter 7 for monitoring performance of a noise-generating industrial facility when the existing ambient noise levels are already high and the noise under investigation noise cannot be directly quantified via noise measurements at the receiver location.

As such, noise emissions from the warehouse facility operations have been evaluated using a combination of on-site attended and unattended noise monitoring, combined with noise modelling.

Three 'reasonable' worst-case assessment scenarios were established based upon on site unattended noise monitoring and video recording over an approximate two-week period, in addition to discussions with Target personnel and observations made during on-site attended noise measurements. These were developed to capture the early morning activities prior to 6:00am, and reasonable worst-case noise-generating activities. All significant noise-generating equipment was included the assessment modelling, in addition to the key noise-generating mechanical plant as required by CoC B85. The noise contribution from the mechanical plant items serving the warehouse and office area are included in the modelling, however, they generate minimal contribution to the overall noise levels from site operations , which are generally controlled by other on-site activities such as truck departures, arrivals and loading activities.

Using the calibrated noise model, noise levels were predicted to all nearby noise sensitive receiver locations, including the residential receivers in the suburbs of Casula, Glenfield, Wattle Grove and Wattle

Grove North. Noise levels were assessed assuming the worst-case prevailing meteorological conditions were present, as required by CoC B80.

The outcome of the compliance noise monitoring and modelling demonstrated that the mechanical plant and other noisy equipment that operate as part of the Target warehouse operations achieve the noise limits presented SSD 7628 CoC B80, which is consistent with the noise emission review undertaken prior to construction to satisfy CoC B84.

APPENDIX A Glossary of terminology

The following is a brief description of the technical terms used to describe noise to assist in understanding the technical issues presented.

Adverse weather	Weather effects that enhance noise (that is, wind and temperature inversions) that occur at a site for a significant period of time (that is, wind occurring more than 30% of the time in any assessment period in any season and/or temperature inversions occurring more than 30% of the nights in winter).
Ambient noise	The all-encompassing noise associated within a given environment at a given time, usually composed of sound from all sources near and far.
Assessment period	The period in a day over which assessments are made.
Assessment Point	A point at which noise measurements are taken or estimated. A point at which noise measurements are taken or estimated.
Background noise	Background noise is the term used to describe the underlying level of noise present in the ambient noise, measured in the absence of the noise under investigation, when extraneous noise is removed. It is described as the average of the minimum noise levels measured on a sound level meter and is measured statistically as the A-weighted noise level exceeded for ninety percent of a sample period. This is represented as the L90 noise level (see below).
Decibel [dB]	The units that sound is measured in. The following are examples of the decibel readings of common sounds in our daytime environment:

threshold of hearing	0 dB	The faintest sound we can hear
	10 dB	Human breathing
almost silent	20 dB	
	30 dB	Quiet bedroom or in a quiet national park location
generally quiet	40 dB	Library
	50 dB	Typical office space or ambience in the city at night
moderately loud	60 dB	CBD mall at lunch time
	70 dB	The sound of a car passing on the street
loud	80 dB	Loud music played at home
	90 dB	The sound of a truck passing on the street
very loud	100 dB	Indoor rock band concert
	110 dB	Operating a chainsaw or jackhammer
extremely loud	120 dB	Jet plane take-off at 100m away
threshold of pain	130 dB	
	140 dB	Military jet take-off at 25m away

dB(A)	A-weighted decibels. The A- weighting noise filter simulates the response of the human ear at relatively low levels, where the ear is not as effective in hearing low frequency sounds as it is in 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.
dB(C)	C-weighted decibels. The C-weighting noise filter simulates the response of the human ear at relatively high levels, where the human ear is nearly equally effective at hearing from mid-low frequency (63Hz) to mid-high frequency (4kHz), but is less effective outside these frequencies.

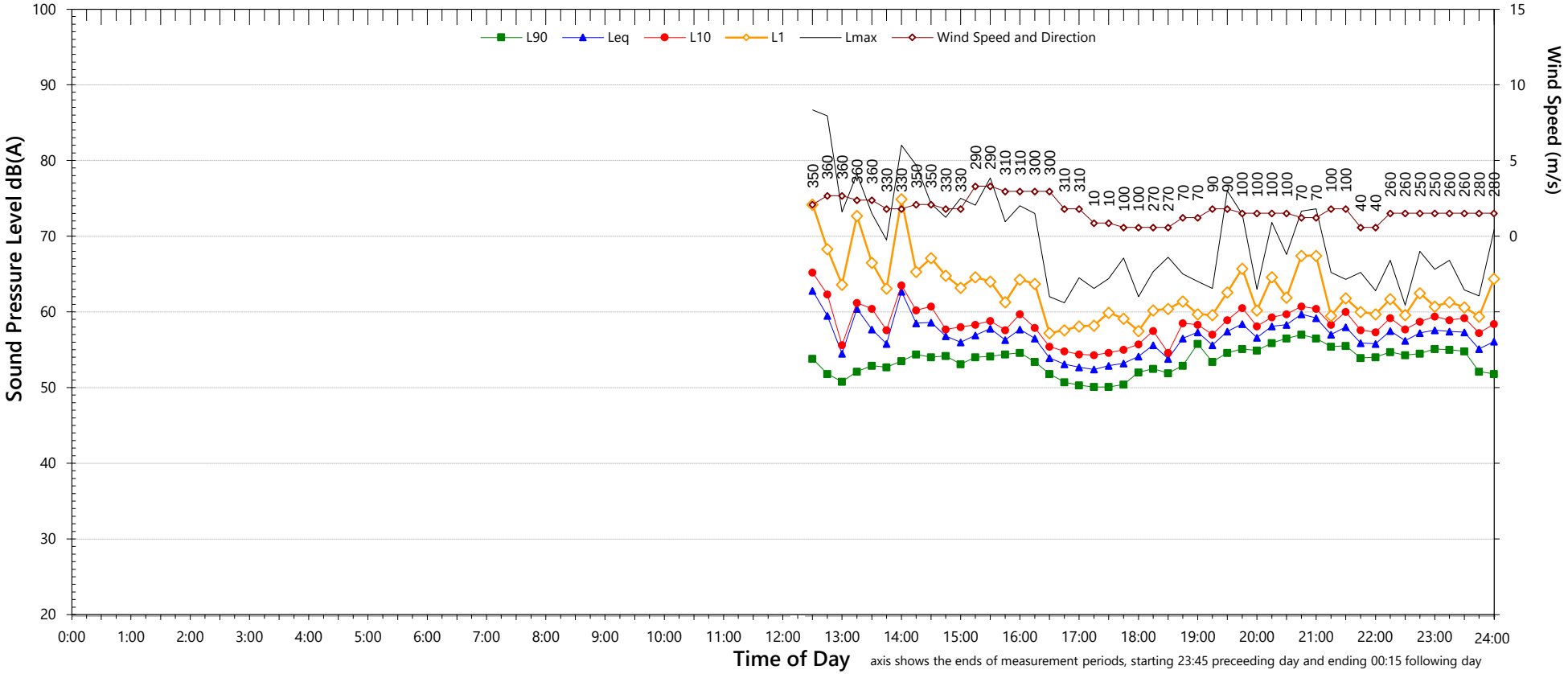
Frequency	Frequency is synonymous to pitch. Sounds have a pitch which is peculiar to the nature of the sound generator. For example, the sound of a tiny bell has a high pitch and the sound of a bass drum has a low pitch. Frequency or pitch can be measured on a scale in units of Hertz or Hz.
Impulsive noise	Having a high peak of short duration or a sequence of such peaks. A sequence of impulses in rapid succession is termed repetitive impulsive noise.
Intermittent noise	The level suddenly drops to that of the background noise several times during the period of observation. The time during which the noise remains at levels different from that of the ambient is one second or more.
L_{Max}	The maximum sound pressure level measured over a given period.
L_{Min}	The minimum sound pressure level measured over a given period.
L_1	The sound pressure level that is exceeded for 1% of the time for which the given sound is measured.
L_{10}	The sound pressure level that is exceeded for 10% of the time for which the given sound is measured.
L_{90}	The level of noise exceeded for 90% of the time. The bottom 10% of the sample is the L90 noise level expressed in units of dB(A).
L_{eq}	The "equivalent noise level" is the summation of noise events and integrated over a selected period of time.
Reflection	Sound wave changed in direction of propagation due to a solid object obscuring its path.
SEL	Sound Exposure Level (SEL) is the constant sound level which, if maintained for a period of 1 second would have the same acoustic energy as the measured noise event. SEL noise measurements are useful as they can be converted to obtain Leq sound levels over any period of time and can be used for predicting noise at various locations.
Sound	A fluctuation of air pressure which is propagated as a wave through air.
Sound absorption	The ability of a material to absorb sound energy through its conversion into thermal energy.
Sound level meter	An instrument consisting of a microphone, amplifier and indicating device, having a declared performance and designed to measure sound pressure levels.
Sound pressure level	The level of noise, usually expressed in decibels, as measured by a standard sound level meter with a microphone.
Sound power level	Ten times the logarithm to the base 10 of the ratio of the sound power of the source to the reference sound power.
Tonal noise	Containing a prominent frequency and characterised by a definite pitch.

APPENDIX B Logger location 1 – Target - North side

Unattended Noise Monitoring Results

Target North

Wednesday, 2 September 2020



axis shows the ends of measurement periods, starting 23:45 preceeding day and ending 00:15 following day

NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{90}	-	53	48
LAeq	-	57	58

Night Time Maximum Noise Levels			(see note 7)
L_{Max} (Range)	71	to	85
L_{Max} - L_{eq} (Range)	16	to	21

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{eq\ 15\ hr}$ and $L_{eq\ 9\ hr}$	60	61
$L_{eq\ 1hr}$ upper 10 percentile	62	64
$L_{eq\ 1hr}$ lower 10 percentile	57	56

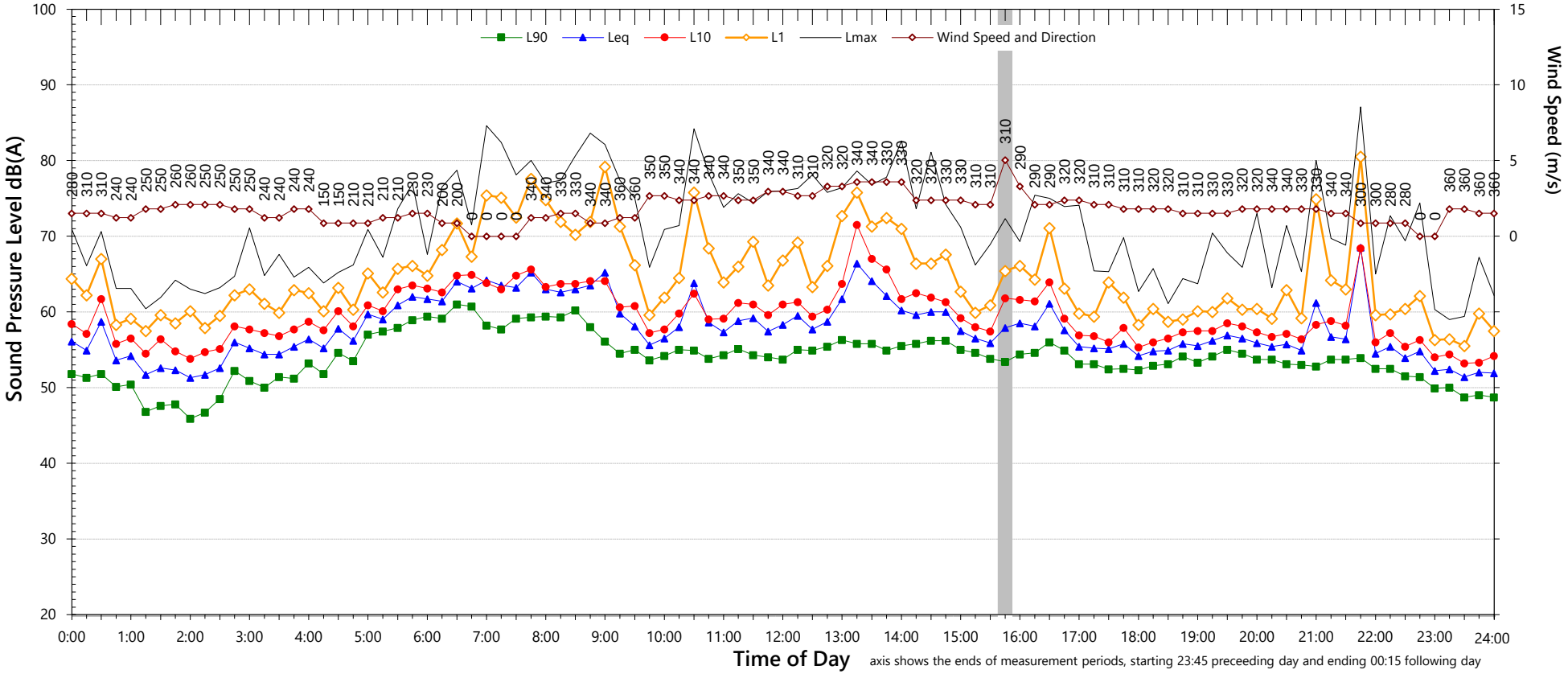
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am til 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. Night time L_{Max} values are shown only where L_{Max} >65dB(A) and where L_{Max}- Leq ≥15dB(A)
8. Meteorological data has been sourced from the nearest Bureau of Meteorology station (Holsworthy Aerodrome AWS)

Unattended Noise Monitoring Results

Target North

Thursday, 3 September 2020



axis shows the ends of measurement periods, starting 23:45 preceeding day and ending 00:15 following day

NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{90}	53	53	49
LAeq	61	59	57

Night Time Maximum Noise Levels			(see note 7)
L_{Max} (Range)	67	to	82
L_{Max} - L_{eq} (Range)	15	to	21

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{eq\ 15\ hr}$ and $L_{eq\ 9\ hr}$	63	60
$L_{eq\ 1hr}$ upper 10 percentile	66	62
$L_{eq\ 1hr}$ lower 10 percentile	58	54

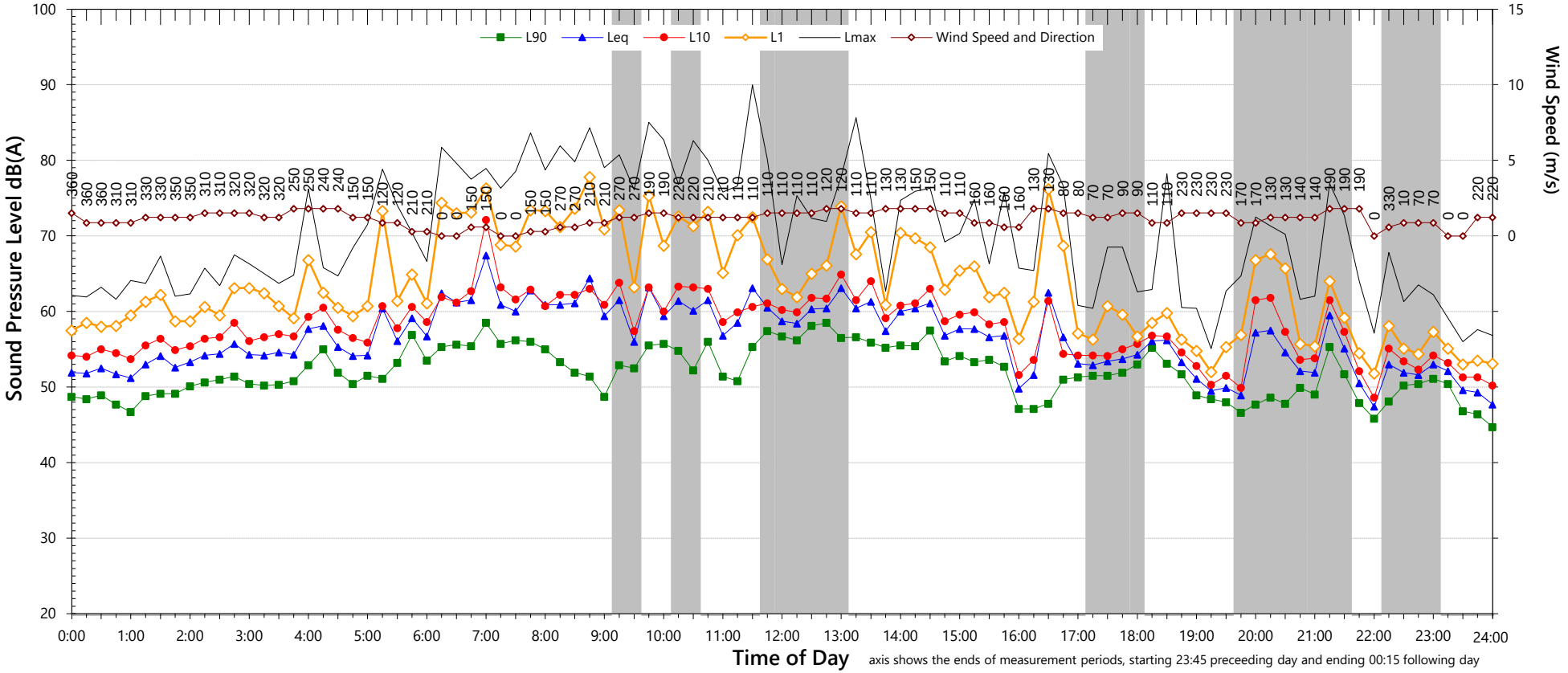
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am til 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. Night time L_{Max} values are shown only where L_{Max} >65dB(A) and where L_{Max}- Leq ≥15dB(A)
8. Meteorological data has been sourced from the nearest Bureau of Meteorology station (Holsworthy Aerodrome AWS)

Unattended Noise Monitoring Results

Target North

Friday, 4 September 2020



axis shows the ends of measurement periods, starting 23:45 preceeding day and ending 00:15 following day

NSW Noise Policy for Industry (Free Field)			
Descriptor	Day[2]	Evening[3]	Night[4 5]
L_{90}	-	-	40
LAeq	-	-	50

Night Time Maximum Noise Levels			(see note 7)
L_{Max} (Range)	72	to	75
L_{Max} - L_{eq} (Range)	15	to	20

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	Day	Night[5]
	7am-10pm	10pm-7am
$L_{eq\ 15\ hr}$ and $L_{eq\ 9\ hr}$	62	53
$L_{eq\ 1hr}$ upper 10 percentile	64	56
$L_{eq\ 1hr}$ lower 10 percentile	53	46

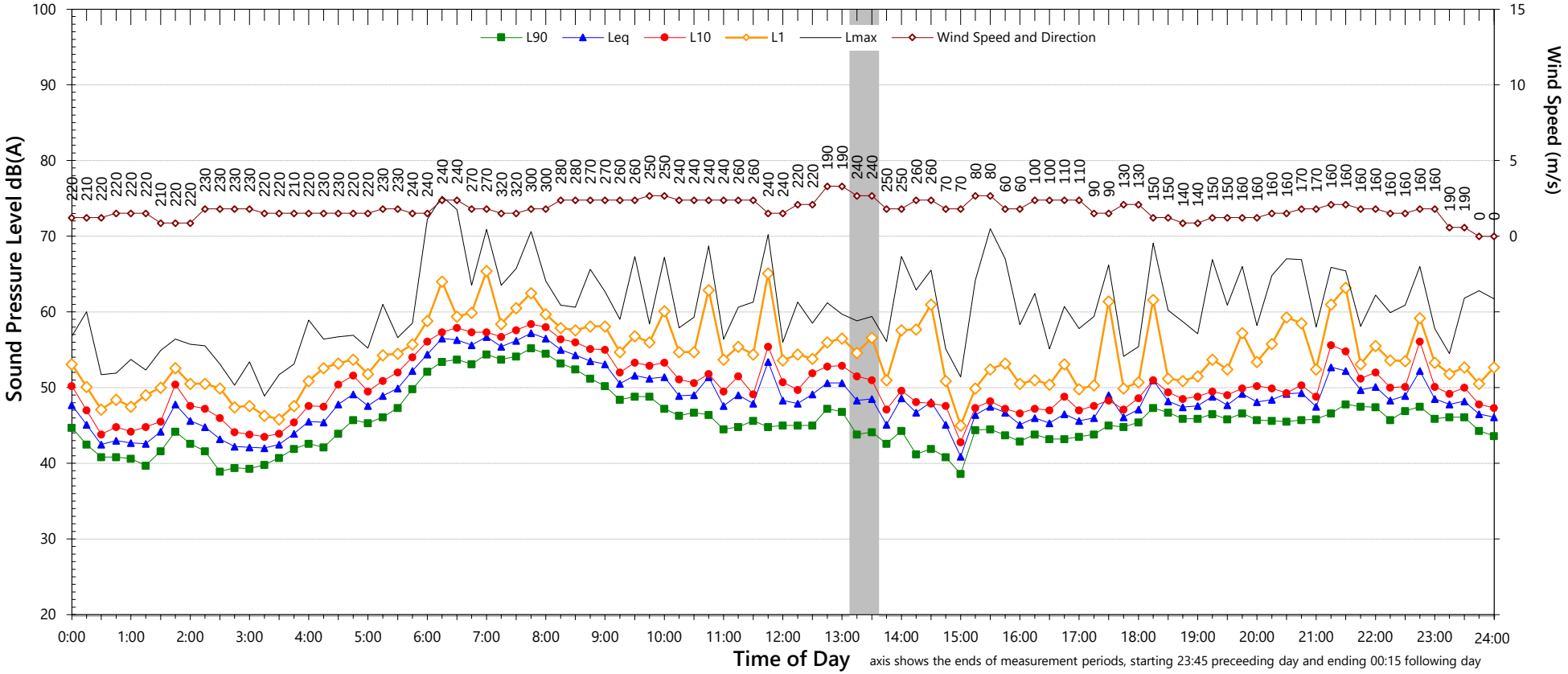
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am til 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. Night time L_{Max} values are shown only where L_{Max} >65dB(A) and where L_{Max}- Leq ≥15dB(A)
8. Meteorological data has been sourced from the nearest Bureau of Meteorology station (Holsworthy Aerodrome AWS)

Unattended Noise Monitoring Results

Target North

Saturday, 5 September 2020



axis shows the ends of measurement periods, starting 23:45 preceeding day and ending 00:15 following day

NSW Noise Policy for Industry (Free Field)			
Descriptor	Day[2]	Evening[3]	Night[4 5]
L_{90}	43	46	41
LAeq	51	50	48

Night Time Maximum Noise Levels			(see note 7)
L_{Max} (Range)	66	to	69
L_{Max} - L_{eq} (Range)	16	to	17

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	Day	Night[5]
	7am-10pm	10pm-7am
$L_{eq\ 15\ hr}$ and $L_{eq\ 9\ hr}$	53	51
$L_{eq\ 1hr}$ upper 10 percentile	55	53
$L_{eq\ 1hr}$ lower 10 percentile	49	48

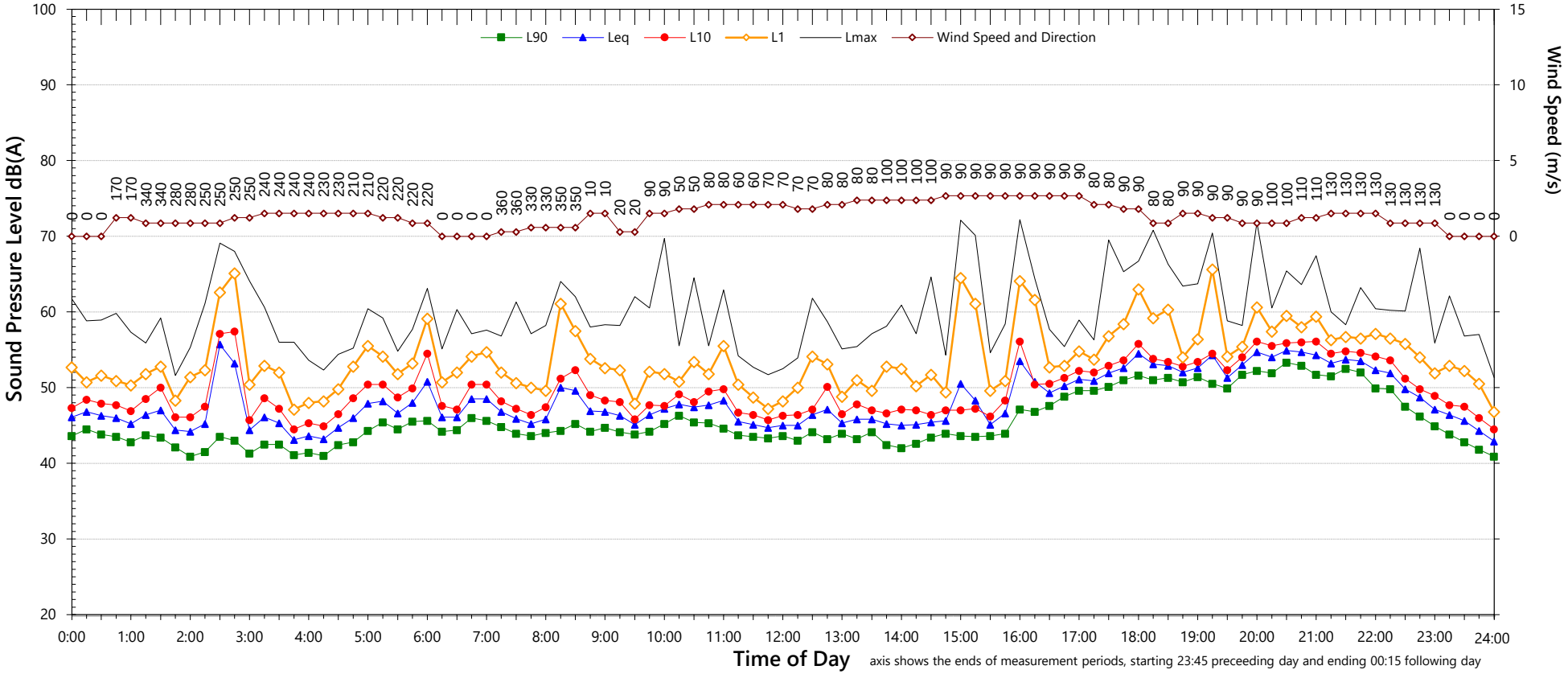
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am til 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. Night time L_{Max} values are shown only where L_{Max} >65dB(A) and where L_{Max}- Leq ≥15dB(A)
8. Meteorological data has been sourced from the nearest Bureau of Meteorology station (Holsworthy Aerodrome AWS)

Unattended Noise Monitoring Results

Target North

Sunday, 6 September 2020



axis shows the ends of measurement periods, starting 23:45 preceeding day and ending 00:15 following day

NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{90}	43	50	39
LAeq	49	54	55

Night Time Maximum Noise Levels			(see note 7)
L_{Max} (Range)	68	to	80
L_{Max} - L_{eq} (Range)	17	to	24

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{eq\ 15\ hr}$ and $L_{eq\ 9\ hr}$	53	57
$L_{eq\ 1hr}$ upper 10 percentile	56	62
$L_{eq\ 1hr}$ lower 10 percentile	48	46

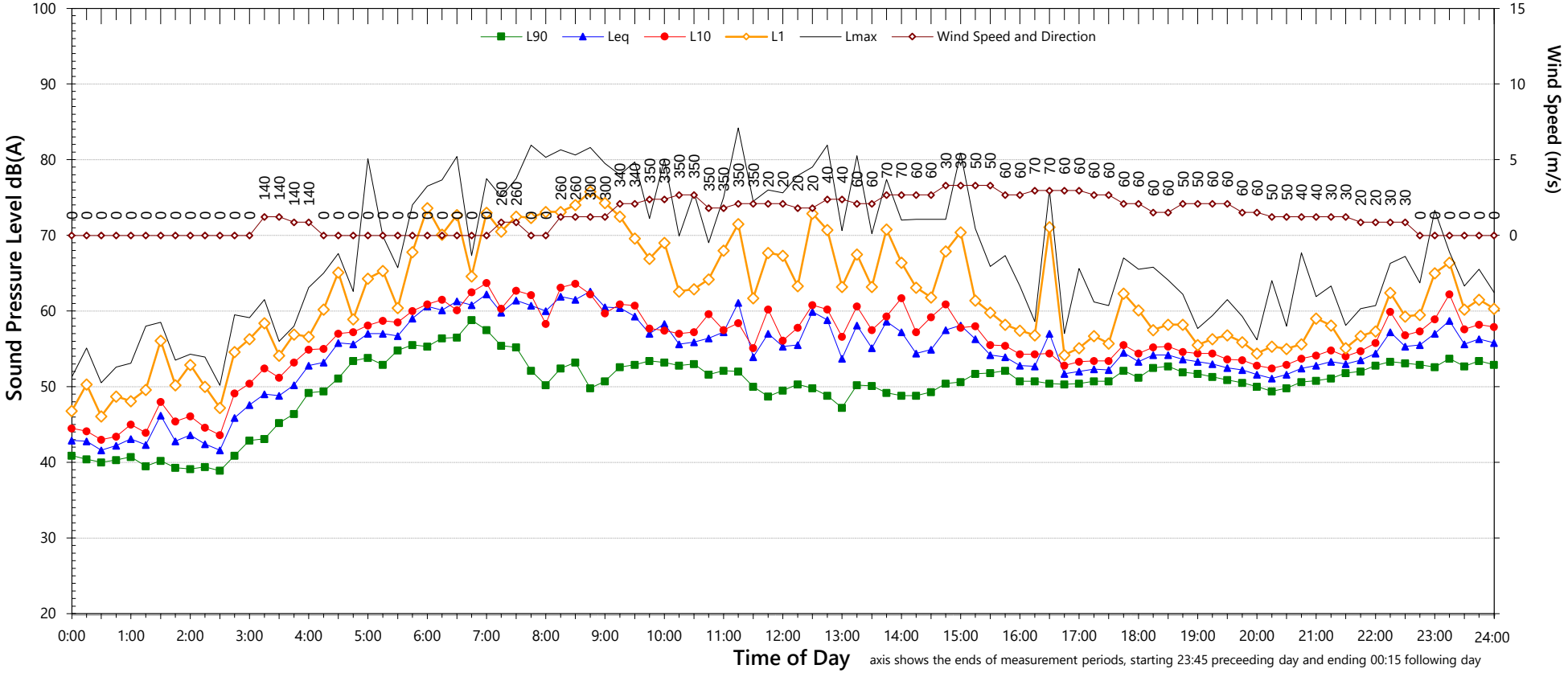
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am til 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. Night time L_{Max} values are shown only where L_{Max} >65dB(A) and where L_{Max}- Leq ≥15dB(A)
8. Meteorological data has been sourced from the nearest Bureau of Meteorology station (Holsworthy Aerodrome AWS)

Unattended Noise Monitoring Results

Target North

Monday, 7 September 2020



axis shows the ends of measurement periods, starting 23:45 preceeding day and ending 00:15 following day

NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{90}	49	50	47
LAeq	58	53	59

Night Time Maximum Noise Levels			(see note 7)
L_{Max} (Range)	68	to	86
L_{Max} - L_{eq} (Range)	15	to	32

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{eq\ 15\ hr}$ and $L_{eq\ 9\ hr}$	60	62
$L_{eq\ 1hr}$ upper 10 percentile	62	63
$L_{eq\ 1hr}$ lower 10 percentile	55	56

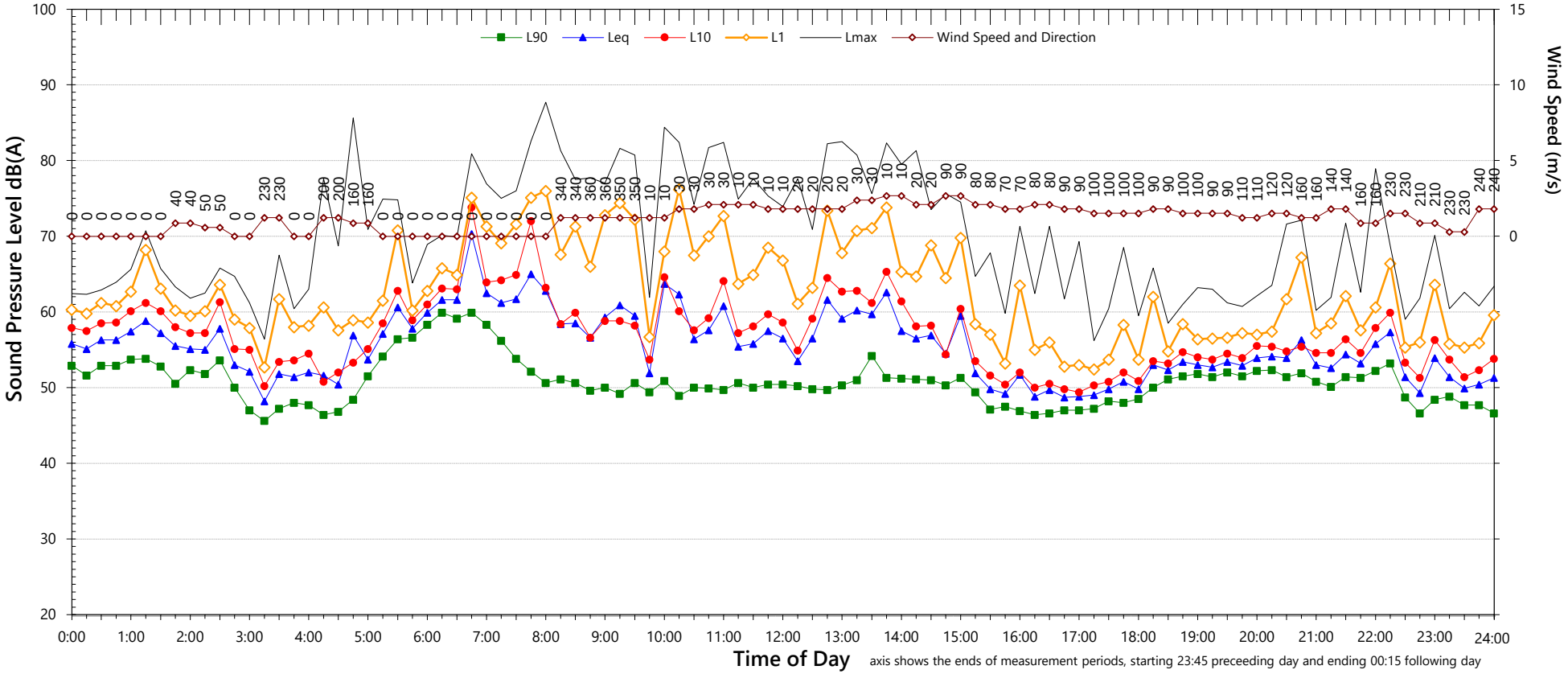
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am til 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. Night time L_{Max} values are shown only where L_{Max} >65dB(A) and where L_{Max}- Leq ≥15dB(A)
8. Meteorological data has been sourced from the nearest Bureau of Meteorology station (Holsworthy Aerodrome AWS)

Unattended Noise Monitoring Results

Target North

Tuesday, 8 September 2020



axis shows the ends of measurement periods, starting 23:45 preceeding day and ending 00:15 following day

NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{90}	47	50	41
LAeq	59	54	52

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{eq\ 15\ hr}$ and $L_{eq\ 9\ hr}$	60	55
$L_{eq\ 1hr}$ upper 10 percentile	63	58
$L_{eq\ 1hr}$ lower 10 percentile	53	50

Night Time Maximum Noise Levels			(see note 7)
L_{Max} (Range)	66	to	77
L_{Max} - L_{eq} (Range)	16	to	24

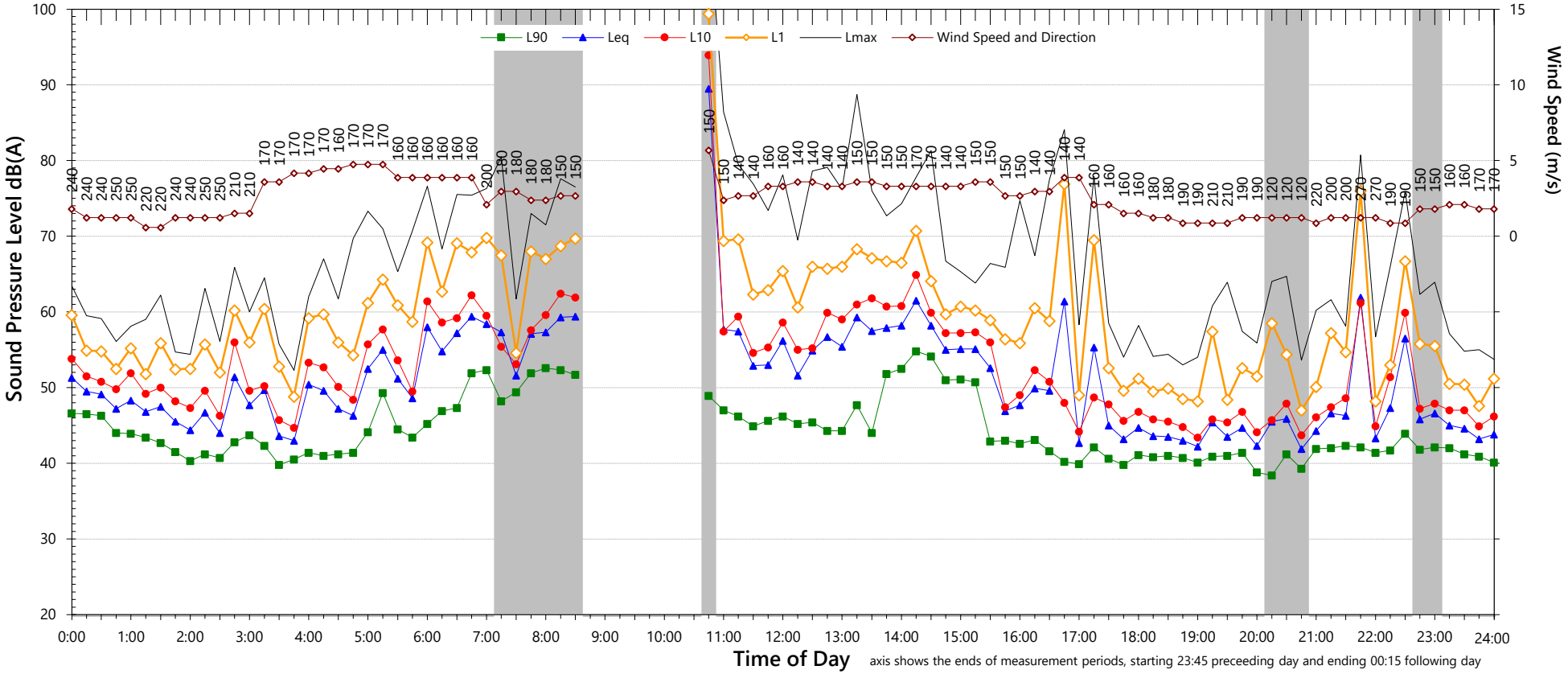
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am til 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. Night time L_{Max} values are shown only where L_{Max} >65dB(A) and where L_{Max}- Leq ≥15dB(A)
8. Meteorological data has been sourced from the nearest Bureau of Meteorology station (Holsworthy Aerodrome AWS)

Unattended Noise Monitoring Results

Target North

Wednesday, 9 September 2020



NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{90}	-	-	39
LAeq	-	-	52

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{eq\ 15\ hr}$ and $L_{eq\ 9\ hr}$	57	54
$L_{eq\ 1hr}$ upper 10 percentile	61	57
$L_{eq\ 1hr}$ lower 10 percentile	47	48

Night Time Maximum Noise Levels			(see note 7)
L_{Max} (Range)	69	to	80
L_{Max} - L_{eq} (Range)	15	to	29

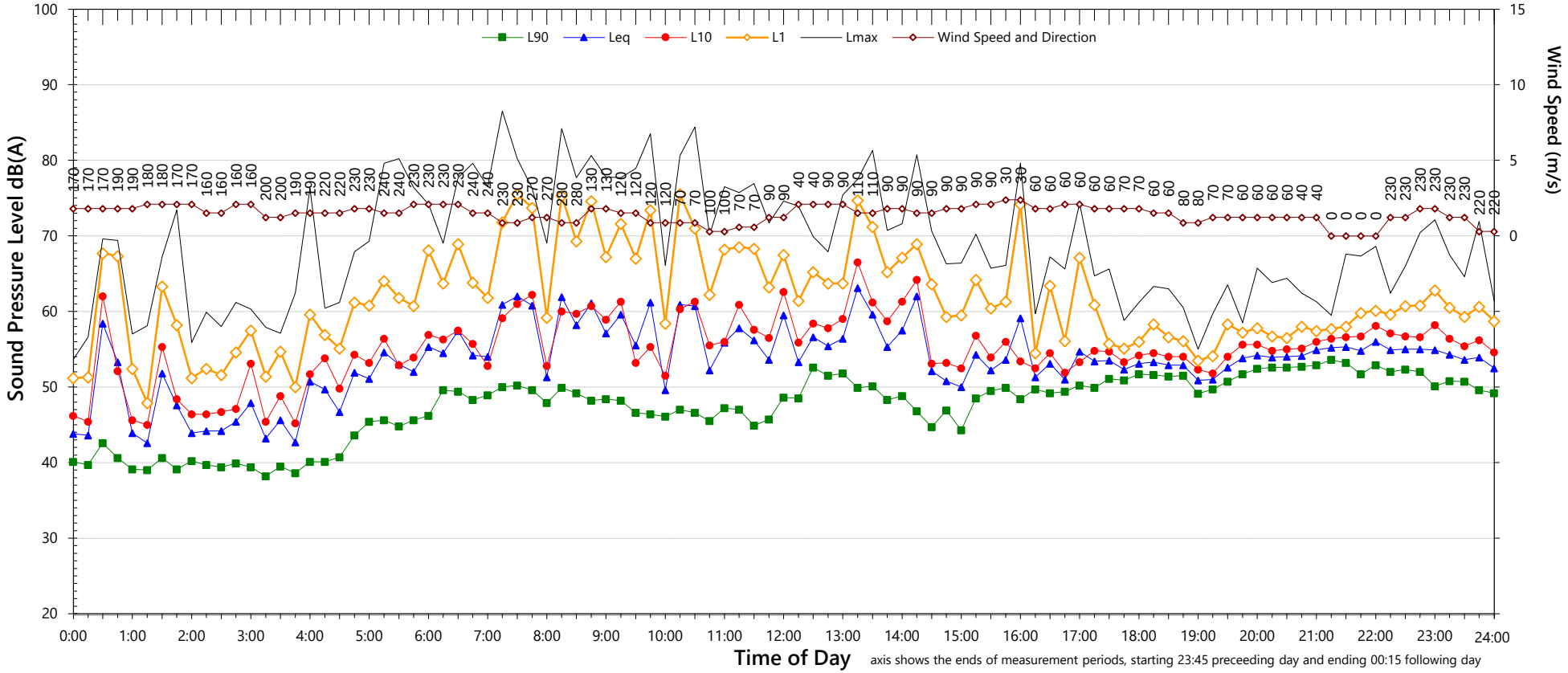
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am til 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. Night time L_{Max} values are shown only where L_{Max} >65dB(A) and where L_{Max}- Leq ≥15dB(A)
8. Meteorological data has been sourced from the nearest Bureau of Meteorology station (Holsworthy Aerodrome AWS)

Unattended Noise Monitoring Results

Target North

Thursday, 10 September 2020



axis shows the ends of measurement periods, starting 23:45 preceeding day and ending 00:15 following day

NSW Noise Policy for Industry (Free Field)			
Descriptor	Day[2]	Evening[3]	Night[4 5]
L_{90}	46	50	46
LAeq	58	54	54

Night Time Maximum Noise Levels			(see note 7)
L_{Max} (Range)	72	to	74
L_{Max} - L_{eq} (Range)	17	to	19

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	Day	Night[5]
	7am-10pm	10pm-7am
$L_{eq\ 15\ hr}$ and $L_{eq\ 9\ hr}$	60	57
$L_{eq\ 1hr}$ upper 10 percentile	62	59
$L_{eq\ 1hr}$ lower 10 percentile	55	52

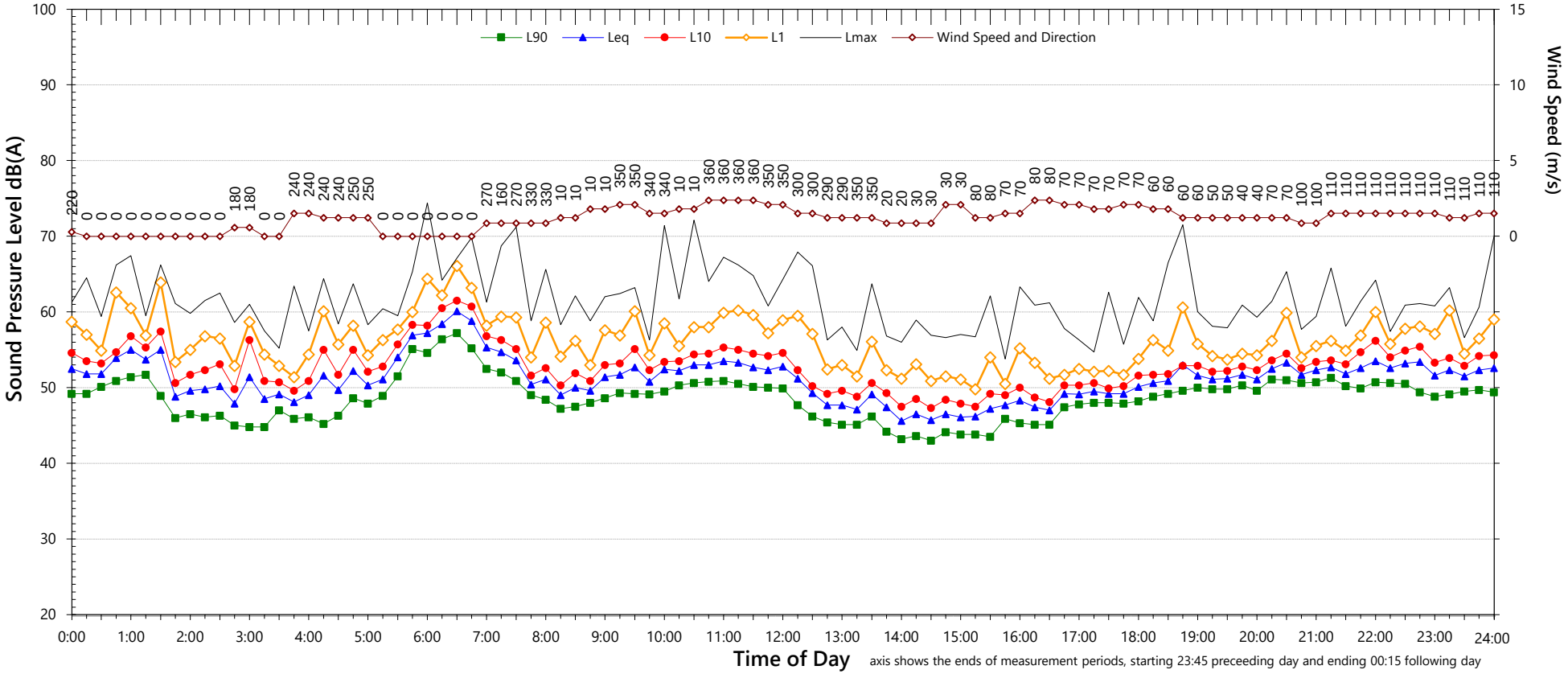
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am til 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. Night time L_{Max} values are shown only where L_{Max} >65dB(A) and where L_{Max}- Leq ≥15dB(A)
8. Meteorological data has been sourced from the nearest Bureau of Meteorology station (Holsworthy Aerodrome AWS)

Unattended Noise Monitoring Results

Target North

Friday, 11 September 2020



axis shows the ends of measurement periods, starting 23:45 preceeding day and ending 00:15 following day

NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{90}	44	49	41
LAeq	50	52	51

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{eq\ 15\ hr}$ and $L_{eq\ 9\ hr}$	53	54
$L_{eq\ 1hr}$ upper 10 percentile	55	55
$L_{eq\ 1hr}$ lower 10 percentile	50	50

Night Time Maximum Noise Levels			(see note 7)
L_{Max} (Range)	69	to	72
L_{Max} - L_{eq} (Range)	16	to	20

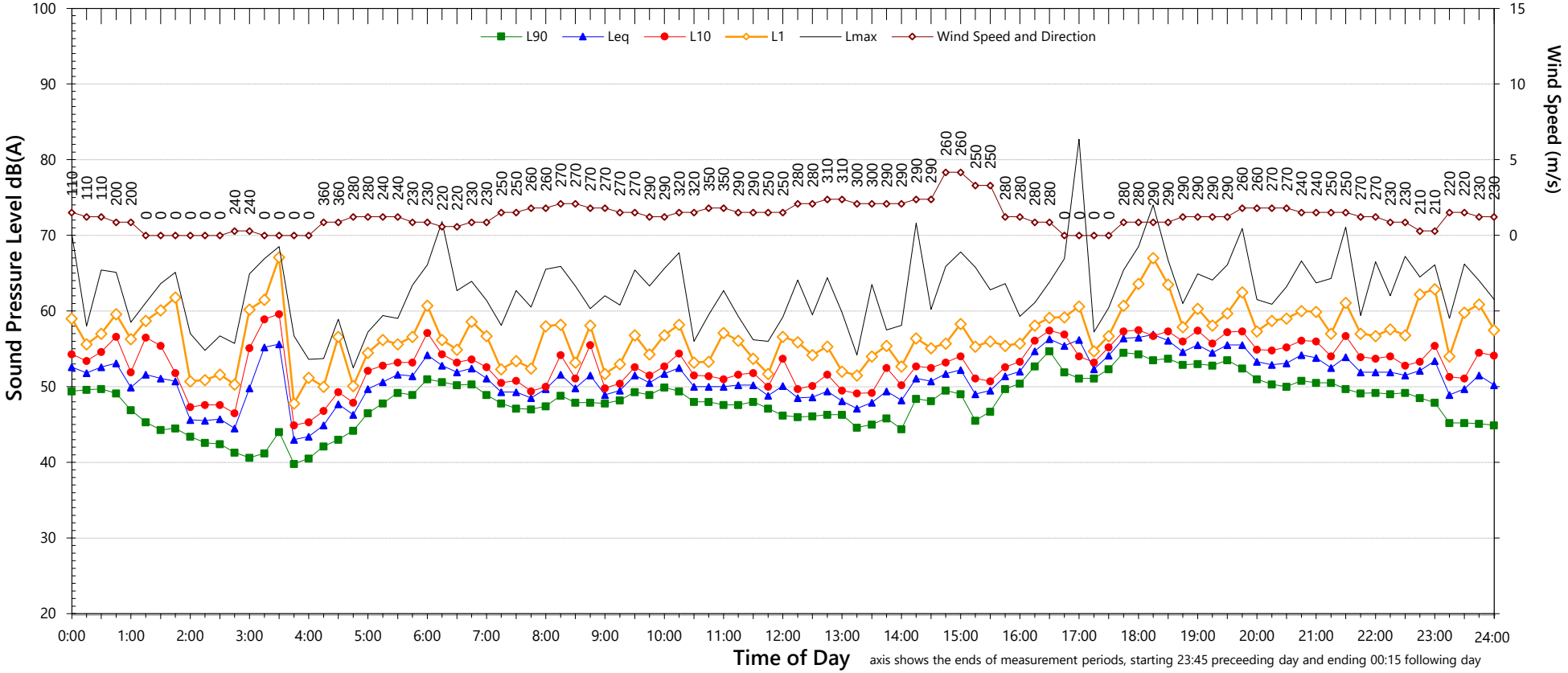
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am til 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. Night time L_{Max} values are shown only where L_{Max} >65dB(A) and where L_{Max}- Leq ≥15dB(A)
8. Meteorological data has been sourced from the nearest Bureau of Meteorology station (Holsworthy Aerodrome AWS)

Unattended Noise Monitoring Results

Target North

Saturday, 12 September 2020



axis shows the ends of measurement periods, starting 23:45 preceeding day and ending 00:15 following day

NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{90}	46	49	45
LAeq	52	54	57

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{eq\ 15\ hr}$ and $L_{eq\ 9\ hr}$	55	59
$L_{eq\ 1hr}$ upper 10 percentile	58	64
$L_{eq\ 1hr}$ lower 10 percentile	51	52

Night Time Maximum Noise Levels			(see note 7)
L_{Max} (Range)	66	to	85
L_{Max} - L_{eq} (Range)	16	to	24

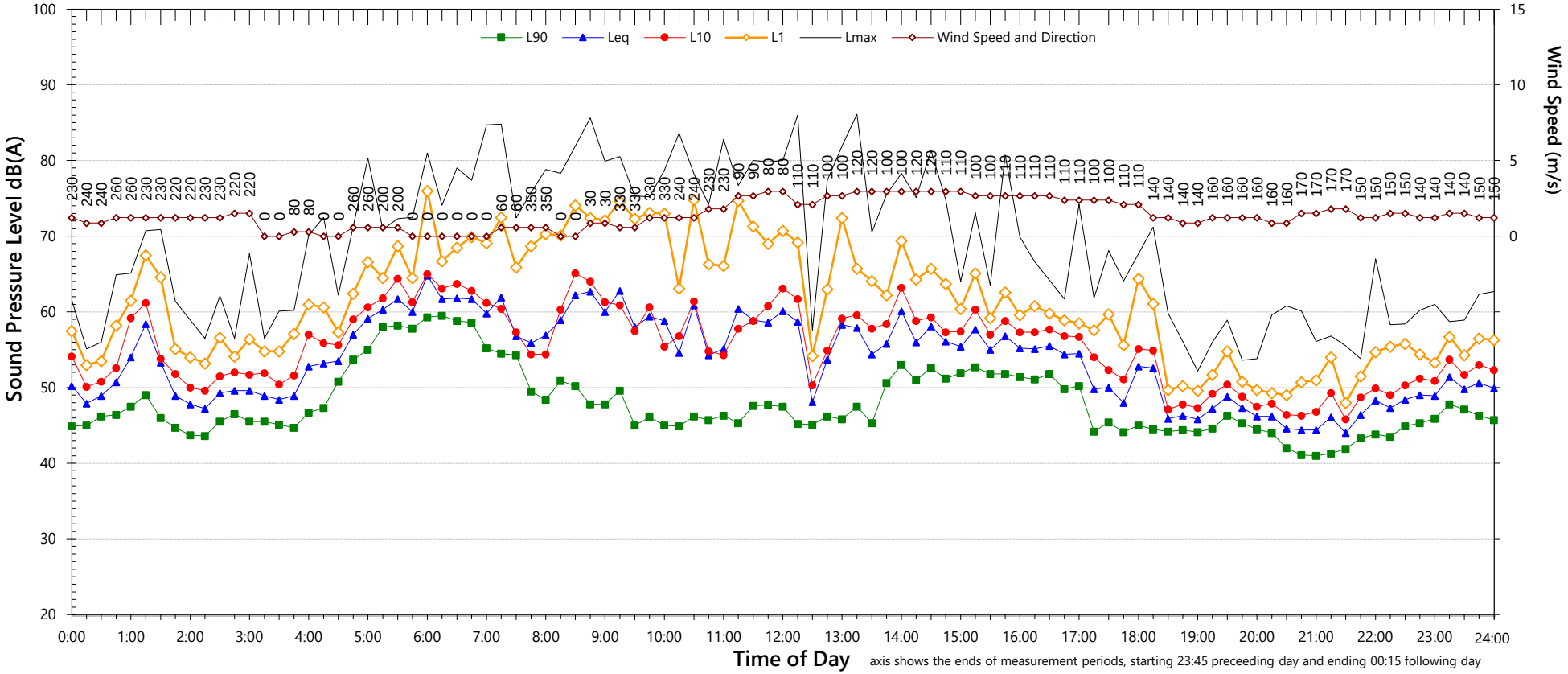
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am til 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. Night time L_{Max} values are shown only where L_{Max} >65dB(A) and where L_{Max}- Leq ≥15dB(A)
8. Meteorological data has been sourced from the nearest Bureau of Meteorology station (Holsworthy Aerodrome AWS)

Unattended Noise Monitoring Results

Target North

Sunday, 13 September 2020



axis shows the ends of measurement periods, starting 23:45 preceeding day and ending 00:15 following day

NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{90}	45	41	38
LAeq	58	47	55

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{eq\ 15\ hr}$ and $L_{eq\ 9\ hr}$	59	58
$L_{eq\ 1hr}$ upper 10 percentile	62	61
$L_{eq\ 1hr}$ lower 10 percentile	49	49

Night Time Maximum Noise Levels			(see note 7)
L_{Max} (Range)	67	to	89
L_{Max} - L_{eq} (Range)	17	to	27

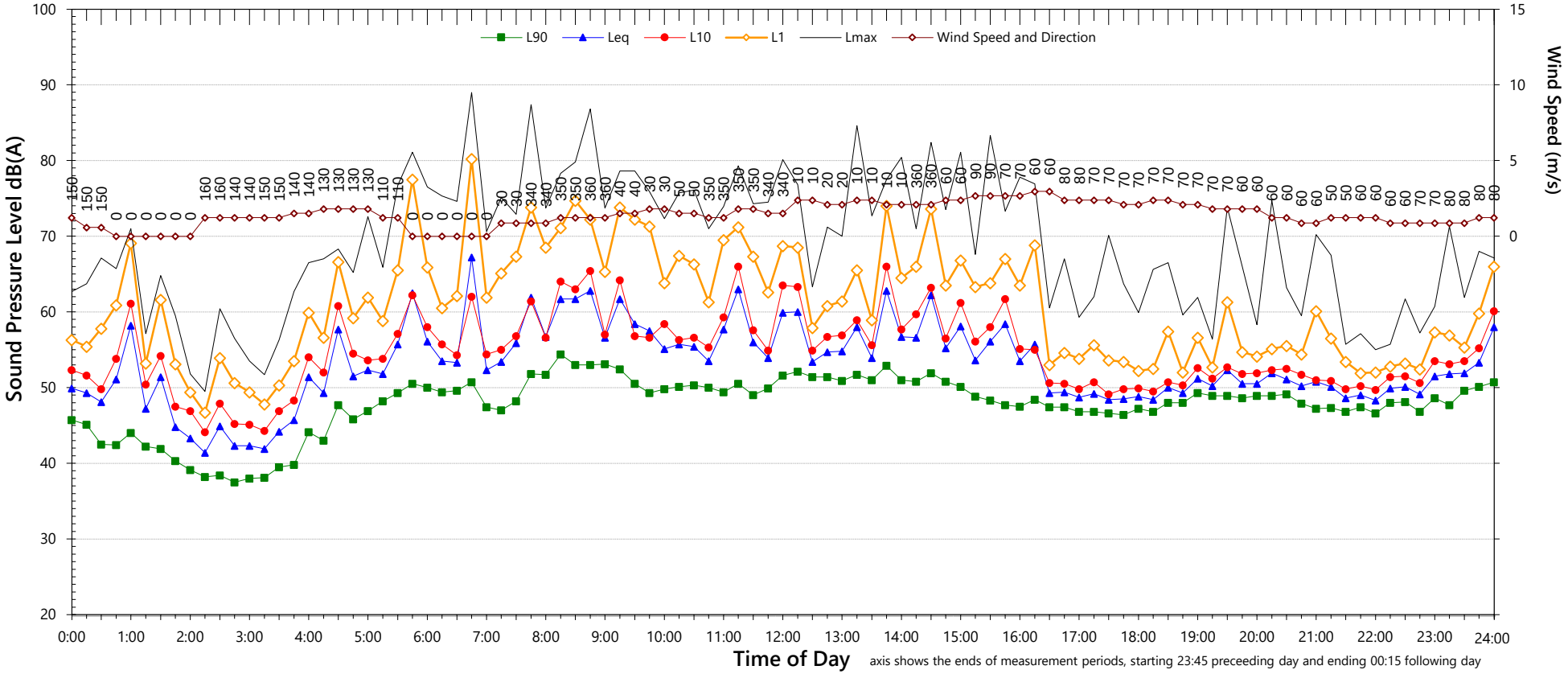
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am til 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. Night time L_{Max} values are shown only where L_{Max} >65dB(A) and where L_{Max}- Leq ≥15dB(A)
8. Meteorological data has been sourced from the nearest Bureau of Meteorology station (Holsworthy Aerodrome AWS)

Unattended Noise Monitoring Results

Target North

Monday, 14 September 2020



axis shows the ends of measurement periods, starting 23:45 preceeding day and ending 00:15 following day

NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{90}	47	47	45
LAeq	58	50	55

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{eq\ 15\ hr}$ and $L_{eq\ 9\ hr}$	59	57
$L_{eq\ 1hr}$ upper 10 percentile	62	59
$L_{eq\ 1hr}$ lower 10 percentile	52	52

Night Time Maximum Noise Levels			(see note 7)
L_{Max} (Range)	71	to	79
L_{Max} - L_{eq} (Range)	17	to	21

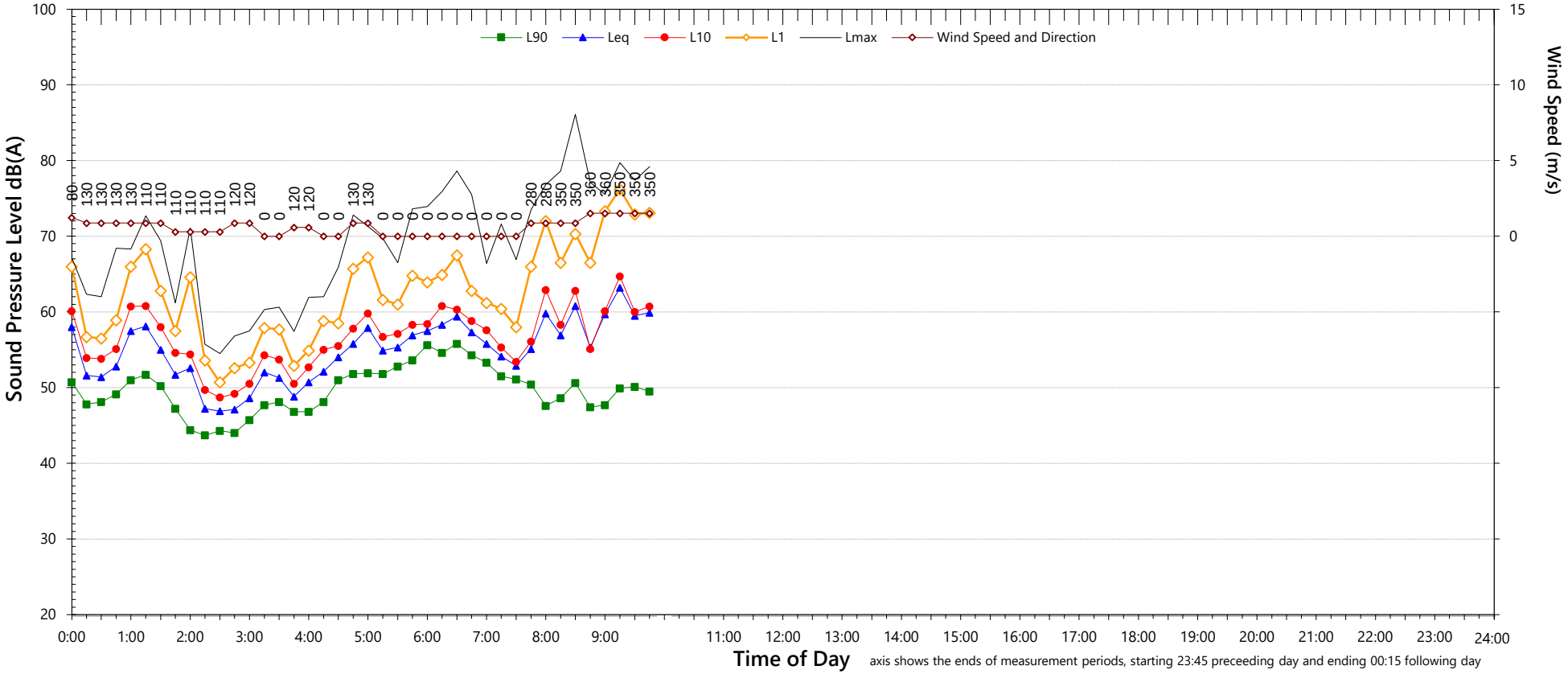
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am til 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. Night time L_{Max} values are shown only where L_{Max} >65dB(A) and where L_{Max}- Leq ≥15dB(A)
8. Meteorological data has been sourced from the nearest Bureau of Meteorology station (Holsworthy Aerodrome AWS)

Unattended Noise Monitoring Results

Target North

Tuesday, 15 September 2020



axis shows the ends of measurement periods, starting 23:45 preceeding day and ending 00:15 following day

NSW Noise Policy for Industry (Free Field)			
Descriptor	Day[2]	Evening[3]	Night[4 5]
L_{90}	-	-	-
LAeq	-	-	-

Night Time Maximum Noise Levels			(see note 7)
L_{Max} (Range)	-	to	-
L_{Max} - L_{eq} (Range)	-	to	-

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	Day	Night[5]
	7am-10pm	10pm-7am
$L_{eq\ 15\ hr}$ and $L_{eq\ 9\ hr}$	61	-
$L_{eq\ 1hr}$ upper 10 percentile	61	-
$L_{eq\ 1hr}$ lower 10 percentile	14	-

Notes:

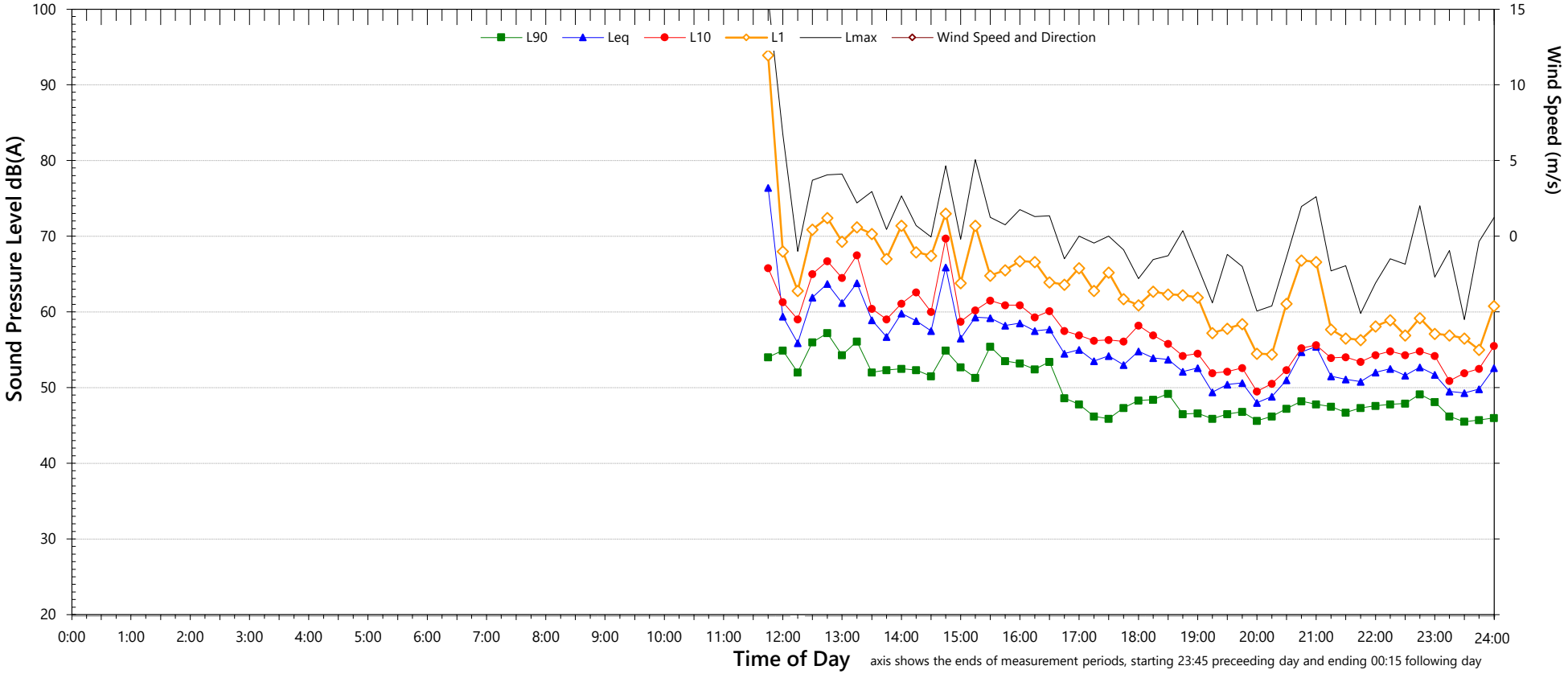
1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am til 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. Night time L_{Max} values are shown only where L_{Max} >65dB(A) and where L_{Max}- Leq ≥15dB(A)
8. Meteorological data has been sourced from the nearest Bureau of Meteorology station (Holsworthy Aerodrome AWS)

APPENDIX C Logger location 2 – Target – South side

Unattended Noise Monitoring Results

Target South

Wednesday, 2 September 2020



NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{90}	-	46	43
LAeq	-	52	60

Night Time Maximum Noise Levels			(see note 7)
L_{Max} (Range)	68	to	91
L_{Max} - L_{eq} (Range)	18	to	23

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{eq\ 15\ hr}$ and $L_{eq\ 9\ hr}$	65	62
$L_{eq\ 1hr}$ upper 10 percentile	65	64
$L_{eq\ 1hr}$ lower 10 percentile	54	53

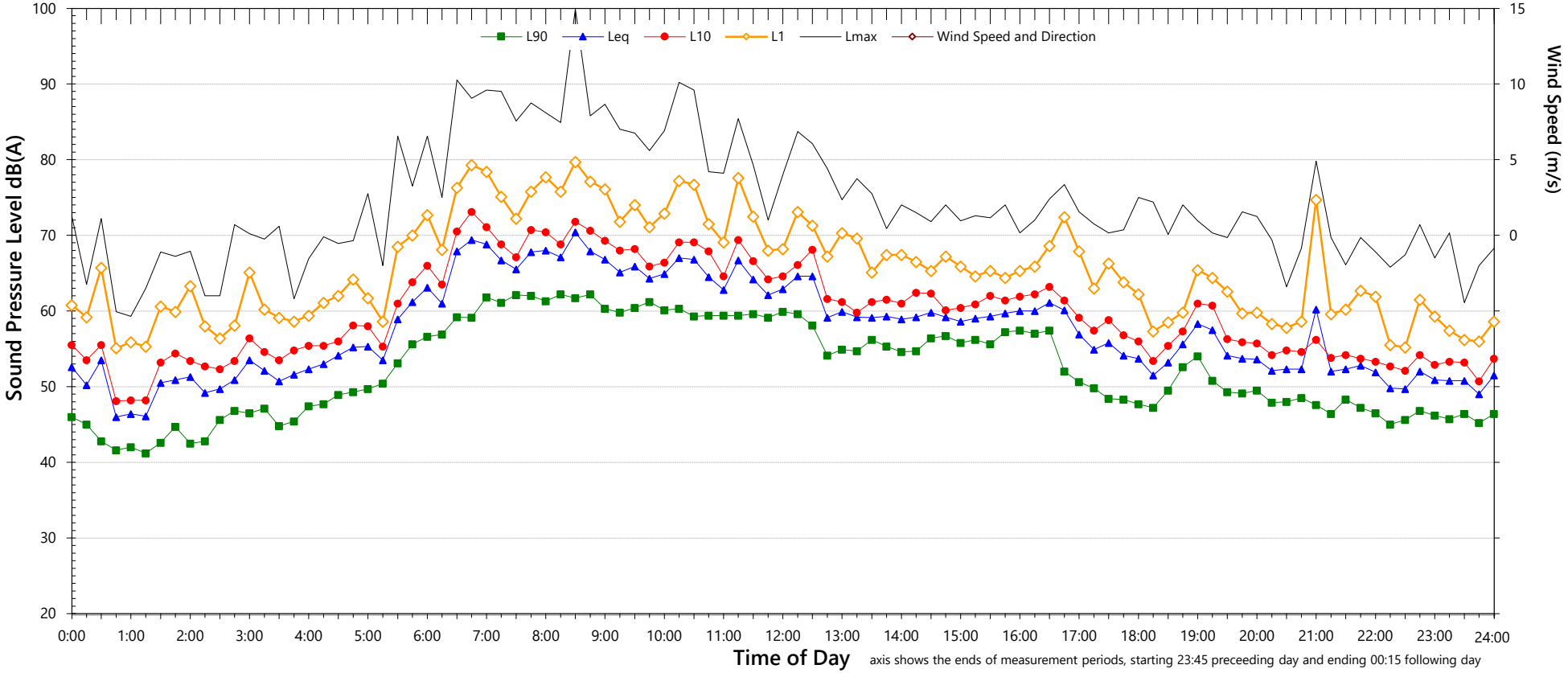
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am til 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. Night time L_{Max} values are shown only where L_{Max} >65dB(A) and where L_{Max}- Leq ≥15dB(A)
8. Meteorological data has been sourced from the nearest Bureau of Meteorology station (Holsworthy Aerodrome AWS)

Unattended Noise Monitoring Results

Target South

Thursday, 3 September 2020



NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{90}	51	47	46
LAeq	64	55	61

Night Time Maximum Noise Levels			(see note 7)
L_{Max} (Range)	70	to	92
L_{Max} - L_{eq} (Range)	18	to	26

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{eq\ 15\ hr}$ and $L_{eq\ 9\ hr}$	65	64
$L_{eq\ 1hr}$ upper 10 percentile	69	69
$L_{eq\ 1hr}$ lower 10 percentile	57	53

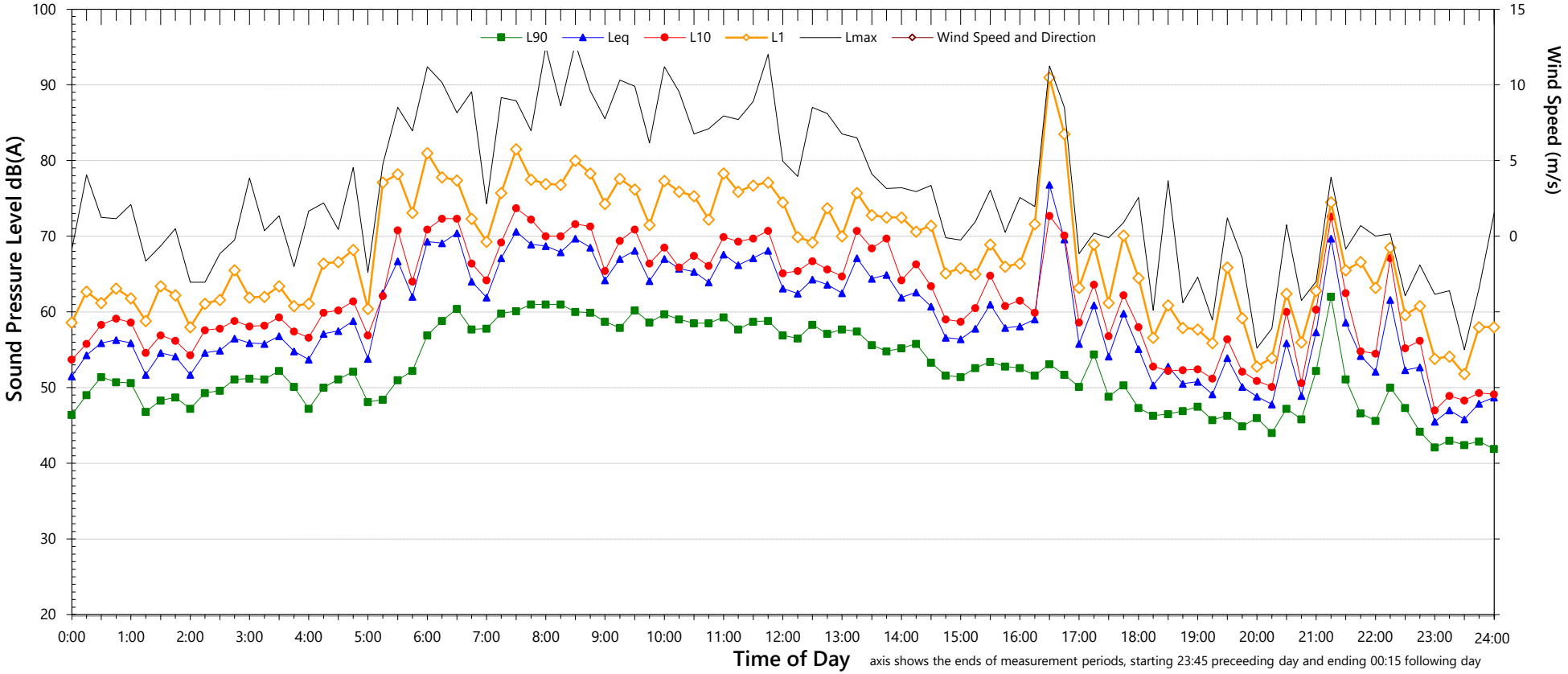
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am til 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. Night time L_{Max} values are shown only where L_{Max} >65dB(A) and where L_{Max}- Leq ≥15dB(A)
8. Meteorological data has been sourced from the nearest Bureau of Meteorology station (Holsworthy Aerodrome AWS)

Unattended Noise Monitoring Results

Target South

Friday, 4 September 2020



NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{90}	51	45	40
LAeq	67	59	51

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{eq\ 15\ hr}$ and $L_{eq\ 9\ hr}$	68	54
$L_{eq\ 1hr}$ upper 10 percentile	71	59
$L_{eq\ 1hr}$ lower 10 percentile	55	47

Night Time Maximum Noise Levels			(see note 7)
L_{Max} (Range)	65	to	79
L_{Max} - L_{eq} (Range)	17	to	26

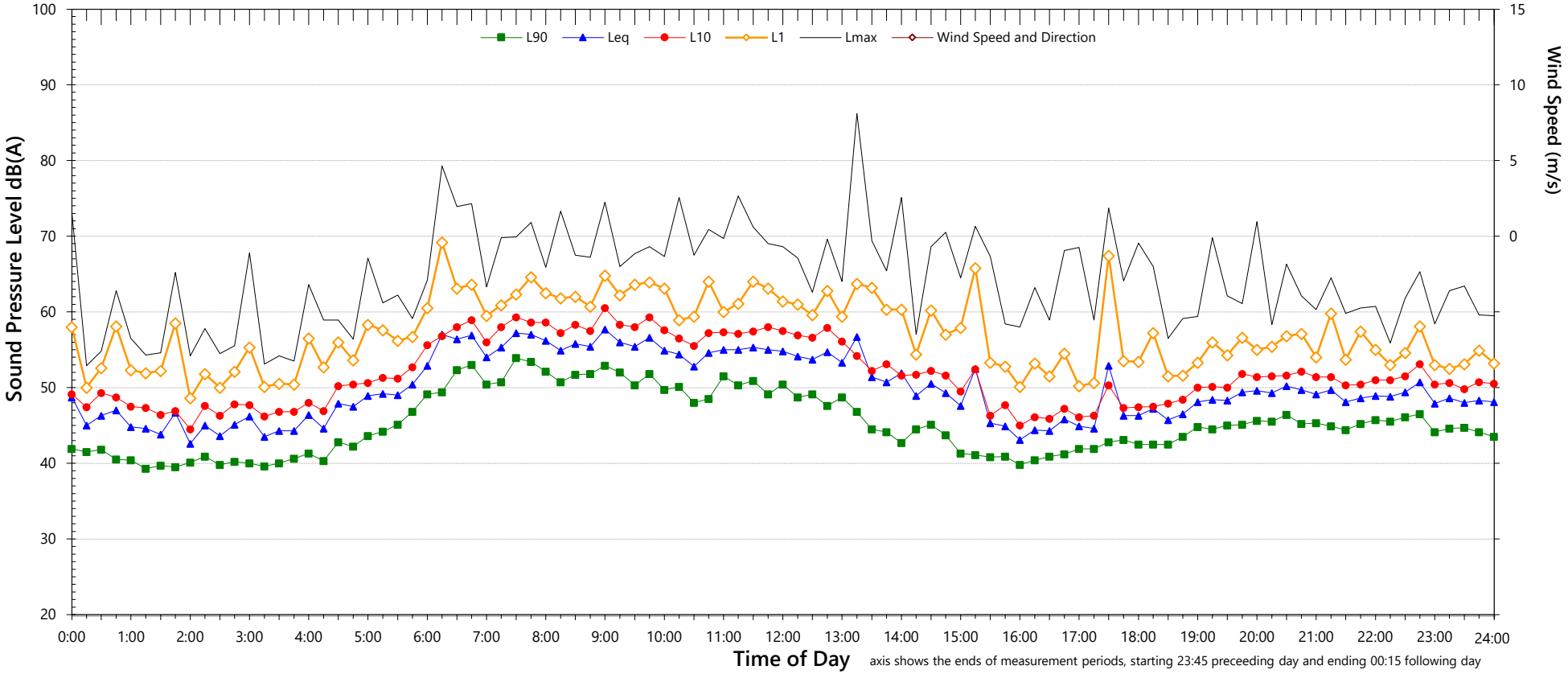
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am til 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. Night time L_{Max} values are shown only where L_{Max} >65dB(A) and where L_{Max}- Leq ≥15dB(A)
8. Meteorological data has been sourced from the nearest Bureau of Meteorology station (Holsworthy Aerodrome AWS)

Unattended Noise Monitoring Results

Target South

Saturday, 5 September 2020



axis shows the ends of measurement periods, starting 23:45 preceeding day and ending 00:15 following day

NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{90}	41	43	40
LAeq	54	49	47

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{eq\ 15\ hr}$ and $L_{eq\ 9\ hr}$	55	50
$L_{eq\ 1hr}$ upper 10 percentile	58	51
$L_{eq\ 1hr}$ lower 10 percentile	50	47

Night Time Maximum Noise Levels			(see note 7)
L_{Max} (Range)	65	to	70
L_{Max} - L_{eq} (Range)	15	to	24

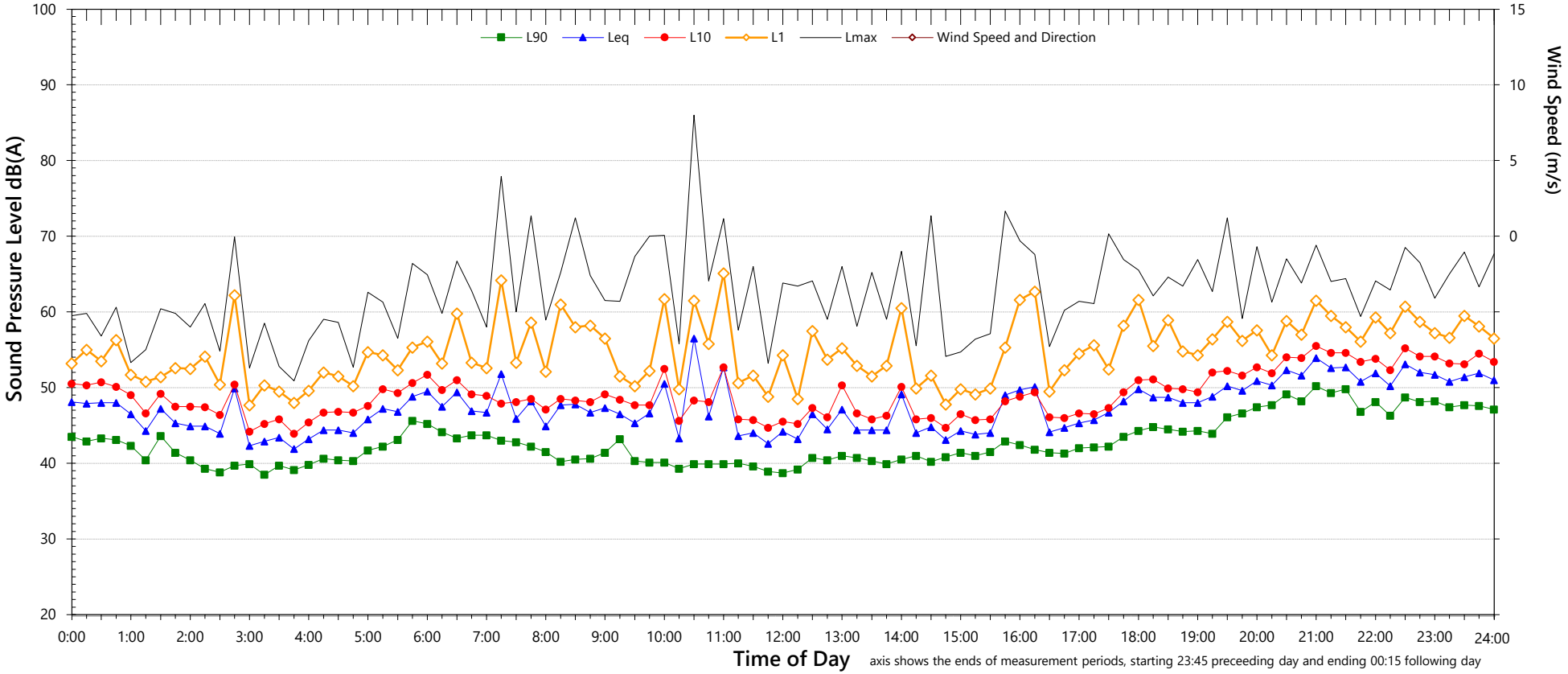
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am til 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. Night time L_{Max} values are shown only where L_{Max} >65dB(A) and where L_{Max}- Leq ≥15dB(A)
8. Meteorological data has been sourced from the nearest Bureau of Meteorology station (Holsworthy Aerodrome AWS)

Unattended Noise Monitoring Results

Target South

Sunday, 6 September 2020



axis shows the ends of measurement periods, starting 23:45 preceeding day and ending 00:15 following day

NSW Noise Policy for Industry (Free Field)			
Descriptor	Day[2]	Evening[3]	Night[4 5]
L_{90}	40	44	46
LAeq	48	51	60

Night Time Maximum Noise Levels			(see note 7)
L_{Max} (Range)	67	to	95
L_{Max} - L_{eq} (Range)	16	to	27

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	Day	Night[5]
	7am-10pm	10pm-7am
$L_{eq\ 15\ hr}$ and $L_{eq\ 9\ hr}$	51	63
$L_{eq\ 1hr}$ upper 10 percentile	55	67
$L_{eq\ 1hr}$ lower 10 percentile	47	53

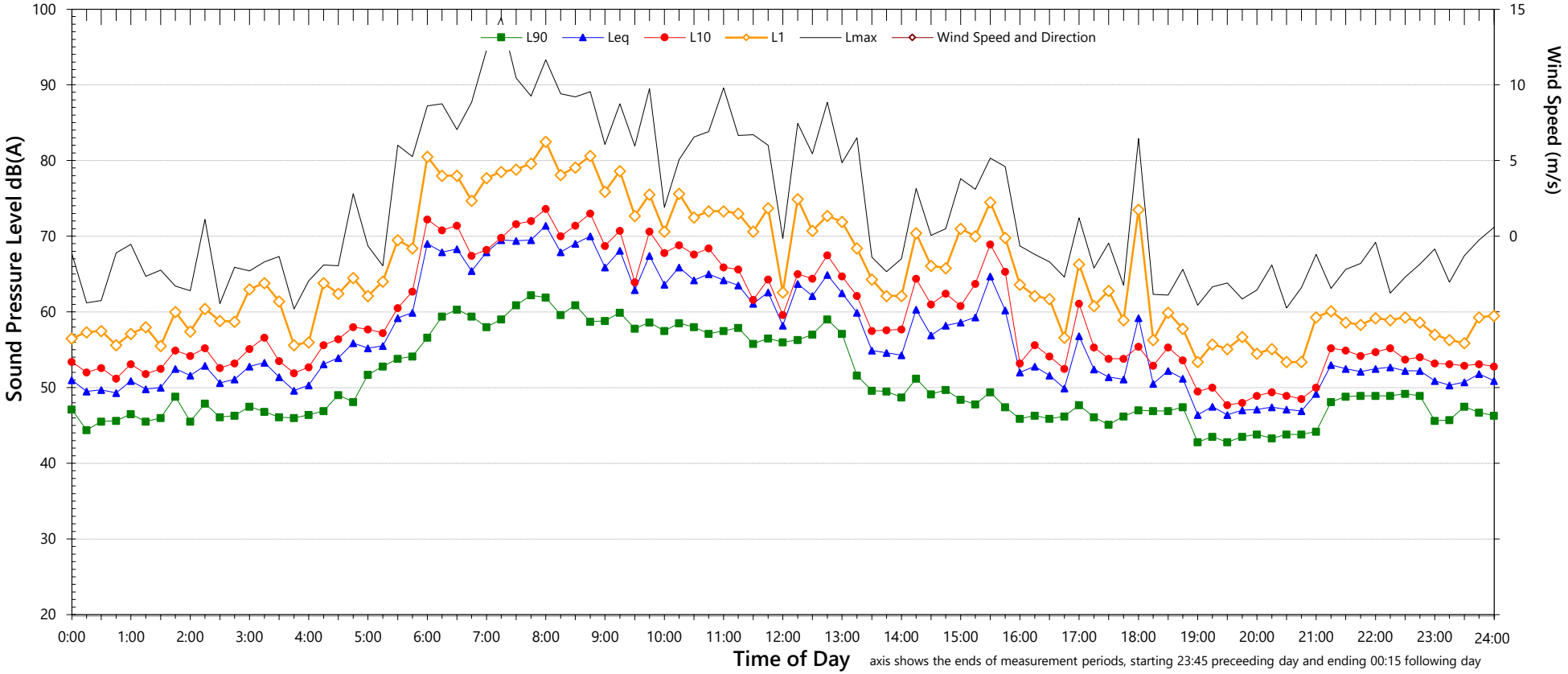
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am til 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. Night time L_{Max} values are shown only where L_{Max} >65dB(A) and where L_{Max}- Leq ≥15dB(A)
8. Meteorological data has been sourced from the nearest Bureau of Meteorology station (Holsworthy Aerodrome AWS)

Unattended Noise Monitoring Results

Target South

Monday, 7 September 2020



NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{90}	46	43	46
LAeq	64	50	57

Night Time Maximum Noise Levels			(see note 7)
L_{Max} (Range)	68	to	87
L_{Max} - L_{eq} (Range)	16	to	23

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{eq\ 15\ hr}$ and $L_{eq\ 9\ hr}$	66	60
$L_{eq\ 1hr}$ upper 10 percentile	70	63
$L_{eq\ 1hr}$ lower 10 percentile	51	54

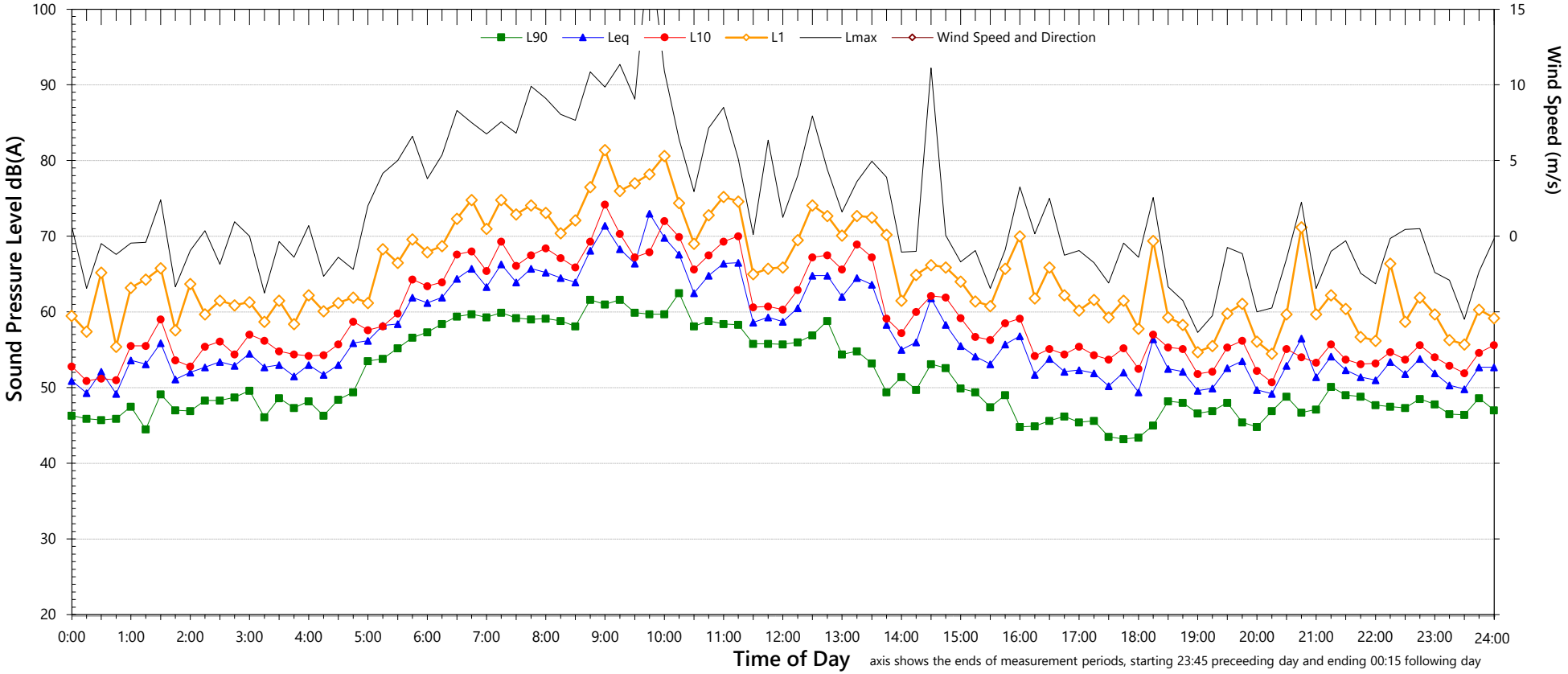
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am til 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. Night time L_{Max} values are shown only where L_{Max} >65dB(A) and where L_{Max}- Leq ≥15dB(A)
8. Meteorological data has been sourced from the nearest Bureau of Meteorology station (Holsworthy Aerodrome AWS)

Unattended Noise Monitoring Results

Target South

Tuesday, 8 September 2020



axis shows the ends of measurement periods, starting 23:45 preceeding day and ending 00:15 following day

NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{90}	45	45	46
LAeq	64	53	60

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{eq\ 15\ hr}$ and $L_{eq\ 9\ hr}$	66	62
$L_{eq\ 1hr}$ upper 10 percentile	70	65
$L_{eq\ 1hr}$ lower 10 percentile	54	55

Night Time Maximum Noise Levels			(see note 7)
L_{Max} (Range)	70	to	92
L_{Max} - L_{eq} (Range)	18	to	29

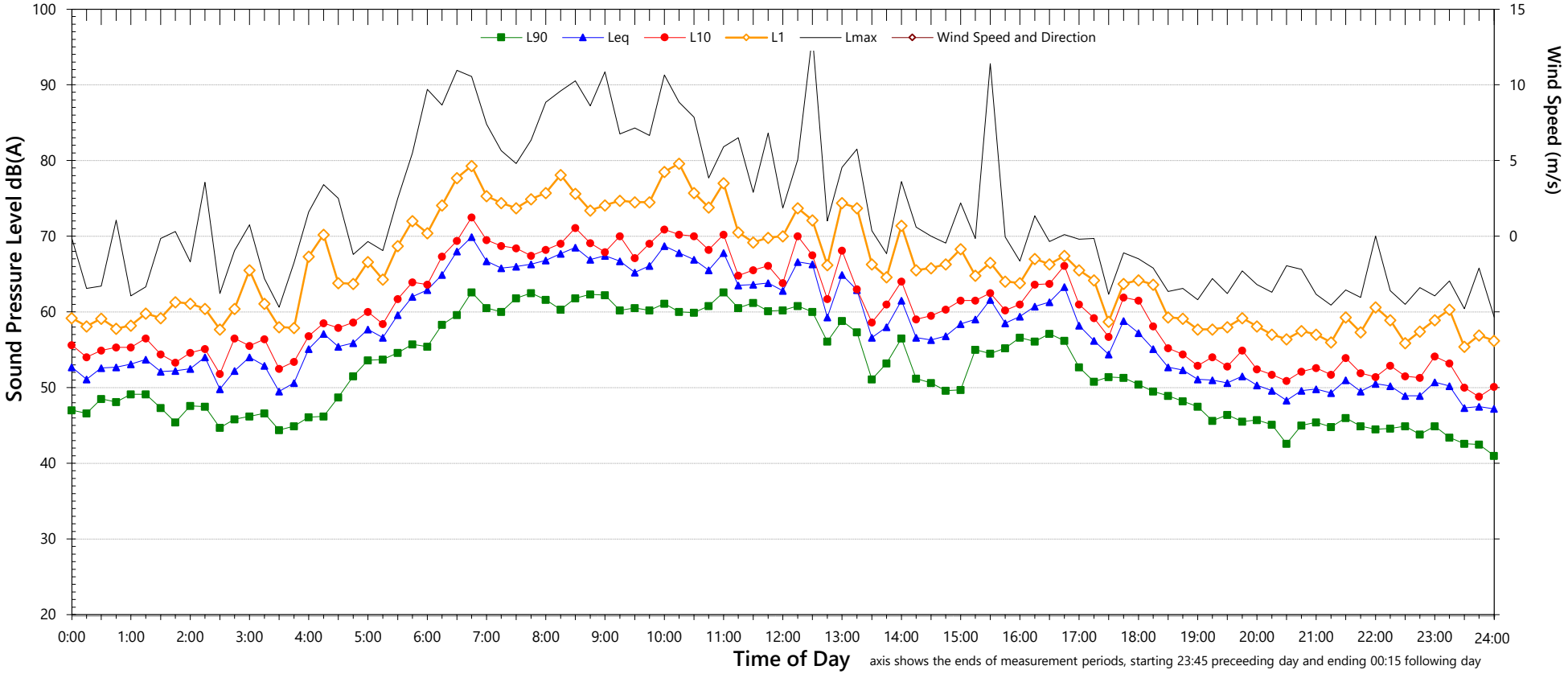
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am til 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. Night time L_{Max} values are shown only where L_{Max} >65dB(A) and where L_{Max}- Leq ≥15dB(A)
8. Meteorological data has been sourced from the nearest Bureau of Meteorology station (Holsworthy Aerodrome AWS)

Unattended Noise Monitoring Results

Target South

Wednesday, 9 September 2020



axis shows the ends of measurement periods, starting 23:45 preceeding day and ending 00:15 following day

NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{90}	51	45	39
LAeq	64	51	57

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{eq\ 15\ hr}$ and $L_{eq\ 9\ hr}$	66	59
$L_{eq\ 1hr}$ upper 10 percentile	70	66
$L_{eq\ 1hr}$ lower 10 percentile	53	51

Night Time Maximum Noise Levels			(see note 7)
L_{Max} (Range)	66	to	92
L_{Max} - L_{eq} (Range)	18	to	28

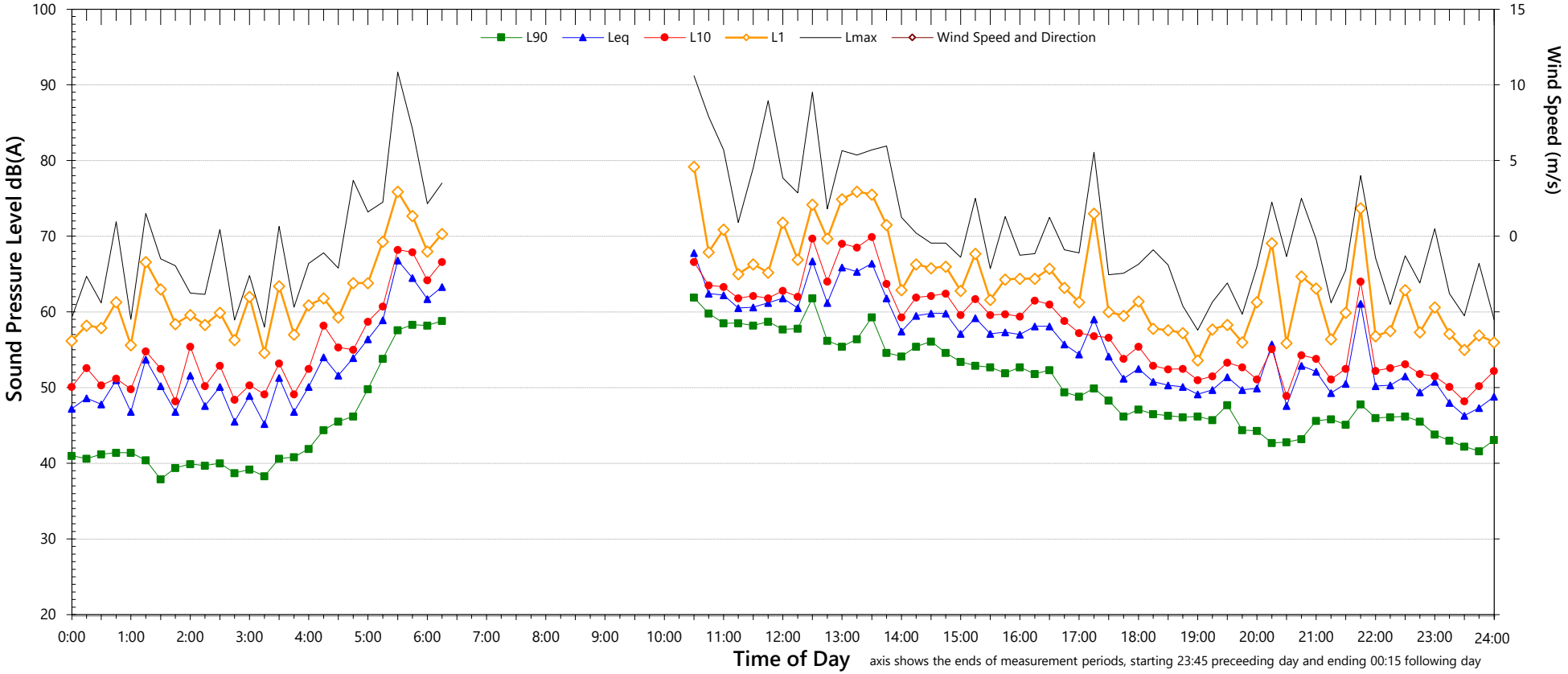
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am til 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. Night time L_{Max} values are shown only where L_{Max} >65dB(A) and where L_{Max}- Leq ≥15dB(A)
8. Meteorological data has been sourced from the nearest Bureau of Meteorology station (Holsworthy Aerodrome AWS)

Unattended Noise Monitoring Results

Target South

Thursday, 10 September 2020



NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{90}	-	43	43
LAeq	-	53	60

Night Time Maximum Noise Levels			(see note 7)
L_{Max} (Range)	66	to	94
L_{Max} - L_{eq} (Range)	17	to	28

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{eq\ 15\ hr}$ and $L_{eq\ 9\ hr}$	63	62
$L_{eq\ 1hr}$ upper 10 percentile	67	67
$L_{eq\ 1hr}$ lower 10 percentile	53	52

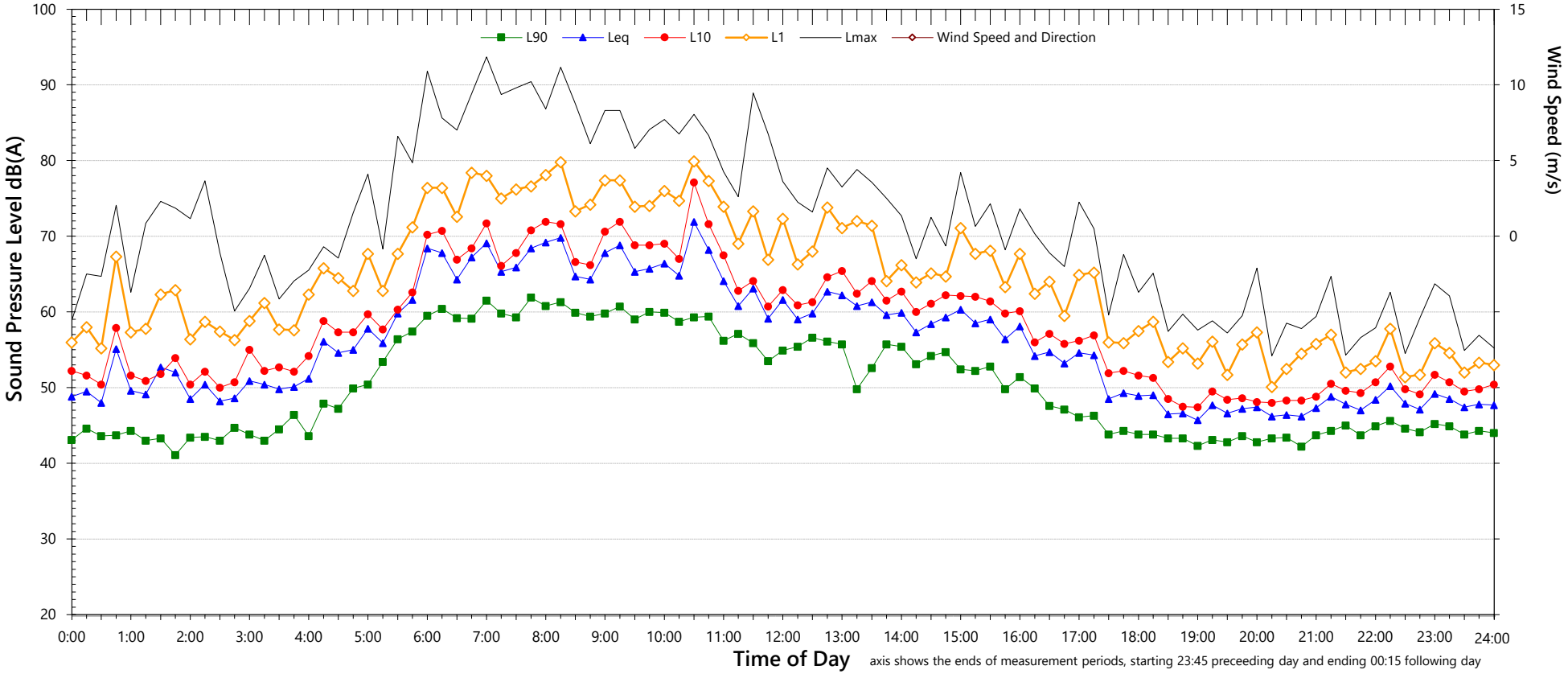
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am til 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. Night time L_{Max} values are shown only where L_{Max} >65dB(A) and where L_{Max}- Leq ≥15dB(A)
8. Meteorological data has been sourced from the nearest Bureau of Meteorology station (Holsworthy Aerodrome AWS)

Unattended Noise Monitoring Results

Target South

Friday, 11 September 2020



NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{90}	47	43	41
LAeq	64	47	50

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{eq\ 15\ hr}$ and $L_{eq\ 9\ hr}$	65	52
$L_{eq\ 1hr}$ upper 10 percentile	70	53
$L_{eq\ 1hr}$ lower 10 percentile	50	49

Night Time Maximum Noise Levels			(see note 7)
L_{Max} (Range)	67	to	71
L_{Max} - L_{eq} (Range)	16	to	19

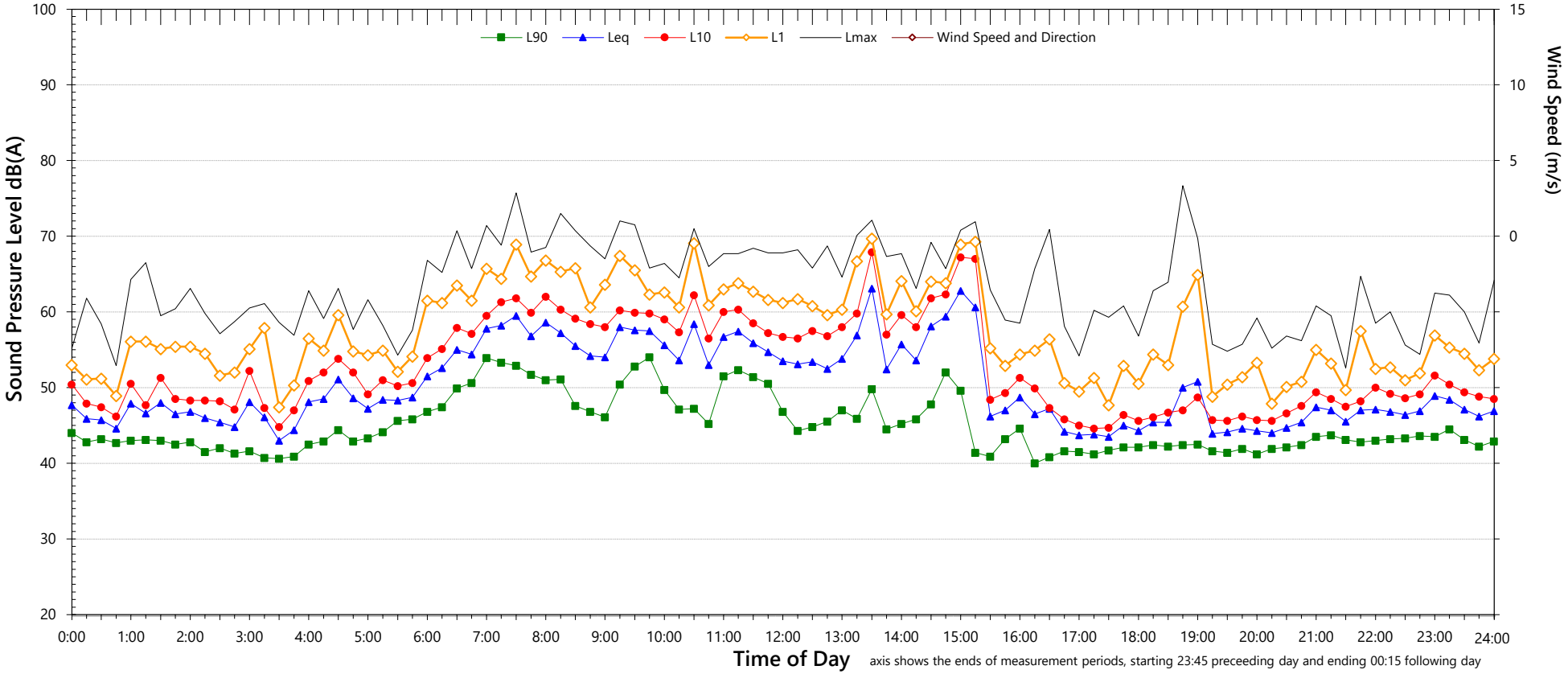
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am til 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. Night time L_{Max} values are shown only where L_{Max} >65dB(A) and where L_{Max}- Leq ≥15dB(A)
8. Meteorological data has been sourced from the nearest Bureau of Meteorology station (Holsworthy Aerodrome AWS)

Unattended Noise Monitoring Results

Target South

Saturday, 12 September 2020



NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{90}	41	42	39
LAeq	56	47	52

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{eq\ 15\ hr}$ and $L_{eq\ 9\ hr}$	58	50
$L_{eq\ 1hr}$ upper 10 percentile	61	51
$L_{eq\ 1hr}$ lower 10 percentile	47	47

Night Time Maximum Noise Levels			(see note 7)
L_{Max} (Range)	66	to	73
L_{Max} - L_{eq} (Range)	15	to	26

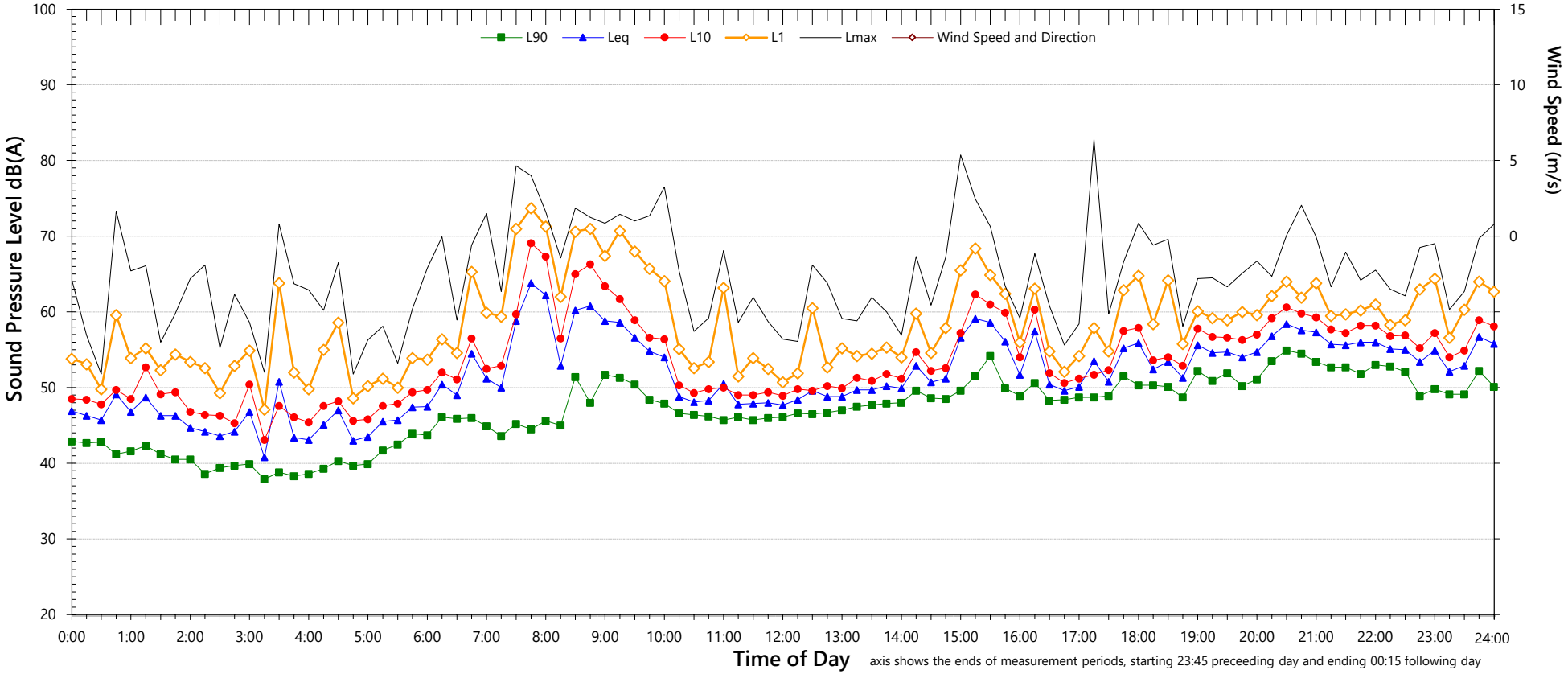
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am til 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. Night time L_{Max} values are shown only where L_{Max} >65dB(A) and where L_{Max}- Leq ≥15dB(A)
8. Meteorological data has been sourced from the nearest Bureau of Meteorology station (Holsworthy Aerodrome AWS)

Unattended Noise Monitoring Results

Target South

Sunday, 13 September 2020



axis shows the ends of measurement periods, starting 23:45 preceeding day and ending 00:15 following day

NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{90}	46	50	49
LAeq	54	56	61

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{eq\ 15\ hr}$ and $L_{eq\ 9\ hr}$	58	64
$L_{eq\ 1hr}$ upper 10 percentile	61	69
$L_{eq\ 1hr}$ lower 10 percentile	51	56

Night Time Maximum Noise Levels			(see note 7)
L_{Max} (Range)	68	to	98
L_{Max} - L_{eq} (Range)	16	to	31

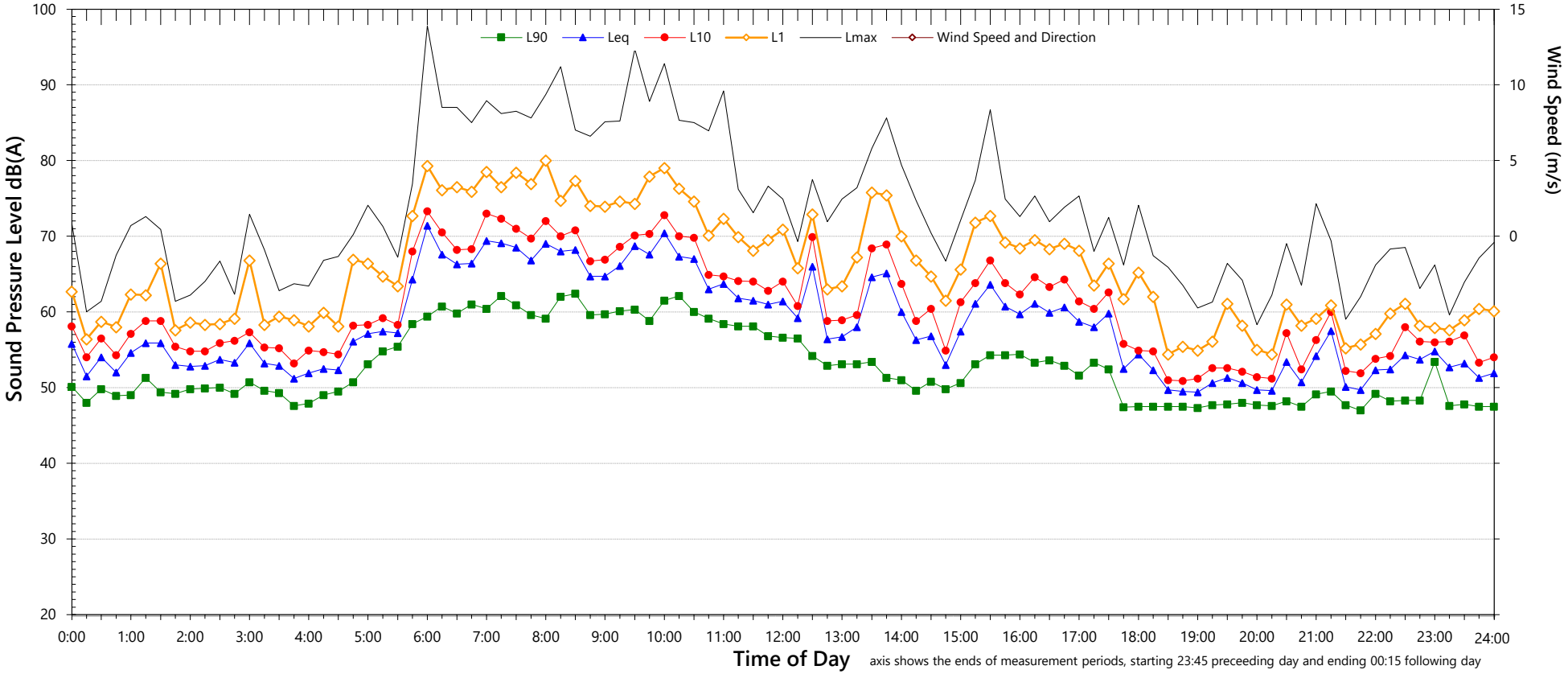
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am til 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. Night time L_{Max} values are shown only where L_{Max} >65dB(A) and where L_{Max}- Leq ≥15dB(A)
8. Meteorological data has been sourced from the nearest Bureau of Meteorology station (Holsworthy Aerodrome AWS)

Unattended Noise Monitoring Results

Target South

Monday, 14 September 2020



NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{90}	51	47	46
LAeq	64	52	59

Night Time Maximum Noise Levels			(see note 7)
L_{Max} (Range)	69	to	90
L_{Max} - L_{eq} (Range)	17	to	25

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{eq\ 15\ hr}$ and $L_{eq\ 9\ hr}$	66	62
$L_{eq\ 1hr}$ upper 10 percentile	70	67
$L_{eq\ 1hr}$ lower 10 percentile	54	53

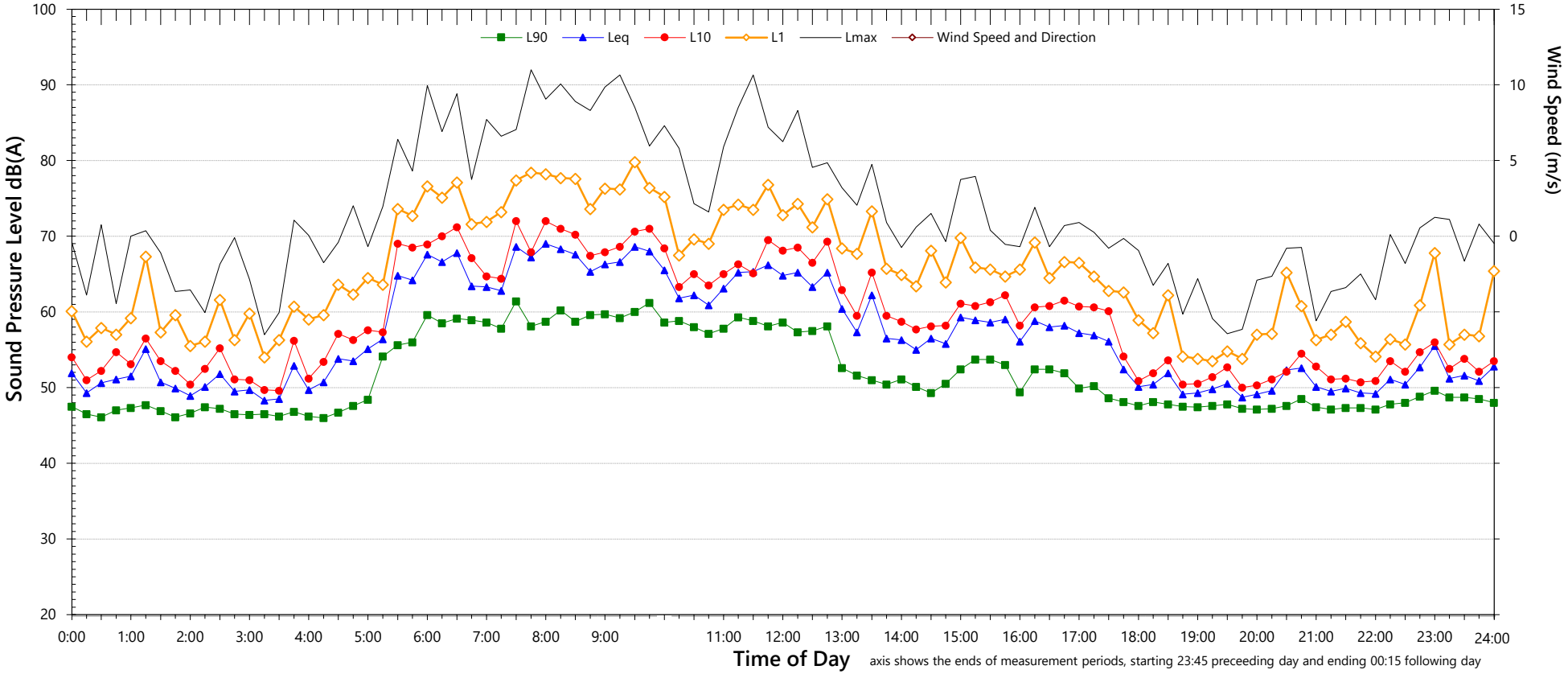
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am til 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. Night time L_{Max} values are shown only where L_{Max} >65dB(A) and where L_{Max}- Leq ≥15dB(A)
8. Meteorological data has been sourced from the nearest Bureau of Meteorology station (Holsworthy Aerodrome AWS)

Unattended Noise Monitoring Results

Target South

Tuesday, 15 September 2020



axis shows the ends of measurement periods, starting 23:45 preceeding day and ending 00:15 following day

NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{90}	50	47	48
LAeq	64	50	57

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{eq\ 15\ hr}$ and $L_{eq\ 9\ hr}$	65	59
$L_{eq\ 1hr}$ upper 10 percentile	69	63
$L_{eq\ 1hr}$ lower 10 percentile	52	54

Night Time Maximum Noise Levels			(see note 7)
L_{Max} (Range)	68	to	84
L_{Max} - L_{eq} (Range)	15	to	25

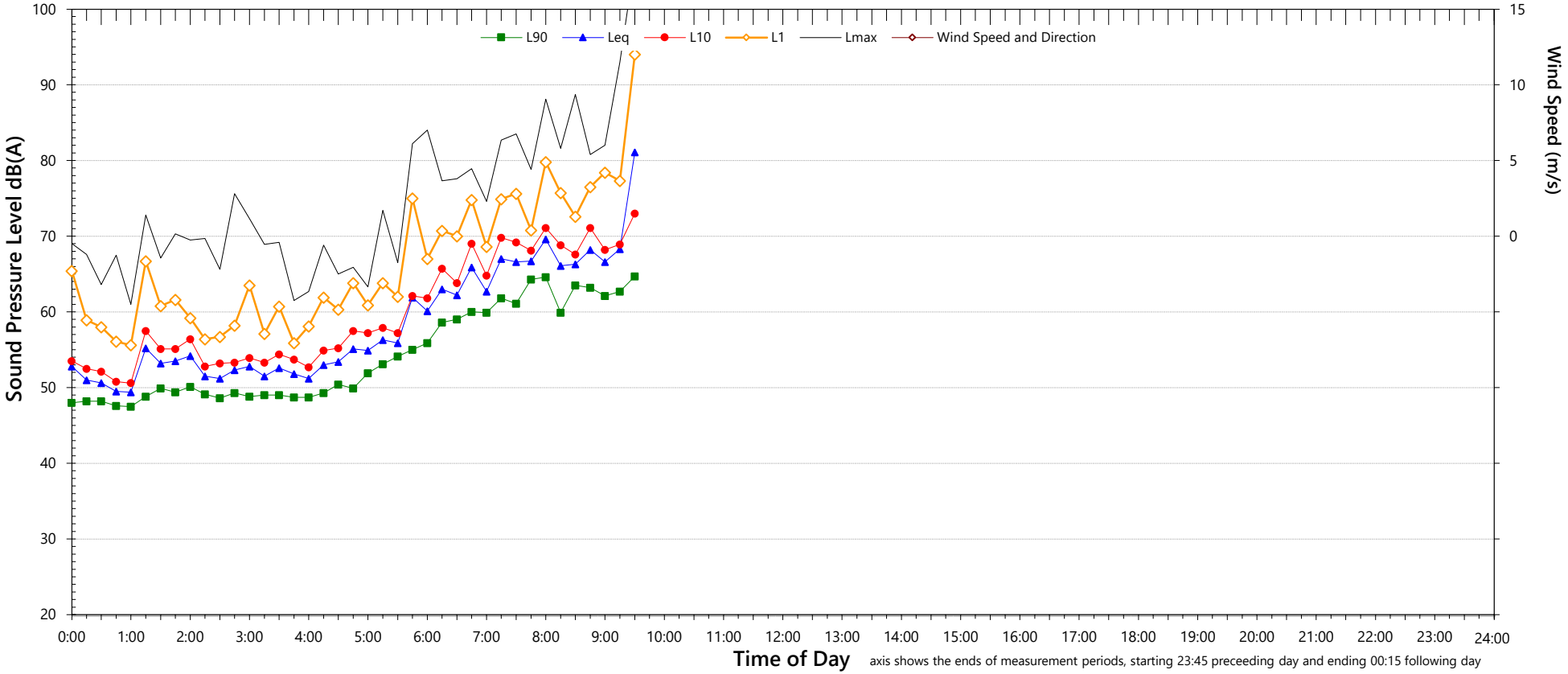
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am til 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. Night time L_{Max} values are shown only where L_{Max} >65dB(A) and where L_{Max}- Leq ≥15dB(A)
8. Meteorological data has been sourced from the nearest Bureau of Meteorology station (Holsworthy Aerodrome AWS)

Unattended Noise Monitoring Results

Target South

Wednesday, 16 September 2020



axis shows the ends of measurement periods, starting 23:45 preceeding day and ending 00:15 following day

NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{90}	-	-	-
LAeq	-	-	-

Night Time Maximum Noise Levels			(see note 7)
L_{Max} (Range)	-	to	-
L_{Max} - L_{eq} (Range)	-	to	-

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{eq\ 15\ hr}$ and $L_{eq\ 9\ hr}$	75	-
$L_{eq\ 1hr}$ upper 10 percentile	79	-
$L_{eq\ 1hr}$ lower 10 percentile	70	-

Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am til 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. Night time L_{Max} values are shown only where L_{Max} >65dB(A) and where L_{Max}- Leq ≥15dB(A)
8. Meteorological data has been sourced from the nearest Bureau of Meteorology station (Holsworthy Aerodrome AWS)

B.7 Warehouse 3A Noise Monitoring Report

Renzo Tonin & Associates Report TL116-05.4F08 Caesarstone Warehouse Ops (r2)

RENZO TONIN & ASSOCIATES
inspired to achieve

Acoustics
Vibration
Structural Dynamics

MOOREBANK LOGISTIC PARK - PRECINCT EAST

Caesarstone Warehouse Operational Compliance Measurements

1 December 2020

Qube Property Management Services Pty Ltd c/- Tactical Group

TL116-05.4F08 Caesarstone Warehouse Ops (r2).docx

35 1982-2017 ACOUSTIC ENGINEERING EXCELLENCE

Sydney Melbourne Brisbane Gold Coast Kuwait Singapore
Renzo Tonin & Associates ABN 29 117 462 861
Level 1/418A Elizabeth St SURRY HILLS NSW 2010 | PO Box 877 STRAWBERRY HILLS NSW 2012
P (02) 8218 0500 F (02) 8218 0501 sydney@renzotonin.com.au www.renzotonin.com.au

aaac Association of Australian Acoustical Consultants

Document details

Detail	Reference
Doc reference:	TL116-05.4F08 Caesarstone Warehouse Ops (r2).docx
Prepared for:	Qube Property Management Services Pty Ltd c/- Tactical Group
Attention:	Cathal McGann

Document control

Date	Revision history	Non-issued revision	Issued revision	Prepared	Instructed	Reviewed / Authorised
06.11.2020	Initial issue (draft)	0	1	J. Liang/ A. Leslie	A. Leslie	C. Weber
1.12.2020	Final	-	2	J.Liang/ A.Leslie	A.Leslie	C. Weber

File Path: R:\AssocSydProjects\TL101-TL150\TL116 cw Moorebank IMT Temporary Noise Monitoring\Task 5 - cw Operation Compliance Monitoring\1 Docs\Report 8 Caesarstone Warehouse\TL116-05.4F08 Caesarstone Warehouse Ops (r2).docx

Important Disclaimers:

The work presented in this document was carried out in accordance with the Renzo Tonin & Associates Quality Assurance System, which is based on Australian/New Zealand Standard AS/NZS ISO 9001.

This document is issued subject to review and authorisation by the suitably qualified and experienced person named in the last column above. If no name appears, this document shall be considered as preliminary or draft only and no reliance shall be placed upon it other than for information to be verified later.

This document is prepared for the particular requirements of our Client referred to above in the 'Document details' which are based on a specific brief with limitations as agreed to with the Client. It is not intended for and should not be relied upon by a third party and no responsibility is undertaken to any third party without prior consent provided by Renzo Tonin & Associates. The information herein should not be reproduced, presented or reviewed except in full. Prior to passing on to a third party, the Client is to fully inform the third party of the specific brief and limitations associated with the commission.

In preparing this report, we have relied upon, and presumed accurate, any information (or confirmation of the absence thereof) provided by the Client and/or from other sources. Except as otherwise stated in the report, we have not attempted to verify the accuracy or completeness of any such information. If the information is subsequently determined to be false, inaccurate or incomplete then it is possible that our observations and conclusions as expressed in this report may change.

We have derived data in this report from information sourced from the Client (if any) and/or available in the public domain at the time or times outlined in this report. The passage of time, manifestation of latent conditions or impacts of future events may require further examination and re-evaluation of the data, findings, observations and conclusions expressed in this report.

We have prepared this report in accordance with the usual care and thoroughness of the consulting profession, for the sole purpose described above and by reference to applicable standards, guidelines, procedures and practices at the date of issue of this report. For the reasons outlined above, however, no other warranty or guarantee, whether expressed or implied, is made as to the data, observations and findings expressed in this report, to the extent permitted by law.

The information contained herein is for the purpose of acoustics only. No claims are made and no liability is accepted in respect of design and construction issues falling outside of the specialist field of acoustics engineering including and not limited to structural integrity, fire rating, architectural buildability and fit-for-purpose, waterproofing and the like. Supplementary professional advice should be sought in respect of these issues.

External cladding disclaimer: No claims are made and no liability is accepted in respect of any external wall and/or roof systems (eg facade / cladding materials, insulation etc) that are: (a) not compliant with or do not conform to any relevant non-acoustic legislation, regulation, standard, instructions or Building Codes; or (b) installed, applied, specified or utilised in such a manner that is not compliant with or does not conform to any relevant non-acoustic legislation, regulation, standard, instructions or Building Codes.

Contents

1 Introduction 5
1.1 Warehouse operations description – Caesarstone 6
1.1.1 Location 6
1.1.2 Operational activities and facilities and hours of operation 6
1.2 Nearby sensitive receivers 6
2 Summary of noise objectives 9
2.1 Compliance assessment noise requirements 9
2.2 Operational noise limits 9
2.3 Discussion of assessment noise limits 10
3 Measurement methodology and results 12
3.1 Compliance measurement methodology 12
3.2 Instrumentation 13
3.3 Receiver unattended noise measurement results 13
3.3.1 Meteorological conditions 16
3.4 On-site attended operational activity noise measurement results 18
3.5 Unattended noise measurements 18
3.6 Modelled operational scenarios 20
3.6.1 Observed operations for modelling 20
3.6.1.1 Ute and despatching operations (Caesarstone south) 21
3.6.1.2 Qube container handling operational area 21
3.6.2 Assessment noise source levels 22
3.6.3 Reasonable worst-case intrusiveness scenarios (15-minute period) 22
3.7 Modelling methodology 25
3.7.1 Overview of noise modelling 25
3.7.2 General modelling assumptions 25
3.7.3 Model validation 26
3.8 Noise compliance assessment 26
4 Conclusion 29
APPENDIX A Glossary of terminology 31
APPENDIX B Logger location 1 – Caesarstone - North side 33
APPENDIX C Logger location 2 – Caesarstone – South side 34

List of tables

Table 1 Noise sensitive receivers and approximate distance from MPE warehouse (Caesarstone) 7
Table 2 SSD 7628 CoC B80 noise limits, dB(A) 10
Table 3 Noise measurement equipment 13

Table 4 Permanent noise monitoring stations 13
Table 5 Receiver permanent noise monitoring locations 14
Table 6 Summary of permanent noise monitoring results at the nearest sensitive residential receivers 15
Table 7 On-site attended measurement results 18
Table 8 Assessment noise source levels 22
Table 9 Representative 'reasonable' worst-case 15-minute intrusive assessment scenarios 24
Table 10 Comparison between measured and modelled noise levels 26
Table 11 Predicted noise levels - Reasonable worst-case scenarios for warehouse (Caesarstone) 27

List of figures

Figure 1 Warehouse location (Caesarstone), MPE precinct and the nearest residential receivers 8
Figure 2 Residential receiver noise monitoring locations 17
Figure 3 Unattended noise logger locations and main noise generation areas (imagery: Nearmap, 2020) 20

1 Introduction

Renzo Tonin & Associates was engaged by Tactical on behalf of Qube Property Management Services Pty Ltd (QUBE) to undertake an operational noise compliance assessment of the warehouse operations carried out by Caesarstone (Warehouse 3A (WH3A)) within the Moorebank Precent East (MPE), located within the Moorebank Logistics Park (MLP) at Moorebank, NSW.

The Sydney Intermodal Terminal Alliance (SIMTA) received approval for the construction and operation of Stages 1 and 2 of the MPE Project (SSD 6766 and SSD 7628 respectively), which together comprise the two stages of development under the MPE Concept Approval (MP10_0193). Warehouse operations, including the site that is operated by Caesarstone (WH3A), fall under the area and activities approved as part of SSD 7628.

This report has been prepared to address the operational noise monitoring requirements outlined in the MPE Operational Noise and Vibration Management Plan[1] (MPE ONVMP) required for the warehouse operations carried out by Caesarstone. Specifically, this report has been prepared to address the requirements of Condition of Consent (CoC) B85 in State Significant Development (SSD) 7628, as detailed in Section 3.2.2 of the MPE ONVMP.

Appendix A contains a glossary of acoustic terms used in this report.

1 Arcadis & Renzo Tonin & Associates, Operational Noise and Vibration Management Plan for Moorebank Logistics Park – East Precinct, Revision 012, dated 27/3/2020, available https://simta.com.au/wordpress/wp-content/uploads/2020/04/ONVMP_V12_redacted.pdf, accessed 8/10/2020

1.1 Warehouse operations description – Caesarstone

1.1.1 Location

The MLP is located approximately 27 kilometres south-west of the Sydney Central Business District and approximately 26 kilometres west of Port Botany, within the Liverpool Local Government Area. The MLP is divided into an East Precinct and a West Precinct, located east and west of Moorebank Avenue respectively, as shown in Figure 1.

1.1.2 Operational activities and facilities and hours of operation

Caesarstone undertakes storage and distribution activities from the warehouse designated WH3A within the MPE. The day to day activities include:

- Receipt and despatch of containers from and to the IMEX terminal
- Loading and unloading of containers
- Storage of stone product
- Despatching and receiving product to commercial customers using internal equipment such as gantry cranes and forklifts
- Internal product moving and loading activities, including use of gantry cranes and forklifts
- General office administrative and support functions.

The despatch activities mostly occur from the south side of the Caesarstone warehouse, typically between the hours of 9:00am and 8:00pm, with the busiest period around 9:00am to 11:00am. The noise generating vehicle movements associated with the general commercial customer activities mostly occur from the southern side of the warehouse. The northern side of the warehouse is the designated area where containers from the IMEX terminal or other sources are transported to and stored for unloading to within the warehouse. These two main areas are shown in Figure 3.

1.2 Nearby sensitive receivers

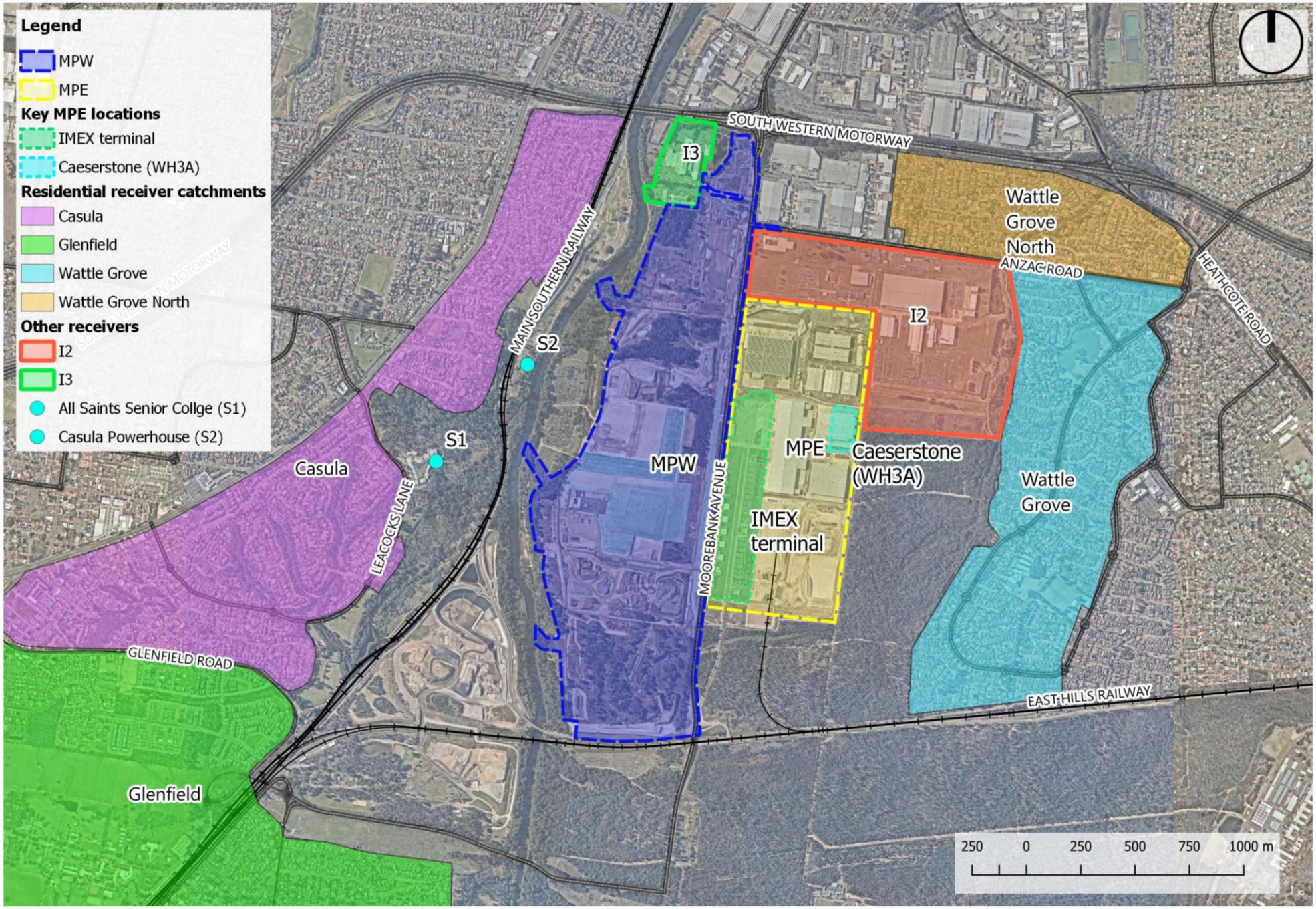
The potentially most affected residential receivers in the vicinity of the MPE, when noise intensive activities at the Caesarstone warehouse are occurring, are located in the suburbs of Casula, Glenfield, Wattle Grove and Wattle Grove North. A summary of the approximate distance to the nearest residential receiver in the surround noise catchment areas (NCAs) is provided in Table 1. The locations of the NCAs or receivers, are shown in Figure 1.

Table 1 Noise sensitive receivers and approximate distance from MPE warehouse (Caesarstone)

Sensitive receiver (Noise Catchment Area (NCA) or Receiver ID)	Receiver type	Approximate distance from MPE precinct warehouse (Caesarstone), metres
Wattle Grove (NCA 1)	Residential	700
Wattle Grove North (NCA 2)		820
Casula (NCA 3)		1,400
Glenfield (NCA 4)		2,700
All Saints Senior College (S1)	Educational	1,800
Casula Powerhouse (S2)		1,400
Defence Joint Logistics Unit (DJLU) (I2)	Industrial	130
ABB (I3)		1,120

Notes: 1. Moorebank Precinct West (MPW) has not been assessed as the final receiver locations have not been confirmed or constructed.

Figure 1 Warehouse location (Caesarstone), MPE precinct and the nearest residential receivers



2 Summary of noise objectives

2.1 Compliance assessment noise requirements

The management of operational noise emission from warehouse activities within MPE Stage 2 is outlined in the MPE ONVMP. Specifically, this report has been prepared to address the requirements of CoC B85 in SSD 7628, as detailed in Section 4.1.1 of the MPE ONVMP.

This report includes noise monitoring performed to address the requirements in CoC B85, as detailed in Table 4-1 in Section 4.1.1 of the MPE ONVMP.

The requirements of CoC B85 state:

> *B85 The Applicant must carry out noise monitoring of mechanical plant and other noisy equipment for a minimum period of one week where valid data is collected following occupation of each warehouse. The monitoring program must be carried out by a suitably qualified and experienced person(s) and a Monitoring Report for Mechanical Plant must be submitted to the Secretary within two months of occupation or each tenancy to verify predicted mechanical plant and equipment noise levels.*

CoC B85 requires that the monitored noise levels be compared against the predicted levels reviewed in accordance with CoC B84.

The noise impacts from warehouse operations were assessed as part of the EIS noise and vibration impact assessment (MPE Stage 2 Noise and Vibration Impact Assessment, Wilkinson Murray, Report No. 12186-S2, Version C, 29 November 2016 (MPE Stage 2 N&V assessment)). The individual noise impacts of warehouse operations were not quantified as part of the EIS. As such, noise level predictions for the warehouse activities are not available for verification with CoC B85.

As per Table 4-1 in Section 4.1.1 of the MPE ONVMP, Table 3-20 and Table 3-21 of the MPE ONVMP detail the predicted $L_{Aeq\ 15\ minute}$ intrusiveness and L_{Amax} sleep disturbance noise limit levels respectively for the overall MPE operations (not for individual warehouses).

As such, for the purposes of addressing CoC B85, instead of comparing the facility noise emission against the noise level predicted in accordance with CoC B84, this report is aims to assess the noise levels from the mechanical plant and other noisy equipment that operate within the facility directly against the noise limits presented in Table 5 of condition B80.

2.2 Operational noise limits

The operational noise limits applicable for the warehouse operations within MPE are presented in Table 5 of SSD 7628 CoC B80 and are reproduced in Table 2. These noise limits are as per Table 3-5 of

the MPE ONVMP. The noise limits are applicable not only to all operational noise sources approved under SSD 7628, but are inclusive of operations as part of MPE Stage 1, approval SSD 6766.

The $L_{Aeq(15\ minute)}$ criteria are applicable during the day, evening and night-time periods and the $L_{A1\ (1\ minute)}$ sleep disturbance noise limits at residential receivers are applicable during the night-time period.

The noise limits are applicable under prevailing meteorological conditions of wind speeds of up to 3 m/s at 10 metres above ground level or stability category 'F' temperature inversion conditions.

Table 2 SSD 7628 CoC B80 noise limits, dB(A)

Sensitive receiver	Day [1] $L_{Aeq,\ 15\ minute}$	Evening [1] $L_{Aeq,\ 15\ minute}$	Night [1] $L_{Aeq,\ 15\ minute}$	Night [1] $L_{A1\ (1\ min)}$
Wattle Grove (NCA 1)	35	35	35	52
Wattle Grove North (NCA 2)	35	35	35	52
Casula (NCA 3)	35	35	35	52
Glenfield (NCA 4)	35	35	35	52

Notes:

1. In accordance with the INP, day is the period from 7:00 am to 6:00 pm Monday to Saturday; or 8:00 am to 6:00 pm on Sundays and public holidays; evening is the period from 6:00 pm to 10:00 pm; and night is the remaining periods.
2. To determine compliance with the $L_{Aeq,15\ minute}$ noise limits, noise from the development is to be measured at the most affected point within the residential boundary, or at the most affected point within 30 metres of a dwelling where the dwelling is more than 30 metres from the boundary. Where it can be demonstrated that direct measurement of noise from the project is impractical, the EPA may accept alternative means of determining compliance (see Chapter 7 Noise Policy for Industry - NPfI) The modification factors in Section 4 of the INP must also be applied to the measured noise levels where applicable.
3. To determine compliance with the L_{A1} noise limits, noise from the project is to be measured at 1 metre from the dwelling façade. Where it can be demonstrated that direct measurement of noise from the project is impractical, the EPA may accept alternative means of determining compliance (see Chapter 7 of the NPfI).
4. The noise emission limits identified above apply under meteorological conditions of:

   (i) wind speeds of up to 3 m/s at 10 metres above ground level; or

   (ii) 'F' atmospheric stability class.

2.3 Discussion of assessment noise limits

As noted in Section 2.2, the noise limits detailed in SSD 7628 CoC B80 are applicable not only to all operational noise sources approved under SSD 7628, but are also inclusive of operations as part of the MPE Stage 1 approval for SSD 6766. Importantly, when assessing compliance with the noise limits, the most affected residential receiver for any individual operations will not necessarily be at the same location. Additionally, it is unlikely that the reasonable worst-case noise levels from any individual operations would also occur in the same 15-minute period.

As part of the recent modification application for SSD 7709 Moorebank Precinct West (MPW) – Stage 2, MOD 1 - Building height increase (July 2020), a review of the applicable operational noise requirements across Moorebank Precinct West (MPW) and Moorebank Precinct East (MPE) was undertaken (Renzo Tonin & Associates document reference TJ741-11F05 (r4), dated 30 June 2020). The review identified that there are number of approval conditions that are applicable across both the MPW and MPE sites for operational noise, and that in the application of these approvals to the site activities, it became apparent that the operational noise requirements were not consistent across the MPE and MPW sites.

Additionally, the review identified that the operational noise limits across MPE and MPW were set substantially below both the noise criteria and the predicted noise levels (even with feasible and reasonable mitigation measures) established during the environmental assessment stages and considering the cumulative operational noise levels from all MPE and MPW operations.

The review recommended that an overall approach for cumulative operational noise management of the Moorebank intermodal terminal precinct (for East and West precinct) for a "whole of complex" approach be adopted, and that consistent noise management objectives for the Moorebank intermodal terminal precinct's operational noise be adopted to cover all operations within MPE and MPW. Appropriate and achievable noise management objectives consistent with EPA's noise policies were also developed in the review.

Following the modification application for SSD 7709 (MOD 1), the submission received from the NSW Environment Protection Authority (NSW EPA) noted the following:

> *However, the current noise limits are set below the predicted noise levels and are not based on the Project Specific Noise Levels (PSNL) derived under the then-applicable Industrial Noise Policy 2000 (now superseded by the Noise Policy for Industry 2017)…. The EPA considers that the resulting noise limits are not achievable for MPW, nor are they achievable for the cumulative MPW and MPE sites.*

Also Liverpool City Council included in their submission:

> *Council considers that site regulation in regard to noise management may be assisted by adopting a precinct approach consistent with the NSW EPA's Noise Policy for Industry (2017)…. Whilst it is acknowledged that current criteria in the Approval may be impracticable, it will be necessary for the Department to consider applying suitable noise limits that are achievable and capable of protecting the amenity and wellbeing of sensitive receivers.*

As such, this operational compliance assessment does not include further quantification of cumulative noise levels, and demonstrates that Caesarstone warehouse operations can achieve the noise limits set out in SSD 7628 CoC B80 in isolation during reasonable worst-case operations.

It is recommended that noise levels from this assessment achieve the required noise limits set out in Table 5 of SSD 7628 CoC B80, and that the site specific noise levels should be considered as part of the operational noise management applicable to the overall Moorebank intermodal terminal precinct.

3 Measurement methodology and results

3.1 Compliance measurement methodology

The Noise Policy for Industry (NPfI) provides guidance in Chapter 7 for monitoring the performance of a noise-generating industrial facility. In Section 7.1.1, the NPfI provides guidance as to how to review noise emissions of a site where the existing ambient noise levels are already high, resulting in the direct quantification of the noise under investigation not being possible via noise measurements at the receiver location. Additionally, it provides guidance about using noise modelling to review the performance of an industrial operation that is co-located with separate but noise-generating industrial sites impacting the same receiver. To satisfy the requirements of CoC B85, the following noise monitoring and assessment steps have been undertaken:

1. Review of permanent noise monitoring at nearby residential receivers during periods when noise intensive activities were taking place within the Caesarstone warehouse facility to determine if noise levels would allow for quantification of operational noise emissions, and to check if operational noise emissions are quantifiable at the receiver locations during periods of noise intensive on-site activities (Section 3.3).

2. On-site attended monitoring of noise-generating activities to quantify noise emission levels of mechanical plant and other noise-generating activities as part of typical warehouse operations (Section 3.4).

3. Unattended noise monitoring within the Caesarstone warehouse facility for a period of two weeks, with concurrent video, to identify the reasonable worst-case operational scenarios for each major noise-generating area (Section 3.5).

The review of unattended noise monitoring data measurements established that the existing ambient noise levels at the nearest receivers were high and controlled by noise sources outside of MPW, in addition to a number of industrial noise-generating facilities being co-located. As such, direct quantification or estimation of operational noise emissions from the warehouse operations at the sensitive receiver locations was not possible. Noise emissions from the warehouse facility (Caesarstone) have been evaluated using a combination of on-site attended and unattended noise monitoring, combined with noise modelling, in order to quantify the industrial noise emissions from Caesarstone operations.

Following the noise monitoring, the following steps were undertaken to assess the noise level contributions at the nearby sensitive receivers:

1. Review observations of warehouse operations, in addition to the noise monitoring results and associated video, to then determine the reasonable worst-case operational scenarios.

2. Setup and calibrate the noise model for the reasonable worst-case operational scenarios.

3. Calculate the operational noise levels from the warehouse operations to all nearby receivers and determine the noise level contribution at the property with the highest noise levels within each NCA.

3.2 Instrumentation

A range of noise monitoring equipment was used to undertake the compliance noise monitoring. A summary of measurement equipment and calibration dates is provided in Table 3.

All of the noise monitoring equipment are Class 1 instruments, with calibration certificates current at the time of the measurements. Before and after each series of attended measurements, the calibration of the sound level meters were verified using a reference calibration of 94 dB at 1 kHz. The difference between pre- and post-calibration levels was within 0.5 dB for all measurements.

Table 3 Noise measurement equipment

Monitoring location/ purpose	Equipment	Serial No	Last date calibrated
On-site attended noise measurements	NTi XL2	A2A-05312-E0	10/10/2018
Unattended on-site noise measurements (Caesarstone North)	NTi XL2	A2A-1352A-E0	20/12/2019
Unattended on-site noise measurements (Caesarstone South)	NTi XL2	A2A-09356-E0	01/05/2019
Field calibration	B&K 4231	2677710	16/03/2020

Four Envirosuite permanent noise monitors are set up at nearest representative residential locations in the community and are labelled NMT01 to NMT04 in Figure 2.

Table 4 Permanent noise monitoring stations

Monitoring location	Description	Equipment	Serial No	Last Date Calibrated
NMT01	Permanent noise monitor	B&K 2250	3025394	12/03/2019
NMT02	Permanent noise monitor	B&K 2250	3025271	12/03/2019
NMT03	Permanent noise monitor	B&K 2250	3025351	12/03/2019
NMT04	Permanent noise monitor	B&K 2250	3025317	12/03/2019

3.3 Receiver unattended noise measurement results

As detailed in Section 1.2, the residential receivers nearby to the Caesarstone warehouse facility are located in the suburbs of Casula, Glenfield, Wattle Grove and Wattle Grove North.

As the most intensive period of operational activities at WH3A (Caesarstone) was during the morning period from 10:00 am, noise monitoring data from the permanent noise monitoring stations have been reviewed for the period of 8:00 am and 10:30 am 10 September 2020 during which onsite noise intensive activities were taking place. The permanent noise monitoring stations were configured to record audio and undertaken short-term statistical noise measurements. During this measurement period, attended noise measurements were undertaken on-site of noise generating activities

(see Section 3.4). This assisted to confirm that noise intensive activities were occurring on-site during the reviewed period of permanent noise monitoring data and noise recordings.

A summary of the monitoring locations and the approximate distance to the warehouse (Caesarstone) is provided in Table 5. These locations along with the noise catchment areas (NCAs) are presented in Figure 2.

Table 5 Receiver permanent noise monitoring locations

Monitoring location ID	Monitoring location (applicable NCA) (see Figure 2)	Approximate distance (m) from warehouse (Caesarstone)
NMT01	22 Glenelg Court, Wattle Grove (Wattle Grove North – NCA2)	810
NMT02	26 Goodenough Street, Glenfield (Glenfield – NCA4)	2,700
NMT03	31 Martindale Court, Wattle Grove (Wattle Grove – NCA1)	700
NMT04	14 Dunmore Crescent, Casula (Casula – NCA3)	1,600

The results of the permanent noise monitoring results on 10 September 2020 are presented in Table 6.

Attended noise measurements were undertaken at these locations as part of the operational noise compliance monitoring during Quarter 1 2020 (*Renzo Tonin and Associates report, TL116-05F04 Moorebank INP Monitoring Q2 2020 (r1), dated 22 July 2020*) and Quarter 2 2020 (*Renzo Tonin and Associates report, TL116-05F03 Moorebank INP Monitoring Q1 2020 (r2), dated 17 April 2020*), during the daytime period. Noise levels similar to those measured for the periods presented in Table 6 were measured at each of the locations. Audio recordings from a sample of the Table 6 measurements were reviewed, and while the main controlling noise sources could not clearly be distinguished, they were likely controlled by road traffic from nearby arterial roads and other environmental noise sources (ie. birds, helicopters) outside of the MLP site. This is consistent with these previous noise measurements.

Because the noise limits are 35 dB(A) $L_{Aeq\ 15\ minute}$, the ambient noise levels were greater than 48 dB(A) $L_{Aeq\ 15\ minute}$, and the background noise levels greater than 41 dB(A) $L_{A90\ 15\ minute}$, and given that on-site activity noise levels are expected to result in noise levels less than 35 dB(A) $L_{Aeq\ 15\ minute}$ at all residential receiver locations, noise from Caesarstone warehouse on-site activities was not expected to be audible and/or distinguishable. Furthermore, if any noise generating activity was audible, direct quantification or estimation of operational noise emissions from the warehouse operations at the sensitive receiver locations would not be possible in the presence of the ambient noise level environment.

Table 6 Summary of permanent noise monitoring results at the nearest sensitive residential receivers

Measurement period	Measured noise level (15 minute), dB(A)			
	L_{Amax}	L_{A1}	L_{Aeq}	L_{90}
NMT01 (22 Glenelg Court, Wattle Grove)				
10/09/2020 8:00 am to 8:15 am	75	64	58	47
10/09/2020 8:15 am to 8:30 am	72	64	58	46
10/09/2020 8:30 am to 8:45 am	80	64	58	46
10/09/2020 8:45 am to 9:00 am	70	63	56	46
10/09/2020 9:00 am to 9:15 am	69	63	55	46
10/09/2020 9:15 am to 9:30 am	76	73	63	44
10/09/2020 9:30 am to 9:45 am	78	74	63	44
10/09/2020 9:45 am to 10:00 am	68	62	53	43
10/09/2020 10:00 am to 10:15 am	66	62	54	44
10/09/2020 10:15 am to 10:30 am	66	63	55	46
NMT02 (26 Goodenough Street, Glenfield)				
10/09/2020 8:00 am to 8:15 am	77	66	55	48
10/09/2020 8:15 am to 8:30 am	70	61	51	46
10/09/2020 8:30 am to 8:45 am	73	64	52	45
10/09/2020 8:45 am to 9:00 am	74	67	53	45
10/09/2020 9:00 am to 9:15 am	78	59	51	45
10/09/2020 9:15 am to 9:30 am	75	61	51	42
10/09/2020 9:30 am to 9:45 am	73	64	51	43
10/09/2020 9:45 am to 10:00 am	73	65	53	44
10/09/2020 10:00 am to 10:15 am	72	60	49	43
10/09/2020 10:15 am to 10:30 am	72	64	51	43
NMT03 (31 Martindale Court, Wattle Grove)				
10/09/2020 8:00 am to 8:15 am	73	67	55	43
10/09/2020 8:15 am to 8:30 am	75	58	48	41
10/09/2020 8:30 am to 8:45 am	74	69	56	41
10/09/2020 8:45 am to 9:00 am	74	61	50	41
10/09/2020 9:00 am to 9:15 am	74	58	48	41
10/09/2020 9:15 am to 9:30 am	69	66	56	42
10/09/2020 9:30 am to 9:45 am	73	69	59	54
10/09/2020 9:45 am to 10:00 am	71	60	54	44
10/09/2020 10:00 am to 10:15 am	77	65	53	42
10/09/2020 10:15 am to 10:30 am	71	66	54	42

Measurement period	Measured noise level (15 minute), dB(A)			
	L_{Amax}	L_{A1}	L_{Aeq}	L_{90}
NMT04 (14 Dunmore Crescent, Casula)				
10/09/2020 8:00 am to 8:15 am	72	61	52	46
10/09/2020 8:15 am to 8:30 am	80	61	53	47
10/09/2020 8:30 am to 8:45 am	71	64	54	47
10/09/2020 8:45 am to 9:00 am	68	64	56	50
10/09/2020 9:00 am to 9:15 am	73	71	61	51
10/09/2020 9:15 am to 9:30 am	75	69	56	49
10/09/2020 9:30 am to 9:45 am	75	64	54	49
10/09/2020 9:45 am to 10:00 am	73	71	58	49
10/09/2020 10:00 am to 10:15 am	68	61	53	49
10/09/2020 10:15 am to 10:30 am	82	75	62	50

Notes:
1. Noise levels at this location are affected by occasional adjacent train movements
2. Data periods shaded in dark grey at weather affected based upon the MLP meteorological data monitoring station, due to prevailing winds. 10:00am to 10:15am and 9:15am to 9:30am should be excluded due to average wind speeds not < 5m/s.

3.3.1 Meteorological conditions

Meteorological conditions for the permanent noise monitoring stations has been reviewed for the monitoring period to determine the prevailing wind conditions. Temperature inversion conditions were not considered, as no onsite noise generating activities were observed during the night period (10:00pm to 7:00am). Data from the MLP meteorological data monitoring station adjacent to Moorebank Avenue, within the MPE site, established in accordance with CoC A54 SSD 7709 has been reviewed. It was determined from the review that the receiver permanent noise monitoring noise measurements were undertaken with periods of worst-case prevailing meteorological conditions in accordance with SSD7628 B80.

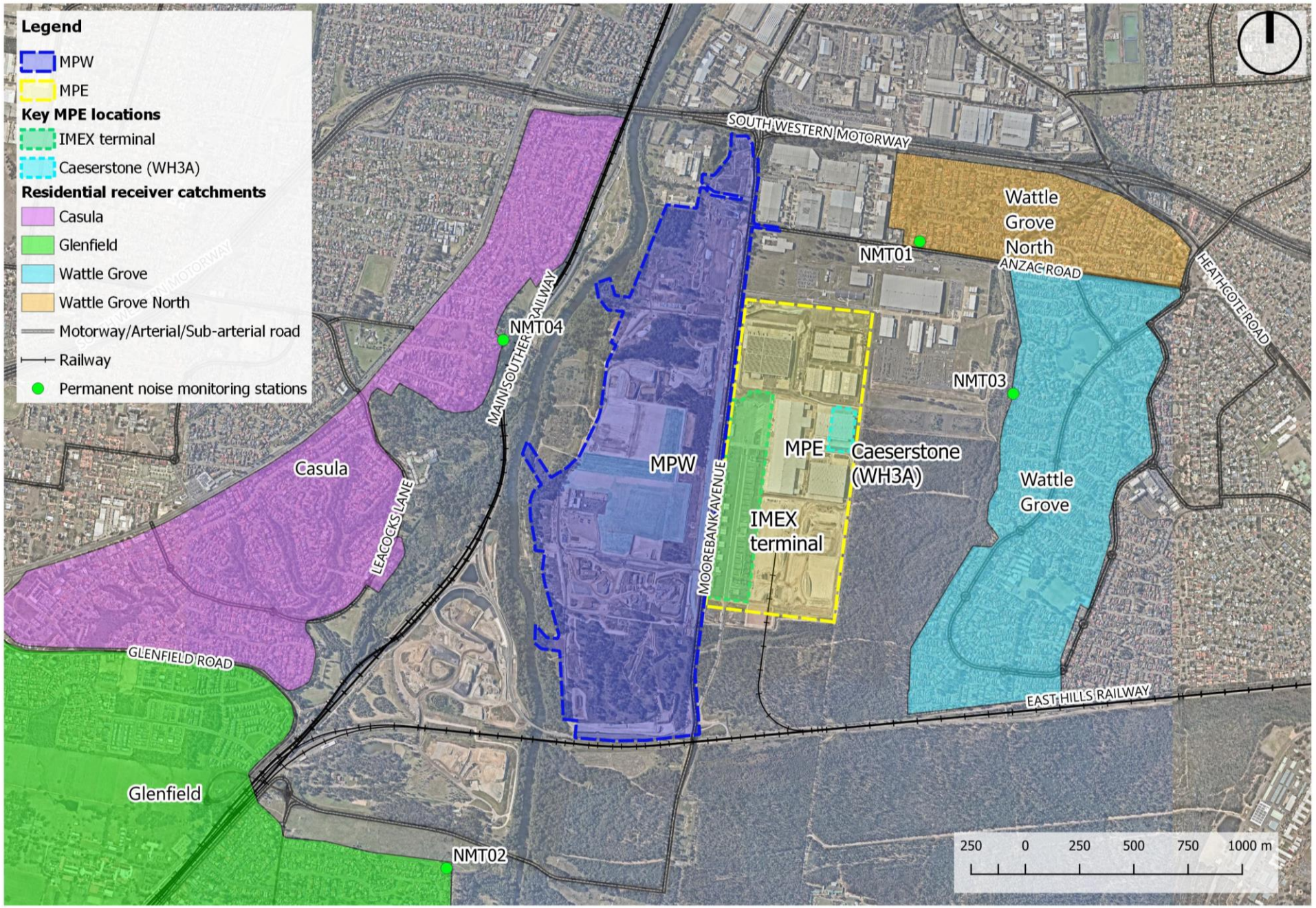
The meteorological conditions experienced during receiver permanent noise monitoring on 10 September 2020 are summarised below:

- During the measurement period at the facility, the equivalent average wind speed was 1-6 m/s and generally from the SSE, varying from E to SW. 25% of the measurement period was E to SE winds. Periods of data where the average wind speed was greater than 5m/s have been excluded as per the NPfI. All other measurements were not impacted by excessive wind during any of the measurement periods.

- No rain occurred during any of the measurement periods.

- The temperature during the measurement period ranged between 18˚C and 24˚C, and the cloud conditions were generally clear skies with a few scattered clouds.

Figure 2 Residential receiver noise monitoring locations



3.4 On-site attended operational activity noise measurement results

Attended noise measurements of individual operational items and typical operations were undertaken at Caesarstone on 10 September 2020, in order to quantify the noise emissions from noise-generating operational activities. These noise levels have been used to assist in establishing the source noise levels in the noise model.

During all measurements, the specific noise source being measured was the dominant noise source. Observations were made of the on-site operations, which have then been reviewed in conjunction with the video data to model 'reasonable' worst-case operational scenarios over the assessment periods. Critical on-site attended measurement results are summarised in Table 7.

Table 7 On-site attended measurement results

Activity noise sources	Date	Time	Measurement duration (t), sec	Measurement distance, m	Measured noise levels, dB(A)	
					$L_{Aeq(t)}$	L_{AFmax}
Ute						
Ute pass-by	10/9/2020	2:21 pm	14	25	60	62
Ute Idling	10/9/2020	8:30 am	10	20	52	54
Combi-lift[1]						
Grabbing & dropping sound	7/9/2020	7:19 am	2	44	67	71
Engine revving	7/9/2020	7:19 am	10	23	75	76
Engine	7/9/2020	7:20 am	20	38	60	61
Reverse beeper	7/9/2020	7:19 am	12	23	71	74
Internal warehouse noise levels (noise breakout)						
Internal noise sources at loading dock door (loading, internal overhead crane)	10/9/2020	8:30 am	480	At loading dock doorway	66	87
Mechanical plant						
Warehouse smoke exhaust fan[2]	16/9/2020	7:51 am	15	11	62	62
Air condenser unit	10/9/2020	5:36 am	60	1	47	48

Notes:
1. Same Combi-lift is used at Caesarstone warehouse with similar container handling activities taking place. As such, noise source levels are based on attended measurement from the Target container handling area on the 7 September 2020.
2. Fan noise levels were not quantifiable from an accessible location, and so fan noise levels are based upon internal noise measurement undertaken at ATS Building Products warehouse, 16 September 2020, as similar model fans are installed within that warehouse.

3.5 Unattended noise measurements

Unattended noise measurements were undertaken over the period between 2 September and 15 September 2020 at a location adjacent to the Caesarstone office building on both side of the warehouse. Two main areas of noise-generating operations were identified across the warehouse site, one on the northern side of the warehouse and one on the southern side. These are shown in Figure 3.

The location of the unattended noise loggers is shown in Figure 3. These were selected so that they would capture noise from the main noise-generating areas as part of the typical warehouse operations. Camera units were setup at west side boundary fence at Caesarstone north and south to assist the engineers in gaining a comprehensive understanding of the site operations and vehicle movements.

The purpose of the noise logging at the selected locations was for the following:

- Determine the noise emissions from the facility at a fixed location close enough to quantify on-site sources.
- Determine the long-term background noise levels when operations were not taking place at the site.
- A source for analysis to determine the duration and nature of the different on-site activities through correlation with the Facility activity data.
- Source of validation for the noise model calibration process.

Detailed unattended noise monitoring results are provided in APPENDIX B for Caesarstone North and APPENDIX C for Caesarstone South. The noise model was validated using the unattended noise logger results, refer to Section 3.7.3 for noise model calibration.

Figure 3 Unattended noise logger locations and main noise generation areas (imagery: Nearmap, 2020)

3.6 Modelled operational scenarios

3.6.1 Observed operations for modelling

Based upon the on-site attended measurements presented in Section 3.4, the video recording for the facility over the unattended monitoring period presented in Section 3.5, and discussions with Caesarstone personnel, 'reasonable' worst-case operational scenarios were established and modelled to satisfy the assessment periods under SSD 7628.

The following section details the key observations of each of the noise-generating activities that take place across the warehouse operations.

3.6.1.1 Ute and despatching operations (Caesarstone south)

The following data on truck operations was obtained from the site observations during the attended measurements on 10 September 2020, and unattended noise measurements / concurrent video recordings between 2 September and 15 September.

- It was observed and confirmed by video movement data, that truck operations were typically commercial customer vehicles, and that a typical 'in-and-out' cycle time in the facility was on median 20 minutes, with each loading cycle taking approximately 10-15 minutes.

- Based upon the attended noise measurement and video data analysis, utes or small trucks operating in the Caesarstone south despatching area travel at a relative low speed of approximately 20 km/h.

- Based upon the attended noise measurement and video data analysis, no loading and unloading of containers or trucks occurred outside of the warehouse on the southside of Caesarstone.

- Loading of products onto commercial customer vehicles operations occurred within the warehouse with the doors open.

- Up to three utes could be loaded simultaneously within the warehouse via the use of overhead gantry cranes.

- The peak periods of commercial customer vehicles entering and exiting the facility from the southern side of the warehouse was between 9:00am to 9:30am, where up to five vehicles movements would occur within a 15 minute period. Commercial customer vehicles continued to enter and exit the facilities during the hours of 9:30am to 8:00pm.

3.6.1.2 Qube container handling operational area

- It was observed that one combi-lift is would be used to move containers in and out of the Caesarstone terminal at the Qube container handling operational area. During on-site measurements, it was observed that the combi-lift operate could operate continuously throughout a 15-minute period when handling containers.

- The use of the reversing beepers at the Qube container handling operational area has been considered within the CadnaA modelling process.

- Impact noise events associated with grabbing and dropping would occur when the combi-lift gripper contact individual containers as part of handling operations.

- Tonal reversing beepers are used when a combi-lift is undertaking container handling activities.

- Movements of containers within the Qube area can occur throughout the day time period. However, it was observed movements typically started from approximately 7:00am. Three

containers movements per week were observed from the video data as container movements happens once during the same day.

3.6.2 Assessment noise source levels

Source levels for the key noise-generating activities on-site have been established based upon the attended noise measurements (Section 3.4) and unattended noise measurements (Section 3.5) during periods of typical operation. The sound power level inputs presented in Table 8 were used in the operational noise compliance modelling, and adjusted for the duration and frequency of operations (Section 3.6.3).

Table 8 Assessment noise source levels

Site items / operation	Individual activity sound power level (SWL) (L_{Aeq}), dB(A)
Caesarstone North	
Container combi-lift (moving container activity)	103
Container Trucks	105
Container movement noise events (L_{AFmax})	107
Caesarstone South	
Utes/small trucks idling on site/no engine load movement	69
Commercial customer vehicle (ute/small truck) moving onsite (Ute/small truck) (typical speed onsite approximately 20km/h)	98
Internal noise breakout	
Internal activities noise[1]	66 L_{Aeq} internal sound pressure level
Mechanical Plant	
Warehouse air smoke exhaust fan[2]	90
Air condenser unit[3]	69
Other noise sources	
Utes/small trucks moving on internal roads within MLP, outside of the Caesarstone site (typical speed on internal roads of 40km/h)	98

Notes:

1. Attended measurement shows breakout via Caesarstone South & North loading dock door during despatching operations Internal noise levels included internal noise intensive periods when gantry cranes, forklifts and vehicles were in use.
2. Based upon internal measurement based upon internal noise measurement undertaken at ATS Building Products warehouse, 16 September 2020, as similar model fans are installed within that warehouse.
3. Located on both the east and south façades of the warehouse.

3.6.3 Reasonable worst-case intrusiveness scenarios (15-minute period)

As the noise limits in CoC B80 are set at 35 dB(A) $L_{Aeq\ 15\ minute}$ for the day, evening and night periods, specific separation of noise intensive periods for each of these time periods has not been undertaken. Instead, it is noted that there are two main areas of noise generation as part of typical warehouse operations, as presented in Figure 3.

In order to assess the operational noise emissions from the warehouse, the 'reasonable' worst-case operations for each of the two main areas of noise generation have been developed, along with the corresponding activities in the other noise-generating areas, in order to review a representative snapshot of activities from the warehouse operations. Each of the assessment scenarios have been developed from an analysis of the video movement data over during the two-week period, in addition to the information detailed in Section 3.6.1.

A representative scenario has been established to assess a 'reasonable' worst-case scenario for the northern side of the warehouse, which is the Qube container operation area. A total of three container movements per week were recorded from the video data which recorded for a period of two weeks. The duration of each container operation was approximately 25 minutes or less. During the periods when containers where being moved within the Qube container operation area, internal loading activities were observed within the Caesarstone warehouse.

The Caesarstone south activities were observed to commence from 9:00am, with a peak period of noise intensive activities around the 10:30am to 11:00am.

Two periods representing the 'reasonable' worst-case operations based upon these peak periods of noise intensive activities have been used to assess operational noise emissions. Table 9 details the two 'reasonable' worst-case scenarios (15-minute period), covering the noise intensive periods for the two main areas of noise generation across the site.

All significant noise-generating equipment has been included the assessment modelling, in addition to the key noise-generating mechanical plant as required by CoC B85. It is noted that the noise contribution from the mechanical plant items serving the warehouse and office area are included in the modelling, however, they generate minimal contribution to the overall noise levels from site operations , which are controlled by other on-site activities such as commercial vehicle departures, arrivals and warehouse internal loading activities.

No onsite noise generating activities were observed during the night period (10:00pm to 7:00am). As such, sources of potential sleep disturbance have not been modelled.

Table 9 Representative 'reasonable' worst-case 15-minute intrusive assessment scenarios

Activity	Caesarstone North 15-minute assessment period (Qube container area)	Caesarstone South 15-minute assessment period
Caesarstone North 15-minute noise intensive period (with container handling taking place)		
Departure	One container truck departure from Qube area with 2 containers.	No activity
Arrival	One Combi-lift and one container truck arrival at Qube container operational area	No activity
On-site operations	Container operations: a) Removing two empty containers from dock 4 and 5 on to the container truck. b) Moving two new containers from the side into dock 4 and 5. *Noise breakout via open warehouse doors.* All loading activity are occurring inside the warehouse with warehouse doors open, three noise generating activities occurring concurrently. a) Crane operations b) Forklift movements c) Ute idling	*Noise breakout via open warehouse doors.* All loading activity are occurring inside the warehouse with warehouse doors open, three noise generating activities occurring concurrently. a) Crane operations b) Forklift movements c) Ute idling
Caesarstone South 15-minute noise intensive period		
Departure	No activity	One Ute departure from dock 2
Arrival	No activity	Four Utes arrive at loading dock: a) Dock 2 b) Dock 3 c) Dock 4 d) Dock 5
On-site operations	*Noise breakout via open warehouse doors.* All loading activity is occurring inside the warehouse with warehouse doors open, three noise generating activities occurring concurrently. a) Crane operations b) Forklift movements c) Utes idling	*Noise breakout via open warehouse doors.* All loading activity is occurring inside the warehouse with warehouse doors open, three noise generating activities occurring concurrently. a) Crane operations b) Forklift movements c) Utes idling
Mechanical plant (All scenarios)		
a) Roof top exhaust fan (3 fans) b) Office condenser (9 units) (2 in operation) c) Warehouse air condenser (12 units)		

3.7 Modelling methodology

3.7.1 Overview of noise modelling

Since ambient noise levels were well above the project noise limit at the nearest residential receivers, and it was not possible to directly measure or estimate the warehouse noise contribution directly, computer noise modelling was used to calculate the operational noise levels from warehouse operations at the nearby noise sensitive receivers.

3.7.2 General modelling assumptions

Modelling and assessment of warehouse noise emissions were determined by modelling the noise sources, receiver locations, existing built structures and topographical features, using CadnaA (version 2020).

The modelling incorporated the worst-case prevailing meteorological conditions, as required by CoC B80, which are wind speeds of up to 3 m/s at 10 metres above ground level for the assessed activities.

The noise predictions are based on the CONCAWE noise prediction algorithms, noting that the nearby noise sensitive receivers are greater 100 metres from the site (except for MPW). The CONCAWE environmental noise prediction method is an appropriate method for predicting noise propagation in these circumstances.

The noise prediction model considers:

- Location of noise sources on-site sensitive receiver locations
- Height of sources and receivers referenced to digital ground contours within the site and outside the site area
- Noise source levels of individual plant, equipment and internal building noise levels, modelled as either point, line or area noise sources. All noise sources associated with the Caesarstone operations within the MPE boundary have been included in the noise modelling, including the truck movements outside of the WH3A Caesarstone warehouse footprint, along internal MPE roads.
- Separation distances between sources and receivers
- Ground type between sources and receivers (mixed soft/ hard)
- Attenuation from buildings and built structures and topography (natural and purpose built)
- Atmospheric losses and assessment meteorological conditions.

The modelled activities and assumptions for the to the equipment operating and the duration and frequency of operation as part of the 'reasonable' worst-case operational scenarios are described in Section 3.6.3.

3.7.3 Model validation

Following the development of each of the representative modelling scenarios, the noise model outputs were compared against the unattended noise measurement results for the period with similar activities to the reasonable' worst-case operational scenario. Validation of the reasonable worst-case on-site activities was undertaken to check the final representative modelling inputs against a period of measured activities. The results of this process are presented in Table 10.

Table 10 Comparison between measured and modelled noise levels

Time period	Logger	Measured noise levels LAeq,15minute (dBA)	Predicted noise levels LAeq,15minute (dBA)	Difference, dB
2:00pm to 2:15pm 2 September 2020[1]	Caesarstone North	73	71	2
10:40am to 10:55am 3 September 2020[2]	Caesarstone South	57	58	1

Notes: 1. Noise generating activities within the facility were as per Table 9*"Caesarstone North 15-minute noise intensive period (With container handling taking place)"*

2. Noise generating activities within the facility were as per Table 9 *"Caesarstone South 15-minute noise intensive period"*

The differences between the modelled and the measured noise levels are the result of the following:

- Noise levels at the logger location are dependent upon the specific location of loading activities and which internal loading dock is being used by a utes at Caesarstone South.
- Differences in modelled levels compared with measured noise levels from the noise breakout from internal warehouse activities will depend upon the specific duration and operating times of noise intensive plant/equipment associated with internal loading activities.
- Modelled levels for ute passbys were based upon a worst-case average sound power level for a range of measured ute passbys. In addition at Caesarstone south, noise contribution from vehicle movements, which varied in duration, speed and location compared to the logger location throughout the activity, which would result in minor differences in measured noise levels.

The results from the validation of the model demonstrate that it is suitable for determining the compliance noise levels for this assessment.

3.8 Noise compliance assessment

Predicted operational compliance noise levels are presented in Table 11 for each of the two compliance assessment scenarios. The noise levels have been predicted to each of the surrounding residential

receiver noise catchments, and the highest residential receiver noise level in each catchment area is the reported level in Table 11. It should be noted that this is not necessarily the same receiver location for each assessment scenario.

These noise levels represent the reasonable worst-case intrusiveness operational scenarios (15-minute period) from typical operations of the warehouse. The results in Table 11 show that the predicted noise levels for the $L_{Aeq\ (15\text{-}minute)}$ assessments comply with the overall operational noise limits presented in Table 2.

As no activities typically take place during the night period (10:00pm to 7:00am), when the $L_{A1\ (1\text{-}minute)}$ noise limits presented in Table 2 are applicable. As such, warehouse operations also satisfy this noise limit.

Table 11 Predicted noise levels - Reasonable worst-case scenarios for warehouse (Caesarstone)

Noise catchment area/ receiver location	$L_{Aeq\ (15\text{-}minute)}$		Compliance
	Noise limits	Predicted noise levels	
Caesarstone North 15-minute noise intensive period (With container handling taking place)			
Wattle Grove (NCA 1)	35	32	Yes
Wattle Grove North (NCA 2)	35	22	Yes
Casula (NCA 3)	35	23	Yes
Glenfield (NCA 4)	35	<20	Yes
All Saints Senior College (S1)	45[1]	<20	Yes
Casula Powerhouse (S2)	45[1]	22	Yes
Defence Joint Logistics Unit (DJLU) (I2)	70[1]	38	Yes
ABB (I3)	70[1]	22	Yes
Caesarstone South 15-minute noise intensive period			
Wattle Grove (NCA 1)	35	27	Yes
Wattle Grove North (NCA 2)	35	20	Yes
Casula (NCA 3)	35	20	Yes
Glenfield (NCA 4)	35	<20	Yes
All Saints Senior College (S1)	45[1]	<20	Yes
Casula Powerhouse (S2)	45[1]	20	Yes
Defence Joint Logistics Unit (DJLU) (I2)	70[1]	<20	Yes
ABB (I3)	70[1]	35	Yes

Notes: 1. Noise limits for these receivers are only applicable when the receiver is in use

The highest modelled noise levels are generated by the container unloading activities on the northern side of the Caesarstone warehouse. The highest modelled noise level was 32 dB(A) $L_{Aeq.15minute}$ at Wattle Grove (NCA 1).

However, video data has shown that these container movement operations only occurred three times per week, over the two weeks, each of 15 minutes or less. As such, this would not be considered a

typical operation. As such, the modelled noise levels for the 'reasonable' worst case Caesarstone North 15-minute noise assessment period will only occur occasionally.

The noise emissions for the Caesarstone South 15-minute noise intensive period, which are predicted to be 27 dB(A) $L_{Aeq.15minute}$ at Wattle Grove, would be more representative of the overall typical noise emissions from the site operations.

4 Conclusion

The noise assessment has been undertaken to address the operational noise requirements for the Caesarstone warehouse (WH3A) within the Moorebank Precent East in accordance with the *Operational Noise and Vibration Management Plan, Moorebank Logistics Park – East Precinct* (dated 27 March 2019, Revision 12) (MPE ONVMP), more specifically to address the requirements of Condition of Consent (CoC) B85 in State Significant Development (SSD) 7628.

As part of the compliance noise assessment, a series of noise measurements were undertaken over a two week period. Unattended noise monitoring was undertaken at two locations within the Caesarstone warehouse over a period of two weeks between 2 September and 15 September 2020. In addition, attended noise measurements were undertaken on 10 September within the Caesarstone warehouse site. The aim of the measurements was to quantify operational noise levels on-site.

In order to quantify the operational noise levels at nearby residential receivers, firstly noise monitoring data from four permanent noise monitoring stations at nearby residential locations was reviewed. This noise monitoring data was reviewed during periods when on-site attended noise measurements were taking place on 10 September 2020. This review confirmed that direct quantification or estimation of operational noise emissions from the warehouse operations at the sensitive receiver locations was not possible because of the existing high ambient noise levels at the nearby receivers.

As such, guidance in Section 7.1.1 of the NSW EPA Noise Policy for Industry (NPfI) has been used to assist in monitoring the performance of Caesarstone operations. Using this approach, noise emissions from the warehouse facility operations have been evaluated using a combination of on-site attended and unattended noise monitoring, combined with noise modelling.

Two 'reasonable' worst-case assessment scenarios were established based upon on site unattended noise monitoring and video recordings over an approximate two-week period, in addition to discussions with Caesarstone personnel and observations made during on-site attended noise measurements. These were developed to capture the 'reasonable' worst case noise intensive periods on the northern and southern sides of the warehouse.

All significant noise-generating equipment was included the assessment modelling, in addition to the key noise-generating mechanical plant as required by CoC B85. The noise contribution from the mechanical plant items serving the warehouse and office area generate minimal contribution to the overall noise levels from site operations, which are generally controlled by other on-site activities such as ute departures, arrivals and internal warehouse loading activities.

Using the calibrated noise model, noise levels were predicted to all nearby noise sensitive receiver locations, including the residential receivers in the suburbs of Casula, Glenfield, Wattle Grove and Wattle Grove North. Noise levels were assessed assuming the worst-case prevailing meteorological conditions were present, as required by CoC B80.

The outcome of the compliance noise monitoring and modelling demonstrated that the mechanical plant and other noisy equipment that operate as part of the Caesarstone warehouse operations achieve the noise limits presented SSD 7628 CoC B80.

APPENDIX A Glossary of terminology

The following is a brief description of the technical terms used to describe noise to assist in understanding the technical issues presented.

Adverse weather	Weather effects that enhance noise (that is, wind and temperature inversions) that occur at a site for a significant period of time (that is, wind occurring more than 30% of the time in any assessment period in any season and/or temperature inversions occurring more than 30% of the nights in winter).
Ambient noise	The all-encompassing noise associated within a given environment at a given time, usually composed of sound from all sources near and far.
Assessment period	The period in a day over which assessments are made.
Assessment Point	A point at which noise measurements are taken or estimated. A point at which noise measurements are taken or estimated.
Background noise	Background noise is the term used to describe the underlying level of noise present in the ambient noise, measured in the absence of the noise under investigation, when extraneous noise is removed. It is described as the average of the minimum noise levels measured on a sound level meter and is measured statistically as the A-weighted noise level exceeded for ninety percent of a sample period. This is represented as the L90 noise level (see below).
Decibel [dB]	The units that sound is measured in. The following are examples of the decibel readings of common sounds in our daytime environment:

threshold of hearing	0 dB	The faintest sound we can hear
	10 dB	Human breathing
almost silent	20 dB	
	30 dB	Quiet bedroom or in a quiet national park location
generally quiet	40 dB	Library
	50 dB	Typical office space or ambience in the city at night
moderately loud	60 dB	CBD mall at lunch time
	70 dB	The sound of a car passing on the street
loud	80 dB	Loud music played at home
	90 dB	The sound of a truck passing on the street
very loud	100 dB	Indoor rock band concert
	110 dB	Operating a chainsaw or jackhammer
extremely loud	120 dB	Jet plane take-off at 100m away
threshold of pain	130 dB	
	140 dB	Military jet take-off at 25m away

dB(A)	A-weighted decibels. The A- weighting noise filter simulates the response of the human ear at relatively low levels, where the ear is not as effective in hearing low frequency sounds as it is in 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.
dB(C)	C-weighted decibels. The C-weighting noise filter simulates the response of the human ear at relatively high levels, where the human ear is nearly equally effective at hearing from mid-low frequency (63Hz) to mid-high frequency (4kHz), but is less effective outside these frequencies.

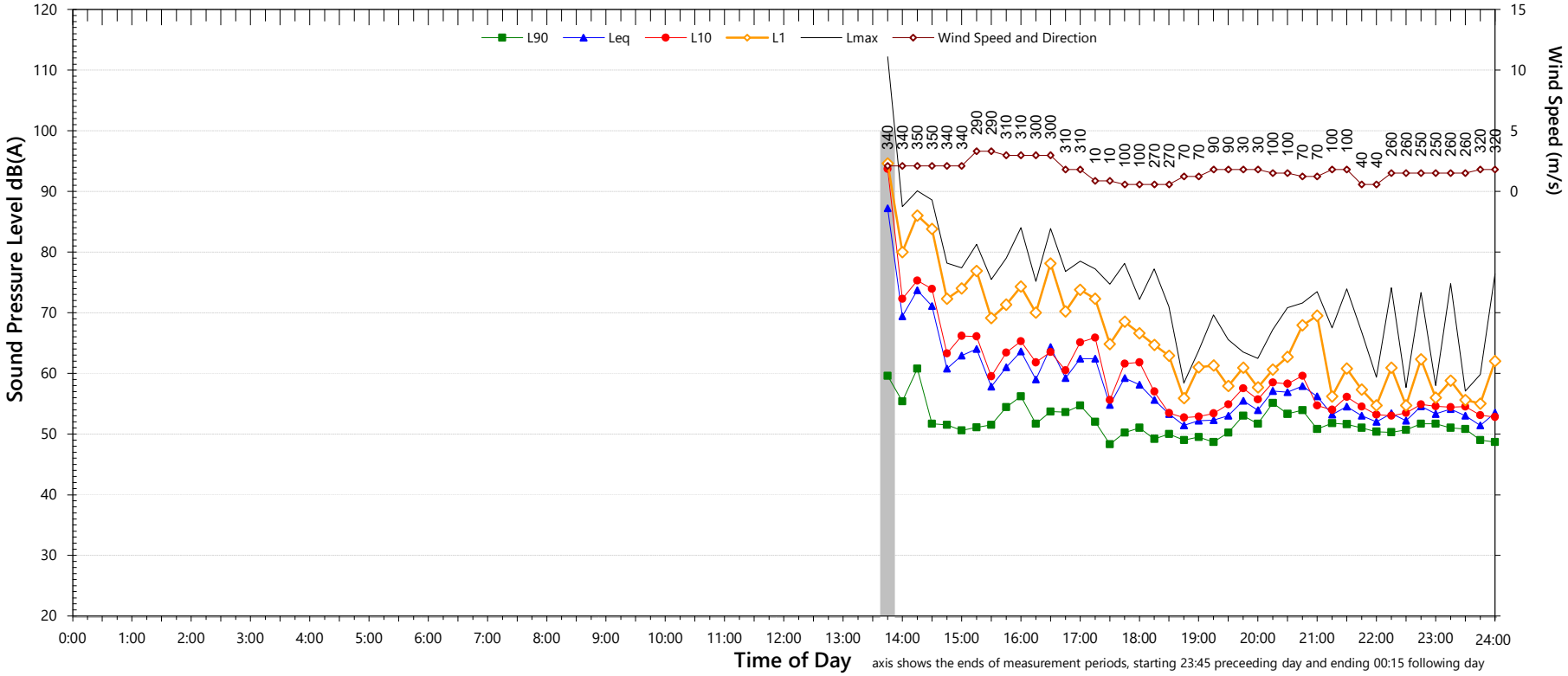
Frequency	Frequency is synonymous to pitch. Sounds have a pitch which is peculiar to the nature of the sound generator. For example, the sound of a tiny bell has a high pitch and the sound of a bass drum has a low pitch. Frequency or pitch can be measured on a scale in units of Hertz or Hz.
Impulsive noise	Having a high peak of short duration or a sequence of such peaks. A sequence of impulses in rapid succession is termed repetitive impulsive noise.
Intermittent noise	The level suddenly drops to that of the background noise several times during the period of observation. The time during which the noise remains at levels different from that of the ambient is one second or more.
L_{Max}	The maximum sound pressure level measured over a given period.
L_{Min}	The minimum sound pressure level measured over a given period.
L_1	The sound pressure level that is exceeded for 1% of the time for which the given sound is measured.
L_{10}	The sound pressure level that is exceeded for 10% of the time for which the given sound is measured.
L_{90}	The level of noise exceeded for 90% of the time. The bottom 10% of the sample is the L90 noise level expressed in units of dB(A).
L_{eq}	The "equivalent noise level" is the summation of noise events and integrated over a selected period of time.
Reflection	Sound wave changed in direction of propagation due to a solid object obscuring its path.
SEL	Sound Exposure Level (SEL) is the constant sound level which, if maintained for a period of 1 second would have the same acoustic energy as the measured noise event. SEL noise measurements are useful as they can be converted to obtain Leq sound levels over any period of time and can be used for predicting noise at various locations.
Sound	A fluctuation of air pressure which is propagated as a wave through air.
Sound absorption	The ability of a material to absorb sound energy through its conversion into thermal energy.
Sound level meter	An instrument consisting of a microphone, amplifier and indicating device, having a declared performance and designed to measure sound pressure levels.
Sound pressure level	The level of noise, usually expressed in decibels, as measured by a standard sound level meter with a microphone.
Sound power level	Ten times the logarithm to the base 10 of the ratio of the sound power of the source to the reference sound power.
Tonal noise	Containing a prominent frequency and characterised by a definite pitch.

APPENDIX B Logger location 1 – Caesarstone - North side

Unattended Noise Monitoring Results

Caesarstone North

Wednesday, 2 September 2020



NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{90}	-	49	46
LAeq	-	55	59

Night Time Maximum Noise Levels			(see note 7)
L_{Max} (Range)	74	to	90
L_{Max} - L_{eq} (Range)	20	to	26

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{eq\ 15\ hr}$ and $L_{eq\ 9\ hr}$	66	62
$L_{eq\ 1hr}$ upper 10 percentile	72	67
$L_{eq\ 1hr}$ lower 10 percentile	56	54

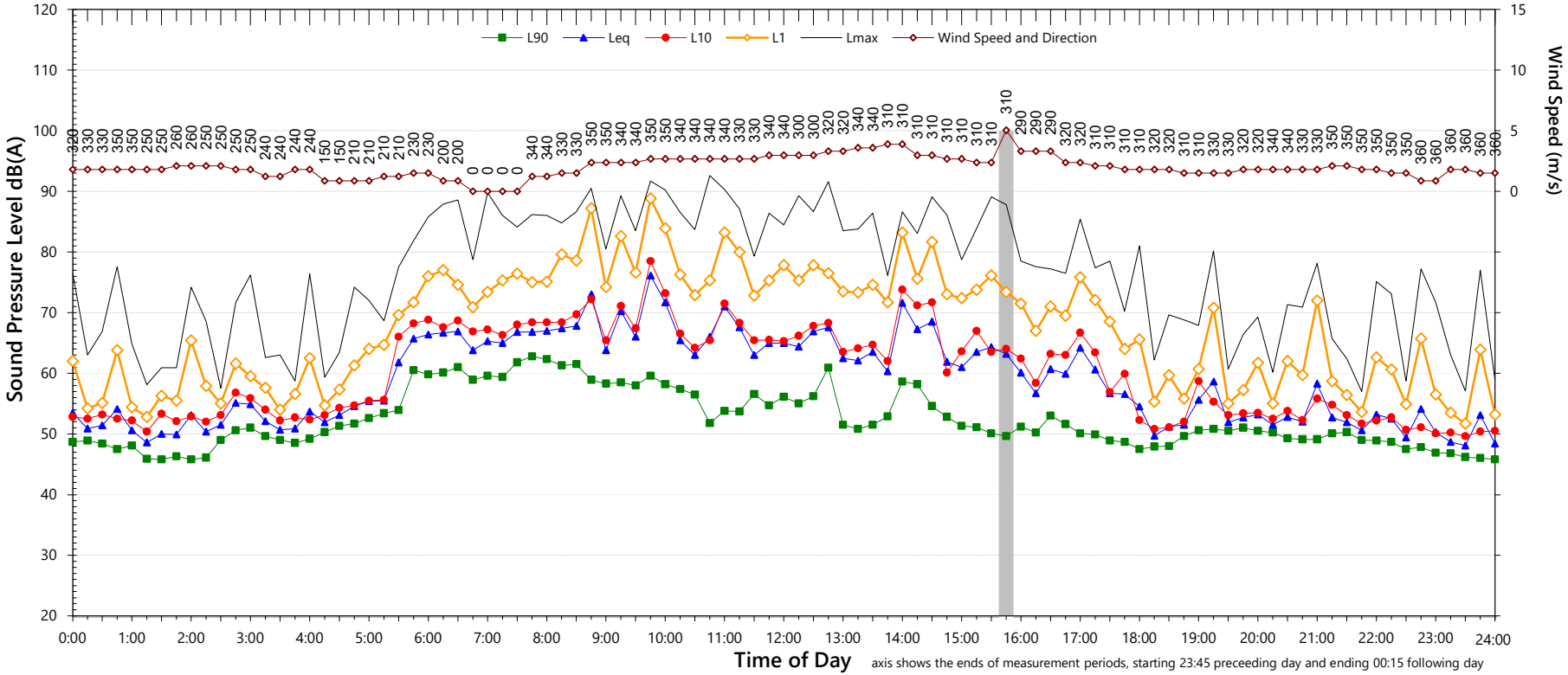
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am til 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. Night time L_{Max} values are shown only where L_{Max} >65dB(A) and where L_{Max}- Leq ≥15dB(A)
8. Meteorological data has been sourced from the nearest Bureau of Meteorology station (Holsworthy Aerodrome AWS)

Unattended Noise Monitoring Results

Caesarstone North

Thursday, 3 September 2020



NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{90}	50	48	46
LAeq	67	54	58

Night Time Maximum Noise Levels			(see note 7)
L_{Max} (Range)	74	to	87
L_{Max} - L_{eq} (Range)	19	to	30

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{eq\ 15\ hr}$ and $L_{eq\ 9\ hr}$	68	61
$L_{eq\ 1hr}$ upper 10 percentile	71	65
$L_{eq\ 1hr}$ lower 10 percentile	56	54

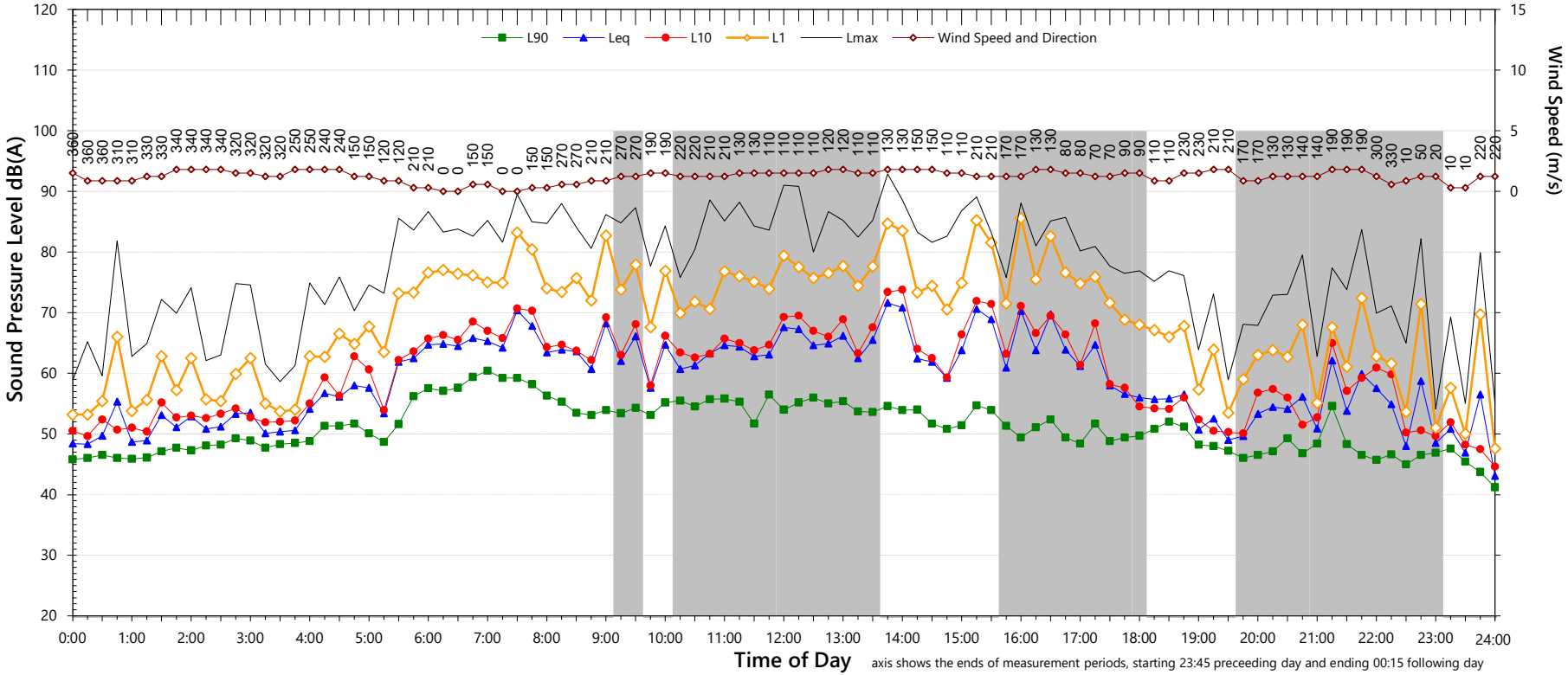
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am til 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. Night time L_{Max} values are shown only where L_{Max} >65dB(A) and where L_{Max}- Leq ≥15dB(A)
8. Meteorological data has been sourced from the nearest Bureau of Meteorology station (Holsworthy Aerodrome AWS)

Unattended Noise Monitoring Results

Caesarstone North

Friday, 4 September 2020



NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{90}	-	-	-
LAeq	-	-	-

Night Time Maximum Noise Levels			(see note 7)
L_{Max} (Range)	74	to	94
L_{Max} - L_{eq} (Range)	26	to	31

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{eq\ 15\ hr}$ and $L_{eq\ 9\ hr}$	68	58
$L_{eq\ 1hr}$ upper 10 percentile	73	58
$L_{eq\ 1hr}$ lower 10 percentile	56	51

Notes:

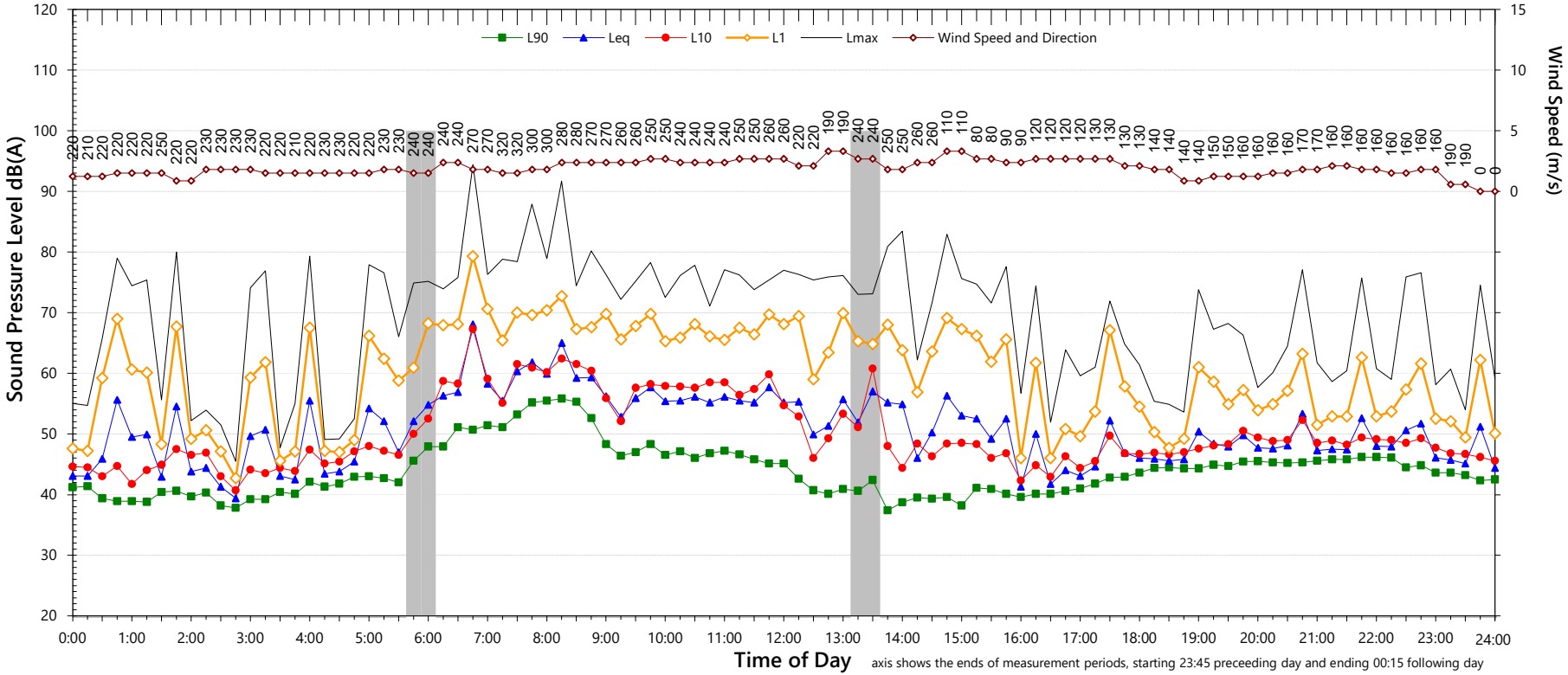
1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am til 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. Night time L_{Max} values are shown only where L_{Max} >65dB(A) and where L_{Max}- Leq ≥15dB(A)
8. Meteorological data has been sourced from the nearest Bureau of Meteorology station (Holsworthy Aerodrome AWS)

Data File: 2020-09-02_SLM_000_123_Rpt_Report.txt Logger Graphs Caeaserstone North QTE-26 Logger Graphs Program (r34)

Unattended Noise Monitoring Results

Caesarstone North

Saturday, 5 September 2020



NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{90}	40	44	41
LAeq	56	49	49

Night Time Maximum Noise Levels			(see note 7)
L_{Max} (Range)	70	to	82
L_{Max} - L_{eq} (Range)	25	to	29

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{eq\ 15\ hr}$ and $L_{eq\ 9\ hr}$	57	52
$L_{eq\ 1hr}$ upper 10 percentile	61	53
$L_{eq\ 1hr}$ lower 10 percentile	50	49

Notes:

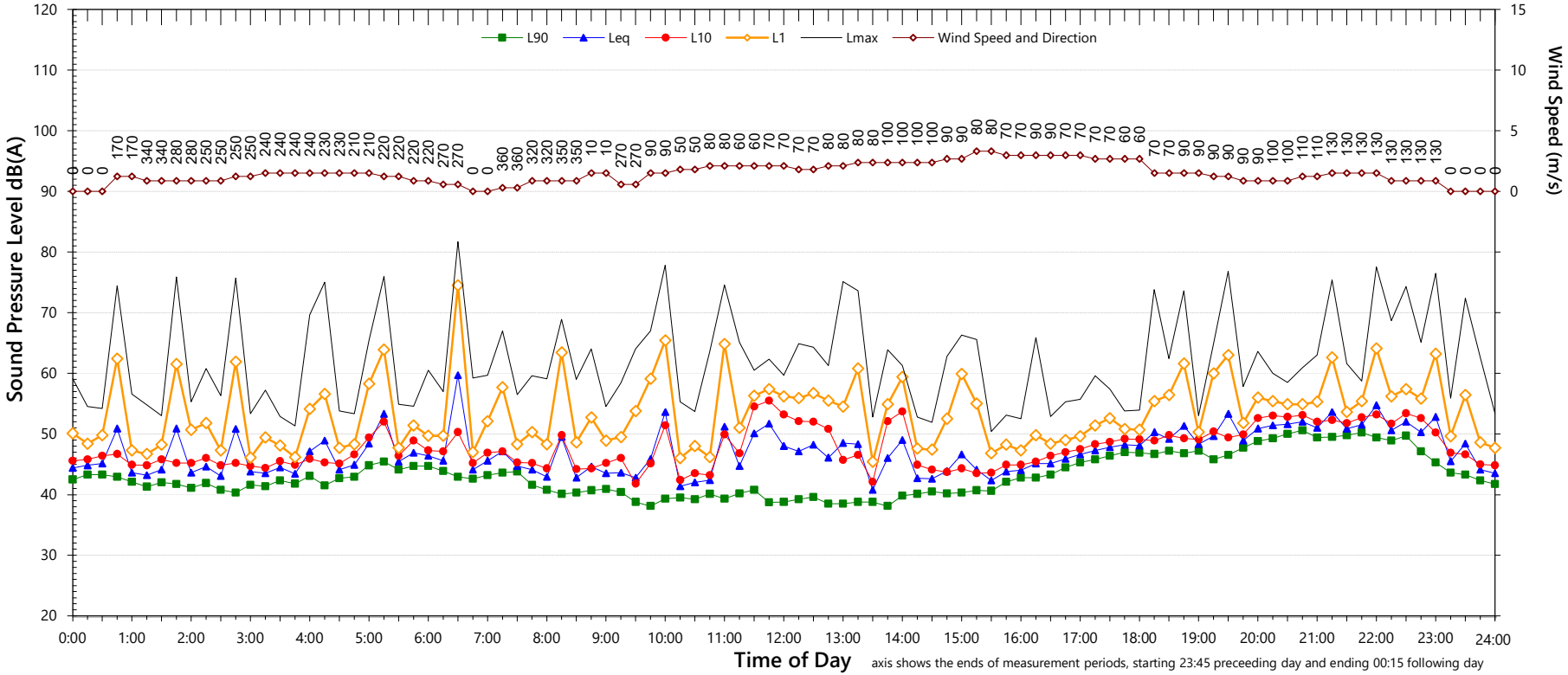
1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am til 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. Night time L_{Max} values are shown only where L_{Max} >65dB(A) and where L_{Max}- Leq ≥15dB(A)
8. Meteorological data has been sourced from the nearest Bureau of Meteorology station (Holsworthy Aerodrome AWS)

Data File: 2020-09-02_SLM_000_123_Rpt_Report.txt Logger Graphs Caeaserstone North QTE-26 Logger Graphs Program (r34)

Unattended Noise Monitoring Results

Caesarstone North

Sunday, 6 September 2020



NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{90}	39	47	41
LAeq	47	51	56

Night Time Maximum Noise Levels			(see note 7)
L_{Max} (Range)	72	to	86
L_{Max} - L_{eq} (Range)	22	to	27

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{eq\ 15\ hr}$ and $L_{eq\ 9\ hr}$	51	59
$L_{eq\ 1hr}$ upper 10 percentile	54	63
$L_{eq\ 1hr}$ lower 10 percentile	47	49

Notes:

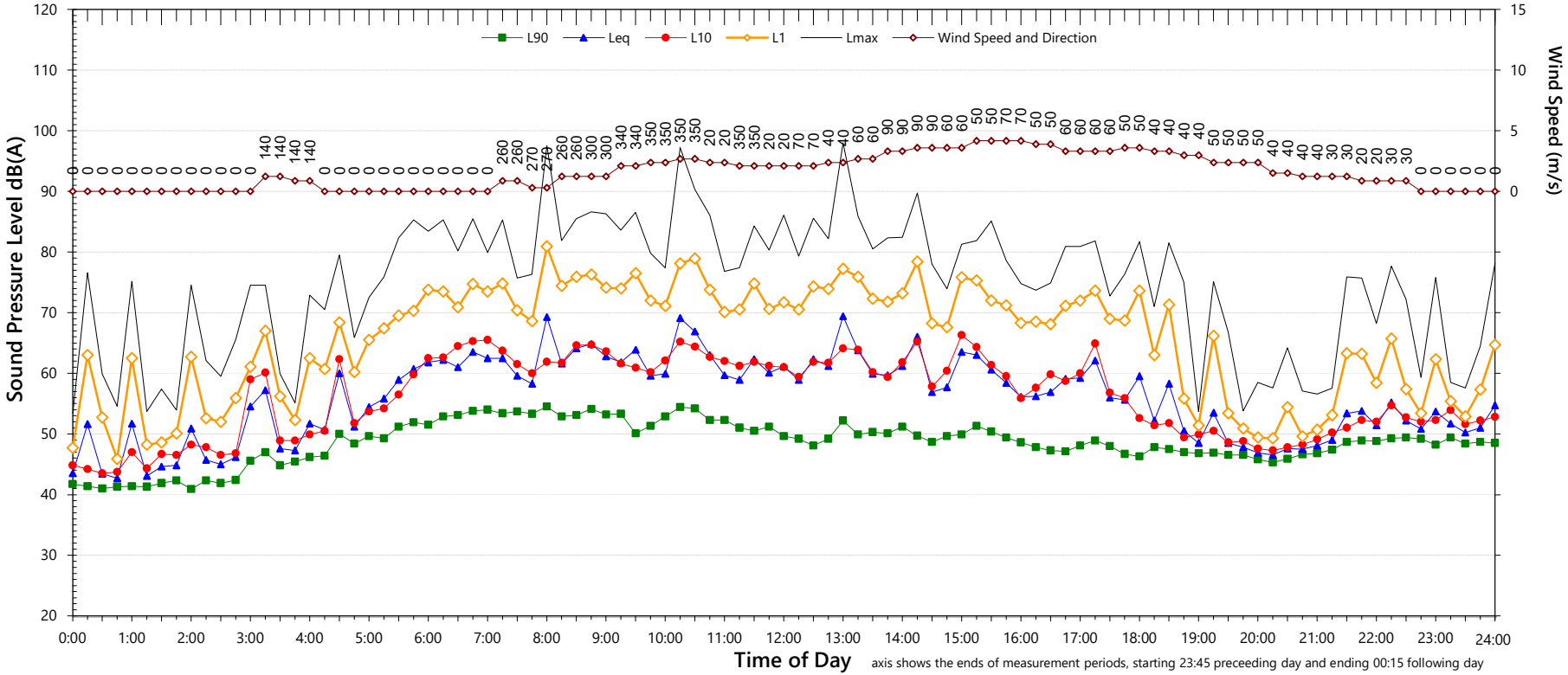
1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am til 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. Night time L_{Max} values are shown only where L_{Max} >65dB(A) and where L_{Max}- Leq ≥15dB(A)
8. Meteorological data has been sourced from the nearest Bureau of Meteorology station (Holsworthy Aerodrome AWS)

Data File: 2020-09-02_SLM_000_123_Rpt_Report.txt Logger Graphs Caeaserstone North QTE-26 Logger Graphs Program (r34)

Unattended Noise Monitoring Results

Caesarstone North

Monday, 7 September 2020



NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{90}	48	46	-
LAeq	63	52	-

Night Time Maximum Noise Levels			(see note 7)
L_{Max} (Range)	74	to	78
L_{Max} - L_{eq} (Range)	22	to	26

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{eq\ 15\ hr}$ and $L_{eq\ 9\ hr}$	64	56
$L_{eq\ 1hr}$ upper 10 percentile	67	57
$L_{eq\ 1hr}$ lower 10 percentile	53	54

Notes:

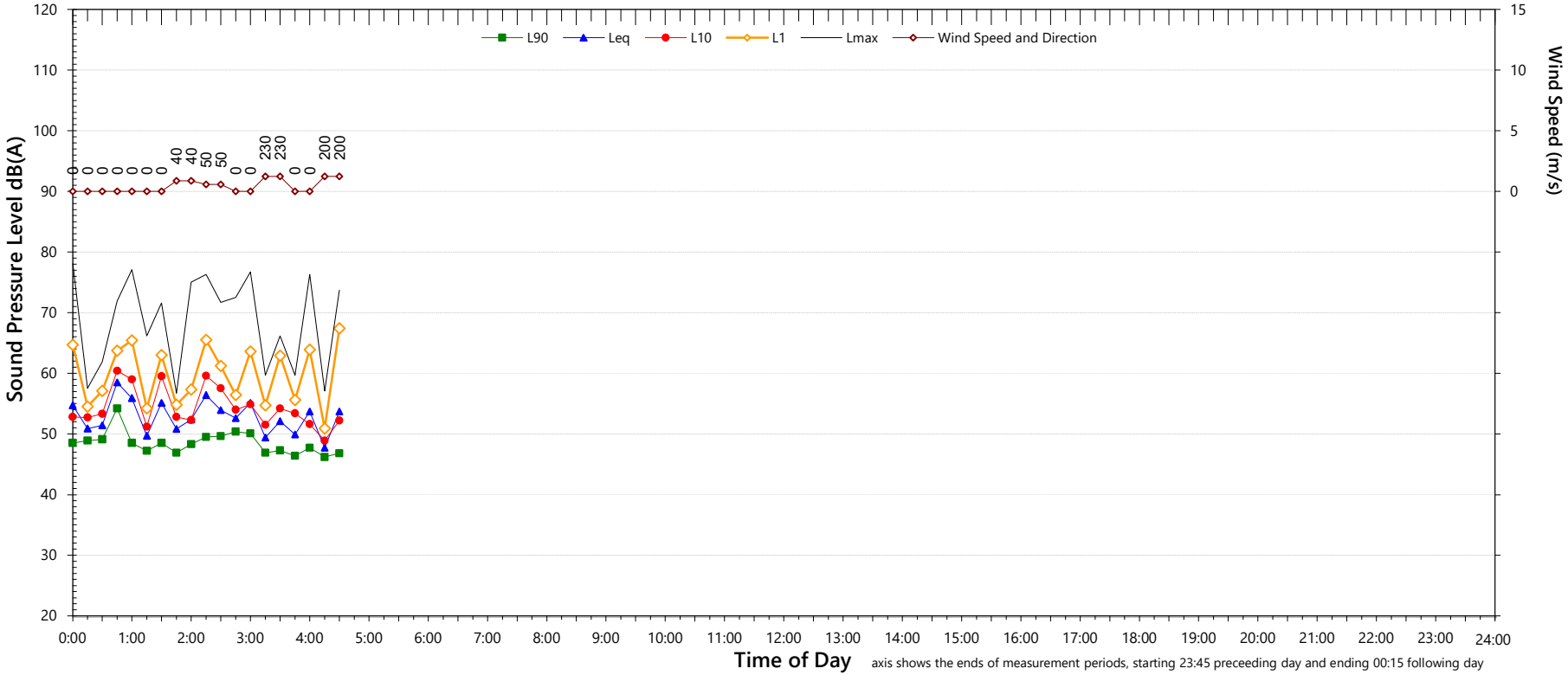
1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am til 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. Night time L_{Max} values are shown only where L_{Max} >65dB(A) and where L_{Max}- Leq ≥15dB(A)
8. Meteorological data has been sourced from the nearest Bureau of Meteorology station (Holsworthy Aerodrome AWS)

Data File: 2020-09-02_SLM_000_123_Rpt_Report.txt Logger Graphs Caeaserstone North QTE-26 Logger Graphs Program (r34)

Unattended Noise Monitoring Results

Caesarstone North

Tuesday, 8 September 2020



NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{90}	-	-	-
LAeq	-	-	-

Night Time Maximum Noise Levels			(see note 7)
L_{Max} (Range)	-	to	-
L_{Max} - L_{eq} (Range)	-	to	-

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{eq\ 15\ hr}$ and $L_{eq\ 9\ hr}$	-	-
$L_{eq\ 1hr}$ upper 10 percentile	-	-
$L_{eq\ 1hr}$ lower 10 percentile	-	-

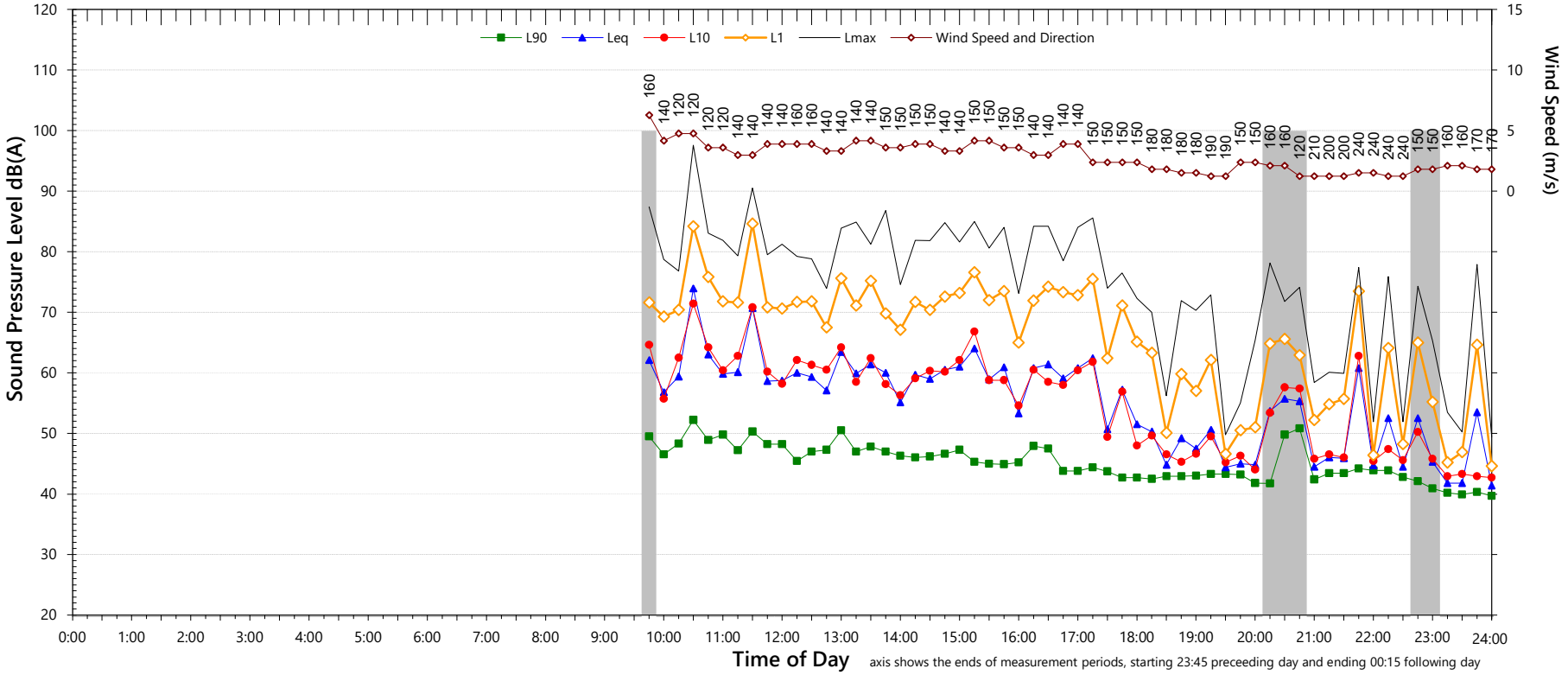
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am til 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. Night time L_{Max} values are shown only where L_{Max} >65dB(A) and where L_{Max}- Leq ≥15dB(A)
8. Meteorological data has been sourced from the nearest Bureau of Meteorology station (Holsworthy Aerodrome AWS)

Unattended Noise Monitoring Results

Caesarstone North

Wednesday, 9 September 2020



NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{90}	-	-	40
LAeq	-	-	61

Night Time Maximum Noise Levels			(see note 7)
L_{Max} (Range)	75	to	96
L_{Max} - L_{eq} (Range)	24	to	31

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{eq\ 15\ hr}$ and $L_{eq\ 9\ hr}$	64	64
$L_{eq\ 1hr}$ upper 10 percentile	67	62
$L_{eq\ 1hr}$ lower 10 percentile	50	50

Notes:

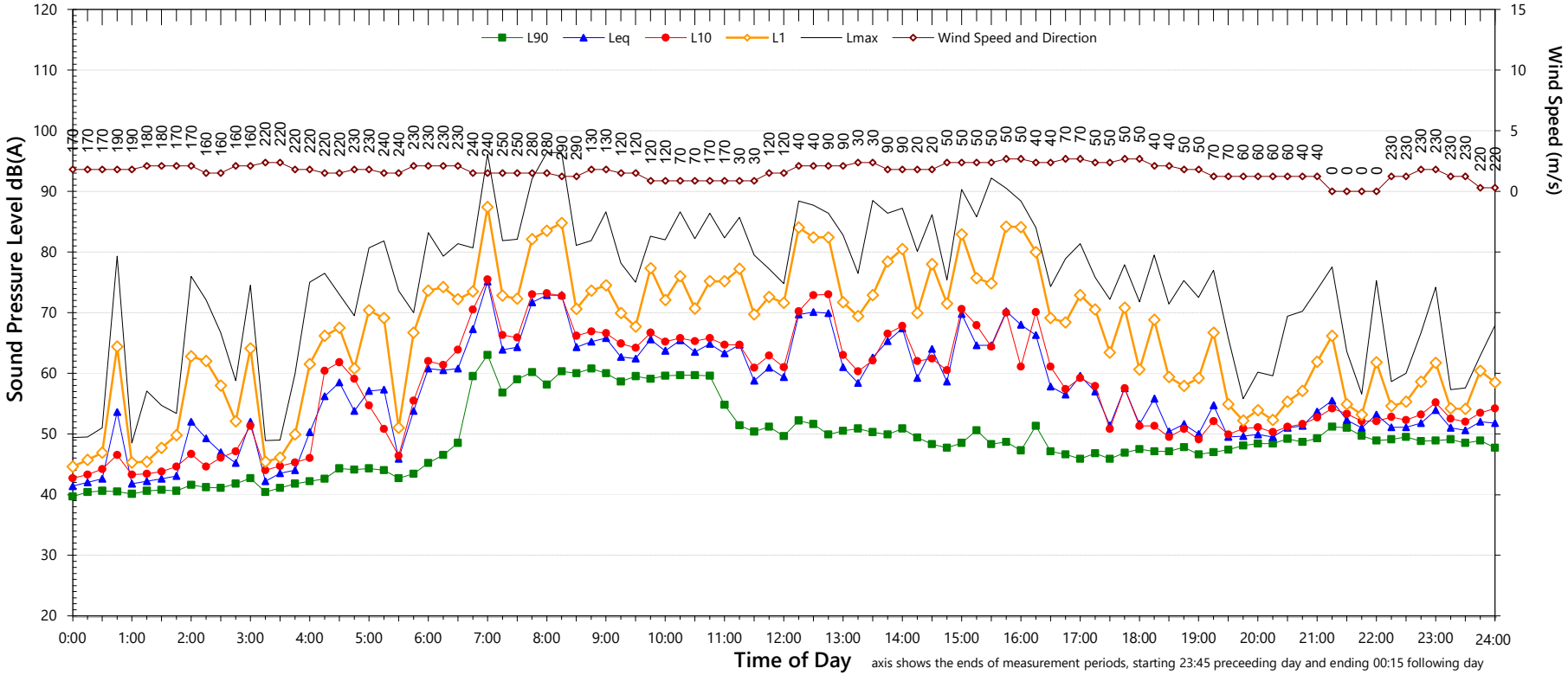
1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am til 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. Night time L_{Max} values are shown only where L_{Max} >65dB(A) and where L_{Max}- Leq ≥15dB(A)
8. Meteorological data has been sourced from the nearest Bureau of Meteorology station (Holsworthy Aerodrome AWS)

Data File: 2020-09-02_SLM_000_123_Rpt_Report.txt Logger Graphs Caeaserstone North QTE-26 Logger Graphs Program (r34)

Unattended Noise Monitoring Results

Caesarstone North

Thursday, 10 September 2020



NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{90}	47	47	46
LAeq	66	52	54

Night Time Maximum Noise Levels			(see note 7)
L_{Max} (Range)	68	to	81
L_{Max} - L_{eq} (Range)	17	to	27

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{eq\ 15\ hr}$ and $L_{eq\ 9\ hr}$	67	56
$L_{eq\ 1hr}$ upper 10 percentile	71	56
$L_{eq\ 1hr}$ lower 10 percentile	55	53

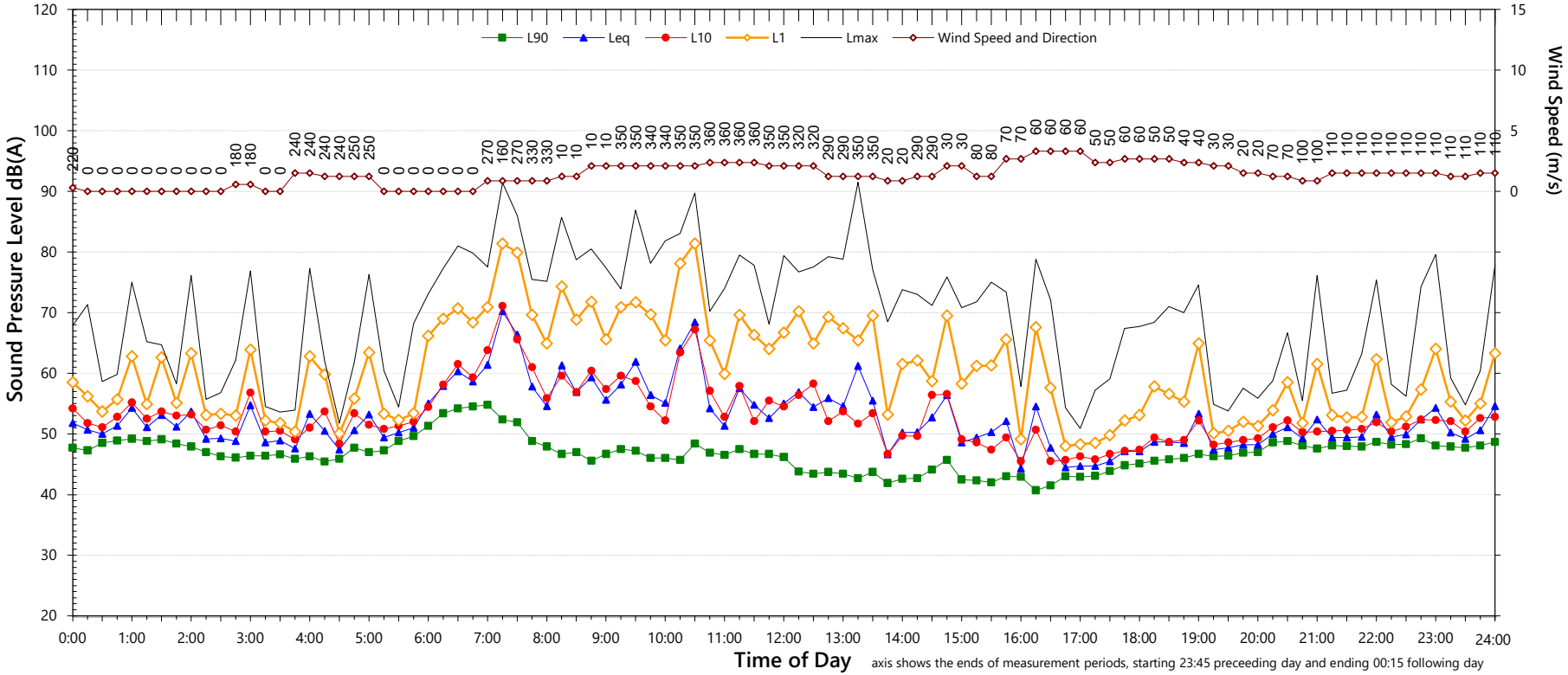
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am til 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. Night time L_{Max} values are shown only where L_{Max} >65dB(A) and where L_{Max}- Leq ≥15dB(A)
8. Meteorological data has been sourced from the nearest Bureau of Meteorology station (Holsworthy Aerodrome AWS)

Unattended Noise Monitoring Results

Caesarstone North

Friday, 11 September 2020



NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{90}	42	46	40
LAeq	59	50	51

Night Time Maximum Noise Levels			(see note 7)
L_{Max} (Range)	71	to	82
L_{Max} - L_{eq} (Range)	18	to	29

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{eq\ 15\ hr}$ and $L_{eq\ 9\ hr}$	61	53
$L_{eq\ 1hr}$ upper 10 percentile	64	55
$L_{eq\ 1hr}$ lower 10 percentile	51	50

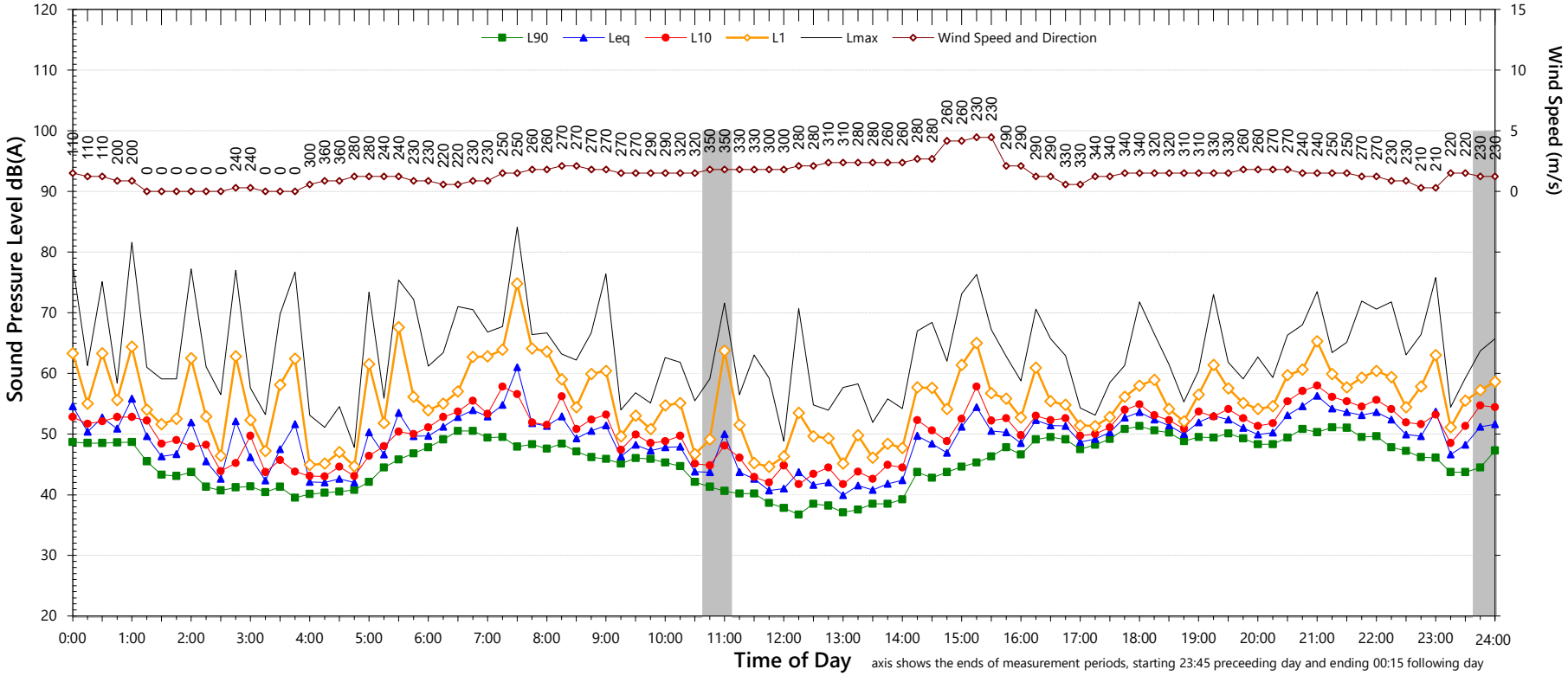
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am til 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. Night time L_{Max} values are shown only where L_{Max} >65dB(A) and where L_{Max}- Leq ≥15dB(A)
8. Meteorological data has been sourced from the nearest Bureau of Meteorology station (Holsworthy Aerodrome AWS)

Unattended Noise Monitoring Results

Caesarstone North

Saturday, 12 September 2020



NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{90}	38	49	45
LAeq	51	53	62

Night Time Maximum Noise Levels			(see note 7)
L_{Max} (Range)	73	to	94
L_{Max} - L_{eq} (Range)	19	to	28

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{eq\ 15\ hr}$ and $L_{eq\ 9\ hr}$	54	63
$L_{eq\ 1hr}$ upper 10 percentile	56	64
$L_{eq\ 1hr}$ lower 10 percentile	45	53

Notes:

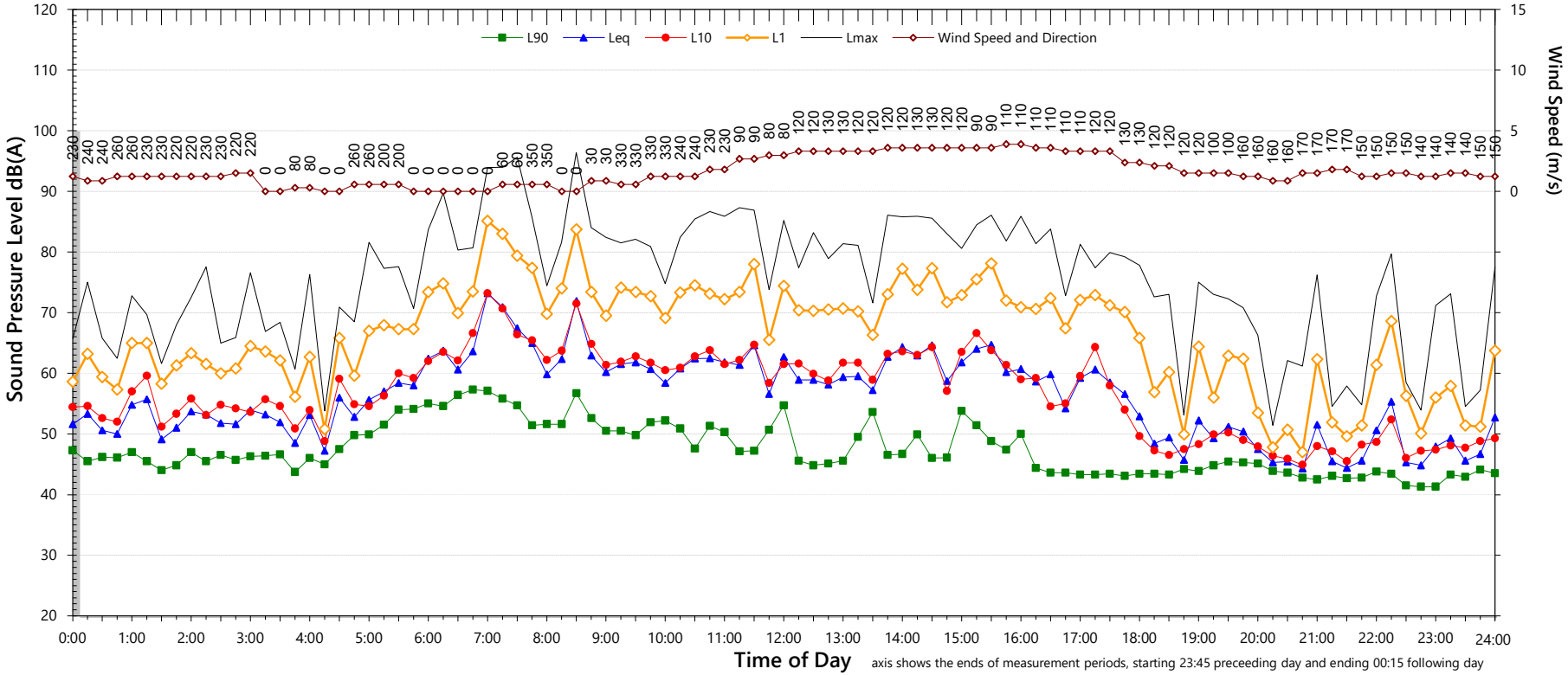
1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am til 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. Night time L_{Max} values are shown only where L_{Max} >65dB(A) and where L_{Max}- Leq ≥15dB(A)
8. Meteorological data has been sourced from the nearest Bureau of Meteorology station (Holsworthy Aerodrome AWS)

Data File: 2020-09-02_SLM_000_123_Rpt_Report.txt Logger Graphs Caeaserstone North QTE-26 Logger Graphs Program (r34)

Unattended Noise Monitoring Results

Caesarstone North

Sunday, 13 September 2020



NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{90}	43	43	38
LAeq	62	49	56

Night Time Maximum Noise Levels			(see note 7)
L_{Max} (Range)	75	to	87
L_{Max} - L_{eq} (Range)	24	to	32

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{eq\ 15\ hr}$ and $L_{eq\ 9\ hr}$	64	59
$L_{eq\ 1hr}$ upper 10 percentile	68	63
$L_{eq\ 1hr}$ lower 10 percentile	51	50

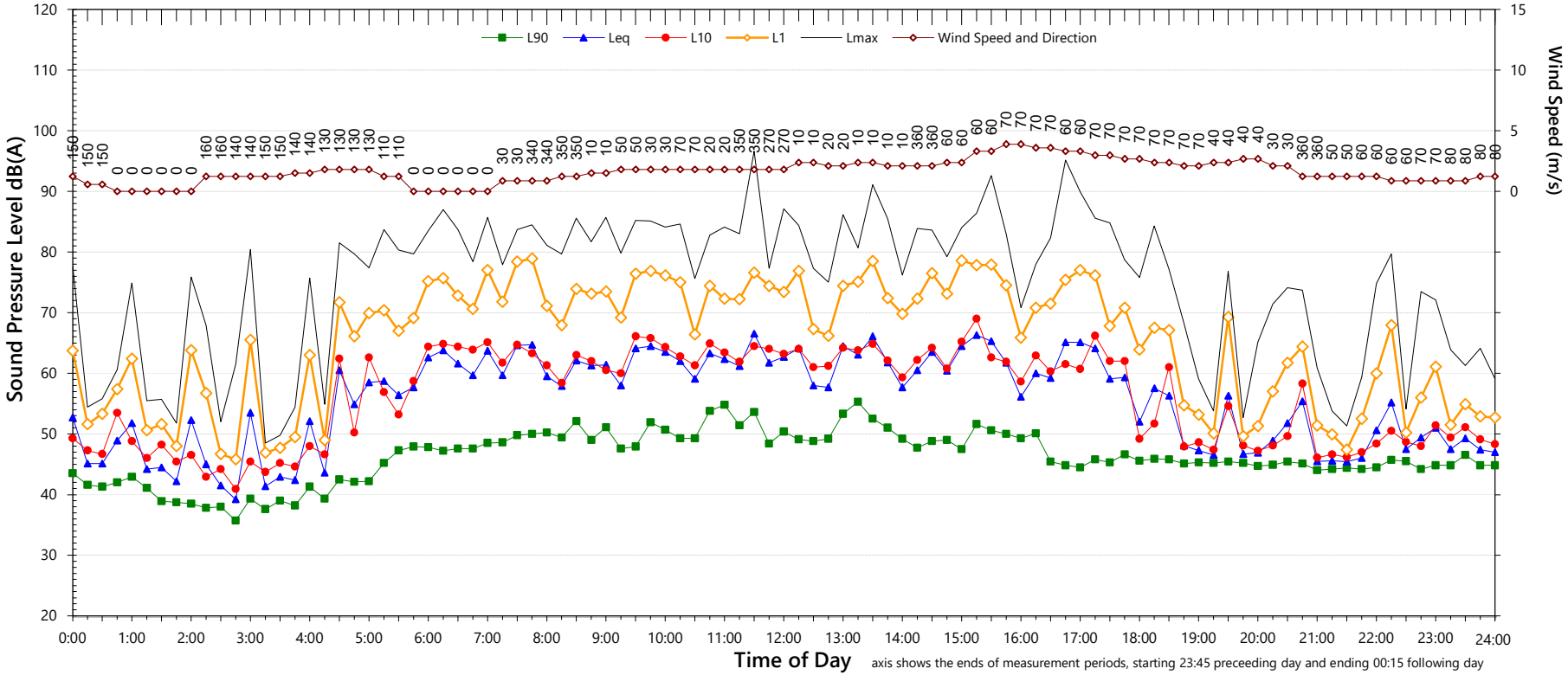
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am til 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. Night time L_{Max} values are shown only where L_{Max} >65dB(A) and where L_{Max}- Leq ≥15dB(A)
8. Meteorological data has been sourced from the nearest Bureau of Meteorology station (Holsworthy Aerodrome AWS)

Unattended Noise Monitoring Results

Caesarstone North

Monday, 14 September 2020



NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{90}	46	44	45
LAeq	63	52	56

Night Time Maximum Noise Levels			(see note 7)
L_{Max} (Range)	71	to	86
L_{Max} - L_{eq} (Range)	16	to	28

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{eq\ 15\ hr}$ and $L_{eq\ 9\ hr}$	64	59
$L_{eq\ 1hr}$ upper 10 percentile	66	62
$L_{eq\ 1hr}$ lower 10 percentile	54	51

Notes:

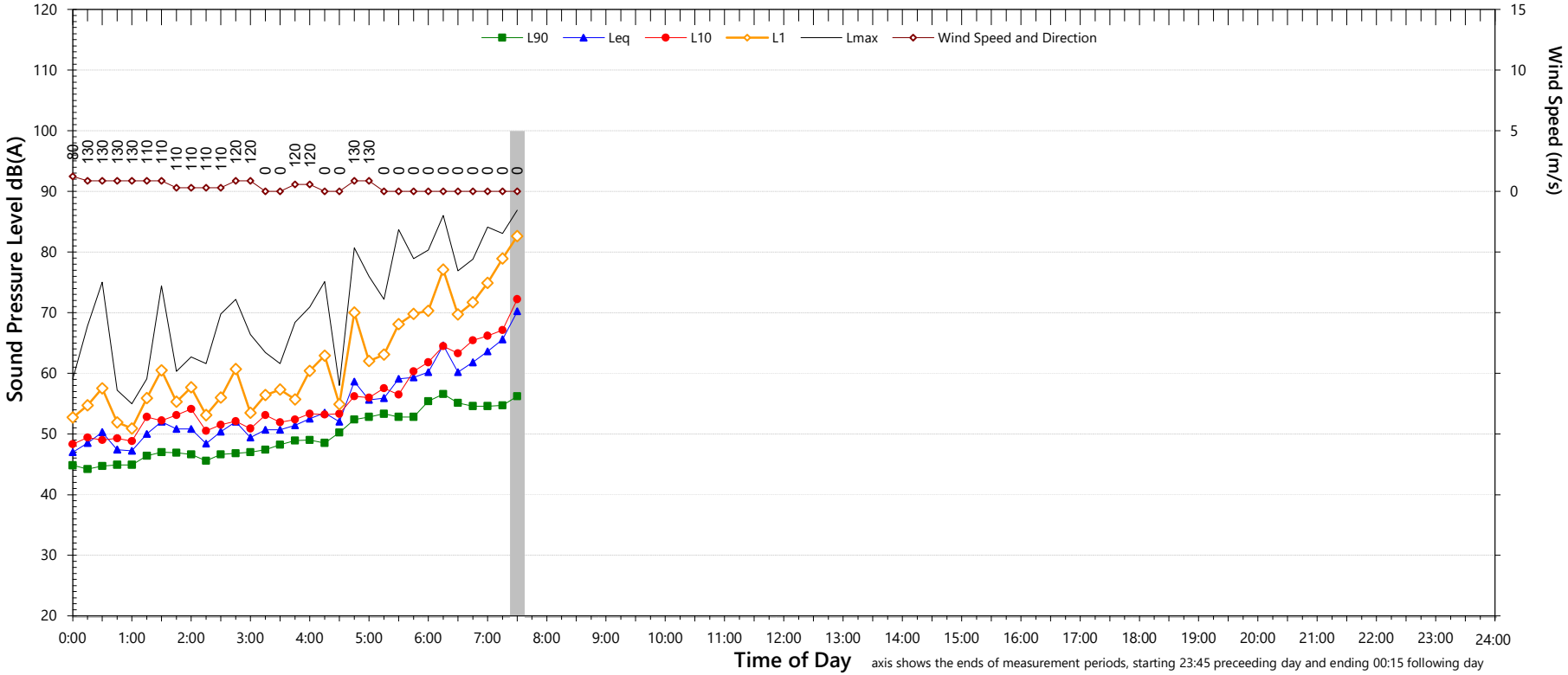
1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am til 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. Night time L_{Max} values are shown only where L_{Max} >65dB(A) and where L_{Max}- Leq ≥15dB(A)
8. Meteorological data has been sourced from the nearest Bureau of Meteorology station (Holsworthy Aerodrome AWS)

Data File: 2020-09-02_SLM_000_123_Rpt_Report.txt Logger Graphs Caeaserstone North QTE-26 Logger Graphs Program (r34)

Unattended Noise Monitoring Results

Caesarstone North

Tuesday, 15 September 2020



NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{90}	-	-	-
LAeq	-	-	-

Night Time Maximum Noise Levels			(see note 7)
L_{Max} (Range)	-	to	-
L_{Max} - L_{eq} (Range)	-	to	-

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{eq\ 15\ hr}$ and $L_{eq\ 9\ hr}$	68	-
$L_{eq\ 1hr}$ upper 10 percentile	68	-
$L_{eq\ 1hr}$ lower 10 percentile	68	-

Notes:

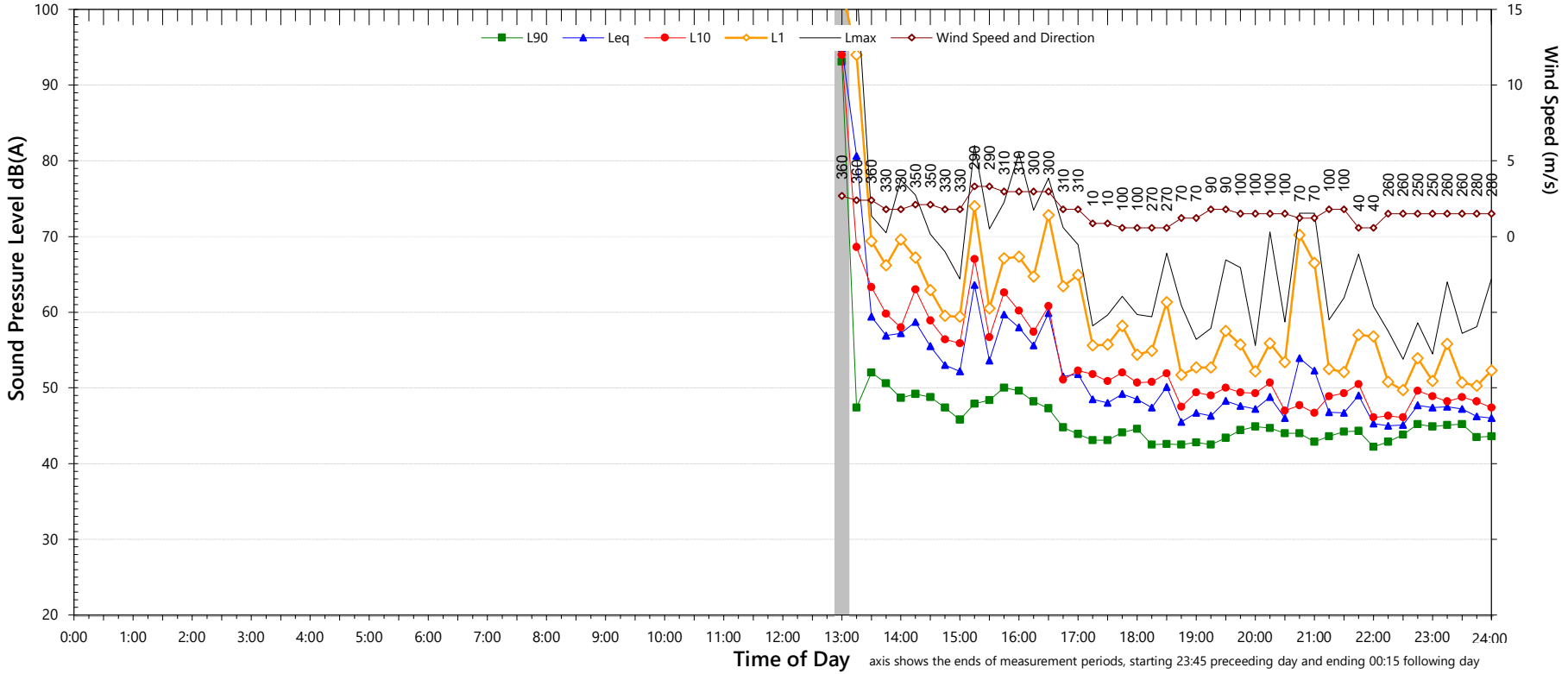
1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am til 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. Night time L_{Max} values are shown only where L_{Max} >65dB(A) and where L_{Max}- Leq ≥15dB(A)
8. Meteorological data has been sourced from the nearest Bureau of Meteorology station (Holsworthy Aerodrome AWS)

APPENDIX C Logger location 2 – Caesarstone – South side

Unattended Noise Monitoring Results

Caesarstone South

Wednesday, 2 September 2020



NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{90}	-	43	41
LAeq	-	49	53

Night Time Maximum Noise Levels			(see note 7)
L_{Max} (Range)	65	to	89
L_{Max} - L_{eq} (Range)	17	to	29

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{eq\ 15\ hr}$ and $L_{eq\ 9\ hr}$	68	55
$L_{eq\ 1hr}$ upper 10 percentile	66	57
$L_{eq\ 1hr}$ lower 10 percentile	50	47

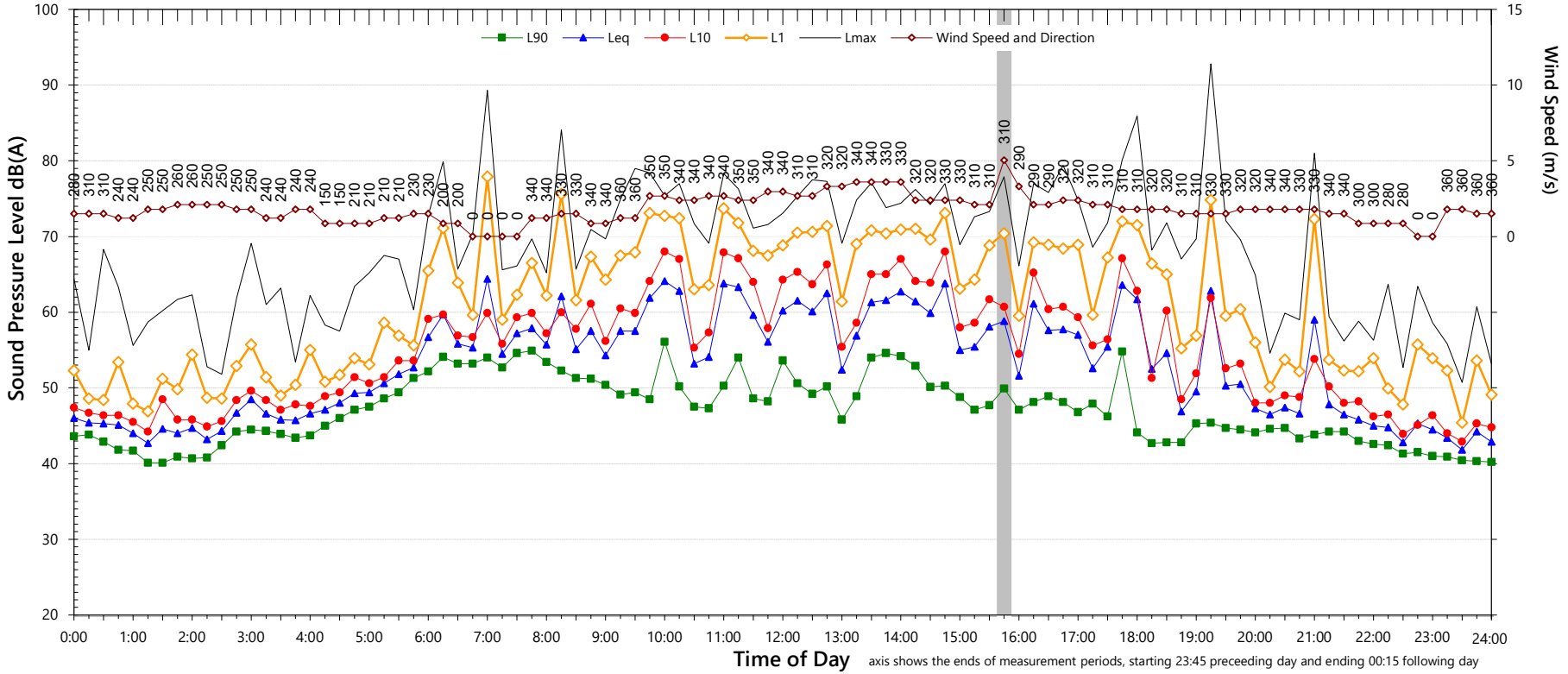
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am til 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. Night time L_{Max} values are shown only where L_{Max} >65dB(A) and where L_{Max}- Leq ≥15dB(A)
8. Meteorological data has been sourced from the nearest Bureau of Meteorology station (Holsworthy Aerodrome AWS)

Unattended Noise Monitoring Results

Caesarstone South

Thursday, 3 September 2020



NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{90}	47	43	40
LAeq	60	54	50

Night Time Maximum Noise Levels			(see note 7)
L_{Max} (Range)	66	to	76
L_{Max} - L_{eq} (Range)	17	to	23

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{eq\ 15\ hr}$ and $L_{eq\ 9\ hr}$	61	52
$L_{eq\ 1hr}$ upper 10 percentile	64	57
$L_{eq\ 1hr}$ lower 10 percentile	55	46

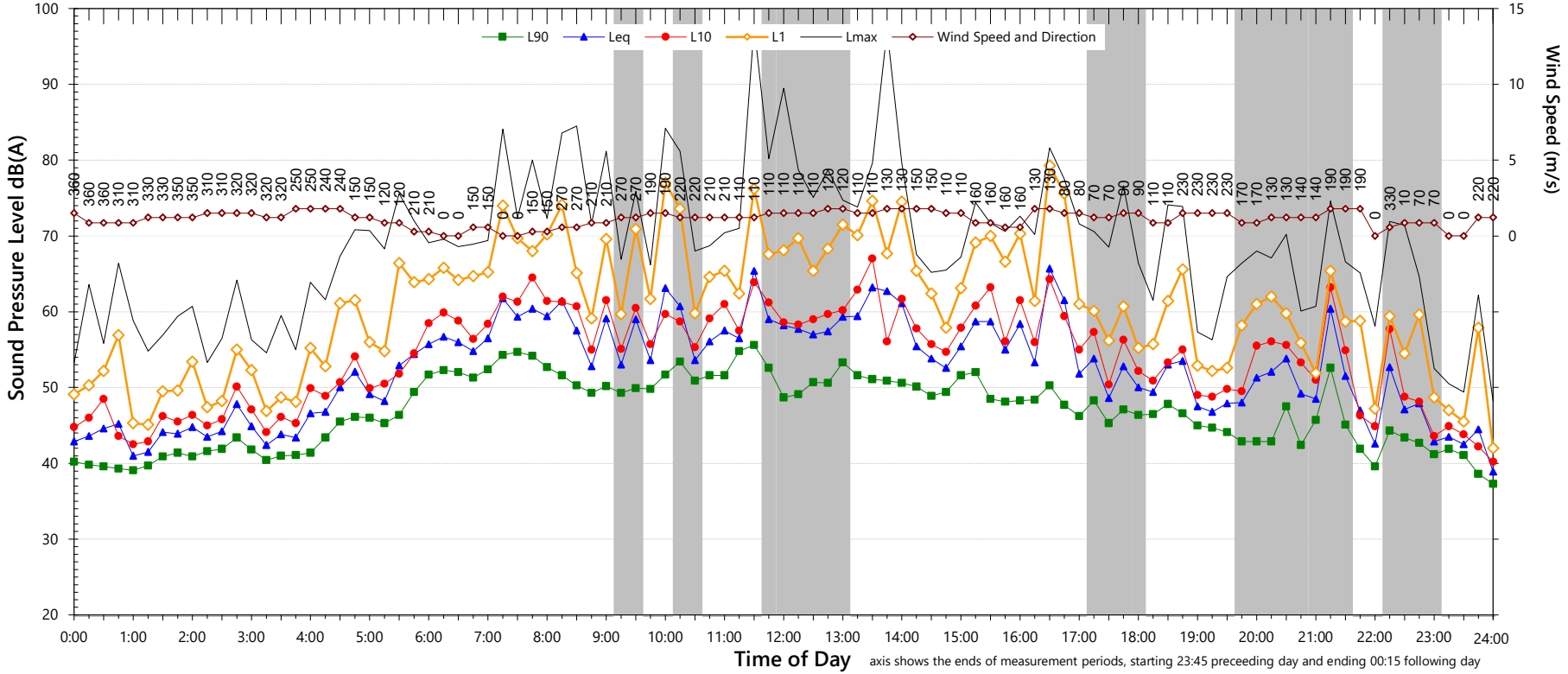
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am til 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. Night time L_{Max} values are shown only where L_{Max} >65dB(A) and where L_{Max}- Leq ≥15dB(A)
8. Meteorological data has been sourced from the nearest Bureau of Meteorology station (Holsworthy Aerodrome AWS)

Unattended Noise Monitoring Results

Caesarstone South

Friday, 4 September 2020



NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{90}	-	-	35
LAeq	-	-	45

Night Time Maximum Noise Levels			(see note 7)
L_{Max} (Range)	70	to	70
L_{Max} - L_{eq} (Range)	17	to	23

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{eq\ 15\ hr}$ and $L_{eq\ 9\ hr}$	62	48
$L_{eq\ 1hr}$ upper 10 percentile	64	50
$L_{eq\ 1hr}$ lower 10 percentile	50	42

Notes:

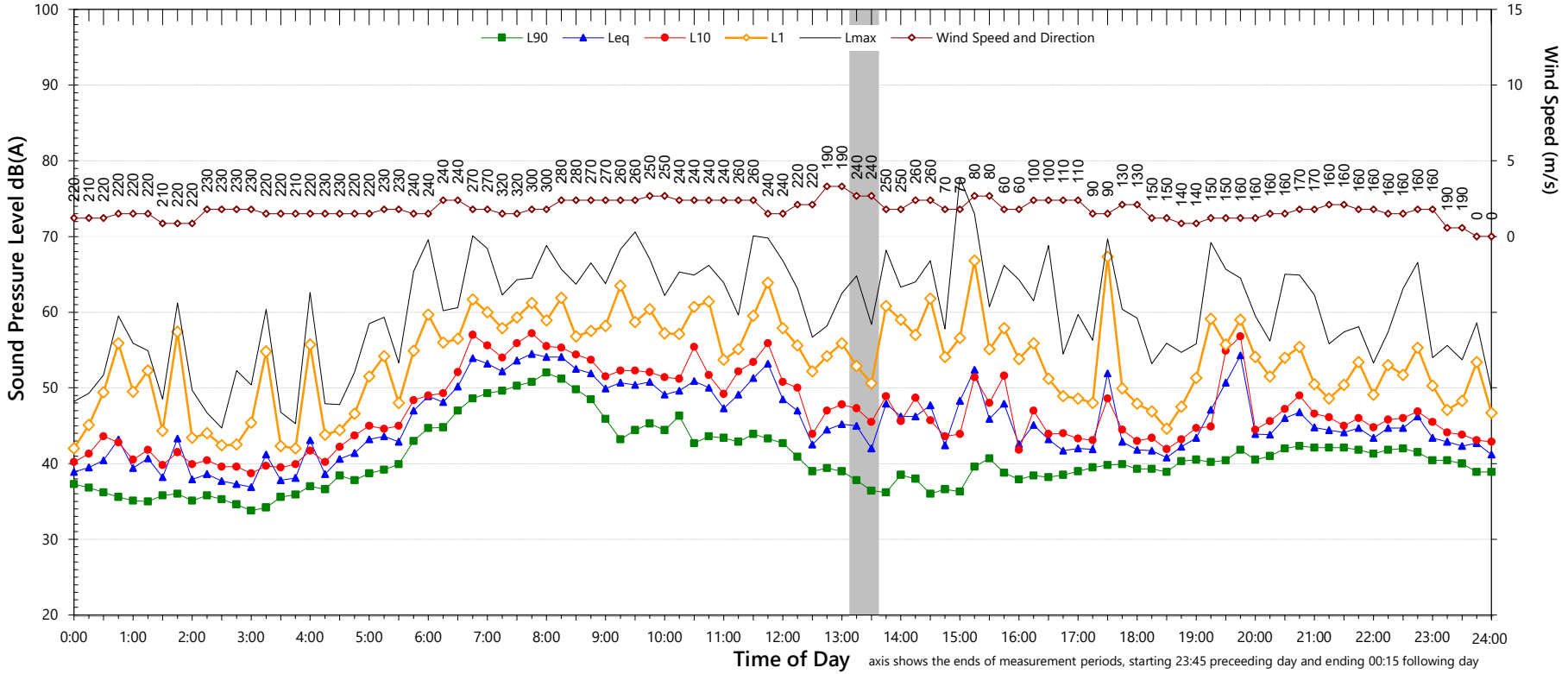
1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am til 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. Night time L_{Max} values are shown only where L_{Max} >65dB(A) and where L_{Max}- Leq ≥15dB(A)
8. Meteorological data has been sourced from the nearest Bureau of Meteorology station (Holsworthy Aerodrome AWS)

Data File: 2020-09-02_SLM_000_123_Rpt_Report.txt Caesarstone South Logger Graphs(r0) QTE-26 Logger Graphs Program (r33)

Unattended Noise Monitoring Results

Caesarstone South

Saturday, 5 September 2020



NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{90}	38	40	36
LAeq	50	47	45

Night Time Maximum Noise Levels			(see note 7)
L_{Max} (Range)	67	to	75
L_{Max} - L_{eq} (Range)	16	to	30

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{eq\ 15\ hr}$ and $L_{eq\ 9\ hr}$	52	45
$L_{eq\ 1hr}$ upper 10 percentile	54	47
$L_{eq\ 1hr}$ lower 10 percentile	46	41

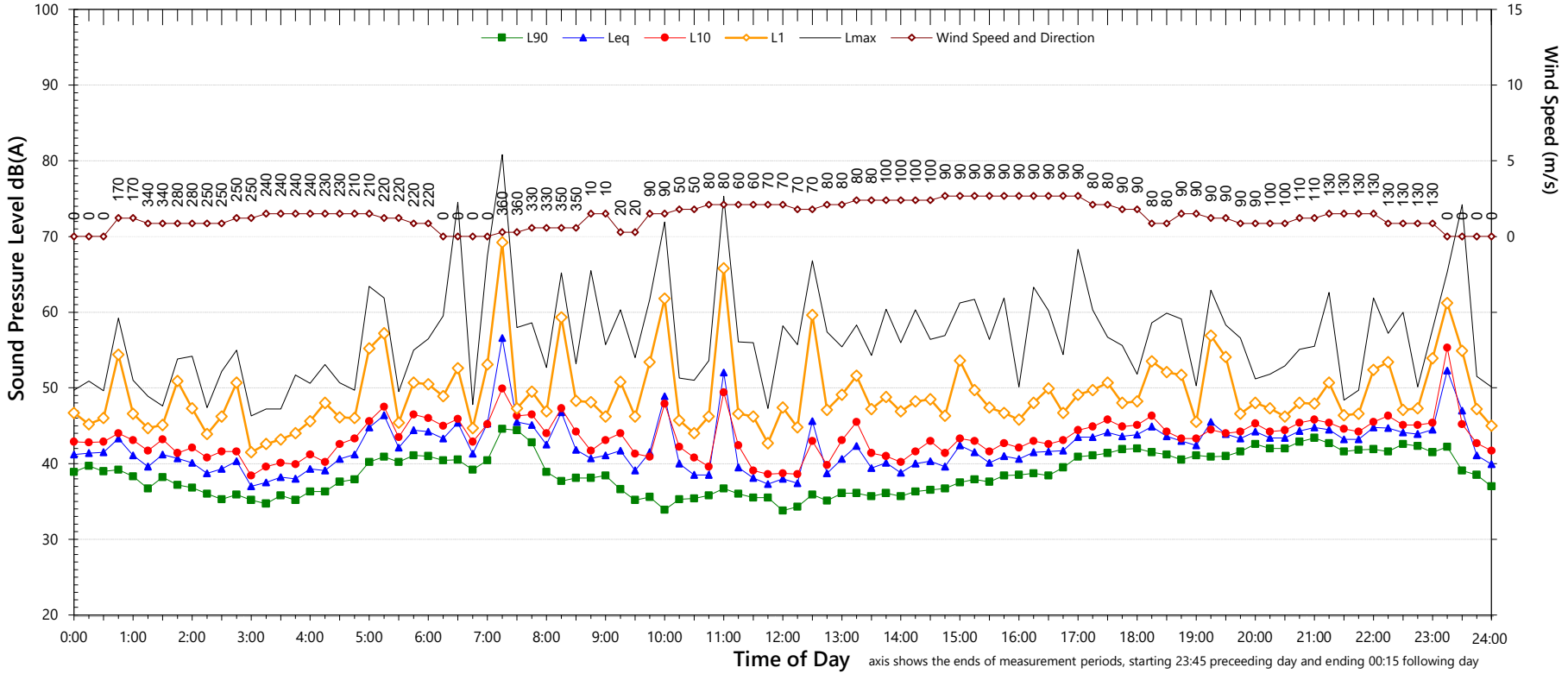
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am til 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. Night time L_{Max} values are shown only where L_{Max} >65dB(A) and where L_{Max}- Leq ≥15dB(A)
8. Meteorological data has been sourced from the nearest Bureau of Meteorology station (Holsworthy Aerodrome AWS)

Unattended Noise Monitoring Results

Caesarstone South

Sunday, 6 September 2020



NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{90}	35	41	36
LAeq	43	44	52

Night Time Maximum Noise Levels			(see note 7)
L_{Max} (Range)	66	to	87
L_{Max} - L_{eq} (Range)	16	to	29

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{eq\ 15\ hr}$ and $L_{eq\ 9\ hr}$	47	54
$L_{eq\ 1hr}$ upper 10 percentile	48	60
$L_{eq\ 1hr}$ lower 10 percentile	43	42

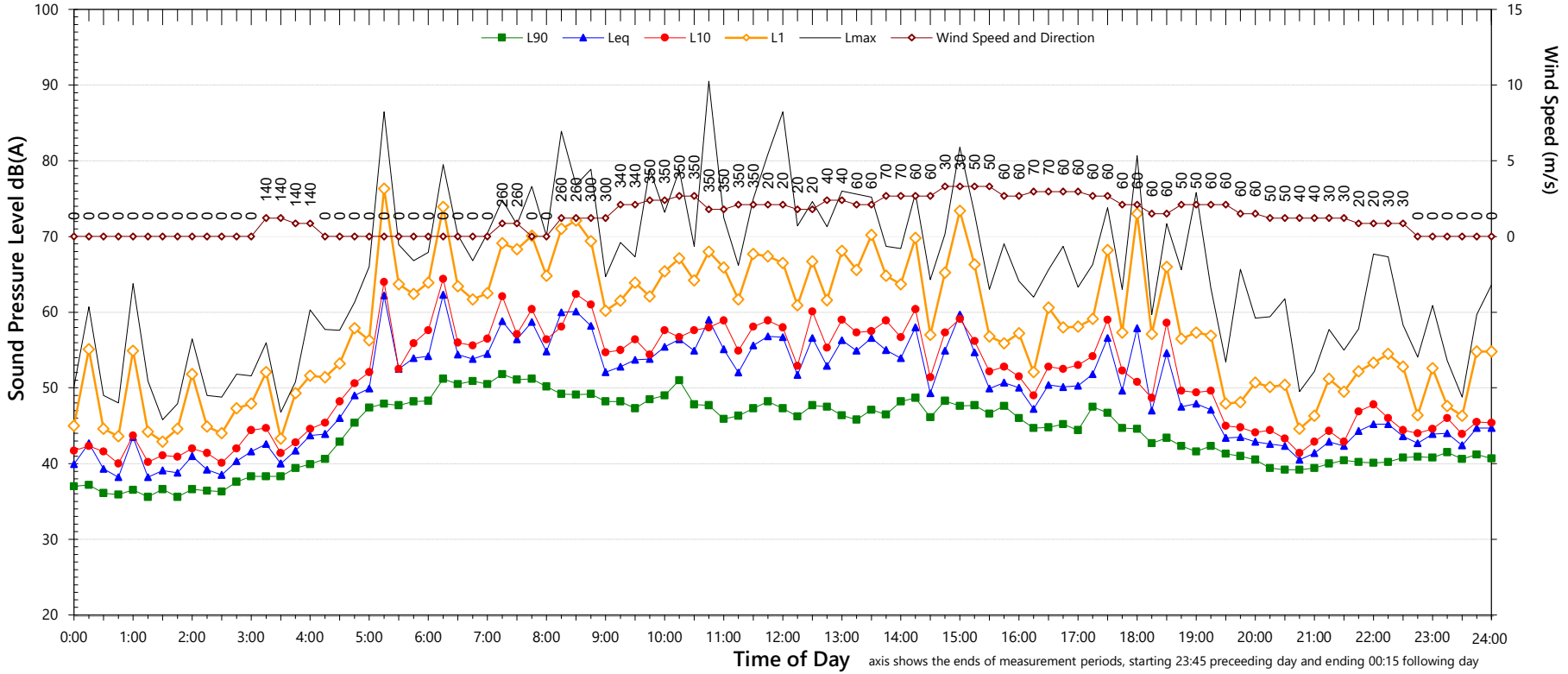
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am til 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. Night time L_{Max} values are shown only where L_{Max} >65dB(A) and where L_{Max}- Leq ≥15dB(A)
8. Meteorological data has been sourced from the nearest Bureau of Meteorology station (Holsworthy Aerodrome AWS)

Unattended Noise Monitoring Results

Caesarstone South

Monday, 7 September 2020



NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{90}	45	39	40
LAeq	56	47	52

Night Time Maximum Noise Levels			(see note 7)
L_{Max} (Range)	67	to	82
L_{Max} - L_{eq} (Range)	16	to	23

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{eq\ 15\ hr}$ and $L_{eq\ 9\ hr}$	57	54
$L_{eq\ 1hr}$ upper 10 percentile	60	58
$L_{eq\ 1hr}$ lower 10 percentile	47	45

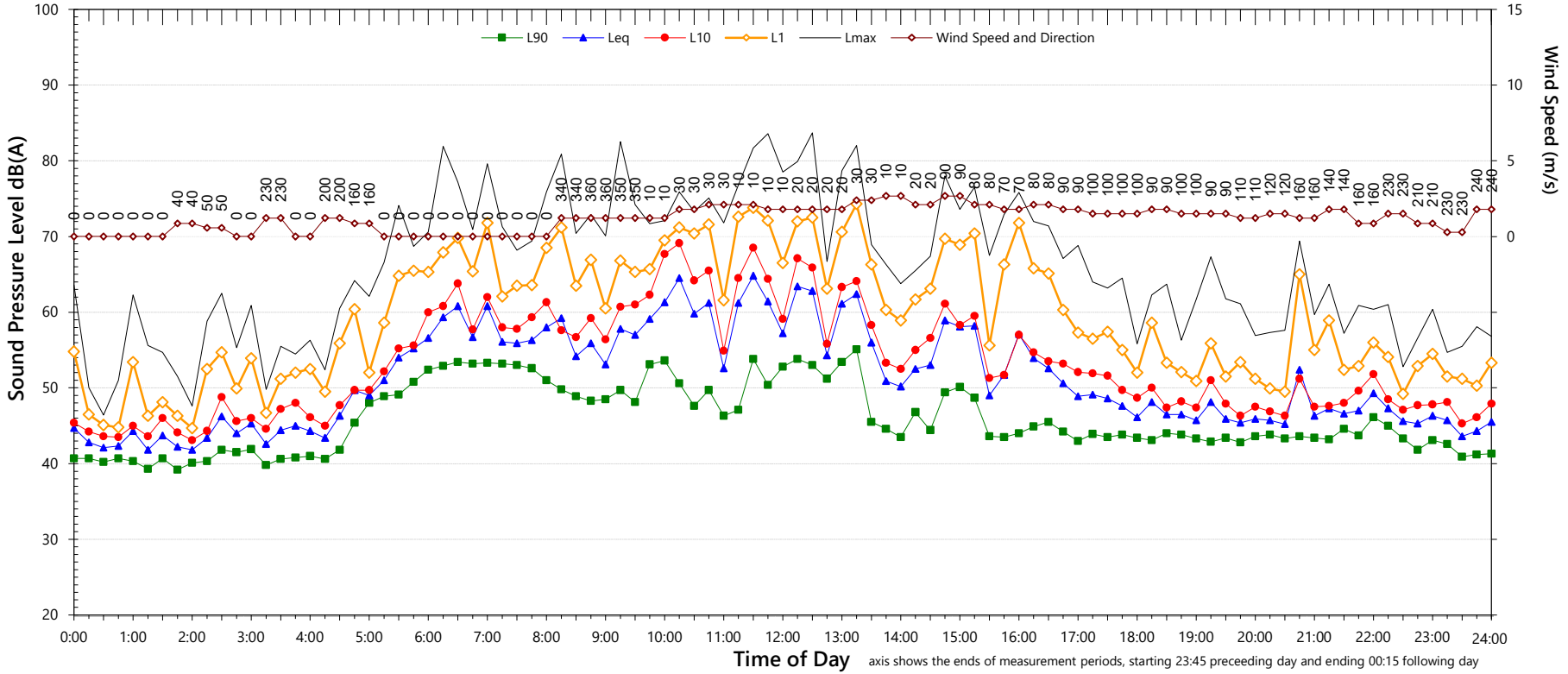
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am til 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. Night time L_{Max} values are shown only where L_{Max} >65dB(A) and where L_{Max}- Leq ≥15dB(A)
8. Meteorological data has been sourced from the nearest Bureau of Meteorology station (Holsworthy Aerodrome AWS)

Unattended Noise Monitoring Results

Caesarstone South

Tuesday, 8 September 2020



NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{90}	44	43	37
LAeq	58	47	48

Night Time Maximum Noise Levels			(see note 7)
L_{Max} (Range)	67	to	73
L_{Max} - L_{eq} (Range)	15	to	21

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{eq\ 15\ hr}$ and $L_{eq\ 9\ hr}$	60	51
$L_{eq\ 1hr}$ upper 10 percentile	64	54
$L_{eq\ 1hr}$ lower 10 percentile	50	44

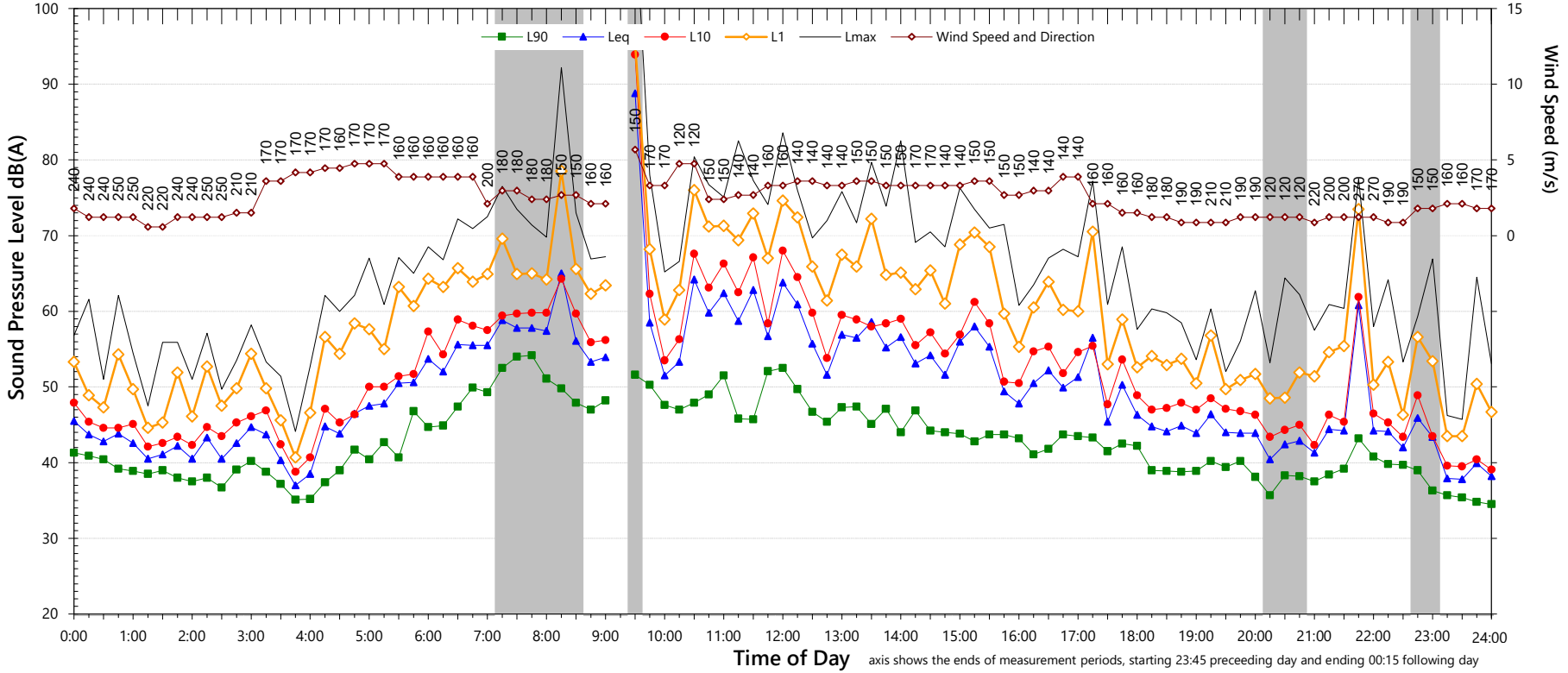
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am til 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. Night time L_{Max} values are shown only where L_{Max} >65dB(A) and where L_{Max}- Leq ≥15dB(A)
8. Meteorological data has been sourced from the nearest Bureau of Meteorology station (Holsworthy Aerodrome AWS)

Unattended Noise Monitoring Results

Caesarstone South

Wednesday, 9 September 2020



NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{90}	42	-	34
LAeq	57	-	56

Night Time Maximum Noise Levels			(see note 7)
L_{Max} (Range)	72	to	74
L_{Max} - L_{eq} (Range)	18	to	26

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{eq\ 15\ hr}$ and $L_{eq\ 9\ hr}$	59	59
$L_{eq\ 1hr}$ upper 10 percentile	63	58
$L_{eq\ 1hr}$ lower 10 percentile	47	41

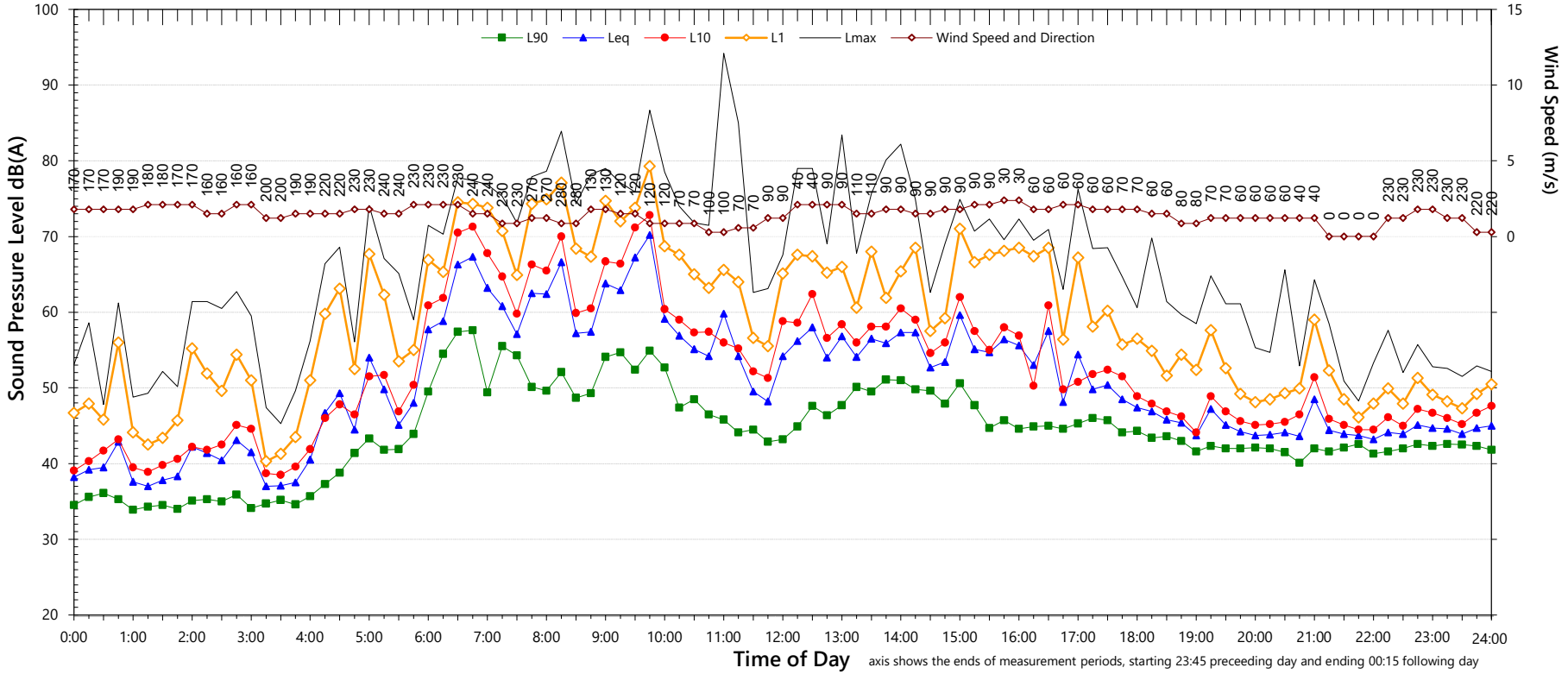
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am til 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. Night time L_{Max} values are shown only where L_{Max} >65dB(A) and where L_{Max}- Leq ≥15dB(A)
8. Meteorological data has been sourced from the nearest Bureau of Meteorology station (Holsworthy Aerodrome AWS)

Unattended Noise Monitoring Results

Caesarstone South

Thursday, 10 September 2020



NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{90}	44	41	39
LAeq	60	45	46

Night Time Maximum Noise Levels			(see note 7)
L_{Max} (Range)	65	to	76
L_{Max} - L_{eq} (Range)	15	to	25

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{eq\ 15\ hr}$ and $L_{eq\ 9\ hr}$	61	48
$L_{eq\ 1hr}$ upper 10 percentile	65	50
$L_{eq\ 1hr}$ lower 10 percentile	48	45

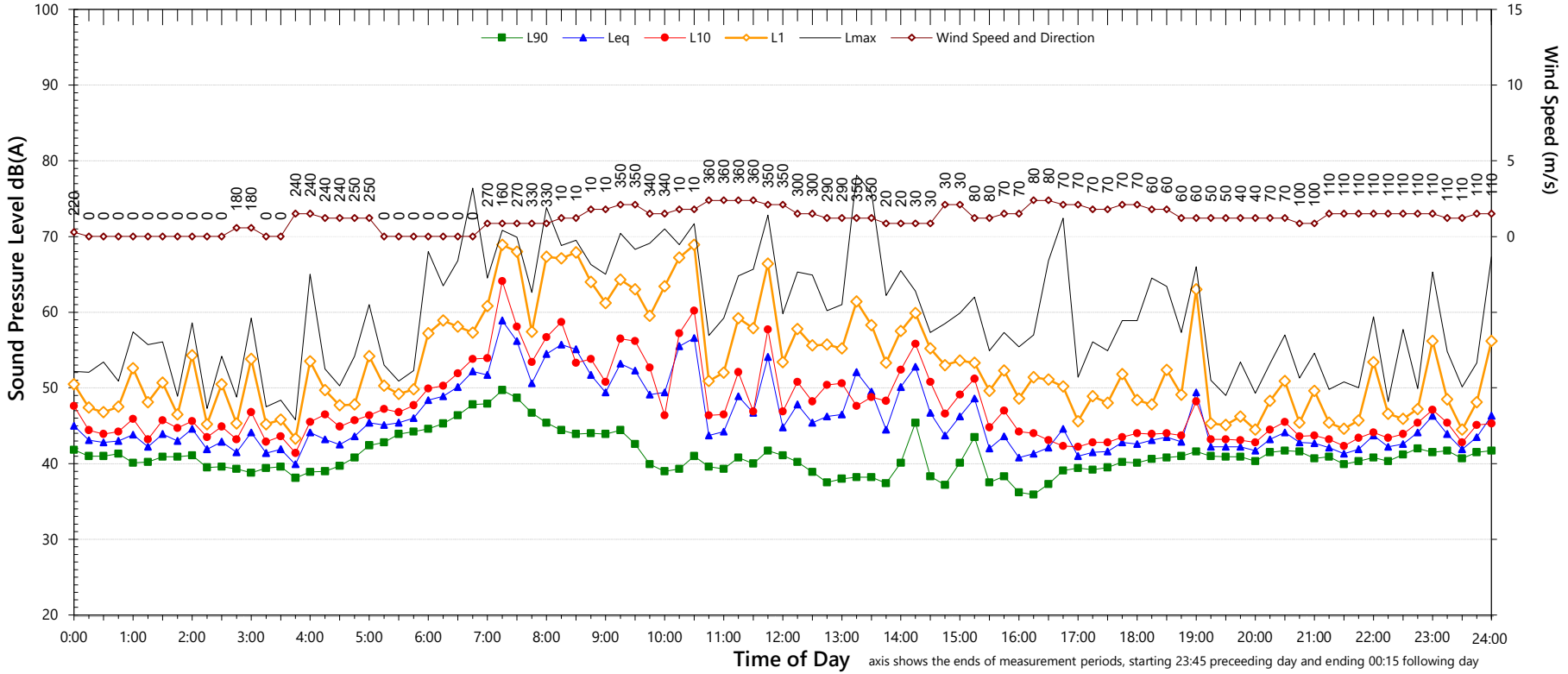
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am til 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. Night time L_{Max} values are shown only where L_{Max} >65dB(A) and where L_{Max}- Leq ≥15dB(A)
8. Meteorological data has been sourced from the nearest Bureau of Meteorology station (Holsworthy Aerodrome AWS)

Unattended Noise Monitoring Results

Caesarstone South

Friday, 11 September 2020



NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{90}	37	40	34
LAeq	51	44	44

Night Time Maximum Noise Levels			(see note 7)
L_{Max} (Range)	65	to	76
L_{Max} - L_{eq} (Range)	16	to	28

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{eq\ 15\ hr}$ and $L_{eq\ 9\ hr}$	52	46
$L_{eq\ 1hr}$ upper 10 percentile	56	48
$L_{eq\ 1hr}$ lower 10 percentile	45	42

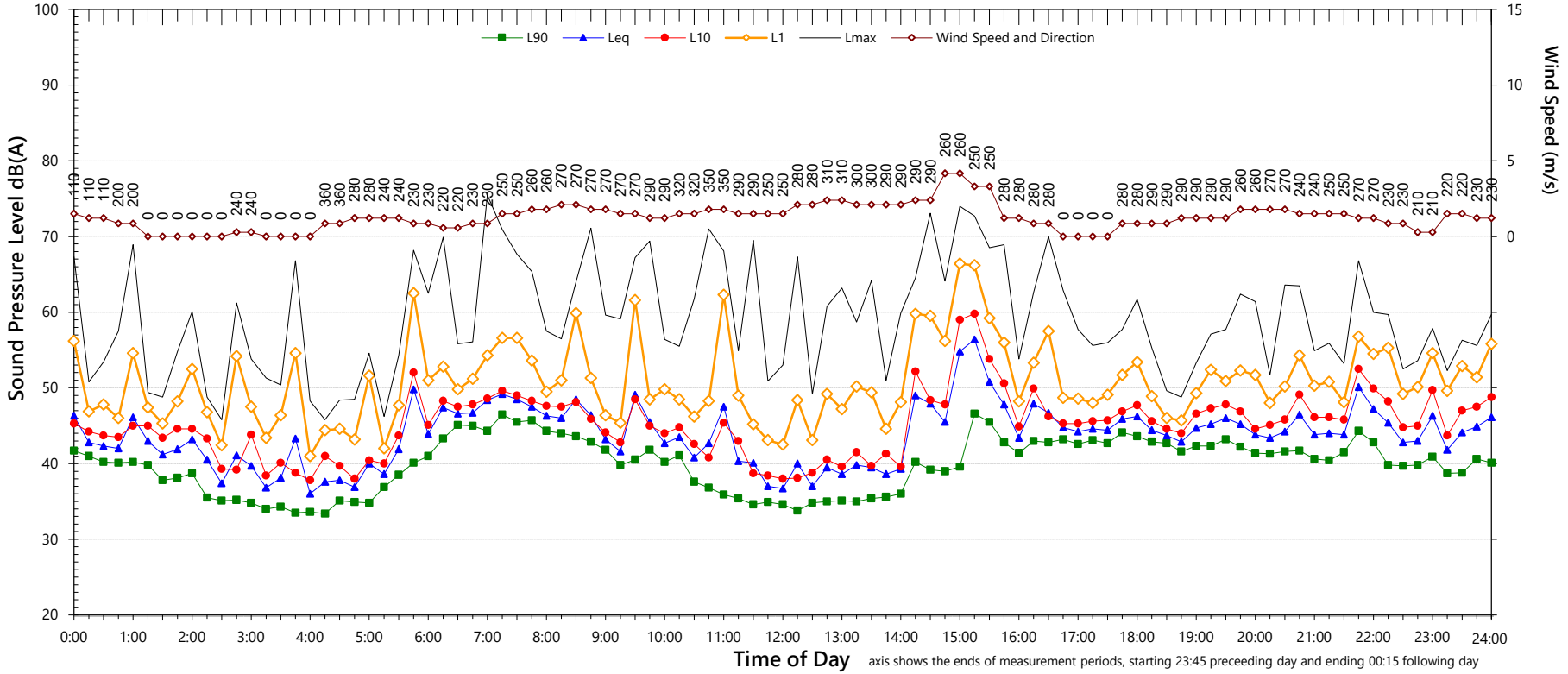
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am til 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. Night time L_{Max} values are shown only where L_{Max} >65dB(A) and where L_{Max}- Leq ≥15dB(A)
8. Meteorological data has been sourced from the nearest Bureau of Meteorology station (Holsworthy Aerodrome AWS)

Unattended Noise Monitoring Results

Caesarstone South

Saturday, 12 September 2020



NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{90}	35	41	39
LAeq	47	45	57

Night Time Maximum Noise Levels			(see note 7)
L_{Max} (Range)	70	to	89
L_{Max} - L_{eq} (Range)	15	to	31

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{eq\ 15\ hr}$ and $L_{eq\ 9\ hr}$	49	59
$L_{eq\ 1hr}$ upper 10 percentile	52	62
$L_{eq\ 1hr}$ lower 10 percentile	42	46

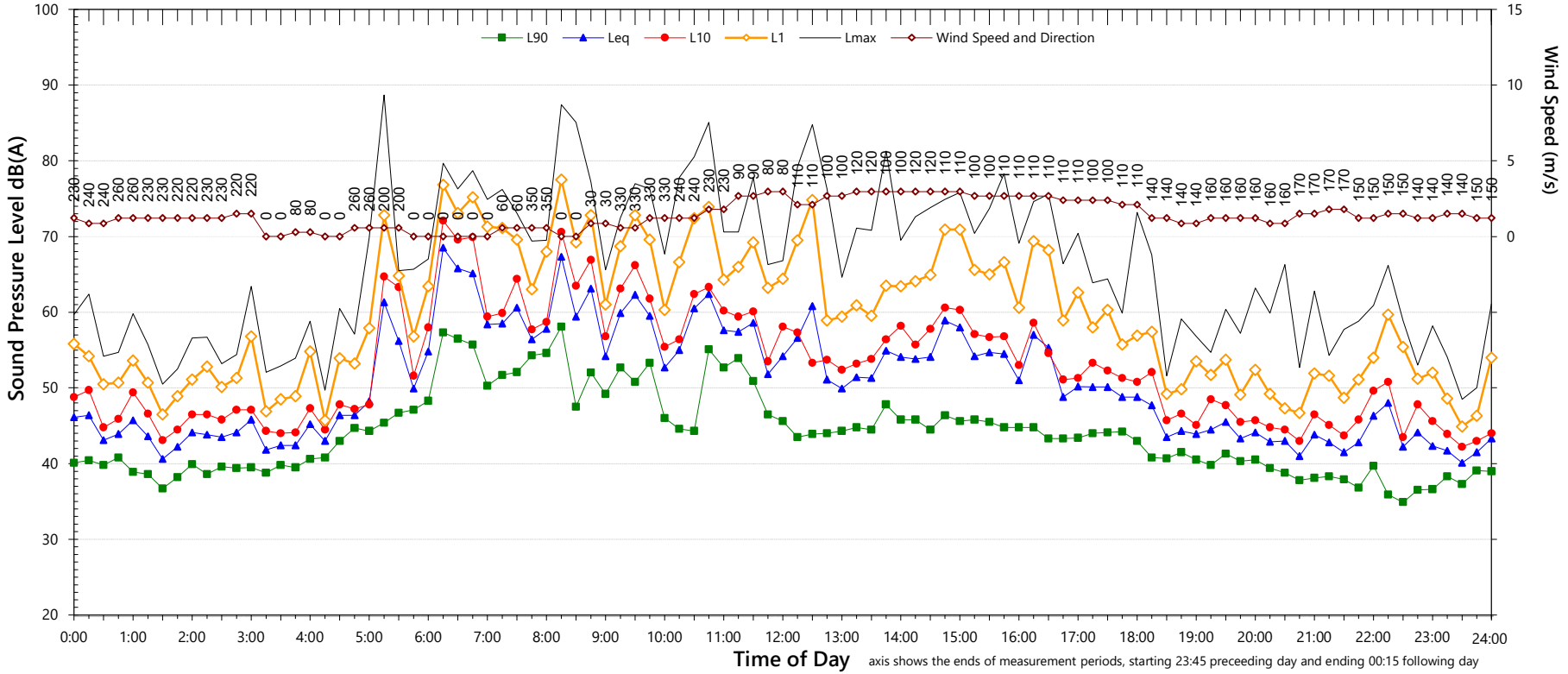
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am til 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. Night time L_{Max} values are shown only where L_{Max} >65dB(A) and where L_{Max}- Leq ≥15dB(A)
8. Meteorological data has been sourced from the nearest Bureau of Meteorology station (Holsworthy Aerodrome AWS)

Unattended Noise Monitoring Results

Caesarstone South

Sunday, 13 September 2020



NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{90}	43	38	34
LAeq	58	44	48

Night Time Maximum Noise Levels			(see note 7)
L_{Max} (Range)	66	to	74
L_{Max} - L_{eq} (Range)	16	to	28

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{eq\ 15\ hr}$ and $L_{eq\ 9\ hr}$	59	50
$L_{eq\ 1hr}$ upper 10 percentile	62	55
$L_{eq\ 1hr}$ lower 10 percentile	47	43

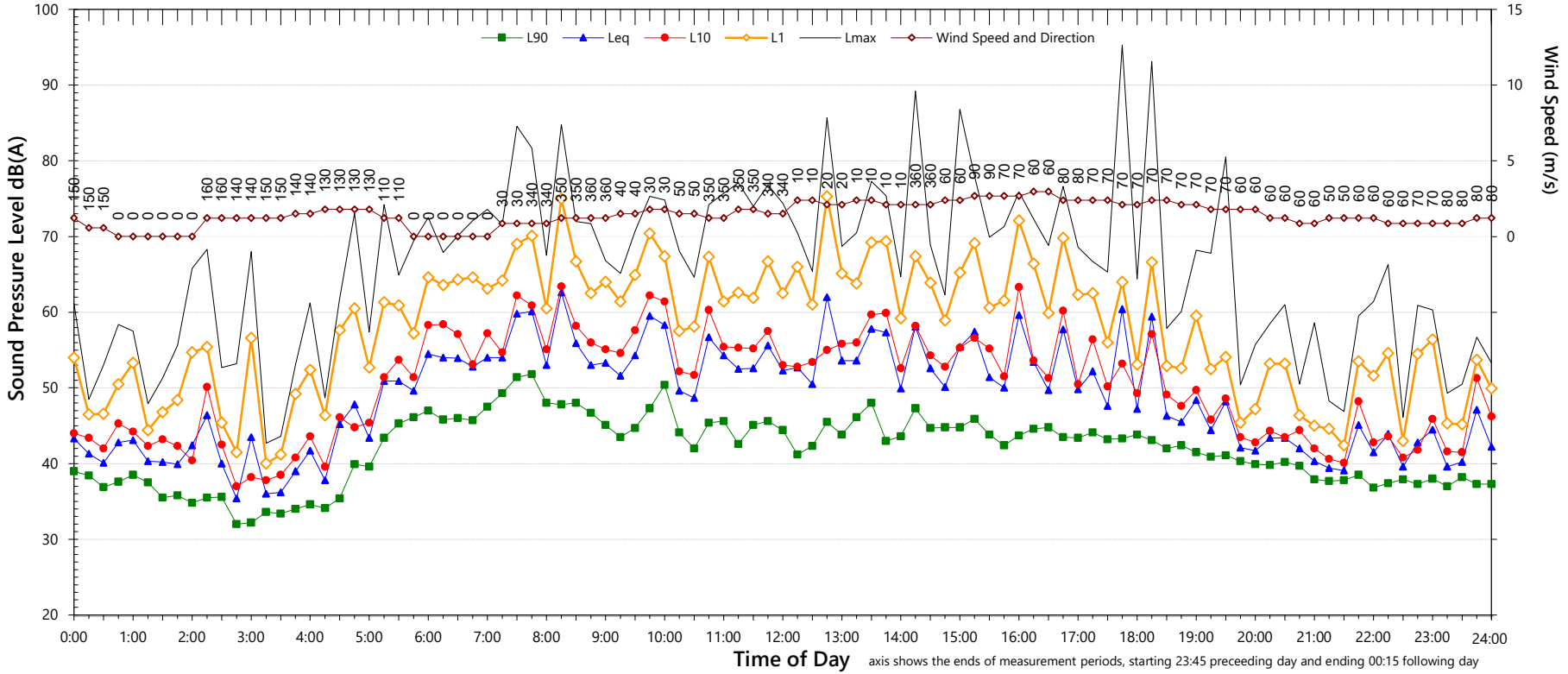
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am til 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. Night time L_{Max} values are shown only where L_{Max} >65dB(A) and where L_{Max}- Leq ≥15dB(A)
8. Meteorological data has been sourced from the nearest Bureau of Meteorology station (Holsworthy Aerodrome AWS)

Unattended Noise Monitoring Results

Caesarstone South

Monday, 14 September 2020



NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{90}	43	38	37
LAeq	56	49	49

Night Time Maximum Noise Levels			(see note 7)
L_{Max} (Range)	66	to	77
L_{Max} - L_{eq} (Range)	15	to	25

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{eq\ 15\ hr}$ and $L_{eq\ 9\ hr}$	58	51
$L_{eq\ 1hr}$ upper 10 percentile	60	55
$L_{eq\ 1hr}$ lower 10 percentile	46	45

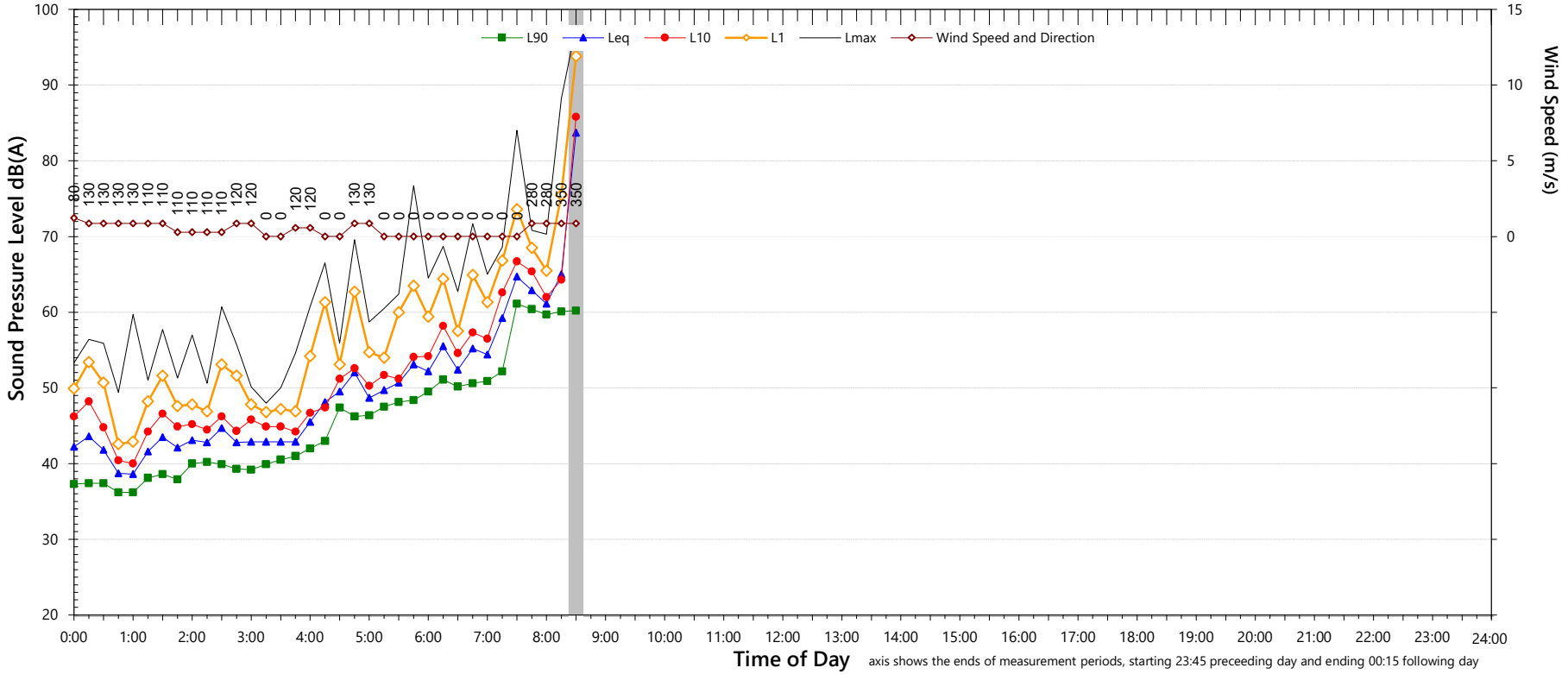
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am til 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. Night time L_{Max} values are shown only where L_{Max} >65dB(A) and where L_{Max}- Leq ≥15dB(A)
8. Meteorological data has been sourced from the nearest Bureau of Meteorology station (Holsworthy Aerodrome AWS)

Unattended Noise Monitoring Results

Caesarstone South

Tuesday, 15 September 2020



NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{90}	-	-	-
LAeq	-	-	-

Night Time Maximum Noise Levels			(see note 7)
L_{Max} (Range)	-	to	-
L_{Max} - L_{eq} (Range)	-	to	-

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{eq\ 15\ hr}$ and $L_{eq\ 9\ hr}$	66	-
$L_{eq\ 1hr}$ upper 10 percentile	67	-
$L_{eq\ 1hr}$ lower 10 percentile	65	-

Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am til 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. Night time L_{Max} values are shown only where L_{Max} >65dB(A) and where L_{Max}- Leq ≥15dB(A)
8. Meteorological data has been sourced from the nearest Bureau of Meteorology station (Holsworthy Aerodrome AWS)

B.8 Warehouse 4B Noise Monitoring Report

Renzo Tonin & Associates Report TL116-05.4F09 ATS Warehouse Operational Compliance (r2)

RENZO TONIN & ASSOCIATES
inspired to achieve

Acoustics
Vibration
Structural Dynamics

MOOREBANK LOGISTIC PARK - PRECINCT EAST

ATS Building Products Warehouse Operational Compliance Measurements

1 December 2020

Qube Property Management Services Pty Ltd c/- Tactical Group

TL116-05.4F09 ATS Warehouse Operational Compliance (r2).docx

35 1982-2017 ACOUSTIC ENGINEERING EXCELLENCE

Sydney Melbourne Brisbane Gold Coast Kuwait Singapore
Renzo Tonin & Associates ABN 29 117 462 861
Level 1/418A Elizabeth St SURRY HILLS NSW 2010 | PO Box 877 STRAWBERRY HILLS NSW 2012
P (02) 8218 0500 F (02) 8218 0501 sydney@renzotonin.com.au www.renzotonin.com.au

aaac Association of Australian Acoustical Consultants

Document details

Detail	Reference
Doc reference:	TL116-05.4F09 ATS Warehouse Operational Compliance (r2).docx
Prepared for:	Qube Property Management Services Pty Ltd c/- Tactical Group
Attention:	Cathal McGann

Document control

Date	Revision history	Non-issued revision	Issued revision	Prepared	Instructed	Reviewed / Authorised
24.11.2020	Initial issue (draft)	0	1	J.Liang/ A.Leslie	A.Leslie	C. Weber
1.12.2020	Final	-	2	J.Liang/ A.Leslie	A.Leslie	C. Weber

File Path: R:\AssocSydProjects\TL101-TL150\TL116 cw Moorebank IMT Temporary Noise Monitoring\Task 5 - cw Operation Compliance Monitoring\1 Docs\Report 9 ATS Warehouse\TL116-05.4F09 ATS Warehouse Operational Compliance (r2).docx

Important Disclaimers:

The work presented in this document was carried out in accordance with the Renzo Tonin & Associates Quality Assurance System, which is based on Australian/New Zealand Standard AS/NZS ISO 9001.

This document is issued subject to review and authorisation by the suitably qualified and experienced person named in the last column above. If no name appears, this document shall be considered as preliminary or draft only and no reliance shall be placed upon it other than for information to be verified later.

This document is prepared for the particular requirements of our Client referred to above in the 'Document details' which are based on a specific brief with limitations as agreed to with the Client. It is not intended for and should not be relied upon by a third party and no responsibility is undertaken to any third party without prior consent provided by Renzo Tonin & Associates. The information herein should not be reproduced, presented or reviewed except in full. Prior to passing on to a third party, the Client is to fully inform the third party of the specific brief and limitations associated with the commission.

In preparing this report, we have relied upon, and presumed accurate, any information (or confirmation of the absence thereof) provided by the Client and/or from other sources. Except as otherwise stated in the report, we have not attempted to verify the accuracy or completeness of any such information. If the information is subsequently determined to be false, inaccurate or incomplete then it is possible that our observations and conclusions as expressed in this report may change.

We have derived data in this report from information sourced from the Client (if any) and/or available in the public domain at the time or times outlined in this report. The passage of time, manifestation of latent conditions or impacts of future events may require further examination and re-evaluation of the data, findings, observations and conclusions expressed in this report.

We have prepared this report in accordance with the usual care and thoroughness of the consulting profession, for the sole purpose described above and by reference to applicable standards, guidelines, procedures and practices at the date of issue of this report. For the reasons outlined above, however, no other warranty or guarantee, whether expressed or implied, is made as to the data, observations and findings expressed in this report, to the extent permitted by law.

The information contained herein is for the purpose of acoustics only. No claims are made and no liability is accepted in respect of design and construction issues falling outside of the specialist field of acoustics engineering including and not limited to structural integrity, fire rating, architectural buildability and fit-for-purpose, waterproofing and the like. Supplementary professional advice should be sought in respect of these issues.

External cladding disclaimer: No claims are made and no liability is accepted in respect of any external wall and/or roof systems (eg facade / cladding materials, insulation etc) that are: (a) not compliant with or do not conform to any relevant non-acoustic legislation, regulation, standard, instructions or Building Codes; or (b) installed, applied, specified or utilised in such a manner that is not compliant with or does not conform to any relevant non-acoustic legislation, regulation, standard, instructions or Building Codes.

Contents

1 Introduction 5
1.1 Warehouse operations description – ATS 6
1.1.1 Location 6
1.1.2 Operational activities and facilities and hours of operation 6
1.2 Nearby sensitive receivers 6
2 Summary of noise objectives 9
2.1 Compliance assessment noise requirements 9
2.2 Operational noise limits 10
2.3 Discussion of assessment noise limits 10
3 Measurement methodology and results 12
3.1 Compliance measurement methodology 12
3.2 Instrumentation 13
3.3 Receiver attended noise measurement results 13
3.3.1 Meteorological conditions 14
3.4 On-site attended operational activity noise measurement results 17
3.5 Unattended noise measurements 18
3.6 Modelled operational scenarios 20
3.6.1 Observed operations for modelling 20
3.6.1.1 Truck and despatching operations (ATS north) 21
3.6.1.2 Qube container handling operational area 21
3.6.2 Assessment noise source levels 22
3.6.3 Reasonable worst-case intrusiveness scenarios (15-minute period) 22
3.7 Modelling methodology 23
3.7.1 Overview of noise modelling 23
3.7.2 General modelling assumptions 24
3.7.3 Model validation 24
3.8 Noise compliance assessment 25
4 Conclusion 27
APPENDIX A Glossary of terminology 29
APPENDIX B Logger location 1 – ATS - North side 31
APPENDIX C Logger location 2 – ATS – South side 32

List of tables

Table 1 Noise sensitive receivers and approximate distance from MPE warehouse (ATS) 7
Table 2 SSD 7628 CoC B80 noise limits, dB(A) 10
Table 3 Noise measurement equipment 13

Table 4 Receiver attended noise monitoring locations 14
Table 5 Summary of attended noise measurement results at the nearest sensitive residential receivers 16
Table 6 On-site attended measurement results 17
Table 7 Assessment noise source levels 22
Table 8 Representative 'reasonable' worst-case 15-minute intrusive assessment scenarios 23
Table 9 Comparison between measured and modelled noise levels 25
Table 10 Predicted noise levels - Reasonable worst-case scenarios for warehouse (ATS) 26

List of figures

Figure 1 Warehouse location (ATS – WH4B), MPE precinct and the nearest residential receivers 8
Figure 2 Attended residential receiver noise monitoring locations 15
Figure 3 ATS South Unattended Noise Measurement Setup 19
Figure 4 ATS North Unattended Noise Measurement Setup 19
Figure 5 Unattended noise logger locations and main noise generation areas (imagery: Nearmap, 2020) 20

1 Introduction

Renzo Tonin & Associates was engaged by Tactical on behalf of Qube Property Management Services Pty Ltd (QUBE) to undertake an operational noise compliance assessment of the warehouse operations carried out by ATS Building Products (Warehouse 4B (WH4B)) within the Moorebank Precent East (MPE), located within the Moorebank Logistics Park (MLP) at Moorebank, NSW.

The Sydney Intermodal Terminal Alliance (SIMTA) received approval for the construction and operation of Stages 1 and 2 of the MPE Project (SSD 6766 and SSD 7628 respectively), which together comprise the two stages of development under the MPE Concept Approval (MP10_0193). Warehouse operations, including the site that is operated by ATS (WH4B), fall under the area and activities approved as part of SSD 7628.

This report has been prepared to address the operational noise monitoring requirements outlined in the MPE Operational Noise and Vibration Management Plan[1] (MPE ONVMP) required for the warehouse operations carried out by ATS. Specifically, this report has been prepared to address the requirements of Condition of Consent (CoC) B85 in State Significant Development (SSD) 7628, as detailed in Section 3.2.2 of the MPE ONVMP.

Appendix A contains a glossary of acoustic terms used in this report.

1 Arcadis & Renzo Tonin & Associates, Operational Noise and Vibration Management Plan for Moorebank Logistics Park – East Precinct, Revision 012, dated 27/3/2020, available https://simta.com.au/wordpress/wp-content/uploads/2020/04/ONVMP_V12_redacted.pdf, accessed 8/10/2020

1.1 Warehouse operations description – ATS

1.1.1 Location

The MLP is located approximately 27 kilometres south-west of the Sydney Central Business District and approximately 26 kilometres west of Port Botany, within the Liverpool Local Government Area. The MLP is divided into an East Precinct and a West Precinct, located east and west of Moorebank Avenue respectively, as shown in Figure 1.

1.1.2 Operational activities and facilities and hours of operation

ATS undertakes warehouse and distribution activities from the warehouse designated WH4B within the MPE. The day to day activities include:

- Receipt and despatch of goods from and to the IMEX terminal
- Packing and unpacking of containers
- Storage and distribution of building products
- Despatching and receiving truck movements in and out of the facility
- Forklift operations
- Cutting of timber products to size (Internal warehouse activity)
- De-termite timber treatment line (Internal warehouse activity)
- General office administrative and support functions.

ATS's warehouse and distribution activities can operate 24 hours, 7 days per week.

The despatch and receiving activities mostly occur from the north side of the ATS warehouse, typically between the hours of 5:00am and 10:00pm, with the busiest period around 5:30am to 6:30am. Additionally, there is a designated area on the southern side of the warehouse where containers from the IMEX terminal are transported to and stored for unloading within the warehouse. These two main areas are shown in Figure 5.

1.2 Nearby sensitive receivers

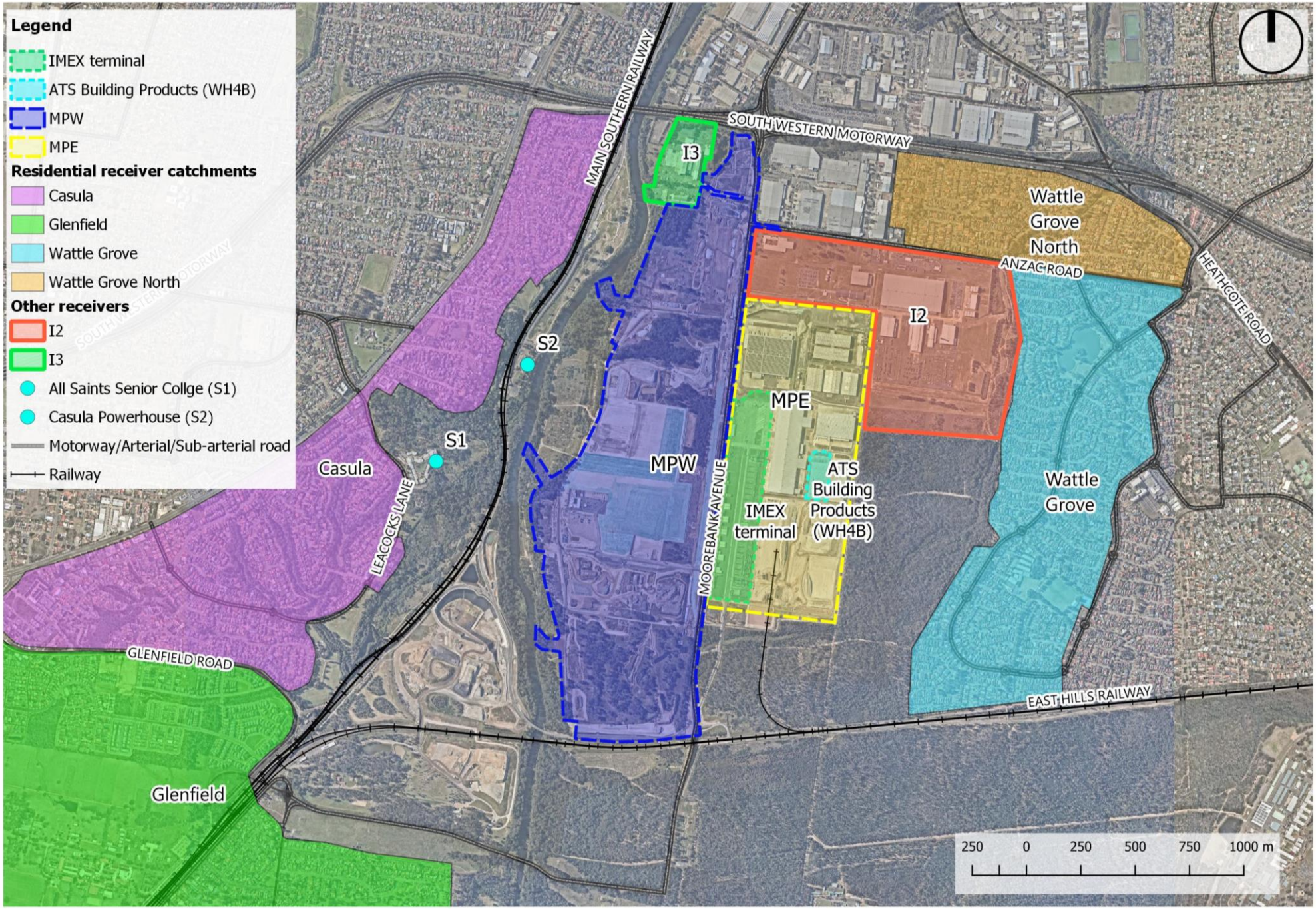
The potentially most affected residential receivers in the vicinity of the MPE (where loading / unloading at ATS north and south occur), are located in the suburbs of Casula, Glenfield, Wattle Grove and Wattle Grove North. A summary of the approximate distance to the nearest residential receiver in the surround noise catchment areas (NCAs) is provided in Table 1. The locations of the NCAs or receivers, are shown in Figure 1.

Table 1 Noise sensitive receivers and approximate distance from MPE warehouse (ATS)

Sensitive receiver (Noise Catchment Area (NCA) or Receiver ID)	Receiver type	Approximate distance from MPE precinct warehouse (ATS), metres
Wattle Grove (NCA 1)	Residential	800
Wattle Grove North (NCA 2)		1,060
Casula (NCA 3)		1,530
Glenfield (NCA 4)		2,530
All Saints Senior College (S1)	Educational	1,720
Casula Powerhouse (S2)		1,380
Defence Joint Logistics Unit (DJLU) (I2)	Industrial	600
ABB (I3)		1,260

Notes: 1. Moorebank Precinct West (MPW) has not been assessed as the final receiver locations have not been confirmed or constructed.

Figure 1 Warehouse location (ATS – WH4B), MPE precinct and the nearest residential receivers



2 Summary of noise objectives

2.1 Compliance assessment noise requirements

The management of operational noise emission from warehouse activities within MPE Stage 2 is outlined in the MPE ONVMP. Specifically, this report has been prepared to address the monitoring requirements of CoC B85 in SSD 7628, as detailed in Section 4.1.1 of the MPE ONVMP.

This report includes noise monitoring performed to address the requirements in CoC B85, as detailed in Table 4-1 in Section 4.1.1 of the MPE ONVMP.

The requirements of CoC B85 state:

> *B85 The Applicant must carry out noise monitoring of mechanical plant and other noisy equipment for a minimum period of one week where valid data is collected following occupation of each warehouse. The monitoring program must be carried out by a suitably qualified and experienced person(s) and a Monitoring Report for Mechanical Plant must be submitted to the Secretary within two months of occupation or each tenancy to verify predicted mechanical plant and equipment noise levels.*

CoC B85 requires that the monitored noise levels be compared against the predicted levels reviewed in accordance with CoC B84.

The noise impacts from warehouse operations were assessed as part of the environment impacts statement noise and vibration impact assessments (MPE Stage 2 Noise and Vibration Impact Assessment, Wilkinson Murray, Report No. 12186-S2, Version C, 29 November 2016 (MPE Stage 2 N&V assessment)). Individual warehouse operations were not assessed and further review of site noise emissions subsequently has not been undertaken. As such, there are no specific predicted noise levels for the warehouse activities at the nearby noise sensitive receivers that can then be used for verification under CoC B85.

As per Table 4-1 in Section 4.1.1 of the MPE ONVMP, Table 3-20 and Table 3-21 of the MPE ONVMP detail the predicted $L_{Aeq\ 15\ minute}$ intrusiveness and L_{Amax} sleep disturbance noise levels respectively for the overall MPE operations (not for an individual warehouses).

As such, for the purposes of addressing CoC B85, instead of comparing the facility noise emission against the noise level predicted in accordance with condition B84, this report is aims to assess the noise levels from the mechanical plant and other noisy equipment that operate within the facility directly against the noise limits presented in Table 5 of condition B80.

2.2 Operational noise limits

The operational noise limits applicable for the warehouse operations within MPE are presented in Table 5 of SSD 7628 CoC B80 and are reproduced in Table 2. These noise limits are as per Table 3-5 of the MPE ONVMP. The noise limits are applicable not only to all operational noise sources approved under SSD 7628, but are inclusive of operations as part of MPE Stage 1, approval SSD 6766.

The $L_{Aeq(15\ minute)}$ criteria are applicable during the day, evening and night-time periods and the $L_{A1\ (1\ minute)}$ sleep disturbance noise limits at residential receivers are applicable during the night-time period.

The noise limits are applicable under prevailing meteorological conditions of wind speeds of up to 3 m/s at 10 metres above ground level or stability category 'F' temperature inversion conditions.

Table 2 SSD 7628 CoC B80 noise limits, dB(A)

Sensitive receiver	Day [1] $L_{Aeq,\ 15\ minute}$	Evening [1] $L_{Aeq,\ 15\ minute}$	Night [1] $L_{Aeq,\ 15\ minute}$	Night [1] $L_{A1\ (1\ min)}$
Wattle Grove (NCA 1)	35	35	35	52
Wattle Grove North (NCA 2)	35	35	35	52
Casula (NCA 3)	35	35	35	52
Glenfield (NCA 4)	35	35	35	52

Notes:

1. In accordance with the INP, day is the period from 7:00am to 6:00pm Monday to Saturday; or 8:00am to 6:00pm on Sundays and public holidays; evening is the period from 6:00pm to 10:00pm; and night is the remaining periods.
2. To determine compliance with the $L_{Aeq,15\ minute}$ noise limits, noise from the development is to be measured at the most affected point within the residential boundary, or at the most affected point within 30 metres of a dwelling where the dwelling is more than 30 metres from the boundary. Where it can be demonstrated that direct measurement of noise from the project is impractical, the EPA may accept alternative means of determining compliance (see Chapter 7 Noise Policy for Industry - NPfI) The modification factors in Section 4 of the INP must also be applied to the measured noise levels where applicable.
3. To determine compliance with the L_{A1} noise limits, noise from the project is to be measured at 1 metre from the dwelling façade. Where it can be demonstrated that direct measurement of noise from the project is impractical, the EPA may accept alternative means of determining compliance (see Chapter 7 of the NPfI).
4. The noise emission limits identified above apply under meteorological conditions of:

   (i) wind speeds of up to 3 m/s at 10 metres above ground level; or

   (ii) 'F' atmospheric stability class.

2.3 Discussion of assessment noise limits

As noted in Section 2.2, the noise limits detailed in SSD 7628 CoC B80 are applicable not only to all operational noise sources approved under SSD 7628, but are also inclusive of operations as part of the MPE Stage 1 approval for SSD 6766. Importantly, when assessing compliance with the noise limits, the most affected residential receiver for any individual operations will not necessarily be at the same location. Additionally, it is unlikely that the reasonable worst-case noise levels from any individual operations would also occur in the same 15-minute period.

As part of the recent modification application for SSD 7709 Moorebank Precinct West (MPW) – Stage 2, MOD 1 - Building height increase (July 2020), a review of the applicable operational noise requirements across Moorebank Precinct West (MPW) and Moorebank Precinct East (MPE) was undertaken (Renzo Tonin & Associates document reference TJ741-11F05 (r4), dated 30 June 2020). The review identified

that there are number of approval conditions that are applicable across both the MPW and MPE sites for operational noise, and that in the application of these approvals to the site activities it became apparent that the operational noise requirements were not consistent across the MPE and MPW sites.

Additionally, the review identified that the operational noise limits across MPE and MPW were set substantially below both the noise criteria and the predicted noise levels (even with feasible and reasonable mitigation measures) established during the environmental assessment stages and considering the cumulative operational noise levels from all MPE and MPW operations.

The review recommended that an overall approach for cumulative operational noise management of the Moorebank intermodal terminal precinct (for East and West precinct) for a "whole of complex" approach be adopted, and that consistent noise management objectives for the Moorebank intermodal terminal precinct's operational noise be adopted to cover all operations within MPE and MPW. Appropriate and achievable noise management objectives consistent with EPA's noise policies were also developed in the review.

Following the modification application for SSD 7709 (MOD 1), the submission received from the NSW Environment Protection Authority (NSW EPA) noted the following:

However, the current noise limits are set below the predicted noise levels and are not based on the Project Specific Noise Levels (PSNL) derived under the then-applicable Industrial Noise Policy 2000 (now superseded by the Noise Policy for Industry 2017)…. The EPA considers that the resulting noise limits are not achievable for MPW, nor are they achievable for the cumulative MPW and MPE sites.

Also Liverpool City Council included in their submission:

Council considers that site regulation in regard to noise management may be assisted by adopting a precinct approach consistent with the NSW EPA's Noise Policy for Industry (2017)…. Whilst it is acknowledged that current criteria in the Approval may be impracticable, it will be necessary for the Department to consider applying suitable noise limits that are achievable and capable of protecting the amenity and wellbeing of sensitive receivers.

As such, this operational compliance assessment does not include further quantification of cumulative noise levels, and demonstrates that the ATS warehouse operations can achieve the noise limits set out in SSD 7628 CoC B80 in isolation during reasonable worst-case operations.

It is recommended that noise levels from this assessment achieve the required noise limits set out in Table 5 of SSD 7628 CoC B80, and that the site specific noise levels should be considered as part of the operational noise management applicable to the overall Moorebank intermodal terminal precinct.

3 Measurement methodology and results

3.1 Compliance measurement methodology

The Noise Policy for Industry (NPfI) provides guidance in Chapter 7 for monitoring the performance of a noise-generating industrial facility. In Section 7.1.1, the NPfI provides guidance as to how to review noise emissions of a site where the existing ambient noise levels are already high, resulting in the direct quantification of the noise under investigation not being possible via noise measurements at the receiver location. Additionally, it provides guidance about using noise modelling to review the performance of an industrial operation that is co-located with separate but noise-generating industrial sites impacting the same receiver.

Noise measurements undertaken as part of this compliance monitoring established that the existing ambient noise levels at the nearby receiver locations meant that the direct quantification or estimation of operational noise emissions from the warehouse operations was not possible.

As such, because of existing high ambient noise levels at the nearest receivers, in addition to a number of industrial noise-generating facilities being co-located, the noise emissions from the warehouse facility (ATS) have been evaluated using a combination of on-site attended and unattended noise monitoring, combined with noise modelling, in order to quantify the industrial noise emissions from ATS operations. To satisfy the requirements of CoC B85, the following noise monitoring and assessment steps have been undertaken:

1. Attended noise monitoring at nearby residential receivers to review existing noise levels and to determine if operational noise emissions are quantifiable (Section 3.3)
2. On-site attended monitoring of noise-generating activities to quantify noise emission levels of mechanical plant and other noise-generating activities as part of typical warehouse operations (Section 3.4)
3. Unattended noise monitoring within the ATS warehouse facility for a period of approximately two weeks, with concurrent video, to identify the reasonable worst-case operational scenarios for each major noise-generating area (Section 3.5).

Following the noise monitoring, the following steps were undertaken to assess the noise level contributions at the nearby sensitive receivers:

4. Review observations of warehouse operations, in addition to the noise monitoring results and associated video, to then determine the reasonable worst-case operational scenarios
5. Setup and calibrate the noise model for the reasonable worst-case operational scenarios
6. Calculate the operational noise levels from the warehouse operations to all nearby receivers and determine the noise level contribution at the property with the highest noise levels within each NCA.

3.2 Instrumentation

A range of noise monitoring equipment was used to undertake the compliance noise monitoring. A summary of measurement equipment and calibration dates is provided in Table 3.

All of the noise monitoring equipment are Class 1 instruments, with calibration certificates current at the time of the measurements. Before and after each series of attended measurements, the calibration of the sound level meters were verified using a reference calibration of 94 dB at 1 kHz. The difference between pre- and post-calibration levels was within 0.5 dB for all measurements.

Table 3 Noise measurement equipment

Monitoring location/ purpose	Equipment	Serial No	Last date calibrated
Receiver attended noise measurements	NTi XL2	A2A-13500-E0	17/01/2020
On-site attended noise measurements	NTi XL2	A2A-12698-E0	01/05/2019
Unattended on-site noise measurements (ATS North)	NTi XL2	A2A-08004-E0	01/11/2018
Unattended on-site noise measurements (ATS South)	NTi XL2	A2A-13529-E0	20/12/2019
Field calibration	B&K 4231	2677710	16/03/2020

3.3 Receiver attended noise measurement results

As detailed in Section 1.2, the nearest residential receivers to the ATS warehouse site are located in the suburbs of Casula, Glenfield, Wattle Grove and Wattle Grove North.

As the most intensive period of operational activities at WH4B (ATS) was during the morning period from 5:30am to 6:30am, attended noise measurements were performed at the nearest residential receiver locations between 5:30am and 8:00am on 7 September 2020. These measurements were undertaken concurrently with on-site unattended noise measurements to confirm that noise intensive activities were occurring on-site during the receiver noise measurements.

Attended noise measurements were undertaken at six potentially noise affected residential receivers in the surrounding residential noise catchment areas. These included nearby residential receiver locations and the locations of the permanent noise monitoring terminals that are established in the suburbs surrounding MLP.

A summary of the monitoring locations and the approximate distance to the warehouse (ATS) is provided in Table 4. The locations and noise catchment areas (NCAs) are presented in Figure 2.

The results of the attended measurements conducted on 7 September 2020 are presented in Table 5.

Table 4 Receiver attended noise monitoring locations

Monitoring location ID	Monitoring location (applicable NCA) (see Figure 2)	Approximate distance (metres) from warehouse (ATS)
M1	25 Yallum Court, Wattle Grove (Wattle Grove – NCA1)	1,100
M2	23 Gracemere Court, Wattle Grove (Wattle Grove – NCA1)	800
M3	31 Martindale Court, Wattle Grove (Wattle Grove – NCA1)	830
M4	39 Glenelg Court, Wattle Grove (Wattle Grove North – NCA2)	850
M5	St Andrews Park, Casula (Casula – NCA3)	1,420
M6	14 Dunmore Crescent, Casula (Casula – NCA3)	1,500
M7	26 Goodenough St, Glenfield (Glenfield – NCA4)	2,650

In all cases, the measured $L_{Aeq(15minute)}$ noise levels at the residential receivers, noise from the direction of the ATS warehouse on-site activities was not audible and/or distinguishable. The noise measurements at each residential receiver location was dominated by noise from sources outside of the MPE operations, mainly dominated by traffic noise levels from nearby arterial roads.

Since the ATS noise emissions were not audible, it was not possible to estimate the industrial noise contribution from the facility at the nearest residential receivers from these measurements.

3.3.1 Meteorological conditions

Meteorological conditions during the period of the receiver attended noise measurements have been reviewed to determine the prevailing wind and temperature inversion conditions. Data from the meteorological data monitoring station adjacent to Moorebank Avenue, within the MPE site, established in accordance with CoC A54 SSD 7709 has been reviewed. It was determined from the review that the attended noise measurements were undertaken under periods with worst-case prevailing meteorological conditions in accordance with SSD 7628 B80.

The meteorological conditions experienced during receiver attended noise measurement on 7 September 2020 are summarised below:

- During the measurement period on 7 September, the temperature inversion conditions between 5:30am and 7:30am were generally Class F temperature inversion (> 95% of the measurement period), based upon calculations using the sigma-theta method referred to in Fact Sheet D of the NPfI;
- During the measurement period at the facility, the equivalent average wind speed was 0.5-1 m/s and generally from the SSW, varying from SE to W. The measurements were not impacted by excessive wind during any of the measurement periods;
- No rain occurred during any of the measurement periods; and
- The temperature during the measurement period ranged between 12˚C and 16˚C, and the cloud conditions were generally clear skies with a few scattered clouds.

Figure 2 Attended residential receiver noise monitoring locations

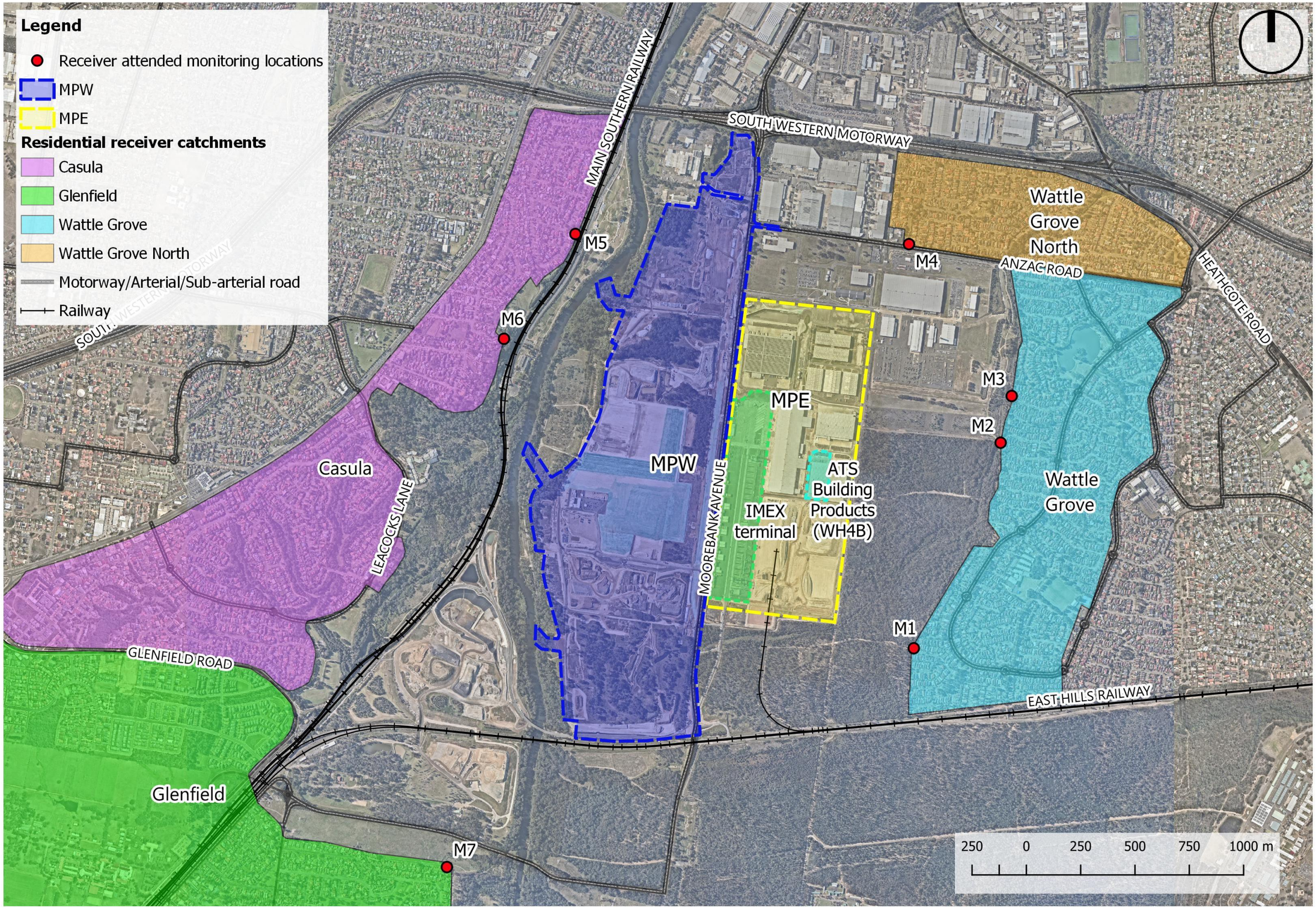


Table 5 Summary of attended noise measurement results at the nearest sensitive residential receivers

ID	Address	Noise limit, dB(A)		Measurement period	Measured noise level (15 minute), dB(A)				Estimated MPE operational noise contribution, dB(A)		Comments and measured noise levels from typical events	ATS noise audible?
		$L_{A1,\ 1\ minute}$	$L_{Aeq,\ 15minute}$		L_{Amax}	L_{A1}	L_{Aeq}	L_{A90}	$L_{A1,\ 1\ minute}$	$L_{Aeq,\ 15minute}$		
Wattle Grove												
M1	25 Yallum Ct, Wattle Grove	52	35	7/09/2020 7:23am to 7:38am	78	62	54	48	Note 1	Note 1	Ambient noise environment dominated by noise from road traffic at north west: Construction 54-57dB(A), bird 65-69dB(A), dog 50-56dB(A), rail traffic 49-52 dB(A).	No
M2	23 Gracemere Court, Wattle Grove	52	35	16/09/2020 6:08am to 6:23am	60	56	53	51	Note 1	Note 1	Ambient noise levels controlled by M5 traffic (54/55 dB(A)) from NW to NNE. Trucks were clearly distinguishable at times on the M5 (up to 60 dB(A)), also peaks are from motorbikes, but generally it is controlled by constant traffic noise. Occasional train movement faintly audible. Other noise sources contributed such as birds and frogs, and distant dogs to the south, and some activities in nearby residence. No noise audible from direction of warehouses.	No
M3	31 Martindale Court, Wattle Grove	52	35	7/09/2020 7:17am to 7:31am	69	61	54	52	Note 1	Note 1	Ambient noise environment dominated by noise from Road traffic from north west: Road traffic 54-55dB(A), Dog barking 64-69 dB(A)	No
Wattle Grove North												
M4	39 Glenelg Court, Wattle Grove North	52	35	7/09/2020 6:53am 7:08am	79	76	68	54	Note 1	Note 1	Ambient noise environment dominated by noise from Anzac Rd: Road traffic 79-80dB(A), Bird 60-62dB(A), Moorebank Ave traffic 54-55 dB(A)	No
Casula												
M5	St Andrews Park, Casula	52	35	7/09/2020 5:28am 05:45am	78	75	60	50	Note 1	Note 1	Ambient noise environment dominated by noise from M5 Motorway: Road traffic 50-51, Rail traffic 75-78dB(A), Bird 66-67 dB(A)	No
M6	14 Dunmore Crescent, Casula (NMT 04 permanent noise monitor)	52	35	7/09/2020 5:53am to 6:09am	69	56	51	49	Note 1	Note 1	Ambient noise environment dominated by noise from M5 Motorway: Road traffic 49-50dB(A), Rail traffic 53-54dB(A), Birds 68-69 dBA	No
Glenfield												
M7	26 Goodenough St, Glenfield	52	35	7/09/2020 6:23am to 6:38am	67	59	56	54	Note 1	Note 1	Ambient noise environment dominated by noise from Cambridge Ave: Road traffic 53-55dB(A), Bird 55-67dB(A), Dog barking 59-60 dB(A), Rail traffic 59-60 dB(A)	No

Notes: 1: Since noise levels from the MLP were not audible during the measurement period, it was not possible to estimate the MLP noise contribution

3.4 On-site attended operational activity noise measurement results

Attended noise measurements of individual operational items and typical operations were undertaken at ATS on 16 September 2020, in order to quantify the noise emissions from noise-generating operational activities. These noise levels have been used to assist in establishing the source noise levels in the noise model.

During all measurements, the specific noise source being measured was the dominant noise source. Observations were made of the on-site operations, which have then been reviewed in conjunction with the video data to model 'reasonable' worst-case operational scenarios over the assessment periods. Critical on-site attended measurement results are summarised in Table 6.

Table 6 On-site attended measurement results

Activity noise sources	Date	Time	Measurement duration (t), sec	Measurement distance, m	Measured noise levels, dB(A)	
					$L_{Aeq(t)}$	L_{AFmax}
Truck						
Truck pass-by	16/9/2020	5:55am	10	10	65	69
Truck Idling	16/9/2020	5:56am	20	5	67	67
Truck reversing beeper	16/9/2020	5:23am	16	38	55	59
Air brake release (container delivery truck)	7/9/2020	1:27pm	5	12	84	87
Combi-lift[1]						
Grabbing & dropping sound	7/9/2020	7:19am	2	44	67	71
Engine revving	7/9/2020	7:19am	10	23	75	76
Engine	7/9/2020	7:20am	20	38	60	61
Reversing beeper	7/9/2020	7:19am	12	23	71	74
Loading						
Loading & unloading activity	16/9/2020	6:06am	13	22	62	80
Forklift						
Forklift pass-by	16/9/2020	5:50am	10	8	66	70
Internal warehouse noise levels (noise breakout)						
Internal noise sources at loading dock door (radio, internal forklift operation)	16/9/2020	7:20am	900	At loading dock doorway	67	82
Mechanical plant						
Warehouse smoke exhaust fan[2]	16/9/2020	7:51am	15	11	62	62
Air condenser unit	16/9/2020	5:23am	60	1	55	56

Notes: 1. Same Combi-lift is used for the container handling at the ATS warehouse as that used at the Target warehouse. Attended measurement of the Target container handling area on the 7 September 2020 have been used for determining sound power levels.

2. Internal noise levels within the ATS warehouse meant that fan noise levels were not audible or quantifiable from accessible locations, and so fan noise levels are based upon Internal noise measurement undertaken at ATS Building Products warehouse, 16 September 2020.

3.5 Unattended noise measurements

Unattended noise measurements were undertaken over the period between 2 September and 15 September 2020 at a location adjacent to the ATS north warehouse (refer to Figure 3) and the period between 7 September and 15 September 2020 at a location of container terminal adjacent to the ATS south warehouse (refer to Figure 4). Two main areas of noise-generating operations were identified across the warehouse site, one on the northern side of the warehouse and one the southern side. These are shown in Figure 5.

The location of the unattended noise loggers is shown in Figure 5. These were selected so that they would capture noise from the main noise-generating areas as part of the typical warehouse operations. Camera units were setup as shown in Figure 5 at the noise logger location at ATS north, and the eastern boundary fence at ATS south, to assist the engineers in gaining a comprehensive understanding of the site operations and truck movements.

The purpose of the noise logging at the selected locations was for the following:

- Determine the noise emissions from the facility at a fixed location close enough to quantify on-site sources;
- Determine the long-term background noise levels when operations were not taking place at the site;
- A source for analysis to determine duration and nature of the different on-site activities through correlation with the facility activity data;
- Source of validation for the noise model calibration process.

Detailed unattended noise monitoring results are provided in APPENDIX B for ATS North and APPENDIX C for ATS South. The noise model was validated using the unattended noise logger results, refer to refer to Section 3.7 for noise model calibration.

Figure 3 ATS South Unattended Noise Measurement Setup

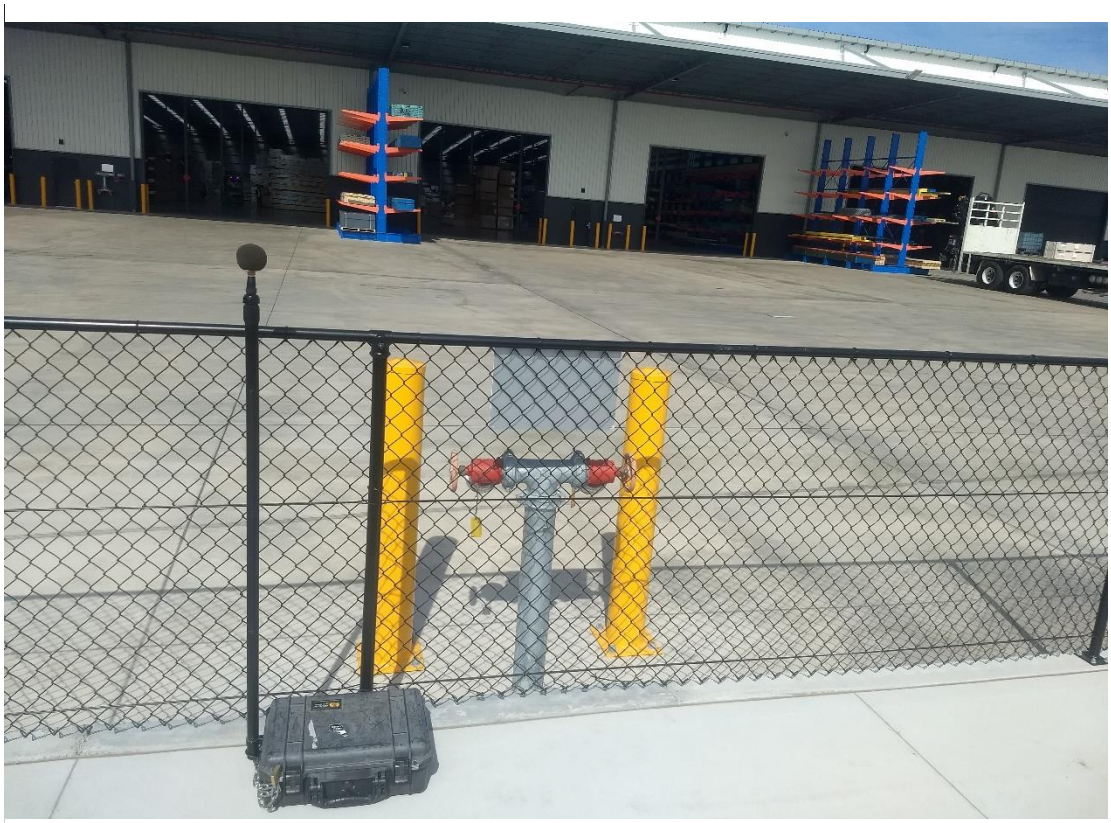


Figure 4 ATS North Unattended Noise Measurement Setup

Figure 5 Unattended noise logger locations and main noise generation areas (imagery: Nearmap, 2020)

MLP operates four continuous noise monitoring stations located in the surrounding residential noise catchment areas, as per Section 4.1.2 of the MPE ONVMP. However, following the attended noise measurements presented in Section 3.3, which found that the warehouse noise emissions were not audible at the nearby residential receivers locations, further analysis of the data from the continuous noise monitoring stations were not undertaken as it would not assist further in this compliance assessment.

3.6 Modelled operational scenarios

3.6.1 Observed operations for modelling

Based upon the on-site attended measurements presented in Section 3.4, the video recording for the facility undertaken for the duration of the unattended monitoring period presented in Section 3.5, and discussions with ATS personnel, 'reasonable' worst-case operational scenarios were established and modelled to satisfy the assessment periods under SSD 7628.

The following section details the key observations of each of the noise-generating activities that take place across the warehouse operations.

3.6.1.1 Truck and despatching operations (ATS north)

The following data on truck operations was obtained from the site observations during the attended noise measurements, and in addition to the unattended noise measurements/concurrent video recordings that were undertaken between 10 September and 12 September 2020.

- It was observed and confirmed by video data, that truck operations were typically crane trucks, and that a typical 'in-and-out' cycle time in the facility was on median 30 minutes, with each loading and unloading cycle taking approximately 30-45 minutes to be fully loaded with building materials.

- ATS trucks are parked inside the warehouse the night prior. The noise intensive period for truck loading activities was typically between 5:30am to 6:30am at ATS north, and then trucks leave the facility after being loaded with materials.

- The maximum number of trucks being loaded with forklift are two simultaneously within the ATS dispatching area, which was confirmed through analysis of the video data and on-site attended measurement. As such, the reasonable worst-case would be two loading events concurrently.

3.6.1.2 Qube container handling operational area

- It was observed that one combi-lift is in use to move containers "in and out" of the ATS terminal at the Qube container handling operational area. From the video data, it was observed that the combi-lift operate could operate continuously throughout a 15-minute period when handling containers.

- Impact noise events associated with grabbing and dropping would occur when the combi-lift gripper contact individual containers as part of handling operations. This sound power level is adopted in the modelling for the sleep disturbance calculations.

- Tonal reversing beepers is used when a combi-lift is undertaking container handling activities.

- Movements of containers within the Qube area can occur throughout the day and night-time period depending upon train arrivals. It was observed from the video data that eleven container movements were recorded within the daytime period over the period between 7 September and 16 September 2020

- Two container movements were observed during the night-time period between 7 September and 16 September 2020. This indicates that night-time container operations at ATS south are not a typical operational scenario, and so this is not incorporated into the 'reasonable' worst-case operational scenario.

3.6.2 Assessment noise source levels

Source levels for the key noise-generating activities on-site have been based on the attended noise measurements (Section 3.4) and unattended noise measurements (Section 3.5) during periods of typical operation. The sound power level inputs presented in Table 7 were used in the operational noise compliance modelling, and adjusted for the duration and frequency of operations (Section 3.6.3).

Table 7 Assessment noise source levels

Site items / operation	Individual activity sound power level (SWL) (L_{Aeq}), dB(A)
ATS North	
Trucks accelerating on site	101
Trucks idling on site/no engine load movement	72
Trucks reversing beeper	86
Truck (container delivery) airbrake event (L_{Amax})	117
Forklift operations	96
Forklift operations (L_{Amax})	111
Loading operations (L_{Amax})	115
ATS South	
Container combi-lift (moving container activity)	103
Container gripping & drop (L_{Amax})	114
Internal noise breakout	
Internal activities noise (breakout via warehouse doors)	67 L_{Aeq} internal sound pressure level
Mechanical Plant	
Warehouse air smoke exhaust fan[1]	90
Air condenser unit (warehouse façade north)	69

Notes:

1. Based upon internal noise measurement undertaken at ATS Building Products warehouse, 16 September 2020.

3.6.3 Reasonable worst-case intrusiveness scenarios (15-minute period)

As the noise limits in CoC B80 are set at 35 dB(A) $L_{Aeq\ 15\ minute}$ for the day, evening and night periods, specific separation of noise intensive periods for each of these time periods has not been undertaken. Instead, it is noted that there are three main areas of noise generation as part of typical warehouse operations, as presented in Figure 5.

In order to assess the operational noise emissions from the warehouse, the 'reasonable' worst-case operations for the three main areas of noise generation have been developed, along with the corresponding activities in the other noise-generating areas, in order to review a representative snapshot of activities from the warehouse operations. Each of the assessment scenarios have been developed from an analysis of the video movement data over during the one-week period, in addition to the information detailed in Section 3.6.1.

As activities at ATS North can occur prior to 6:00am, a representative scenario has been selected to assess a 'reasonable' worst-case scenario prior to 7:00am (night-time period). The most noise intensive activities for ATS north during the night period are the morning preparation and despatch activities which occur around the 6:00am period. The Qube container operational area at ATS is most active during daytime period after 7:00am. These two sets of activities represent the 'reasonable' worst-case operations for the two main areas of noise generation, and have been modelled to assess operational noise emissions. Table 8 provides the details of these two 'reasonable' worst-case scenarios (15-minute period).

All significant noise-generating equipment has been included the assessment modelling, in addition to the key noise-generating mechanical plant as required by CoC B85. The noise contribution from the mechanical plant items serving the warehouse and office area are included in the modelling, however, noise emissions from the site was generally controlled by other on-site activities such as truck departures, arrivals, loading and unloading activities.

Table 8 Representative 'reasonable' worst-case 15-minute intrusive assessment scenarios

Activity	**ATS North** **15-minute assessment period**	**ATS South** **15-minute assessment period (Qube container area)**
ATS North 15-minute noise intensive period (Morning peak – typically 5:30am to 6:30am)		
Departure	Five crane truck departures from ATS north dispatching area	No activity
Arrival	Two crane trucks arrive and move into the warehouse via dock 1	No activity
Operation	Two crane trucks being loaded concurrently outside of the warehouse with two forklifts.	No activity
ATS South 15-minute noise intensive period (Daytime period with container handling taking place)		
Departure	No activity	One container truck departs
Arrival	No activity	One container truck and one combi-lift
Operation	External loading activities: a) Two trucks being loaded with two forklifts Noise breakout via open warehouse doors: b) Forklifts collecting goods are occurring inside the warehouse with warehouse doors open.	Container operations: a) Moving new containers into ATS warehouse site b) Removing container from ATS warehouse site onto container truck
Mechanical Plant		
a) Roof top exhaust fan (4 fans) b) Warehouse Air condenser (8 units)		

3.7 Modelling methodology

3.7.1 Overview of noise modelling

Since noise levels from the warehouse operations were not audible at the nearest residential receivers, and it was not possible to directly measure or estimate the warehouse noise contribution directly,

computer noise modelling was used to calculate the operational noise levels from warehouse operations at the nearby noise sensitive receivers.

3.7.2 General modelling assumptions

Modelling and assessment of warehouse noise emissions was determined by modelling the noise sources, receiver locations, existing built structures and topographical features, using CadnaA (version 2020).

The modelling incorporated the worst-case prevailing meteorological conditions, as required by CoC B80, which are wind speeds of up to 3 m/s at 10 metres above ground level or stability category 'F' temperature inversion conditions.

The noise predictions are based on the CONCAWE noise prediction algorithms, noting that the nearby noise sensitive receivers are greater 100 metres from the site (except for MPW). The CONCAWE environmental noise prediction method is an appropriate method for predicting the noise propagation in these circumstances.

The noise prediction model considers:

- Location of noise sources on-site sensitive receiver locations
- Height of sources and receivers referenced to digital ground contours within the site and outside the site area
- Noise source levels of individual plant, equipment and internal building noise levels, modelled as either point, line or area noise sources. All noise sources associated with the ATS operations within the MPE boundary have been included in the noise modelling, including the truck movements outside of the WH4B ATS warehouse footprint, along internal MPE roads.
- Separation distances between sources and receivers
- Ground type between sources and receivers (mixed soft/ hard)
- Attenuation from buildings and built structures and topography (natural and purpose built)
- Atmospheric losses and assessment meteorological conditions.

The modelled activities and assumptions for the duration and frequency that the equipment operate as part of the 'reasonable' worst-case operational scenarios are described in Section 3.6.3.

3.7.3 Model validation

Following the development of each of the modelling scenarios, the noise model outputs were compared with the unattended noise measurement results for a period equivalent to the reasonable worst-case operational scenario. Validation of the reasonable worst-case on-site activities was

undertaken to check the final modelling inputs against a representative period, with the results of this process presented in Table 9.

Table 9 Comparison between measured and modelled noise levels

Time period	Logger	Measured noise levels $L_{Aeq,15minute}$ (dB(A))	Predicted noise levels $L_{Aeq,15minute}$ (dB(A))	Difference, dB(A)
5:55am to 6:10am 11 September 2020	ATS North	64	62	2
1:15pm to 1:30pm 7 September 2020	ATS South (Qube container handling area)	70	68	2

The differences between the modelled and the measured noise levels are the result of the following:

- For ATS North, the modelled levels for loading and unloading activities assumed that activities could be undertaken anywhere across the external hardstand. As such, the noise model has distributed this activity across this area. Actual operations would occur at specific loading docks with varying durations, which would change throughout the day. Modelled levels were based on worst-case average sound power levels of measured activities in this area. Differences between the specific locations and duration of activities during the comparison period is the likely reason for the differences between the measured and modelled levels. Similar minor differences resulted from assumed locations and durations of forklift operations.

- For ATS South, the modelled container handling and combi-lift levels assumed activities were assumed to generally occur in the middle of the container handling area, as any loading dock could be used as part of operations. During handing activities, containers could be placed at any loading dock or shifted between them. Differences between the specific locations and duration of activities (ie. truck movement close to logger) during the comparison period is the likely reason for the differences between the measured and modelled levels.

The results from the validation of the model demonstrates that it is suitable for determining the compliance noise levels for this assessment.

3.8 Noise compliance assessment

Predicted operational compliance noise levels are presented in Table 10 for each of the two compliance assessment scenarios. The noise levels have been predicted to each of the surrounding residential receiver noise catchments, and the highest residential receiver noise level in each catchment area is the reported level in Table 10. It should be noted that this is not necessarily the same receiver location for each assessment scenario.

These noise levels represent the reasonable worst-case intrusiveness operational scenarios (15-minute period) from typical operations of the warehouse. The results in Table 10 show that the predicted noise levels for both the $L_{Aeq\ (15\text{-}minute)}$ and $L_{A1\ (1\text{-}minute)}$ assessments comply with the overall operational noise limits presented in Table 2.

Table 10 Predicted noise levels - Reasonable worst-case scenarios for warehouse (ATS)

Noise catchment area/ receiver location	$L_{Aeq\ (15\text{-}minute)}$		Compliance	$L_{A1\ (1\text{-}minute)}$		Compliance
	Noise limits	Predicted noise levels		Noise limits	Predicted noise levels	
ATS North 15-minute noise intensive period (Morning peak – typically 5:30am to 6:30am)						
Wattle Grove (NCA 1)	35	27	Yes	52	38	Yes
Wattle Grove North (NCA 2)	35	21	Yes	52	29	Yes
Casula (NCA 3)	35	21	Yes	52	28	Yes
Glenfield (NCA 4)	35	< 20	Yes	52	<20	Yes
All Saints Senior College (S1)	45[1]	< 20	Yes	-	N/A	N/A
Casula Powerhouse (S2)	45[1]	23	Yes	-	N/A	N/A
Defence Joint Logistics Unit (DJLU) (I2)	70[1]	33	Yes	-	N/A	N/A
ABB (I3)	70[1]	21	Yes	-	N/A	N/A
ATS South 15-minute noise intensive period (Daytime period with container handling taking place)						
Wattle Grove (NCA 1)	35	30	Yes	52	38[2]	Yes
Wattle Grove North (NCA 2)	35	< 20	Yes	52	29[2]	Yes
Casula (NCA 3)	35	20	Yes	52	28[2]	Yes
Glenfield (NCA 4)	35	< 20	Yes	52	<20[2]	Yes
All Saints Senior College (S1)	45[1]	21	Yes	-	N/A	N/A
Casula Powerhouse (S2)	45[1]	21	Yes	-	N/A	N/A
Defence Joint Logistics Unit (DJLU) (I2)	70[1]	31	Yes	-	N/A	N/A
ABB (I3)	70[1]	20	Yes	-	N/A	N/A

Notes;
1. Noise limits for these receivers are only applicable when the receiver is in use
2. Activities do not typically occur during the night period, but levels have been included for completeness.

4 Conclusion

The noise assessment has been undertaken to address the operational noise requirements for the ATS warehouse (WH4B) within the Moorebank Precinct East in accordance with the *Operational Noise and Vibration Management Plan, Moorebank Logistics Park – East Precinct* (dated 27 March 2019, Revision 12) (MPE ONVMP), more specifically to address the requirements of Condition of Consent (CoC) B85 in State Significant Development (SSD) 7628.

As part of the compliance noise assessment, a series of noise measurements were undertaken over a two week period. Unattended noise monitoring was undertaken at two locations near the ATS warehouse in September 2020. Attended noise measurements were also performed at the nearest residential receivers and in close proximity to the ATS warehouse site. The aim of the attended measurements was to quantify operational noise levels at the nearby residential receivers and to confirm operational noise sources levels on site.

Attended noise measurements were undertaken on 7 September 2020 to determine if noise levels from warehouse operations were audible and quantifiable at nearby receivers. These measurements identified that the existing ambient noise levels were too high for direct quantification or estimation of operational noise emissions from the warehouse operations. For this reason, guidance from the NSW EPA Noise Policy for Industry (NPfI) Chapter 7 has been followed in order to compare the site noise emissions with the noise limits.

Noise emissions from the warehouse facility operations have been evaluated using a combination of the on-site attended and unattended noise monitoring, combined with noise modelling.

Two 'reasonable' worst-case assessment scenarios were established based upon on site unattended noise monitoring and video recording over the monitoring period, in addition to discussions with ATS personnel and observations made during on-site attended noise measurements. These were developed to capture the 'reasonable' worst-case operations for the two main areas of noise generation on the site. On the north side, this occurred prior to 7:00am as part of the morning preparation and despatch activities, while on the south side this was container handling activities that typically occurred during the daytime period after 7:00am.

All significant noise-generating equipment was included the assessment noise modelling, in addition to the key noise-generating mechanical plant as required by CoC B85. The noise contribution from the mechanical plant items serving the warehouse and office area are included in the modelling, however, noise emissions from the site was generally controlled by other on-site activities such as truck departures, arrivals, loading and unloading activities.

Using the calibrated noise model, noise levels were predicted to all nearby noise sensitive receiver locations, including the residential receivers in the suburbs of Casula, Glenfield, Wattle Grove and Wattle Grove North. Noise levels were assessed assuming the worst-case prevailing meteorological conditions were present, as required by CoC B80.

The outcome of the compliance noise monitoring and modelling demonstrated that the mechanical plant and other noisy equipment that operate as part of the ATS warehouse operations achieve the noise limits presented SSD 7628 CoC B80, which is consistent with the noise emission review undertaken prior to construction to satisfy CoC B84.

APPENDIX A Glossary of terminology

The following is a brief description of the technical terms used to describe noise to assist in understanding the technical issues presented.

Adverse weather	Weather effects that enhance noise (that is, wind and temperature inversions) that occur at a site for a significant period of time (that is, wind occurring more than 30% of the time in any assessment period in any season and/or temperature inversions occurring more than 30% of the nights in winter).
Ambient noise	The all-encompassing noise associated within a given environment at a given time, usually composed of sound from all sources near and far.
Assessment period	The period in a day over which assessments are made.
Assessment Point	A point at which noise measurements are taken or estimated. A point at which noise measurements are taken or estimated.
Background noise	Background noise is the term used to describe the underlying level of noise present in the ambient noise, measured in the absence of the noise under investigation, when extraneous noise is removed. It is described as the average of the minimum noise levels measured on a sound level meter and is measured statistically as the A-weighted noise level exceeded for ninety percent of a sample period. This is represented as the L90 noise level (see below).
Decibel [dB]	The units that sound is measured in. The following are examples of the decibel readings of common sounds in our daytime environment:

threshold of hearing	0 dB	The faintest sound we can hear
	10 dB	Human breathing
almost silent	20 dB	
	30 dB	Quiet bedroom or in a quiet national park location
generally quiet	40 dB	Library
	50 dB	Typical office space or ambience in the city at night
moderately loud	60 dB	CBD mall at lunch time
	70 dB	The sound of a car passing on the street
loud	80 dB	Loud music played at home
	90 dB	The sound of a truck passing on the street
very loud	100 dB	Indoor rock band concert
	110 dB	Operating a chainsaw or jackhammer
extremely loud	120 dB	Jet plane take-off at 100m away
threshold of pain	130 dB	
	140 dB	Military jet take-off at 25m away

dB(A)	A-weighted decibels. The A- weighting noise filter simulates the response of the human ear at relatively low levels, where the ear is not as effective in hearing low frequency sounds as it is in 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.
dB(C)	C-weighted decibels. The C-weighting noise filter simulates the response of the human ear at relatively high levels, where the human ear is nearly equally effective at hearing from mid-low frequency (63Hz) to mid-high frequency (4kHz), but is less effective outside these frequencies.

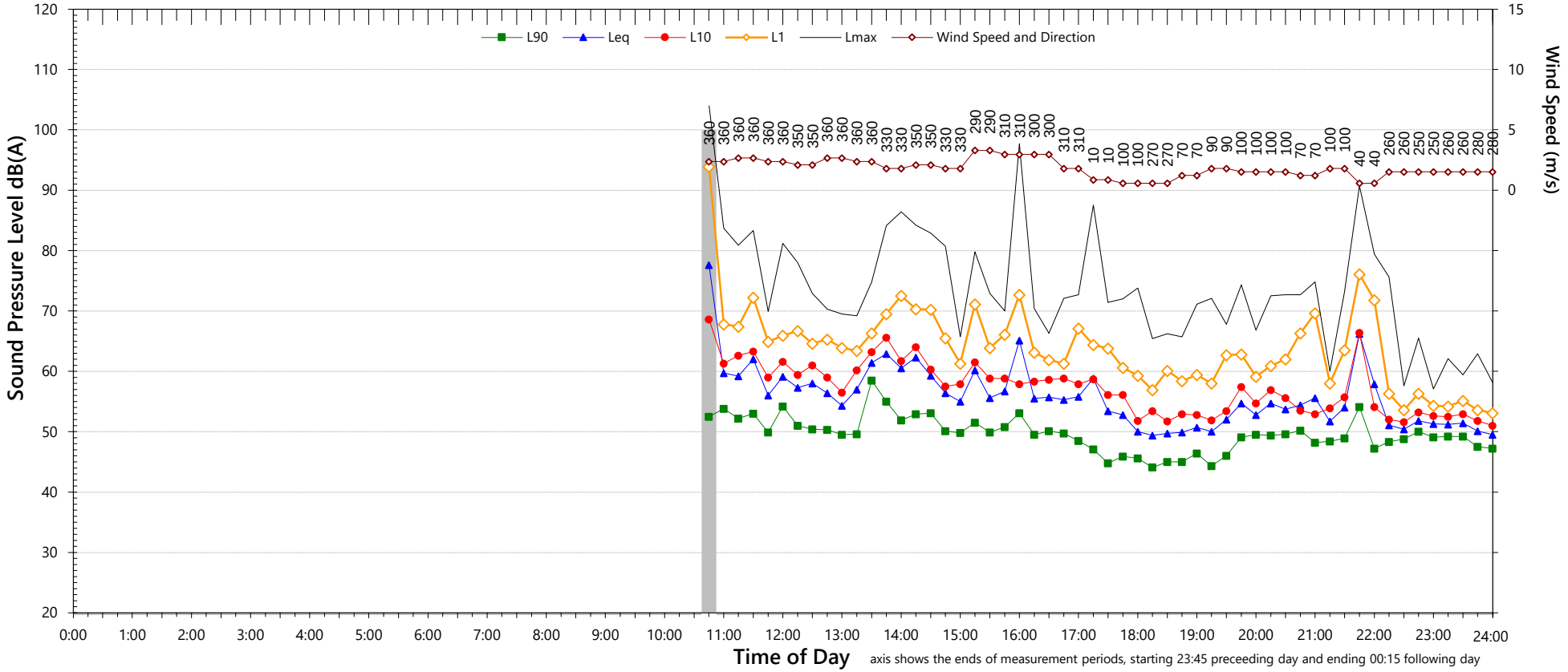
Frequency	Frequency is synonymous to pitch. Sounds have a pitch which is peculiar to the nature of the sound generator. For example, the sound of a tiny bell has a high pitch and the sound of a bass drum has a low pitch. Frequency or pitch can be measured on a scale in units of Hertz or Hz.
Impulsive noise	Having a high peak of short duration or a sequence of such peaks. A sequence of impulses in rapid succession is termed repetitive impulsive noise.
Intermittent noise	The level suddenly drops to that of the background noise several times during the period of observation. The time during which the noise remains at levels different from that of the ambient is one second or more.
L_{Max}	The maximum sound pressure level measured over a given period.
L_{Min}	The minimum sound pressure level measured over a given period.
L_1	The sound pressure level that is exceeded for 1% of the time for which the given sound is measured.
L_{10}	The sound pressure level that is exceeded for 10% of the time for which the given sound is measured.
L_{90}	The level of noise exceeded for 90% of the time. The bottom 10% of the sample is the L90 noise level expressed in units of dB(A).
L_{eq}	The "equivalent noise level" is the summation of noise events and integrated over a selected period of time.
Reflection	Sound wave changed in direction of propagation due to a solid object obscuring its path.
SEL	Sound Exposure Level (SEL) is the constant sound level which, if maintained for a period of 1 second would have the same acoustic energy as the measured noise event. SEL noise measurements are useful as they can be converted to obtain Leq sound levels over any period of time and can be used for predicting noise at various locations.
Sound	A fluctuation of air pressure which is propagated as a wave through air.
Sound absorption	The ability of a material to absorb sound energy through its conversion into thermal energy.
Sound level meter	An instrument consisting of a microphone, amplifier and indicating device, having a declared performance and designed to measure sound pressure levels.
Sound pressure level	The level of noise, usually expressed in decibels, as measured by a standard sound level meter with a microphone.
Sound power level	Ten times the logarithm to the base 10 of the ratio of the sound power of the source to the reference sound power.
Tonal noise	Containing a prominent frequency and characterised by a definite pitch.

APPENDIX B Logger location 1 – ATS - North side

Unattended Noise Monitoring Results

ATS North

Wednesday, 2 September 2020



NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{90}	-	45	45
LAeq	-	57	56

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{eq\ 15\ hr}$ and $L_{eq\ 9\ hr}$	61	58
$L_{eq\ 1hr}$ upper 10 percentile	64	64
$L_{eq\ 1hr}$ lower 10 percentile	55	51

Night Time Maximum Noise Levels			(see note 7)
L_{Max} (Range)	66	to	84
L_{Max} - L_{eq} (Range)	15	to	24

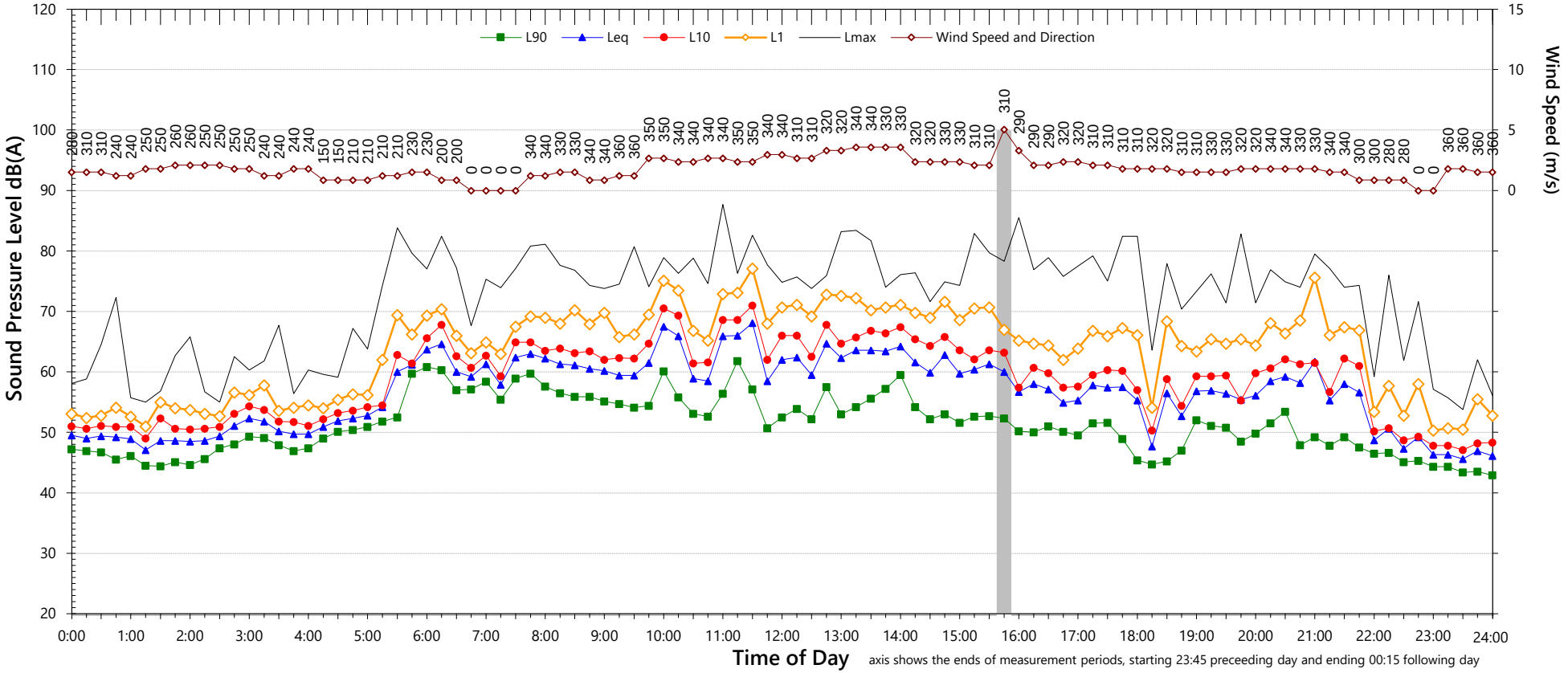
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am til 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. Night time L_{Max} values are shown only where L_{Max} >65dB(A) and where L_{Max}- Leq ≥15dB(A)
8. Meteorological data has been sourced from the nearest Bureau of Meteorology station (Holsworthy Aerodrome AWS)

Unattended Noise Monitoring Results

ATS North

Thursday, 3 September 2020



axis shows the ends of measurement periods, starting 23:45 preceeding day and ending 00:15 following day

NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{90}	50	46	43
LAeq	62	57	55

Night Time Maximum Noise Levels			(see note 7)
L_{Max} (Range)	67	to	92
L_{Max} - L_{eq} (Range)	15	to	32

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{eq\ 15\ hr}$ and $L_{eq\ 9\ hr}$	64	57
$L_{eq\ 1hr}$ upper 10 percentile	66	62
$L_{eq\ 1hr}$ lower 10 percentile	58	49

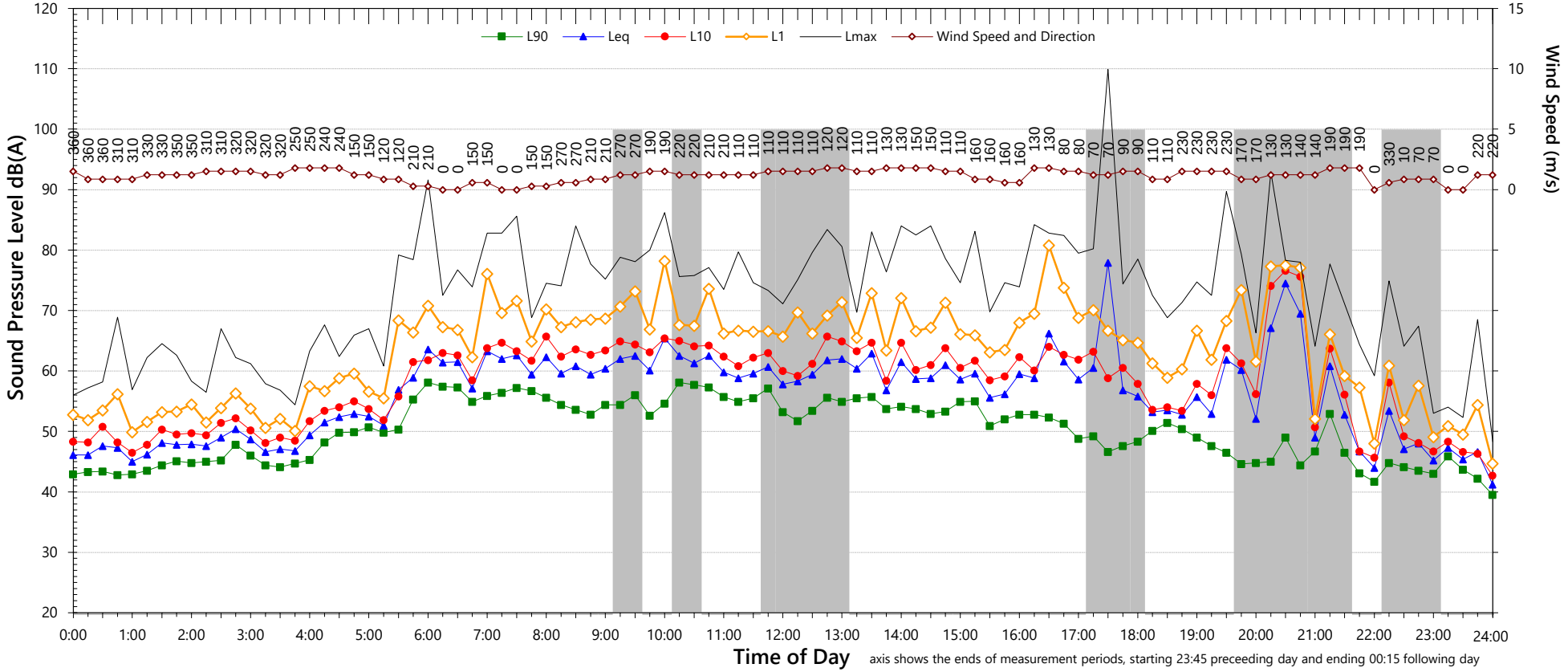
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am til 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. Night time L_{Max} values are shown only where L_{Max} >65dB(A) and where L_{Max}- Leq ≥15dB(A)
8. Meteorological data has been sourced from the nearest Bureau of Meteorology station (Holsworthy Aerodrome AWS)

Unattended Noise Monitoring Results

ATS North

Friday, 4 September 2020



NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{90}	-	-	35
LAeq	-	-	50

Night Time Maximum Noise Levels			(see note 7)
L_{Max} (Range)	66	to	88
L_{Max} - L_{eq} (Range)	17	to	30

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{eq\ 15\ hr}$ and $L_{eq\ 9\ hr}$	63	52
$L_{eq\ 1hr}$ upper 10 percentile	65	52
$L_{eq\ 1hr}$ lower 10 percentile	57	42

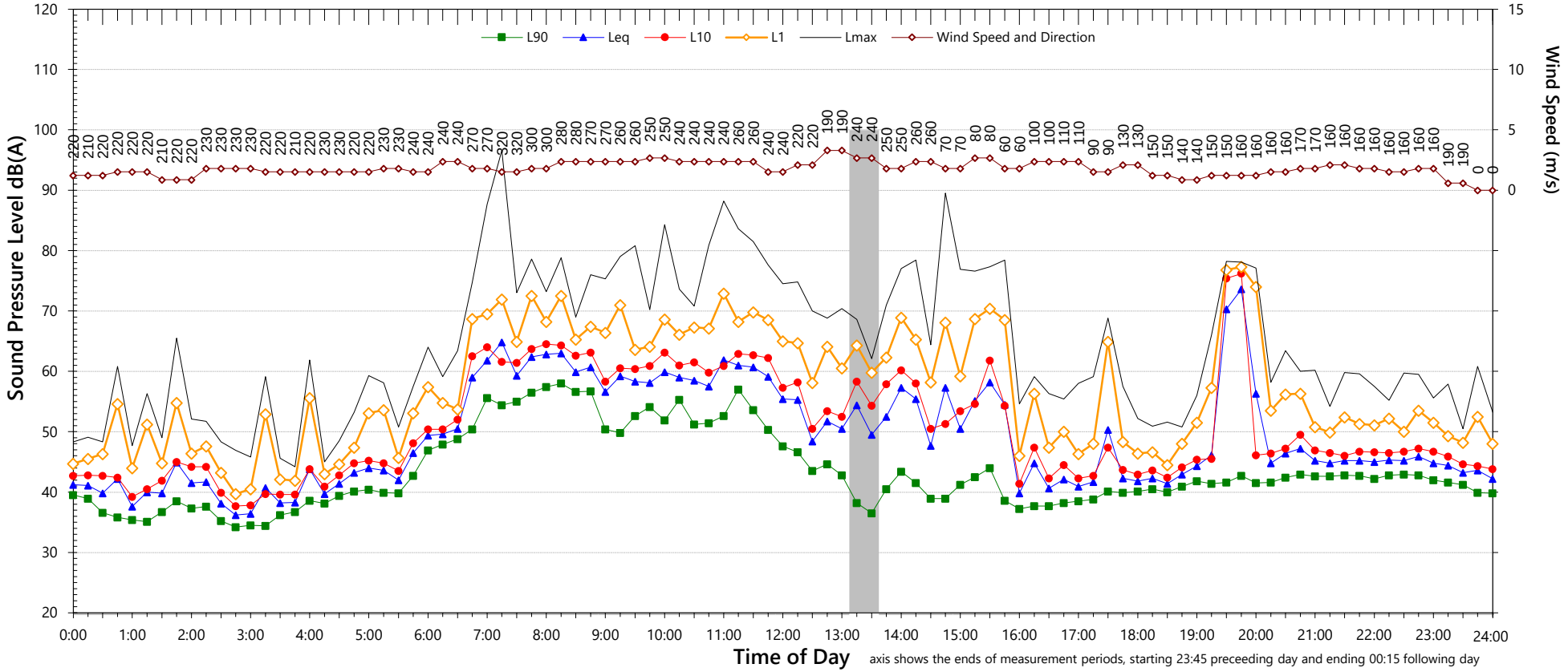
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am til 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. Night time L_{Max} values are shown only where L_{Max} >65dB(A) and where L_{Max}- Leq ≥15dB(A)
8. Meteorological data has been sourced from the nearest Bureau of Meteorology station (Holsworthy Aerodrome AWS)

Unattended Noise Monitoring Results

ATS North

Saturday, 5 September 2020



axis shows the ends of measurement periods, starting 23:45 preceeding day and ending 00:15 following day

NSW Noise Policy for Industry (Free Field)			
Descriptor	Day[2]	Evening[3]	Night[4 5]
L_{90}	39	41	38
LAeq	58	63	44

Night Time Maximum Noise Levels			(see note 7)
L_{Max} (Range)	66	to	67
L_{Max} - L_{eq} (Range)	16	to	23

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	Day	Night[5]
	7am-10pm	10pm-7am
$L_{eq\ 15\ hr}$ and $L_{eq\ 9\ hr}$	63	46
$L_{eq\ 1hr}$ upper 10 percentile	64	48
$L_{eq\ 1hr}$ lower 10 percentile	46	44

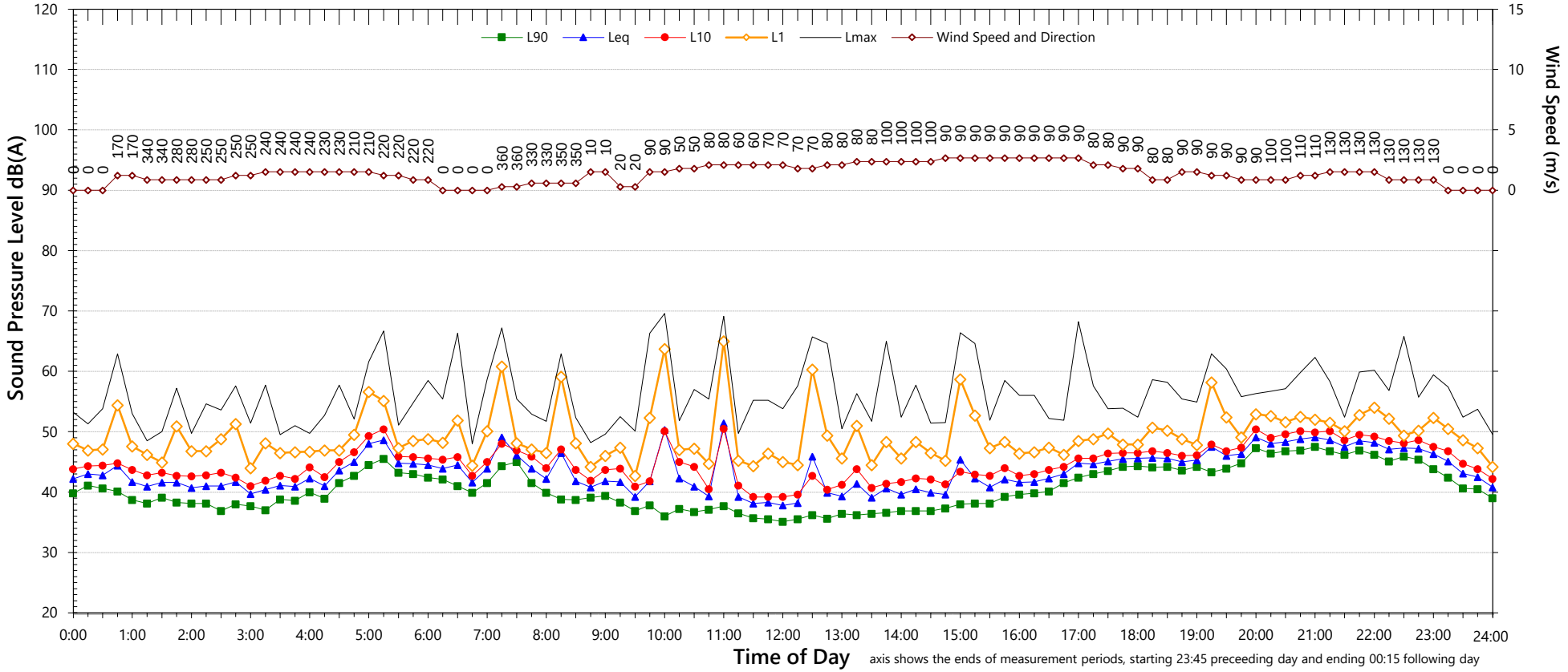
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am til 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. Night time L_{Max} values are shown only where L_{Max} >65dB(A) and where L_{Max}- Leq ≥15dB(A)
8. Meteorological data has been sourced from the nearest Bureau of Meteorology station (Holsworthy Aerodrome AWS)

Unattended Noise Monitoring Results

ATS North

Sunday, 6 September 2020



axis shows the ends of measurement periods, starting 23:45 preceeding day and ending 00:15 following day

NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{90}	36	44	38
LAeq	43	48	53

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{eq\ 15\ hr}$ and $L_{eq\ 9\ hr}$	48	55
$L_{eq\ 1hr}$ upper 10 percentile	50	61
$L_{eq\ 1hr}$ lower 10 percentile	43	43

Night Time Maximum Noise Levels			(see note 7)
L_{Max} (Range)	66	to	79
L_{Max} - L_{eq} (Range)	16	to	26

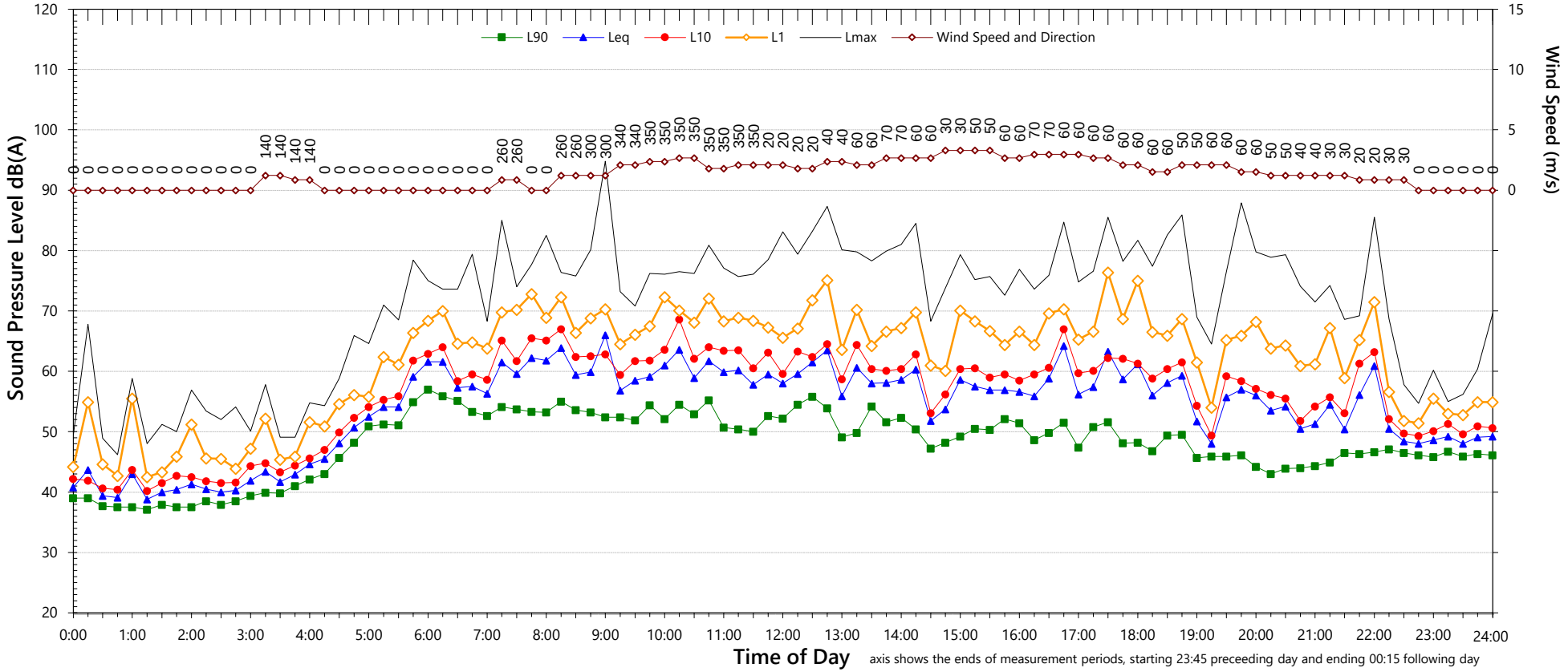
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am til 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. Night time L_{Max} values are shown only where L_{Max} >65dB(A) and where L_{Max}- Leq ≥15dB(A)
8. Meteorological data has been sourced from the nearest Bureau of Meteorology station (Holsworthy Aerodrome AWS)

Unattended Noise Monitoring Results

ATS North

Monday, 7 September 2020



axis shows the ends of measurement periods, starting 23:45 preceeding day and ending 00:15 following day

NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{90}	48	44	44
LAeq	60	56	55

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{eq\ 15\ hr}$ and $L_{eq\ 9\ hr}$	62	57
$L_{eq\ 1hr}$ upper 10 percentile	64	62
$L_{eq\ 1hr}$ lower 10 percentile	58	51

Night Time Maximum Noise Levels			(see note 7)
L_{Max} (Range)	65	to	89
L_{Max} - L_{eq} (Range)	16	to	28

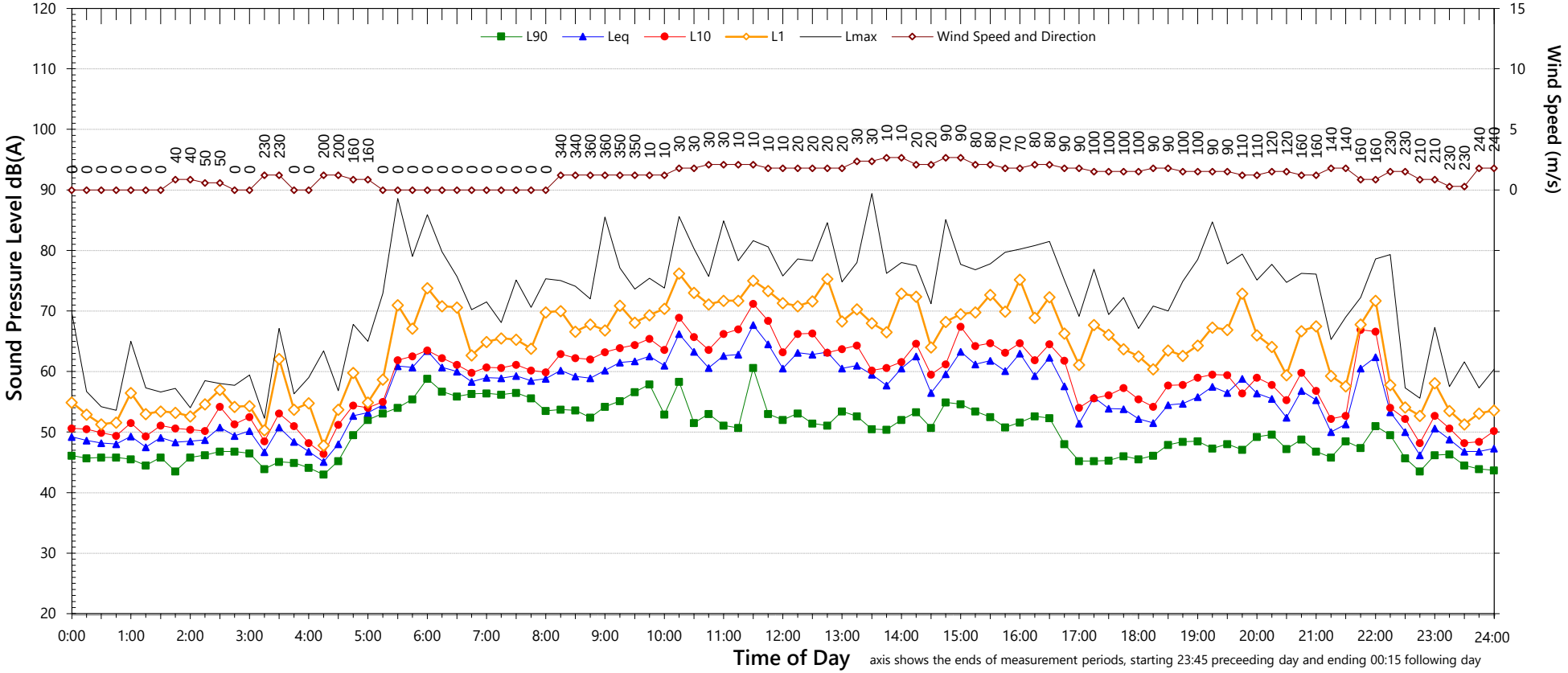
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am til 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. Night time L_{Max} values are shown only where L_{Max} >65dB(A) and where L_{Max}- Leq ≥15dB(A)
8. Meteorological data has been sourced from the nearest Bureau of Meteorology station (Holsworthy Aerodrome AWS)

Unattended Noise Monitoring Results

ATS North

Tuesday, 8 September 2020



axis shows the ends of measurement periods, starting 23:45 preceeding day and ending 00:15 following day

NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{90}	47	46	37
LAeq	61	57	54

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{eq\ 15\ hr}$ and $L_{eq\ 9\ hr}$	63	57
$L_{eq\ 1hr}$ upper 10 percentile	66	62
$L_{eq\ 1hr}$ lower 10 percentile	57	44

Night Time Maximum Noise Levels			(see note 7)
L_{Max} (Range)	66	to	81
L_{Max} - L_{eq} (Range)	18	to	29

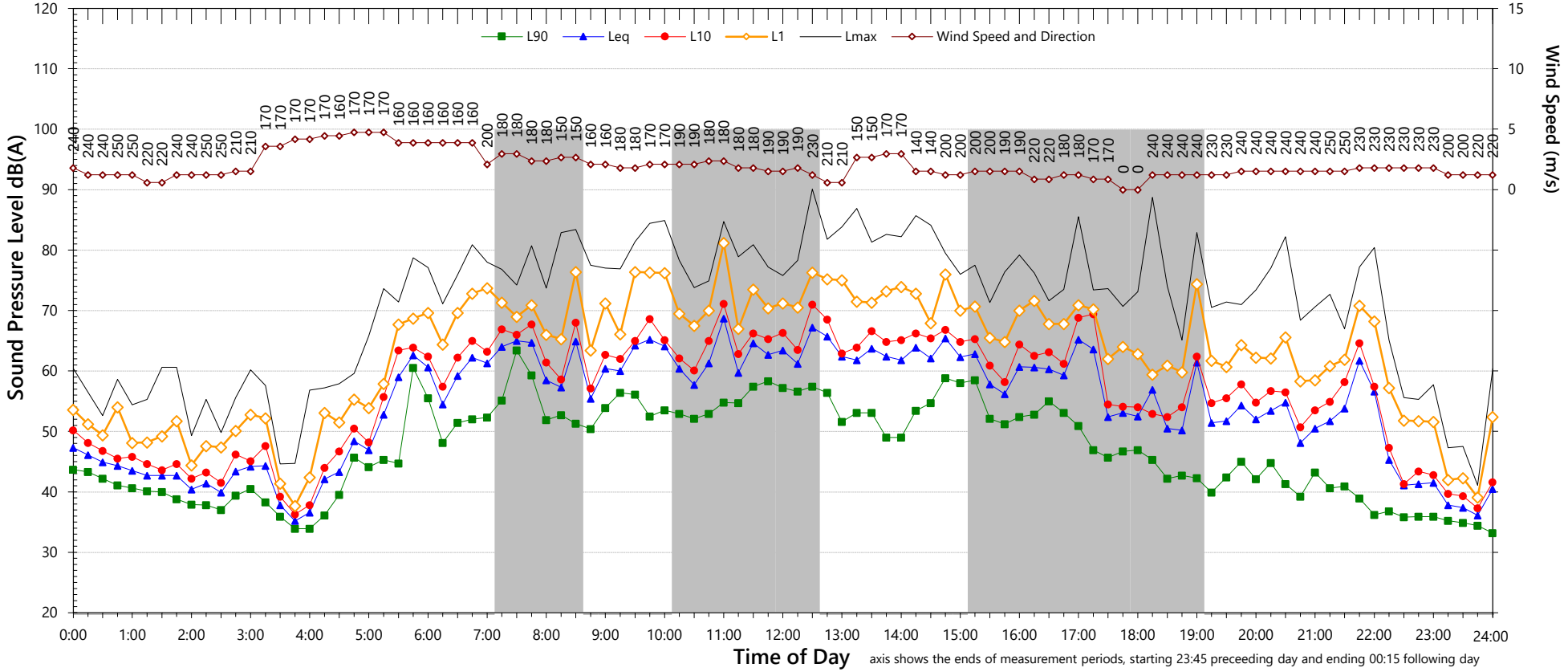
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am til 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. Night time L_{Max} values are shown only where L_{Max} >65dB(A) and where L_{Max}- Leq ≥15dB(A)
8. Meteorological data has been sourced from the nearest Bureau of Meteorology station (Holsworthy Aerodrome AWS)

Unattended Noise Monitoring Results

ATS North

Wednesday, 9 September 2020



axis shows the ends of measurement periods, starting 23:45 preceeding day and ending 00:15 following day

NSW Noise Policy for Industry (Free Field)			
Descriptor	Day[2]	Evening[3]	Night[4 5]
L_{90}	-	-	33
LAeq	-	-	64

Night Time Maximum Noise Levels			(see note 7)
L_{Max} (Range)	65	to	110
L_{Max} - L_{eq} (Range)	15	to	37

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	Day	Night[5]
	7am-10pm	10pm-7am
$L_{eq\ 15\ hr}$ and $L_{eq\ 9\ hr}$	64	66
$L_{eq\ 1hr}$ upper 10 percentile	66	66
$L_{eq\ 1hr}$ lower 10 percentile	55	40

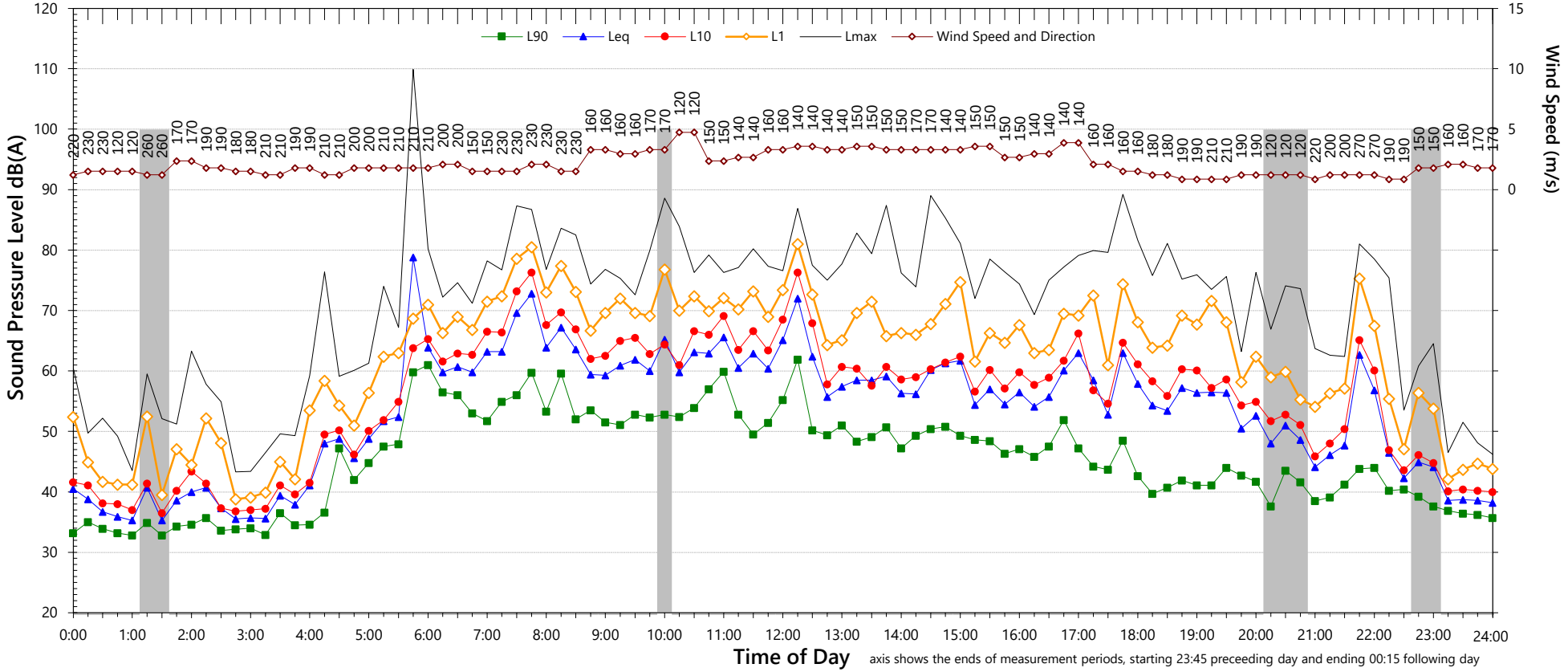
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am til 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. Night time L_{Max} values are shown only where L_{Max} >65dB(A) and where L_{Max}- Leq ≥15dB(A)
8. Meteorological data has been sourced from the nearest Bureau of Meteorology station (Holsworthy Aerodrome AWS)

Unattended Noise Monitoring Results

ATS North

Thursday, 10 September 2020



NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{90}	46	-	36
LAeq	63	-	57

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{eq\ 15\ hr}$ and $L_{eq\ 9\ hr}$	65	59
$L_{eq\ 1hr}$ upper 10 percentile	68	64
$L_{eq\ 1hr}$ lower 10 percentile	58	42

Night Time Maximum Noise Levels			(see note 7)
L_{Max} (Range)	67	to	82
L_{Max} - L_{eq} (Range)	18	to	31

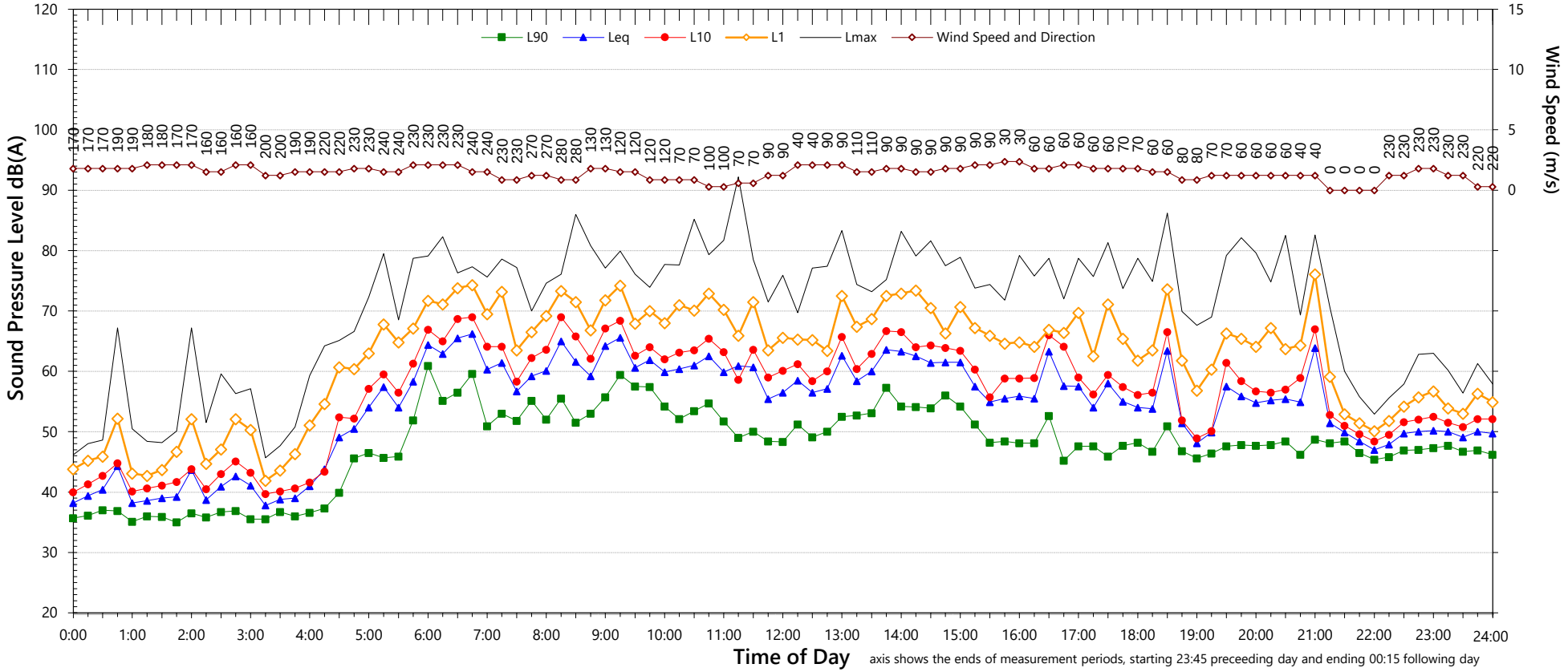
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am til 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. Night time L_{Max} values are shown only where L_{Max} >65dB(A) and where L_{Max}- Leq ≥15dB(A)
8. Meteorological data has been sourced from the nearest Bureau of Meteorology station (Holsworthy Aerodrome AWS)

Unattended Noise Monitoring Results

ATS North

Friday, 11 September 2020



axis shows the ends of measurement periods, starting 23:45 preceeding day and ending 00:15 following day

NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{90}	48	46	43
LAeq	61	57	51

Night Time Maximum Noise Levels			(see note 7)
L_{Max} (Range)	66	to	82
L_{Max} - L_{eq} (Range)	15	to	25

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{eq\ 15\ hr}$ and $L_{eq\ 9\ hr}$	62	53
$L_{eq\ 1hr}$ upper 10 percentile	65	54
$L_{eq\ 1hr}$ lower 10 percentile	58	50

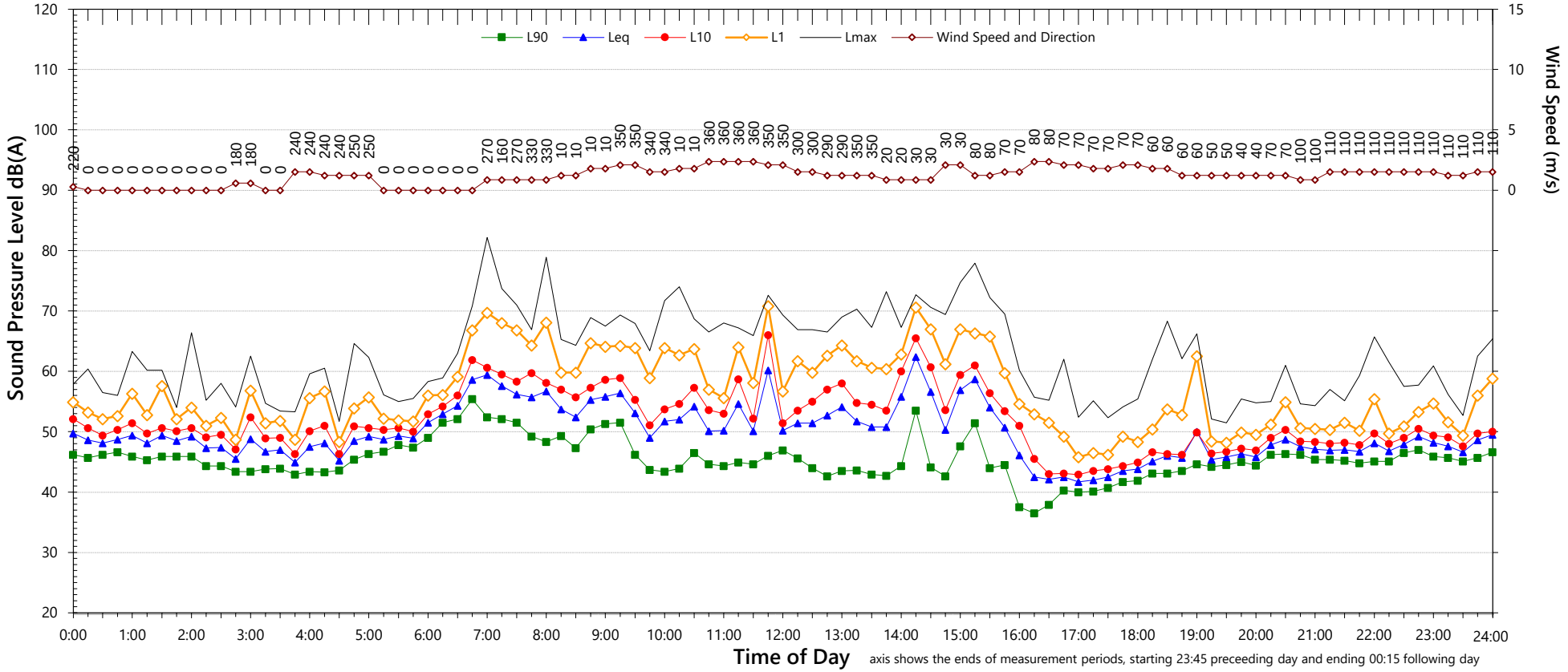
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am til 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. Night time L_{Max} values are shown only where L_{Max} >65dB(A) and where L_{Max}- Leq ≥15dB(A)
8. Meteorological data has been sourced from the nearest Bureau of Meteorology station (Holsworthy Aerodrome AWS)

Unattended Noise Monitoring Results

ATS North

Saturday, 12 September 2020



axis shows the ends of measurement periods, starting 23:45 preceeding day and ending 00:15 following day

NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{90}	40	43	37
LAeq	54	47	48

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{eq\ 15\ hr}$ and $L_{eq\ 9\ hr}$	56	50
$L_{eq\ 1hr}$ upper 10 percentile	59	52
$L_{eq\ 1hr}$ lower 10 percentile	47	42

Night Time Maximum Noise Levels			(see note 7)
L_{Max} (Range)	65	to	69
L_{Max} - L_{eq} (Range)	15	to	25

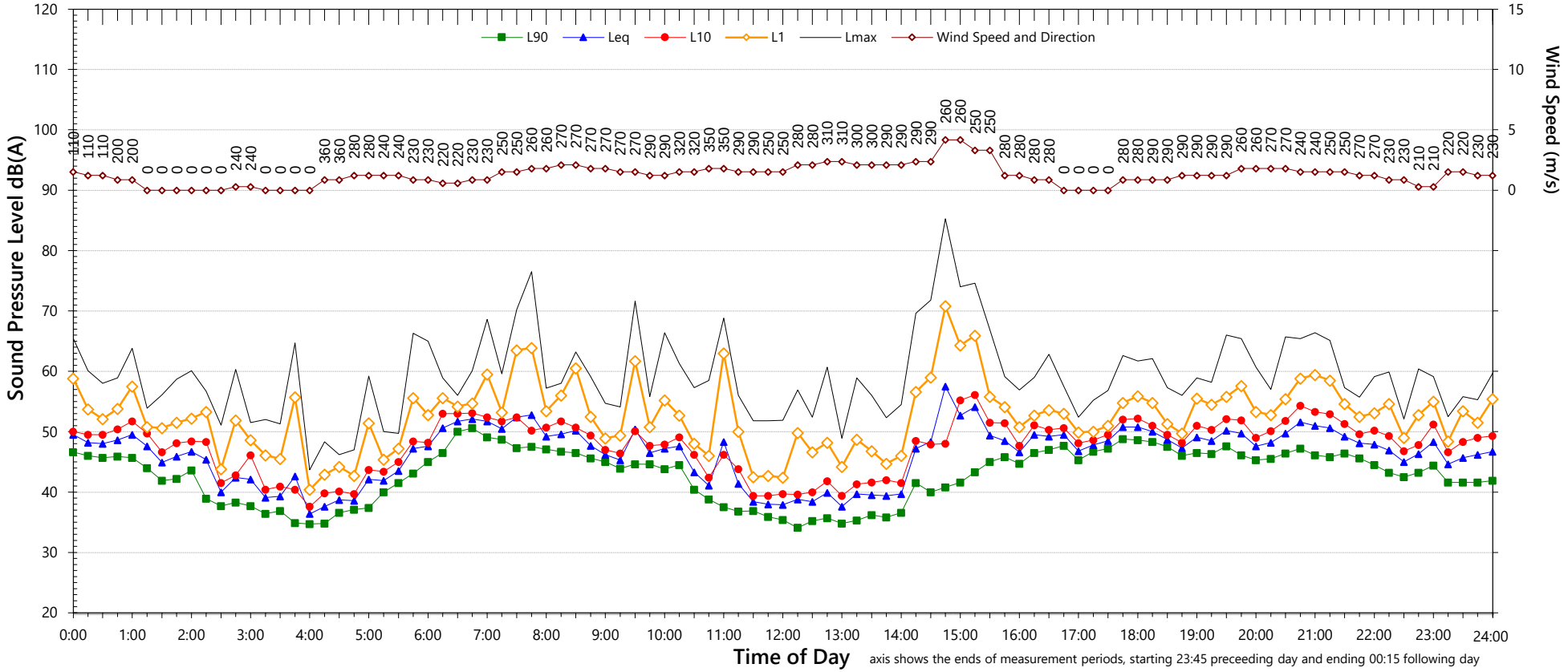
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am til 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. Night time L_{Max} values are shown only where L_{Max} >65dB(A) and where L_{Max}- Leq ≥15dB(A)
8. Meteorological data has been sourced from the nearest Bureau of Meteorology station (Holsworthy Aerodrome AWS)

Unattended Noise Monitoring Results

ATS North

Sunday, 13 September 2020



axis shows the ends of measurement periods, starting 23:45 preceeding day and ending 00:15 following day

NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{90}	35	45	41
LAeq	48	49	56

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{eq\ 15\ hr}$ and $L_{eq\ 9\ hr}$	51	59
$L_{eq\ 1hr}$ upper 10 percentile	54	62
$L_{eq\ 1hr}$ lower 10 percentile	42	49

Night Time Maximum Noise Levels			(see note 7)
L_{Max} (Range)	72	to	86
L_{Max} - L_{eq} (Range)	23	to	35

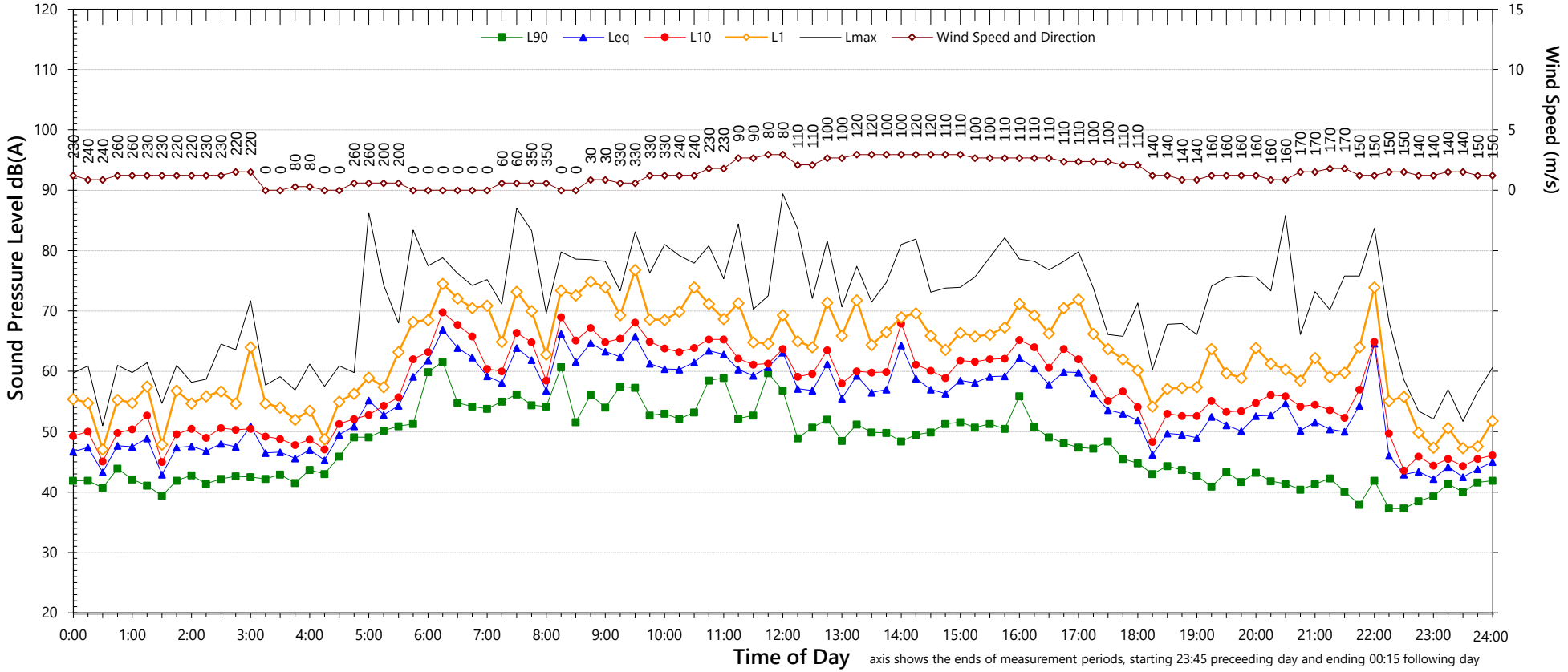
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am til 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. Night time L_{Max} values are shown only where L_{Max} >65dB(A) and where L_{Max}- Leq ≥15dB(A)
8. Meteorological data has been sourced from the nearest Bureau of Meteorology station (Holsworthy Aerodrome AWS)

Unattended Noise Monitoring Results

ATS North

Monday, 14 September 2020



axis shows the ends of measurement periods, starting 23:45 preceeding day and ending 00:15 following day

NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{90}	48	40	35
LAeq	61	55	54

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{eq\ 15\ hr}$ and $L_{eq\ 9\ hr}$	62	56
$L_{eq\ 1hr}$ upper 10 percentile	65	61
$L_{eq\ 1hr}$ lower 10 percentile	55	44

Night Time Maximum Noise Levels			(see note 7)
L_{Max} (Range)	67	to	87
L_{Max} - L_{eq} (Range)	17	to	33

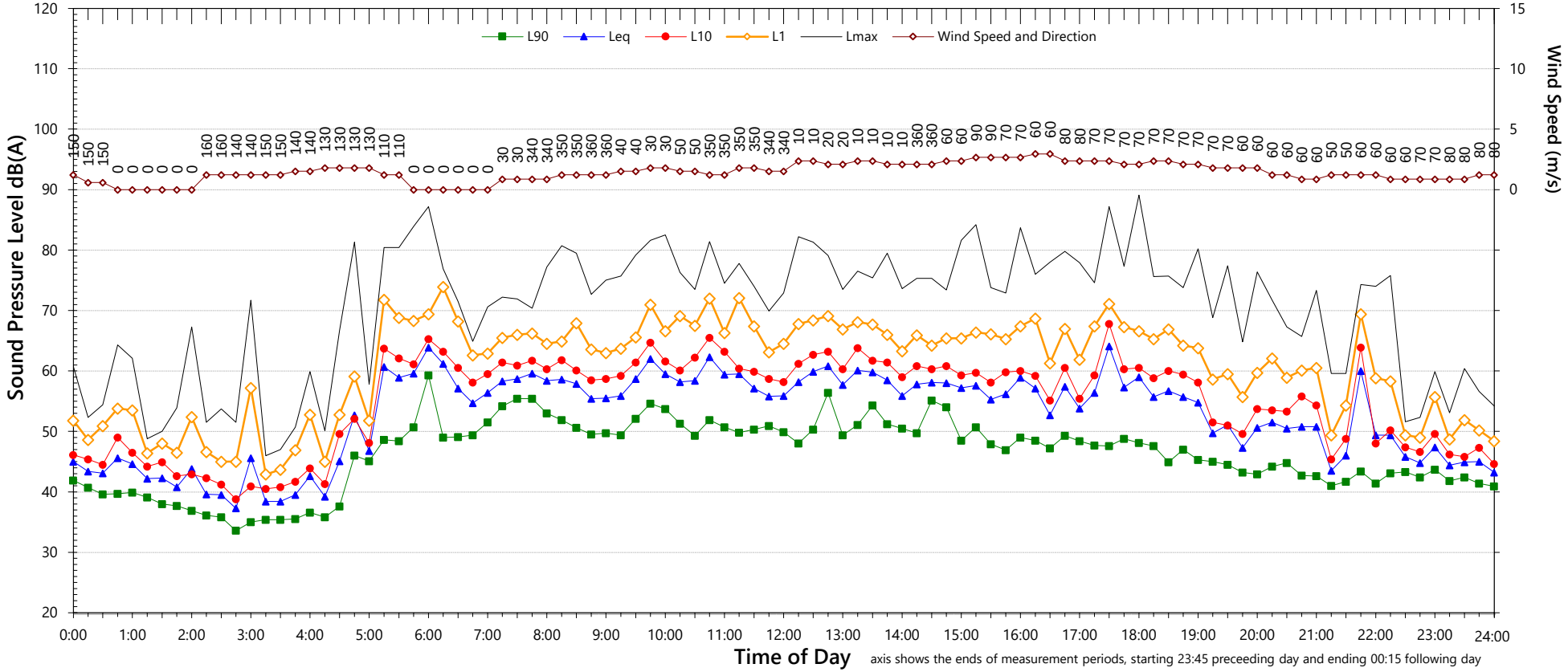
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am til 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. Night time L_{Max} values are shown only where L_{Max} >65dB(A) and where L_{Max}- Leq ≥15dB(A)
8. Meteorological data has been sourced from the nearest Bureau of Meteorology station (Holsworthy Aerodrome AWS)

Unattended Noise Monitoring Results

ATS North

Tuesday, 15 September 2020



axis shows the ends of measurement periods, starting 23:45 preceeding day and ending 00:15 following day

NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{90}	48	42	41
LAeq	59	53	55

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{eq\ 15\ hr}$ and $L_{eq\ 9\ hr}$	60	57
$L_{eq\ 1hr}$ upper 10 percentile	62	61
$L_{eq\ 1hr}$ lower 10 percentile	55	47

Night Time Maximum Noise Levels			(see note 7)
L_{Max} (Range)	76	to	81
L_{Max} - L_{eq} (Range)	16	to	29

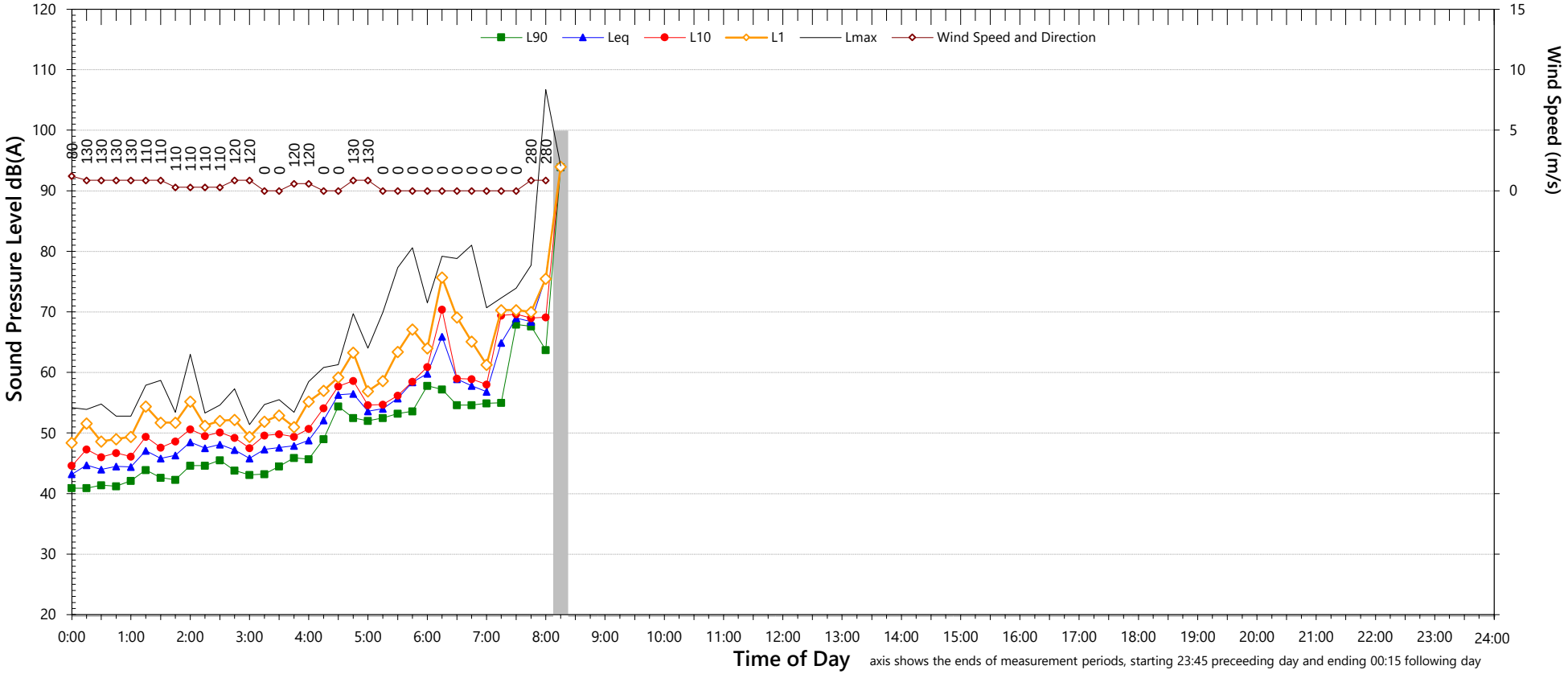
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am til 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. Night time L_{Max} values are shown only where L_{Max} >65dB(A) and where L_{Max}- Leq ≥15dB(A)
8. Meteorological data has been sourced from the nearest Bureau of Meteorology station (Holsworthy Aerodrome AWS)

Unattended Noise Monitoring Results

ATS North

Wednesday, 16 September 2020



NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{90}	-	-	-
LAeq	-	-	-

Night Time Maximum Noise Levels			(see note 7)
L_{Max} (Range)	-	to	-
L_{Max} - L_{eq} (Range)	-	to	-

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{eq\ 15\ hr}$ and $L_{eq\ 9\ hr}$	74	-
$L_{eq\ 1hr}$ upper 10 percentile	74	-
$L_{eq\ 1hr}$ lower 10 percentile	74	-

Notes:

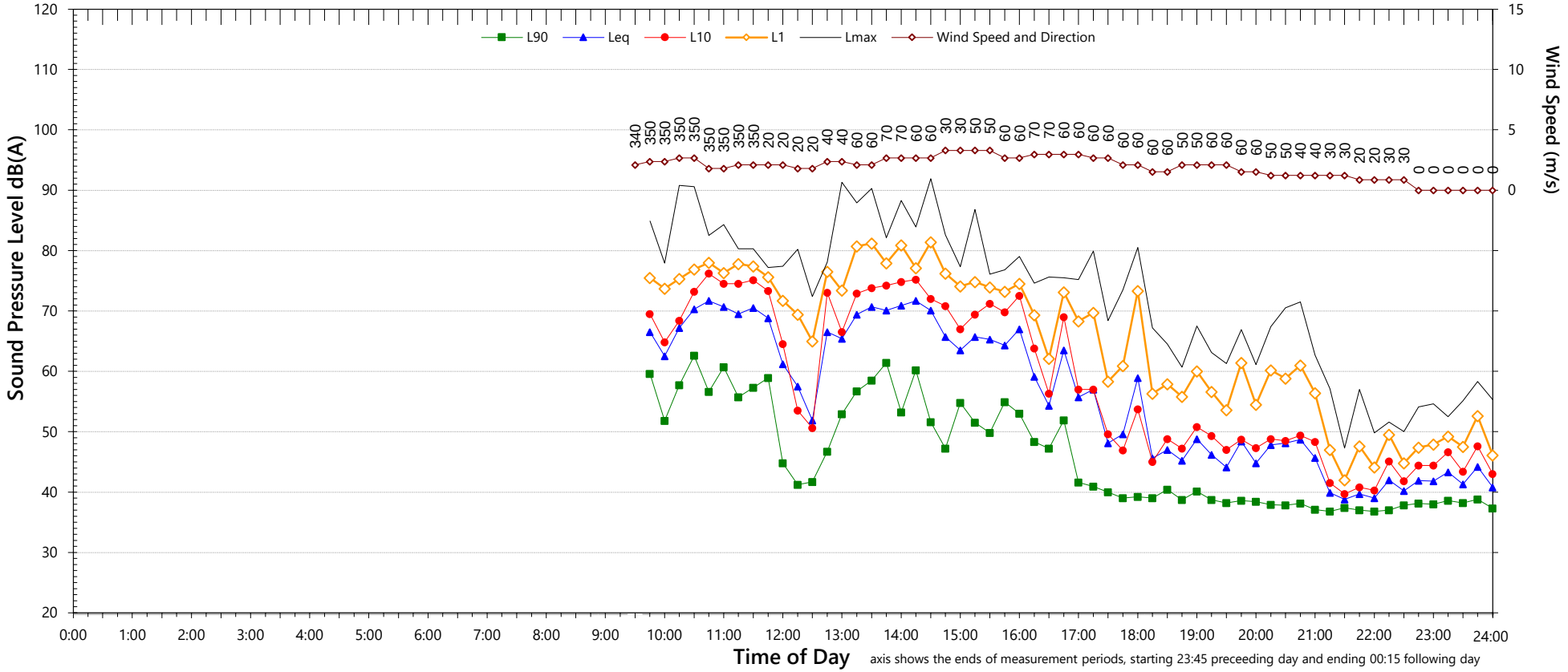
1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am til 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. Night time L_{Max} values are shown only where L_{Max} >65dB(A) and where L_{Max}- Leq ≥15dB(A)
8. Meteorological data has been sourced from the nearest Bureau of Meteorology station (Holsworthy Aerodrome AWS)

APPENDIX C Logger location 2 – ATS – South side

Unattended Noise Monitoring Results

ATS South

Monday, 7 September 2020



axis shows the ends of measurement periods, starting 23:45 preceeding day and ending 00:15 following day

NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{90}	-	37	38
LAeq	-	46	50

Night Time Maximum Noise Levels			(see note 7)
L_{Max} (Range)	76	to	81
L_{Max} - L_{eq} (Range)	16	to	25

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{eq\ 15\ hr}$ and $L_{eq\ 9\ hr}$	68	53
$L_{eq\ 1hr}$ upper 10 percentile	72	55
$L_{eq\ 1hr}$ lower 10 percentile	49	44

Notes:

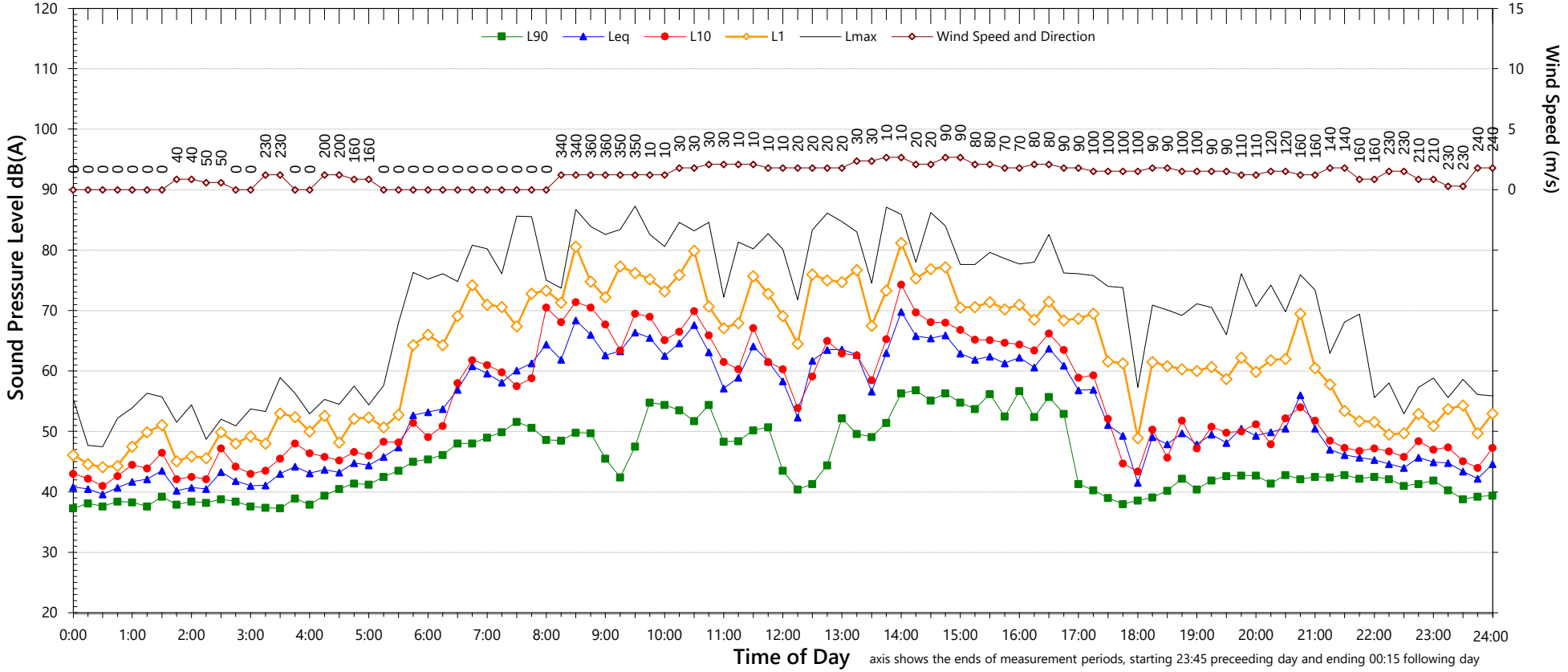
1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am til 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. Night time L_{Max} values are shown only where L_{Max} >65dB(A) and where L_{Max}- Leq ≥15dB(A)
8. Meteorological data has been sourced from the nearest Bureau of Meteorology station (Holsworthy Aerodrome AWS)

Data File: 2020-09-07_SLM_000_123_Rpt_Report.txt ATS south(r0) QTE-26 Logger Graphs Program (r34)

Unattended Noise Monitoring Results

ATS South

Tuesday, 8 September 2020



axis shows the ends of measurement periods, starting 23:45 preceeding day and ending 00:15 following day

NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{90}	41	40	36
LAeq	63	50	53

Night Time Maximum Noise Levels			(see note 7)
L_{Max} (Range)	66	to	97
L_{Max} - L_{eq} (Range)	15	to	35

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{eq\ 15\ hr}$ and $L_{eq\ 9\ hr}$	65	56
$L_{eq\ 1hr}$ upper 10 percentile	68	60
$L_{eq\ 1hr}$ lower 10 percentile	52	44

Notes:

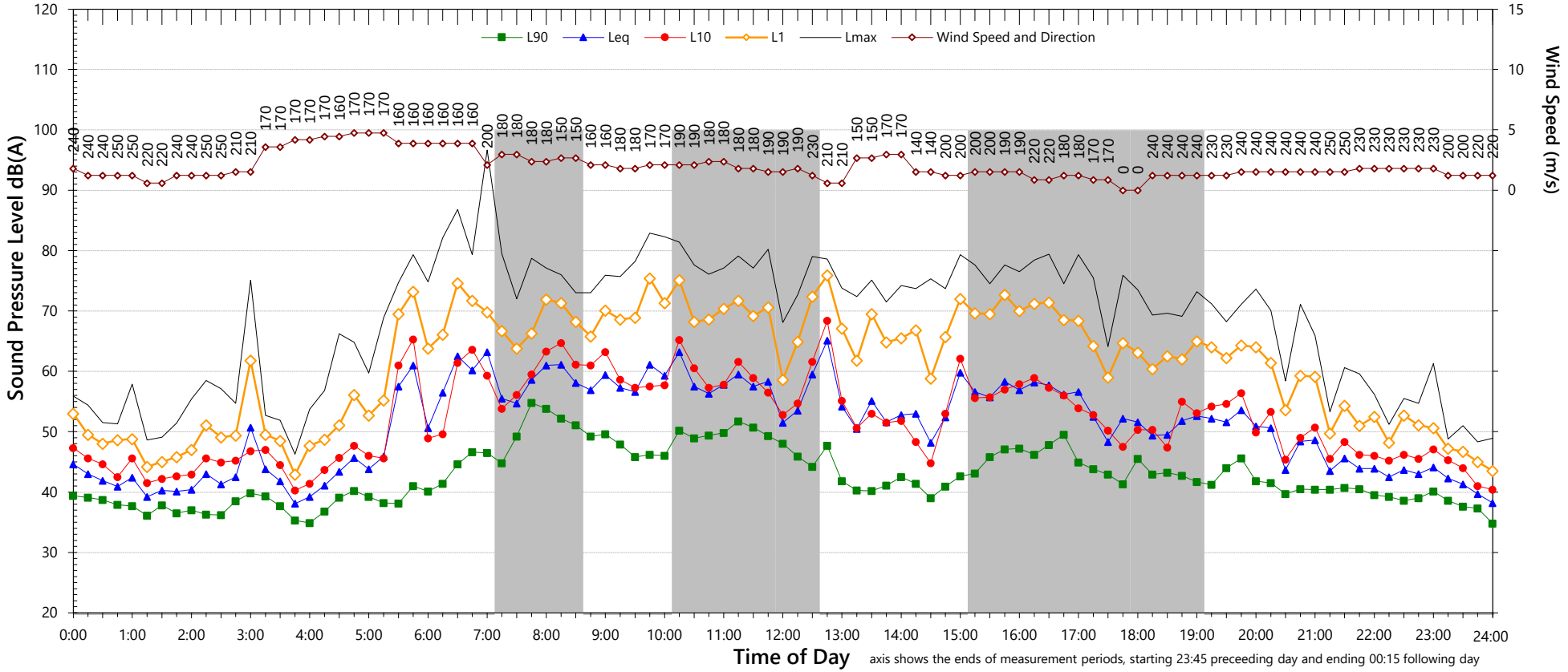
1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am til 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. Night time L_{Max} values are shown only where L_{Max} >65dB(A) and where L_{Max}- Leq ≥15dB(A)
8. Meteorological data has been sourced from the nearest Bureau of Meteorology station (Holsworthy Aerodrome AWS)

Data File: 2020-09-07_SLM_000_123_Rpt_Report.txt ATS south(r0) QTE-26 Logger Graphs Program (r34)

Unattended Noise Monitoring Results

ATS South

Wednesday, 9 September 2020



NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{90}	-	-	34
LAeq	-	-	50

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{eq\ 15\ hr}$ and $L_{eq\ 9\ hr}$	59	52
$L_{eq\ 1hr}$ upper 10 percentile	62	52
$L_{eq\ 1hr}$ lower 10 percentile	50	40

Night Time Maximum Noise Levels			(see note 7)
L_{Max} (Range)	69	to	81
L_{Max} - L_{eq} (Range)	16	to	23

Notes:

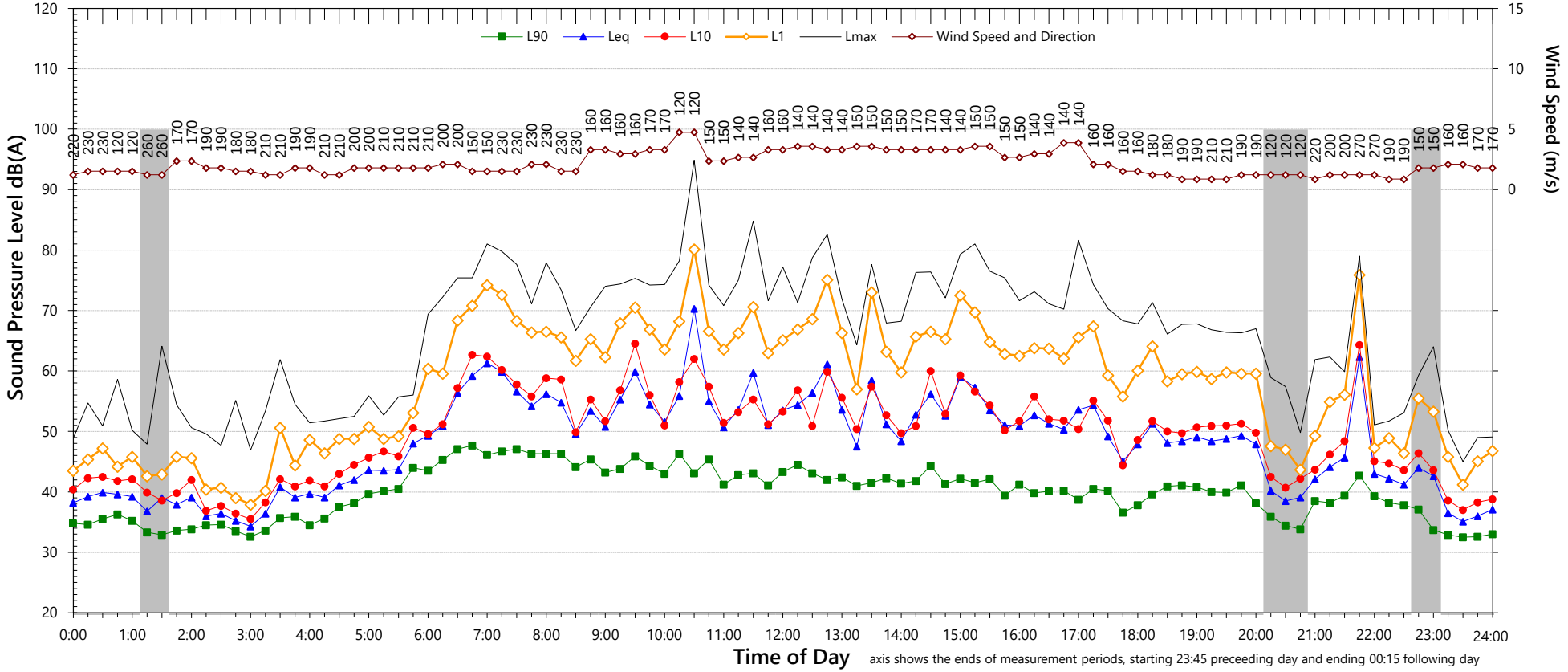
1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am til 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. Night time L_{Max} values are shown only where L_{Max} >65dB(A) and where L_{Max}- Leq ≥15dB(A)
8. Meteorological data has been sourced from the nearest Bureau of Meteorology station (Holsworthy Aerodrome AWS)

Data File: 2020-09-07_SLM_000_123_Rpt_Report.txt ATS south(r0) QTE-26 Logger Graphs Program (r34)

Unattended Noise Monitoring Results

ATS South

Thursday, 10 September 2020



NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{90}	40	-	32
LAeq	57	-	51

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{eq\ 15\ hr}$ and $L_{eq\ 9\ hr}$	59	54
$L_{eq\ 1hr}$ upper 10 percentile	60	58
$L_{eq\ 1hr}$ lower 10 percentile	51	39

Night Time Maximum Noise Levels			(see note 7)
L_{Max} (Range)	69	to	84
L_{Max} - L_{eq} (Range)	16	to	30

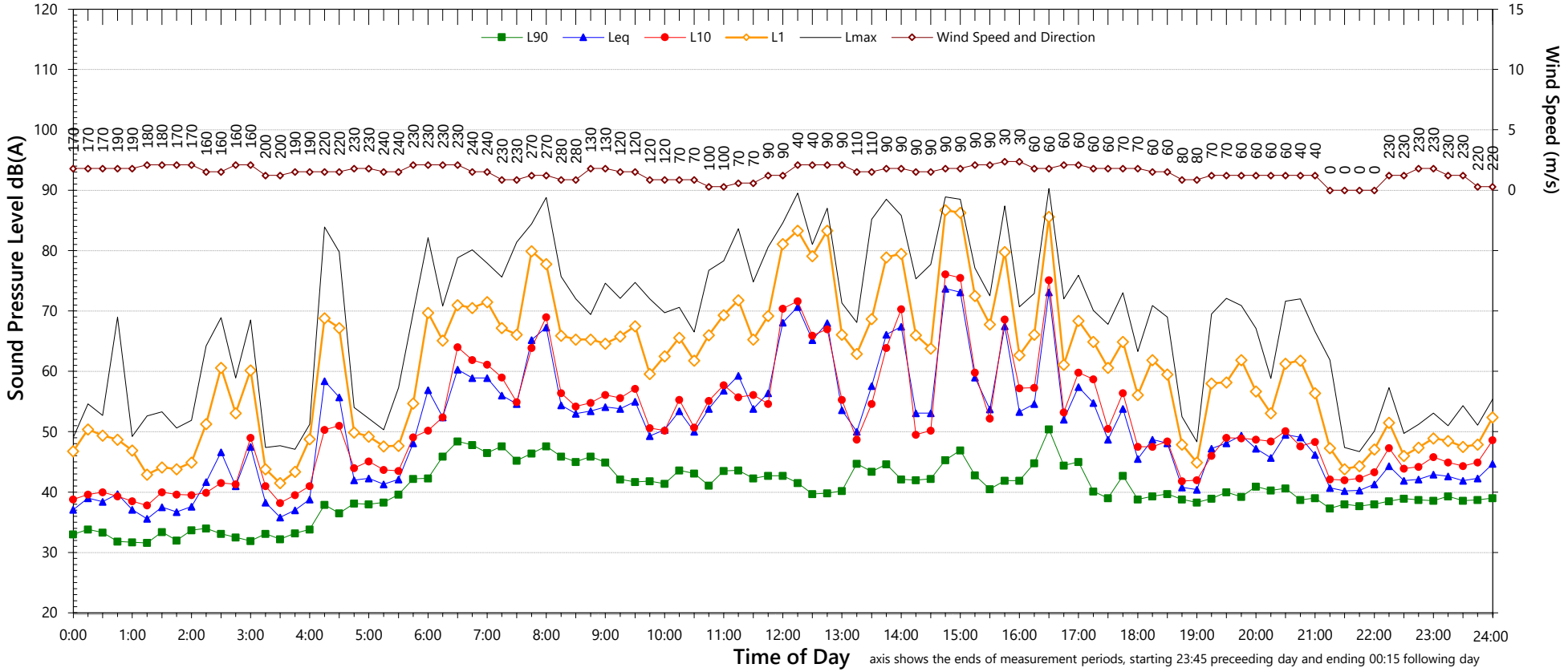
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am til 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. Night time L_{Max} values are shown only where L_{Max} >65dB(A) and where L_{Max}- Leq ≥15dB(A)
8. Meteorological data has been sourced from the nearest Bureau of Meteorology station (Holsworthy Aerodrome AWS)

Unattended Noise Monitoring Results

ATS South

Friday, 11 September 2020



axis shows the ends of measurement periods, starting 23:45 preceeding day and ending 00:15 following day

NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{90}	40	38	36
LAeq	65	46	47

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{eq\ 15\ hr}$ and $L_{eq\ 9\ hr}$	66	50
$L_{eq\ 1hr}$ upper 10 percentile	70	52
$L_{eq\ 1hr}$ lower 10 percentile	49	43

Night Time Maximum Noise Levels			(see note 7)
L_{Max} (Range)	75	to	79
L_{Max} - L_{eq} (Range)	16	to	27

Notes:

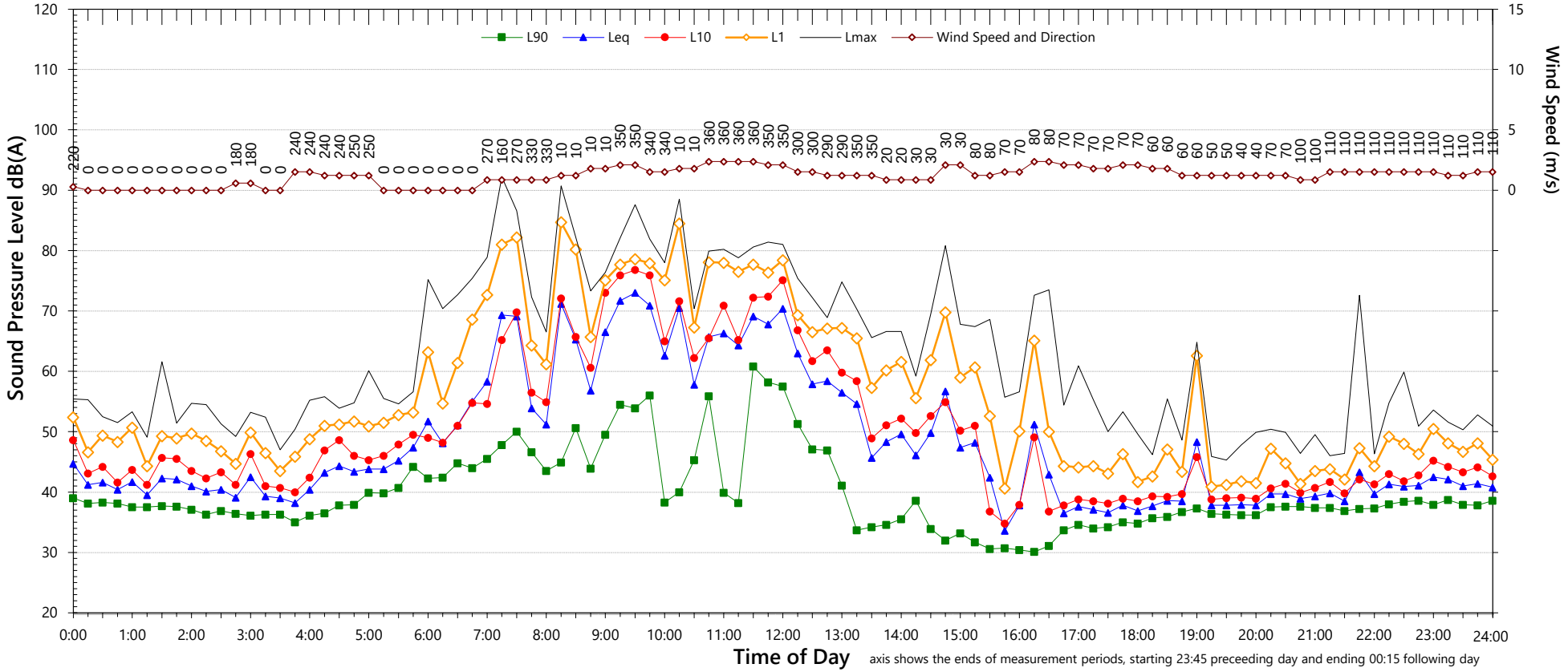
1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am til 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. Night time L_{Max} values are shown only where L_{Max} >65dB(A) and where L_{Max}- Leq ≥15dB(A)
8. Meteorological data has been sourced from the nearest Bureau of Meteorology station (Holsworthy Aerodrome AWS)

Data File: 2020-09-07_SLM_000_123_Rpt_Report.txt ATS south(r0) QTE-26 Logger Graphs Program (r34)

Unattended Noise Monitoring Results

ATS South

Saturday, 12 September 2020



axis shows the ends of measurement periods, starting 23:45 preceeding day and ending 00:15 following day

NSW Noise Policy for Industry (Free Field)			
Descriptor	Day[2]	Evening[3]	Night[4 5]
L_{90}	31	36	34
LAeq	65	41	43

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	Day	Night[5]
	7am-10pm	10pm-7am
$L_{eq\ 15\ hr}$ and $L_{eq\ 9\ hr}$	66	45
$L_{eq\ 1hr}$ upper 10 percentile	70	47
$L_{eq\ 1hr}$ lower 10 percentile	41	41

Night Time Maximum Noise Levels			(see note 7)
L_{Max} (Range)	76	to	77
L_{Max} - L_{eq} (Range)	17	to	33

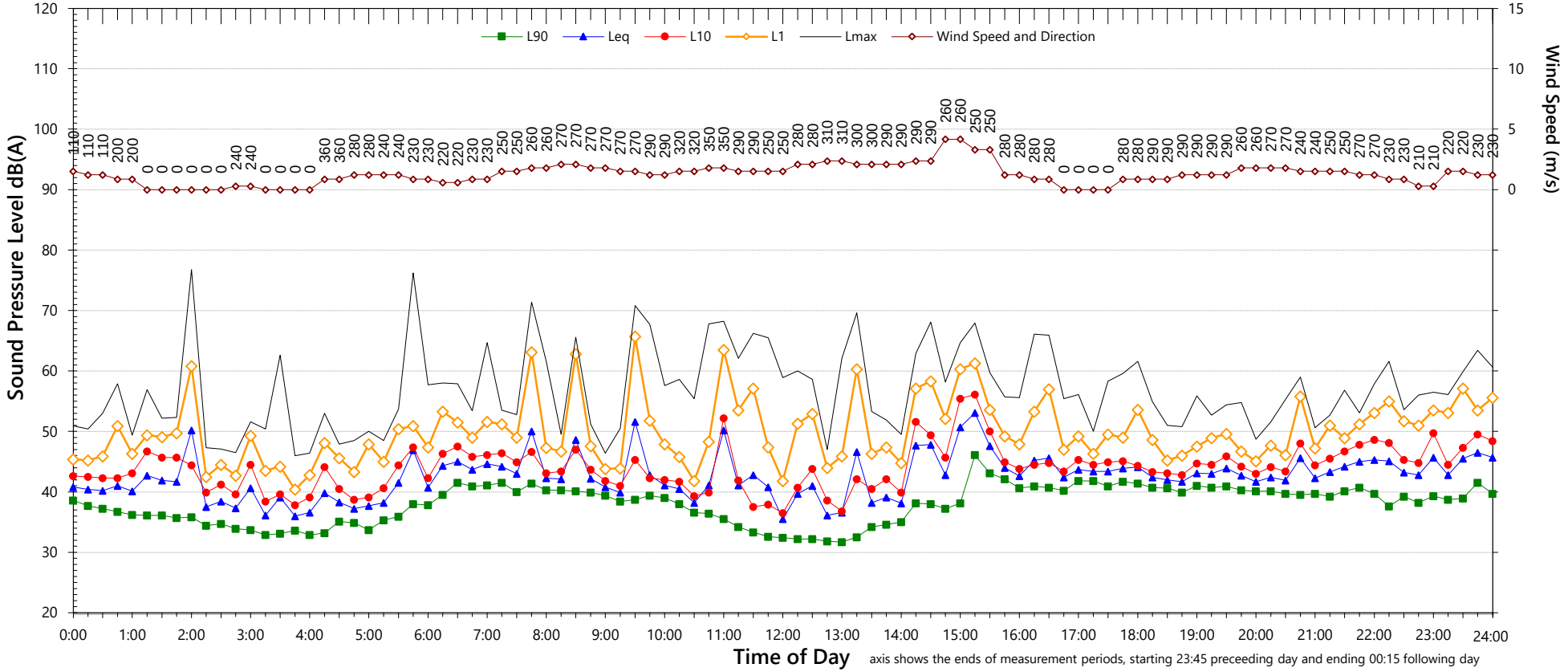
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am til 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. Night time L_{Max} values are shown only where L_{Max} >65dB(A) and where L_{Max}- Leq ≥15dB(A)
8. Meteorological data has been sourced from the nearest Bureau of Meteorology station (Holsworthy Aerodrome AWS)

Unattended Noise Monitoring Results

ATS South

Sunday, 13 September 2020



axis shows the ends of measurement periods, starting 23:45 preceeding day and ending 00:15 following day

NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{90}	32	40	37
LAeq	45	43	49

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{eq\ 15\ hr}$ and $L_{eq\ 9\ hr}$	47	52
$L_{eq\ 1hr}$ upper 10 percentile	50	53
$L_{eq\ 1hr}$ lower 10 percentile	44	45

Night Time Maximum Noise Levels			(see note 7)
L_{Max} (Range)	68	to	79
L_{Max} - L_{eq} (Range)	15	to	28

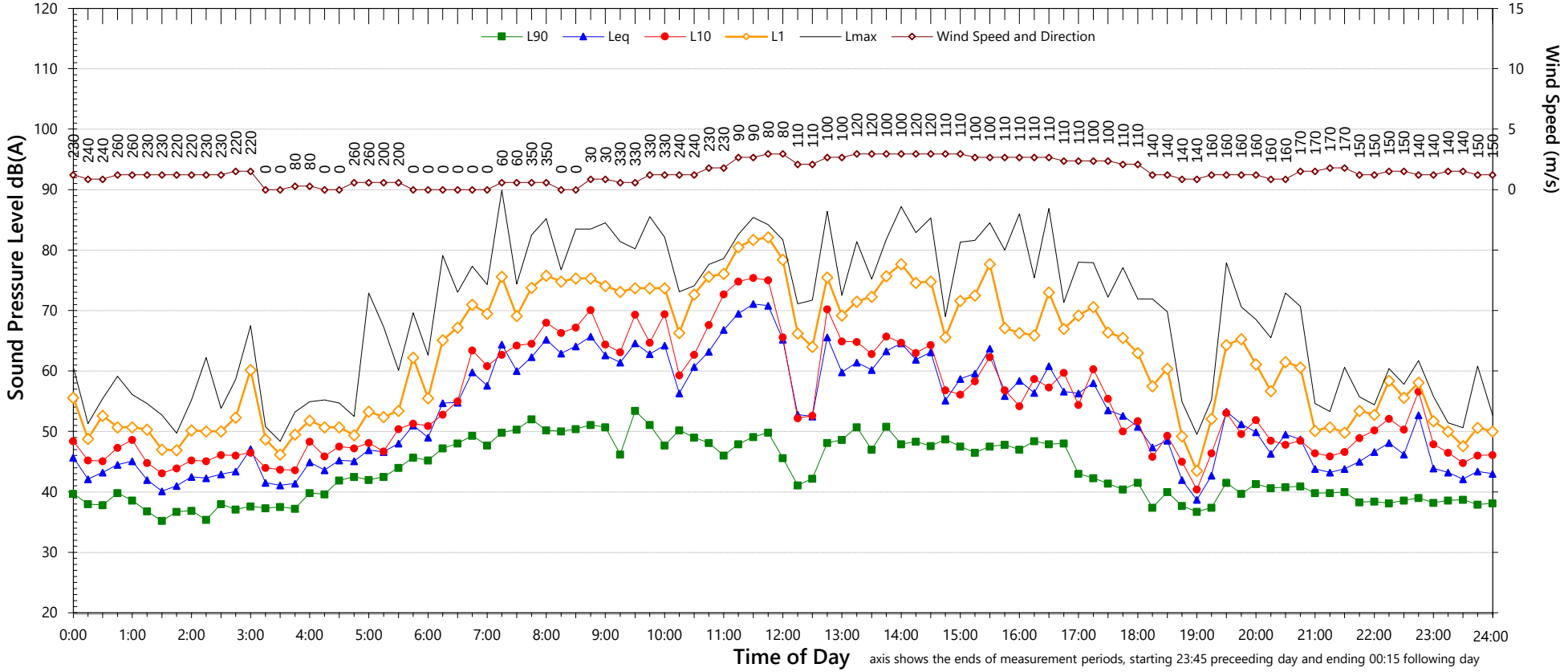
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am til 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. Night time L_{Max} values are shown only where L_{Max} >65dB(A) and where L_{Max}- Leq ≥15dB(A)
8. Meteorological data has been sourced from the nearest Bureau of Meteorology station (Holsworthy Aerodrome AWS)

Unattended Noise Monitoring Results

ATS South

Monday, 14 September 2020



axis shows the ends of measurement periods, starting 23:45 preceeding day and ending 00:15 following day

NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{90}	42	37	35
LAeq	63	48	51

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{eq\ 15\ hr}$ and $L_{eq\ 9\ hr}$	65	54
$L_{eq\ 1hr}$ upper 10 percentile	66	56
$L_{eq\ 1hr}$ lower 10 percentile	49	44

Night Time Maximum Noise Levels			(see note 7)
L_{Max} (Range)	79	to	82
L_{Max} - L_{eq} (Range)	18	to	27

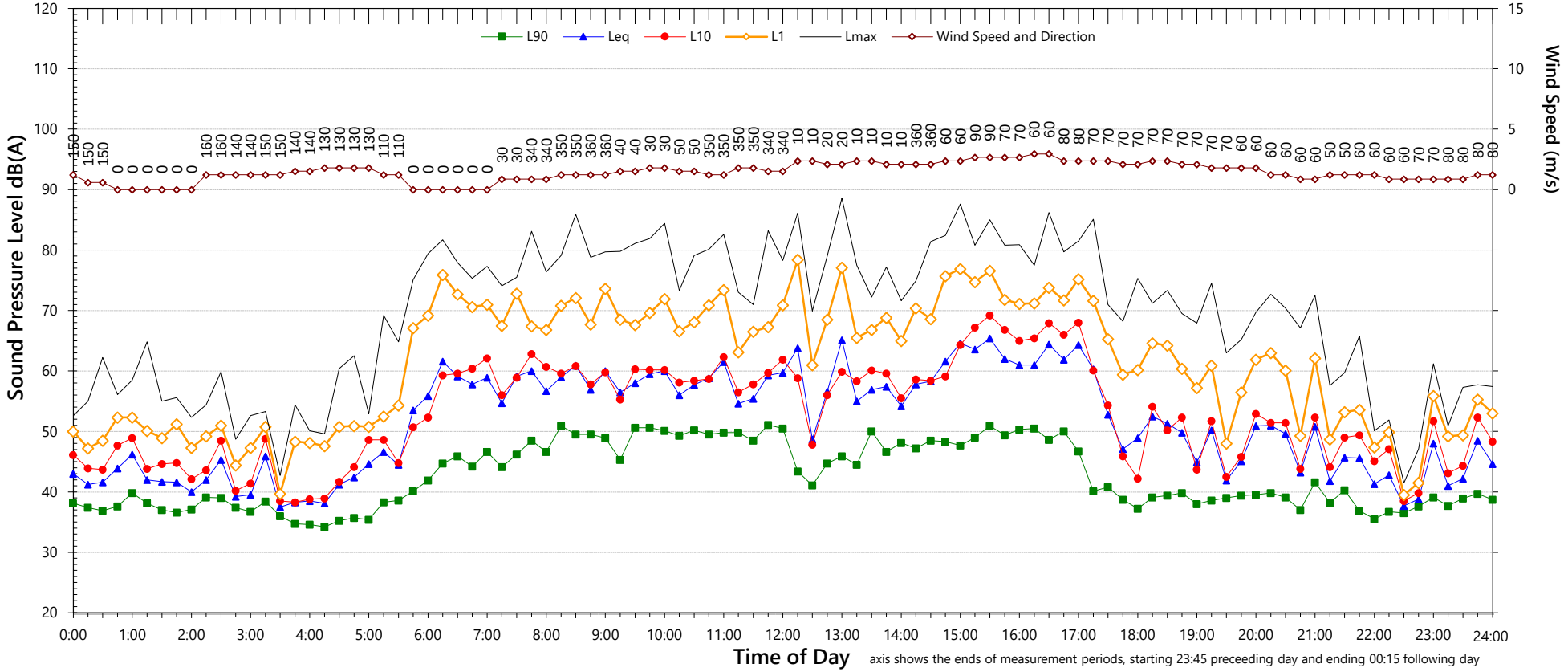
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am til 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. Night time L_{Max} values are shown only where L_{Max} >65dB(A) and where L_{Max}- Leq ≥15dB(A)
8. Meteorological data has been sourced from the nearest Bureau of Meteorology station (Holsworthy Aerodrome AWS)

Unattended Noise Monitoring Results

ATS South

Tuesday, 15 September 2020



axis shows the ends of measurement periods, starting 23:45 preceeding day and ending 00:15 following day

NSW Noise Policy for Industry (Free Field)			
Descriptor	Day[2]	Evening[3]	Night[4 5]
L_{90}	42	37	37
LAeq	60	49	51

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	Day	Night[5]
	7am-10pm	10pm-7am
$L_{eq\ 15\ hr}$ and $L_{eq\ 9\ hr}$	61	53
$L_{eq\ 1hr}$ upper 10 percentile	65	56
$L_{eq\ 1hr}$ lower 10 percentile	51	46

Night Time Maximum Noise Levels			(see note 7)
L_{Max} (Range)	70	to	81
L_{Max} - L_{eq} (Range)	17	to	24

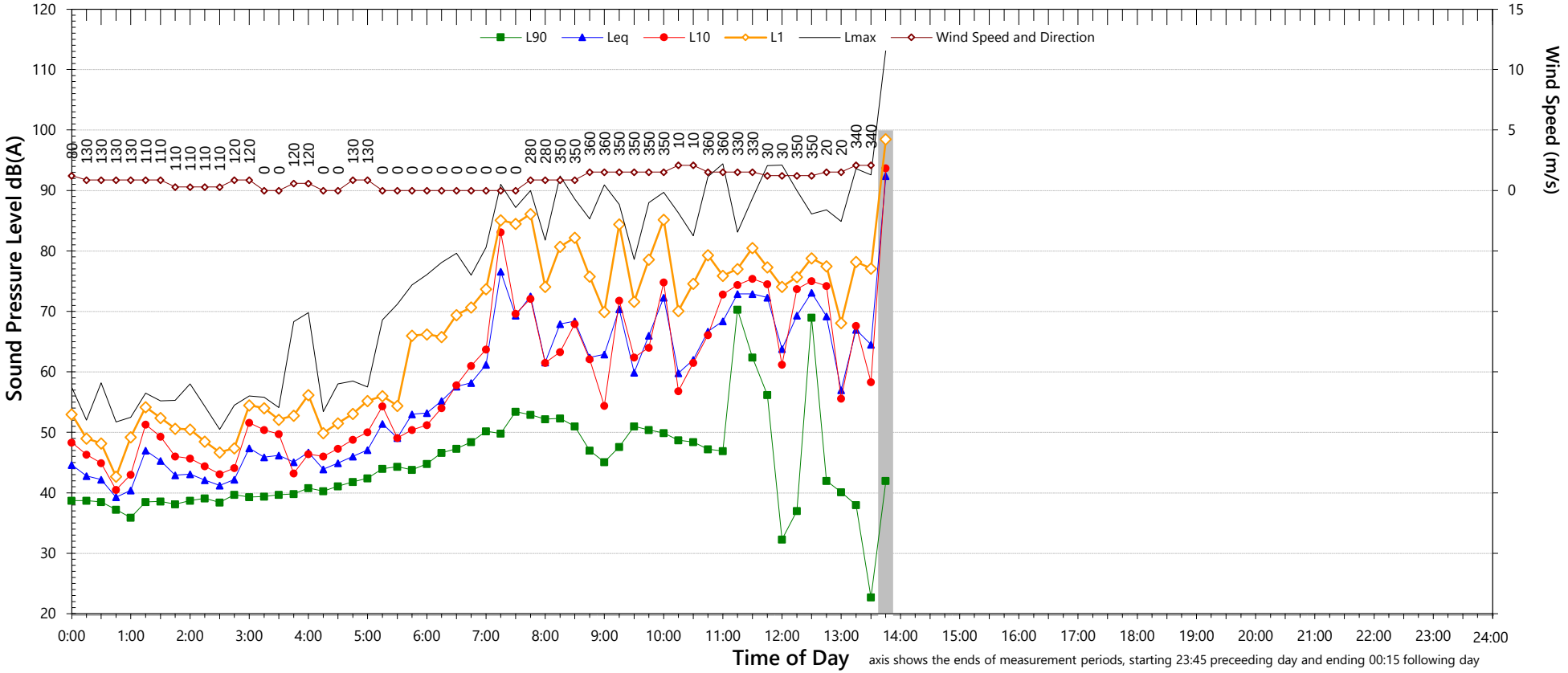
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am til 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. Night time L_{Max} values are shown only where L_{Max} >65dB(A) and where L_{Max}- Leq ≥15dB(A)
8. Meteorological data has been sourced from the nearest Bureau of Meteorology station (Holsworthy Aerodrome AWS)

Unattended Noise Monitoring Results

ATS South

Wednesday, 16 September 2020



NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{90}	-	-	-
LAeq	-	-	-

Night Time Maximum Noise Levels			(see note 7)
L_{Max} (Range)	-	to	-
L_{Max} - L_{eq} (Range)	-	to	-

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{eq\ 15\ hr}$ and $L_{eq\ 9\ hr}$	72	-
$L_{eq\ 1hr}$ upper 10 percentile	75	-
$L_{eq\ 1hr}$ lower 10 percentile	68	-

Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am til 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. Night time L_{Max} values are shown only where L_{Max} >65dB(A) and where L_{Max}- Leq ≥15dB(A)
8. Meteorological data has been sourced from the nearest Bureau of Meteorology station (Holsworthy Aerodrome AWS)

Data File: 2020-09-07_SLM_000_123_Rpt_Report.txt ATS south(r0) QTE-26 Logger Graphs Program (r34)

B.9 Warehouse 3B Noise Monitoring Report

Renzo Tonin & Associates Report TL116-09F01 Warehouse 3B Ops (r2)

RENZO TONIN & ASSOCIATES
inspired to achieve

Acoustics
Vibration
Structural Dynamics

MOOREBANK LOGISTIC PARK - PRECINCT EAST

Warehouse 3B Operational Compliance Measurements

6 April 2021

Qube Property Management Services Pty Ltd c/- Tactical Group

TL116-09F01 Warehouse 3B Ops (r2)

Sydney Melbourne Brisbane Gold Coast Kuwait Singapore
Renzo Tonin & Associates ABN 29 117 462 861
Level 1/418A Elizabeth St SURRY HILLS NSW 2010 | PO Box 877 STRAWBERRY HILLS NSW 2012
P (02) 8218 0500 F (02) 8218 0501 sydney@renzotonin.com.au www.renzotonin.com.au

Document details

Detail	Reference
Doc reference:	TL116-09F01 Warehouse 3B Ops (r2)
Prepared for:	Qube Property Management Services Pty Ltd c/- Tactical Group
Attention:	Cathal McGann

Document control

Date	Revision history	Non-issued revision	Issued revision	Prepared	Instructed	Reviewed / Authorised
29.03.2021	Initial issue (draft)	0	1	J. Liang/ A. Leslie	A. Leslie	C. Weber
06.04.2021	Final	-	2	J. Liang/ A. Leslie	A. Leslie	C. Weber

File Path: R:\AssocSydProjects\TL101-TL150\TL116 cw Moorebank IMT Temporary Noise Monitoring\Task 9 - cw Warehouse Compliance Monitoring\1 Docs\WH3B\TL116-09F01 Warehouse 3B Ops (r2).docx

Important Disclaimers:

The work presented in this document was carried out in accordance with the Renzo Tonin & Associates Quality Assurance System, which is based on Australian/New Zealand Standard AS/NZS ISO 9001.

This document is issued subject to review and authorisation by the suitably qualified and experienced person named in the last column above. If no name appears, this document shall be considered as preliminary or draft only and no reliance shall be placed upon it other than for information to be verified later.

This document is prepared for the particular requirements of our Client referred to above in the 'Document details' which are based on a specific brief with limitations as agreed to with the Client. It is not intended for and should not be relied upon by a third party and no responsibility is undertaken to any third party without prior consent provided by Renzo Tonin & Associates. The information herein should not be reproduced, presented or reviewed except in full. Prior to passing on to a third party, the Client is to fully inform the third party of the specific brief and limitations associated with the commission.

In preparing this report, we have relied upon, and presumed accurate, any information (or confirmation of the absence thereof) provided by the Client and/or from other sources. Except as otherwise stated in the report, we have not attempted to verify the accuracy or completeness of any such information. If the information is subsequently determined to be false, inaccurate or incomplete then it is possible that our observations and conclusions as expressed in this report may change.

We have derived data in this report from information sourced from the Client (if any) and/or available in the public domain at the time or times outlined in this report. The passage of time, manifestation of latent conditions or impacts of future events may require further examination and re-evaluation of the data, findings, observations and conclusions expressed in this report.

We have prepared this report in accordance with the usual care and thoroughness of the consulting profession, for the sole purpose described above and by reference to applicable standards, guidelines, procedures and practices at the date of issue of this report. For the reasons outlined above, however, no other warranty or guarantee, whether expressed or implied, is made as to the data, observations and findings expressed in this report, to the extent permitted by law.

The information contained herein is for the purpose of acoustics only. No claims are made and no liability is accepted in respect of design and construction issues falling outside of the specialist field of acoustics engineering including and not limited to structural integrity, fire rating, architectural buildability and fit-for-purpose, waterproofing and the like. Supplementary professional advice should be sought in respect of these issues.

External cladding disclaimer: No claims are made and no liability is accepted in respect of any external wall and/or roof systems (eg facade / cladding materials, insulation etc) that are: (a) not compliant with or do not conform to any relevant non-acoustic legislation, regulation, standard, instructions or Building Codes; or (b) installed, applied, specified or utilised in such a manner that is not compliant with or does not conform to any relevant non-acoustic legislation, regulation, standard, instructions or Building Codes.

Contents

1 Introduction 5
1.1 Warehouse operations description – WH3B 6
1.1.1 Location 6
1.1.2 Operational activities and facilities and hours of operation 6
1.2 Nearby sensitive receivers 6
2 Summary of noise objectives 9
2.1 Compliance assessment noise requirements 9
2.2 Operational noise limits 9
2.3 Discussion of assessment noise limits 10
3 Measurement methodology and results 12
3.1 Compliance measurement methodology 12
3.2 Instrumentation 13
3.3 Receiver unattended noise measurement results 13
3.3.1 Meteorological conditions 17
3.4 On-site attended operational activity noise measurement results 17
3.5 Unattended noise measurements 18
3.6 Modelled operational scenarios 19
3.6.1 Observed operations for modelling 19
3.6.1.1 Loading and Unloading operations (WH3B south) 20
3.6.1.2 Qube container handling operational area (WH3B north) 20
3.6.2 Assessment noise source levels 21
3.6.3 Reasonable worst-case intrusiveness scenarios (15-minute period) 21
3.7 Modelling methodology 23
3.7.1 Overview of noise modelling 23
3.7.2 General modelling assumptions 23
3.7.3 Model validation 24
3.8 Noise compliance assessment 25
4 Conclusion 27
APPENDIX A Glossary of terminology 28
APPENDIX B Logger location 1 – WH3B - North side 30
APPENDIX C Logger location 2 – WH3B – South side 31

List of tables

Table 1 Noise sensitive receivers and approximate distance from MPE WH3B 7
Table 2 SSD 7628 CoC B80 noise limits, dB(A) 10
Table 3 Noise measurement equipment 13

Table 4 Permanent noise monitoring stations 13
Table 5 Receiver permanent noise monitoring locations 14
Table 6 Summary of permanent noise monitoring results at the nearest sensitive residential receivers 16
Table 7 On-site attended noise measurement results 18
Table 8 Assessment noise source levels 21
Table 9 Representative 'reasonable' worst-case 15-minute intrusive assessment scenarios 23
Table 10 Comparison between measured and modelled noise levels 24
Table 11 Predicted noise levels - Reasonable 15-minute worst-case scenarios for WH3B north 26
Table 12 Predicted noise levels - Reasonable 15-minute worst-case scenarios for WH3B south 26

List of figures

Figure 1 Warehouse location WH3B, MPE precinct and the nearest residential receiver catchments 8
Figure 2 Residential receiver noise monitoring locations NMT01 to NMT04 15
Figure 3 Unattended noise logger locations and main noise generation areas (imagery: Nearmap, 2021) 19

1 Introduction

Renzo Tonin & Associates was engaged by Tactical on behalf of Qube Property Management Services Pty Ltd (QUBE) to undertake an operational noise compliance assessment of the warehouse operations carried out by Warehouse 3B (WH3B) within the Moorebank Precent East (MPE), located within the Moorebank Logistics Park (MLP) at Moorebank, NSW.

The Sydney Intermodal Terminal Alliance (SIMTA) received approval for the construction and operation of Stages 1 and 2 of the MPE Project (SSD 6766 and SSD 7628 respectively), which together comprise the two stages of development under the MPE Concept Approval (MP10_0193). Warehouse operations, including the site that is operated by WH3B fall under the area and activities approved as part of SSD 7628.

This report has been prepared to address the operational noise monitoring requirements outlined in the MPE Operational Noise and Vibration Management Plan[1] (MPE ONVMP) required for the warehouse operations carried out by WH3B. Specifically, this report has been prepared to address the requirements of Condition of Consent (CoC) B85 in State Significant Development (SSD) 7628, as detailed in Section 3.2.2 of the MPE ONVMP.

Appendix A contains a glossary of acoustic terms used in this report.

1 Arcadis & Renzo Tonin & Associates, Operational Noise and Vibration Management Plan for Moorebank Logistics Park – East Precinct, Revision 012, dated 27/3/2020, available https://simta.com.au/wordpress/wp-content/uploads/2020/04/ONVMP_V12_redacted.pdf, accessed 25/3/2021

1.1 Warehouse operations description – WH3B

1.1.1 Location

The MLP is located approximately 27 kilometres south-west of the Sydney Central Business District and approximately 26 kilometres west of Port Botany, within the Liverpool Local Government Area. The MLP is divided into an East Precinct and a West Precinct, located east and west of Moorebank Avenue respectively, as shown in Figure 1.

1.1.2 Operational activities and facilities and hours of operation

Operational activities at WH3B include storage and distribution activities at the position shown in Figure 1. The day to day activities include:

- Receipt and despatch of containers from and to the IMEX terminal
- Loading and unloading of containers
- Storage of products
- Despatching and receiving product to commercial customers using internal equipment such as forklifts
- Internal product moving and loading activities, including use of forklifts
- General office administrative and support functions.

The despatch activities mostly occur from the south side of the WH3B, typically between the hours of 7:00am and 6:00pm, however the busiest period of noise generating activities typically occurs around 9:00am to 1:00pm There are no activities that typically occur during the night period (10:00pm to 7:00am) within the site. The noise generating vehicle movements associated with the general deliveries and commercial customer activities mostly occur from the southern side of the warehouse. The northern side of the warehouse is the designated area where containers from the IMEX terminal or other sources are transported to and stored for unloading to within the warehouse. These two main areas are shown in Figure 3.

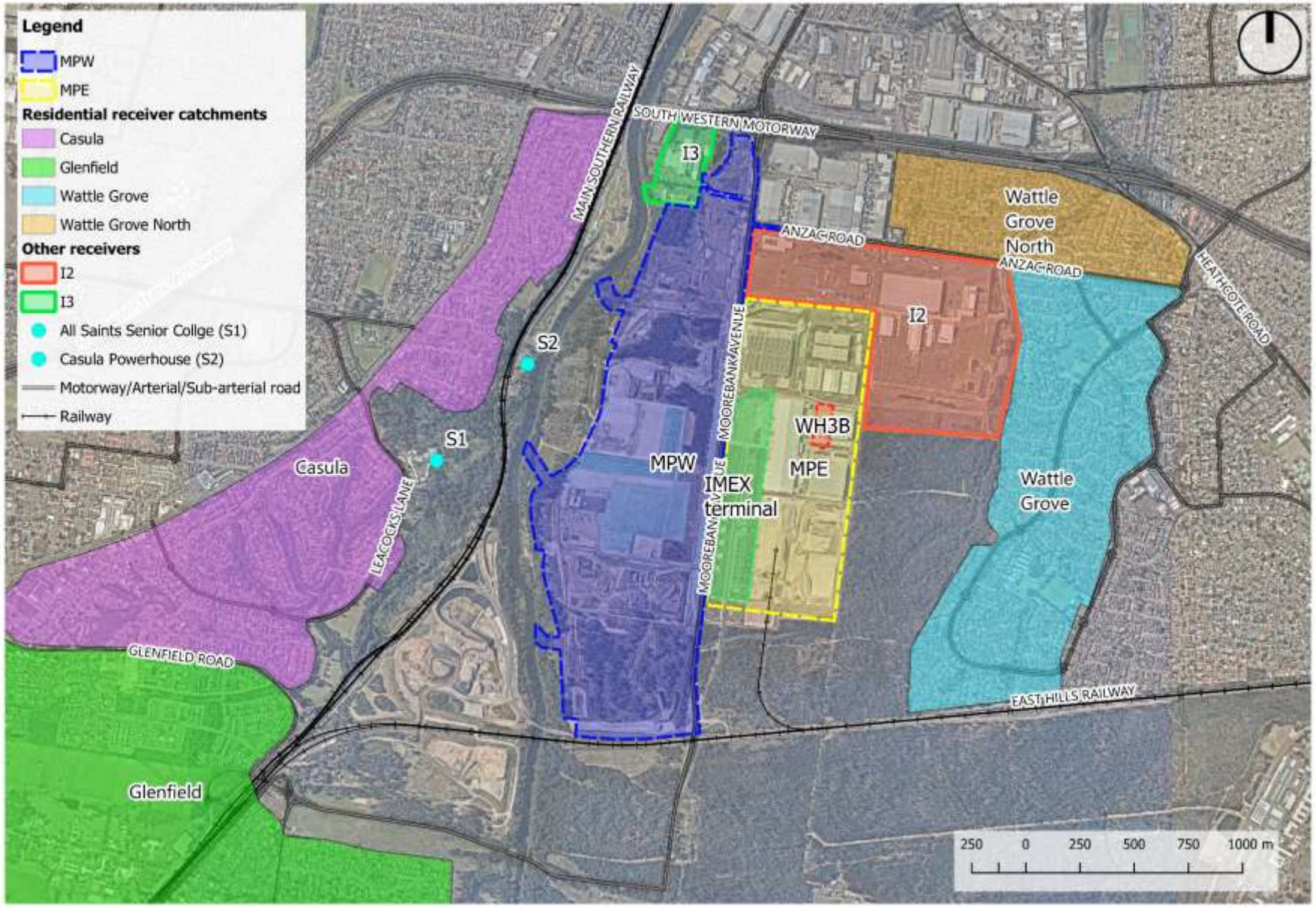
1.2 Nearby sensitive receivers

The potentially most affected residential receivers in the vicinity of the MPE, when noise intensive activities at the WH3B are occurring, are located in the suburbs of Casula, Glenfield, Wattle Grove and Wattle Grove North. A summary of the approximate distance to the nearest residential receiver in the surround noise catchment areas (NCAs) is provided in Table 1. The locations of the NCAs or receivers, are shown in Figure 1.

Table 1 Noise sensitive receivers and approximate distance from MPE WH3B

Sensitive receiver (Noise Catchment Area (NCA) or Receiver ID)	Receiver type	Approximate distance from MPE precinct WH3B, metres
Wattle Grove (NCA 1)	Residential	800
Wattle Grove North (NCA 2)		820
Casula (NCA 3)		1,400
Glenfield (NCA 4)		2,700
All Saints Senior College (S1)	Educational	1,800
Casula Powerhouse (S2)		1,400
Defence Joint Logistics Unit (DJLU) (I2)	Industrial	230
ABB (I3)		1,120

Figure 1 Warehouse location WH3B, MPE precinct and the nearest residential receiver catchments



2 Summary of noise objectives

2.1 Compliance assessment noise requirements

The management of operational noise emission from warehouse activities within MPE Stage 2 is outlined in the MPE ONVMP. Specifically, this report has been prepared to address the requirements of CoC B85 in SSD 7628, as detailed in Section 4.1.1 of the MPE ONVMP.

This report includes noise monitoring performed to address the requirements in CoC B85, as detailed in Table 4-1 in Section 4.1.1 of the MPE ONVMP.

The requirements of CoC B85 state:

> *B85 The Applicant must carry out noise monitoring of mechanical plant and other noisy equipment for a minimum period of one week where valid data is collected following occupation of each warehouse. The monitoring program must be carried out by a suitably qualified and experienced person(s) and a Monitoring Report for Mechanical Plant must be submitted to the Secretary within two months of occupation or each tenancy to verify predicted mechanical plant and equipment noise levels.*

CoC B85 requires that the monitored noise levels be compared against the predicted levels reviewed in accordance with CoC B84.

The noise impacts from warehouse operations were assessed as part of the EIS noise and vibration impact assessment (MPE Stage 2 Noise and Vibration Impact Assessment, Wilkinson Murray, Report No. 12186-S2, Version C, 29 November 2016 (MPE Stage 2 N&V assessment)). The individual noise impacts of warehouse operations were not quantified as part of the EIS. As such, noise level predictions for the warehouse activities are not available for verification with CoC B85.

As per Table 4-1 in Section 4.1.1 of the MPE ONVMP, Table 3-20 and Table 3-21 of the MPE ONVMP detail the predicted $L_{Aeq\ 15\ minute}$ intrusiveness and L_{Amax} sleep disturbance noise limit levels respectively for the overall MPE operations (not for individual warehouses).

As such, for the purposes of addressing CoC B85, instead of comparing the facility noise emission against the noise level predicted in accordance with CoC B84, this report is aims to assess the noise levels from the mechanical plant and other noisy equipment that operate within the facility directly against the noise limits presented in Table 5 of condition B80.

2.2 Operational noise limits

The operational noise limits applicable for the warehouse operations within MPE are presented in Table 5 of SSD 7628 CoC B80 and are reproduced in Table 2. These noise limits are as per Table 3-5 of

the MPE ONVMP. The noise limits are applicable not only to all operational noise sources approved under SSD 7628, but are inclusive of operations as part of MPE Stage 1, approval SSD 6766.

The $L_{Aeq(15\ minute)}$ criteria are applicable during the day, evening and night-time periods and the $L_{A1\ (1\ minute)}$ sleep disturbance noise limits at residential receivers are applicable during the night-time period.

The noise limits are applicable under prevailing meteorological conditions of wind speeds of up to 3 m/s at 10 metres above ground level or stability category 'F' temperature inversion conditions.

Table 2 SSD 7628 CoC B80 noise limits, dB(A)

Sensitive receiver	Day [1] $L_{Aeq,\ 15\ minute}$	Evening [1] $L_{Aeq,\ 15\ minute}$	Night [1] $L_{Aeq,\ 15\ minute}$	Night [1] $L_{A1\ (1\ min)}$
Wattle Grove (NCA 1)	35	35	35	52
Wattle Grove North (NCA 2)	35	35	35	52
Casula (NCA 3)	35	35	35	52
Glenfield (NCA 4)	35	35	35	52

Notes:

1. In accordance with the INP, day is the period from 7:00 am to 6:00 pm Monday to Saturday; or 8:00 am to 6:00 pm on Sundays and public holidays; evening is the period from 6:00 pm to 10:00 pm; and night is the remaining periods.
2. To determine compliance with the $L_{Aeq,15\ minute}$ noise limits, noise from the development is to be measured at the most affected point within the residential boundary, or at the most affected point within 30 metres of a dwelling where the dwelling is more than 30 metres from the boundary. Where it can be demonstrated that direct measurement of noise from the project is impractical, the EPA may accept alternative means of determining compliance (see Chapter 7 Noise Policy for Industry - NPfI) The modification factors in Section 4 of the INP must also be applied to the measured noise levels where applicable.
3. To determine compliance with the L_{A1} noise limits, noise from the project is to be measured at 1 metre from the dwelling façade. Where it can be demonstrated that direct measurement of noise from the project is impractical, the EPA may accept alternative means of determining compliance (see Chapter 7 of the NPfI).
4. The noise emission limits identified above apply under meteorological conditions of:

   (i) wind speeds of up to 3 m/s at 10 metres above ground level; or

   (ii) 'F' atmospheric stability class.

2.3 Discussion of assessment noise limits

As noted in Section 2.2, the noise limits detailed in SSD 7628 CoC B80 are applicable not only to all operational noise sources approved under SSD 7628, but are also inclusive of operations as part of the MPE Stage 1 approval for SSD 6766. Importantly, when assessing compliance with the noise limits, the most affected residential receiver for any individual operations will not necessarily be at the same location. Additionally, it is unlikely that the reasonable worst-case noise levels from any individual operations would also occur in the same 15-minute period.

As part of the recent modification application for SSD 7709 Moorebank Precinct West (MPW) – Stage 2, MOD 1 - Building height increase, which was approved 24 December 2020, a review of the applicable operational noise requirements across Moorebank Precinct West (MPW) and Moorebank Precinct East (MPE) was undertaken (Renzo Tonin & Associates document reference TJ741-11F05 (r4), dated 30 June 2020). The review identified that there are number of approval conditions that are applicable across both the MPW and MPE sites for operational noise, and that in the application of these approvals to the site activities, it became apparent that the operational noise requirements were not consistent across the MPE and MPW sites.

Additionally, the review identified that the operational noise limits across MPE and MPW were set substantially below both the noise criteria and the predicted noise levels (even with feasible and reasonable mitigation measures) established during the environmental assessment stages and considering the cumulative operational noise levels from all MPE and MPW operations.

The review recommended that an overall approach for cumulative operational noise management of the Moorebank intermodal terminal precinct (for East and West precinct) for a "whole of complex" approach be adopted, and that consistent noise management objectives for the Moorebank intermodal terminal precinct's operational noise be adopted to cover all operations within MPE and MPW. Appropriate and achievable noise management objectives consistent with EPA's noise policies were also developed in the review.

Following the modification application for SSD 7709 (MOD 1), the submission received from the NSW Environment Protection Authority (NSW EPA) noted the following:

> *However, the current noise limits are set below the predicted noise levels and are not based on the Project Specific Noise Levels (PSNL) derived under the then-applicable Industrial Noise Policy 2000 (now superseded by the Noise Policy for Industry 2017)…. The EPA considers that the resulting noise limits are not achievable for MPW, nor are they achievable for the cumulative MPW and MPE sites.*

Also Liverpool City Council included in their submission:

> *Council considers that site regulation in regard to noise management may be assisted by adopting a precinct approach consistent with the NSW EPA's Noise Policy for Industry (2017)…. Whilst it is acknowledged that current criteria in the Approval may be impracticable, it will be necessary for the Department to consider applying suitable noise limits that are achievable and capable of protecting the amenity and wellbeing of sensitive receivers.*

As such, this operational compliance assessment does not include further quantification of cumulative noise levels, and demonstrates that WH3B operations can achieve the noise limits set out in SSD 7628 CoC B80 in isolation during reasonable worst-case operations.

It is recommended that noise levels from this assessment achieve the required noise limits set out in Table 5 of SSD 7628 CoC B80, and that the site specific noise levels should be considered as part of the operational noise management applicable to the overall Moorebank intermodal terminal precinct.

3 Measurement methodology and results

3.1 Compliance measurement methodology

The Noise Policy for Industry (NPfI) provides guidance in Chapter 7 for monitoring the performance of a noise-generating industrial facility. In Section 7.1.1, the NPfI provides guidance as to how to review noise emissions of a site where the existing ambient noise levels are already high, resulting in the direct quantification of the noise under investigation not being possible via noise measurements at the receiver location. Additionally, the NPfI provides guidance about using noise modelling to review the performance of an industrial operation that is co-located with separate but noise-generating industrial sites impacting the same receiver. To satisfy the requirements of CoC B85, the following noise monitoring and assessment steps have been undertaken:

1. Review of permanent noise monitoring at nearby residential receivers during periods when noise intensive activities were taking place within the WH3B facility to determine if noise levels would allow for quantification of operational noise emissions, by checking if operational noise emissions are audible, distinguishable and quantifiable at the receiver locations during periods of noise intensive on-site activities (Section 3.3).

2. On-site attended monitoring of noise-generating activities to quantify noise emission levels of mechanical plant and other noise-generating activities as part of typical warehouse operations (Section 3.4).

3. Unattended noise monitoring at the WH3B facility for a period of one week, with concurrent video, to identify the reasonable worst-case operational scenarios and periods for each major noise-generating area (Section 3.5).

The review of unattended noise monitoring data measurements in Section 3.3 established that the existing ambient noise levels at the nearest receivers were high and controlled by noise sources outside of MPW, in addition to a number of industrial noise-generating facilities being co-located. As such, direct quantification or estimation of operational noise emissions from the warehouse operations at the sensitive receiver locations was not possible. Noise emissions from the WH3B have been evaluated using a combination of on-site attended and unattended noise monitoring, combined with noise modelling, in order to quantify the industrial noise emissions from WH3B operations.

The following steps were undertaken to assess the noise level contributions at the nearby sensitive receivers:

1. Review observations of warehouse operations, in addition to the noise monitoring results and associated video, to then determine the reasonable worst-case operational scenarios.

2. Setup and calibrate the noise model for the reasonable worst-case operational scenarios.

3. Calculate the operational noise levels from the warehouse operations to all nearby receivers and determine the noise level contribution at the property with the highest noise levels within each NCA.

3.2 Instrumentation

A range of noise monitoring equipment was used to undertake the compliance noise monitoring. A summary of measurement equipment and calibration dates is provided in Table 3.

All of the noise monitoring equipment are Class 1 instruments, with calibration certificates current at the time of the measurements. Before and after each series of attended measurements, the calibration of the sound level meters were verified using a reference calibration of 94 dB at 1 kHz. The difference between pre- and post-calibration levels was within 0.5 dB for all measurements.

Table 3 Noise measurement equipment

Monitoring location/ purpose	Equipment	Serial No	Last date calibrated
On-site attended noise measurements	NTi XL2	A2A-16217-E0	05/07/2019
Unattended on-site noise measurements (WH3B North)	NTi XL2	A2A-09356-E0	01/05/2019
Unattended on-site noise measurements (WH3B South)	NTi XL2	A2A-08004-E0	16/12/2020
Field calibration	B&K 4231	3016756	27/11/2020

Four Envirosuite permanent noise monitors are set up at nearest representative residential locations in the community and are labelled NMT01 to NMT04 in Figure 2.

Table 4 Permanent noise monitoring stations

Monitoring location	Description	Equipment	Serial No	Last Date Calibrated
NMT01	Permanent noise monitor	B&K 2250	3025394	12/03/2019
NMT02	Permanent noise monitor	B&K 2250	3025271	12/03/2019
NMT03	Permanent noise monitor	B&K 2250	3025351	12/03/2019
NMT04	Permanent noise monitor	B&K 2250	3025317	12/03/2019

3.3 Receiver unattended noise measurement results

As detailed in Section 1.2, the residential receivers nearby to the WH3B are located in the suburbs of Casula, Glenfield, Wattle Grove and Wattle Grove North.

As the most intensive period of operational activities at WH3B typically occurs during the daytime period from 12:00 pm and there are no night period activities (10:00pm to 7:00am), noise monitoring data from the permanent noise monitoring stations have been reviewed for the period between 11:00 am and 1:00 pm on 4 March 2021, during which onsite noise intensive activities were confirmed to be taking place. The permanent noise monitoring stations were configured to record audio and undertaken short-term statistical noise measurements. During this measurement period, concurrent unattended noise measurements were undertaken on-site of noise generating activities (see Section 3.4). This assisted to confirm that noise intensive activities were occurring on-site during the reviewed period of permanent noise monitoring data and noise recordings.

A summary of the monitoring locations and the approximate distance to the WH3B is provided in Table 5. These locations along with the noise catchment areas (NCAs) are presented in Figure 2.

Table 5 Receiver permanent noise monitoring locations

Monitoring location ID	Monitoring location (applicable NCA) (see Figure 2)	Approximate distance (m) from WH3B
NMT01	22 Glenelg Court, Wattle Grove (Wattle Grove North – NCA2)	810
NMT02	26 Goodenough Street, Glenfield (Glenfield – NCA4)	2,700
NMT03	31 Martindale Court, Wattle Grove (Wattle Grove – NCA1)	700
NMT04	14 Dunmore Crescent, Casula (Casula – NCA3)	1,600

The results of the permanent noise monitoring results on 4 March 2021 are presented in Table 6.

The ambient noise levels during the reviewed monitoring period were greater than 48 dB(A) $L_{Aeq\ 15\ minute}$ at all monitoring locations, with corresponding background noise levels no less than 47 dB(A) $L_{A90\ 15\ minute}$ at all monitoring locations. Sample reviewed audio could not clearly distinguish noise levels corresponding to concurrent onsite activities. As such, given that noise levels are expected to be below the overall noise limit of 35 dB(A) $L_{Aeq\ 15\ minute,}$ were not audible and/or distinguishable at nearby receivers because of high ambient noise levels, direct quantification or estimation of operational noise emissions from the warehouse operations at the sensitive receiver locations would not be possible via direct measurement in the presence of the ambient noise level environment. As such, it appropriate to use the alternative methodology of modelling to determine compliance as detailed in Section 7.1.1 of the NPfI.

Figure 2 Residential receiver noise monitoring locations NMT01 to NMT04

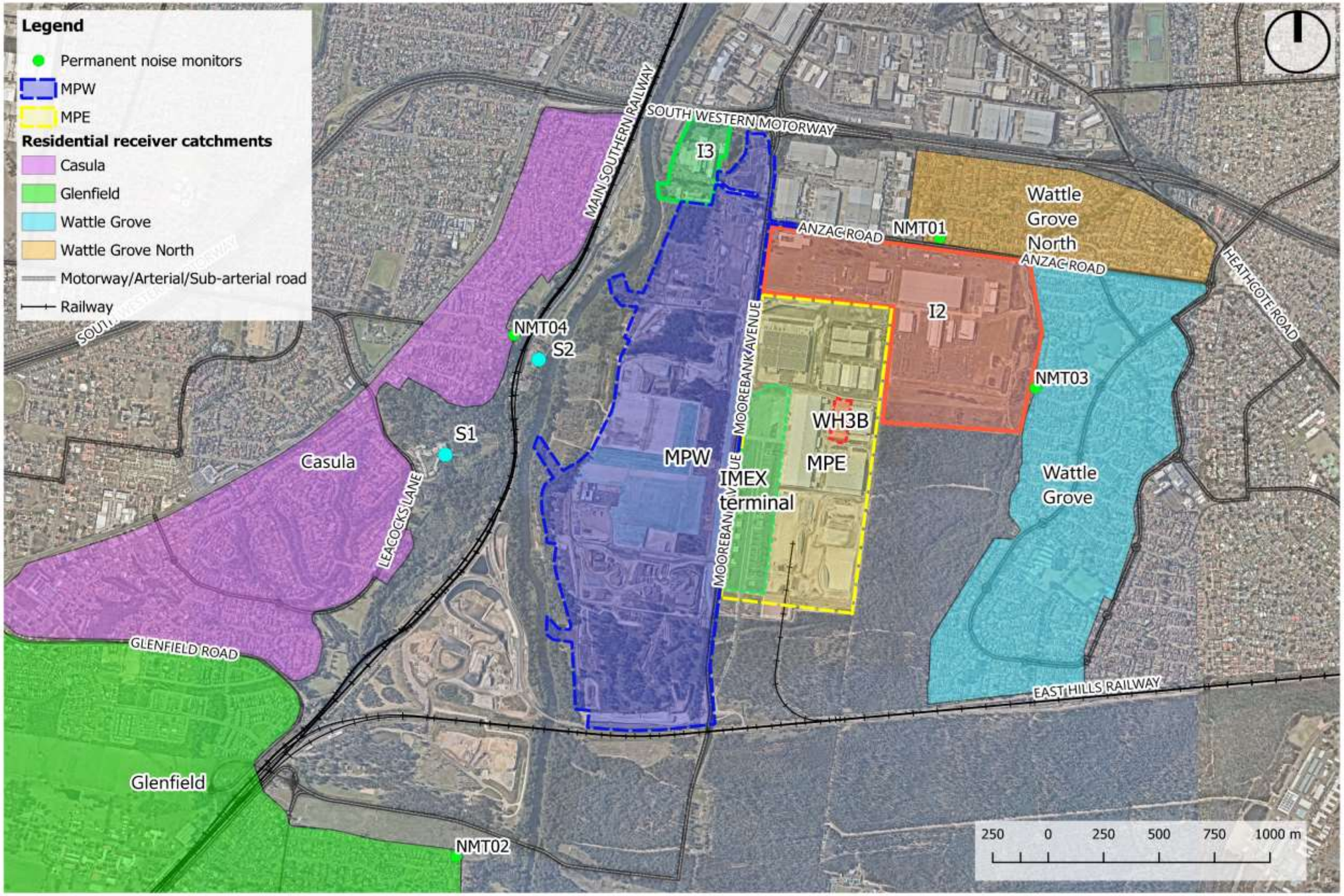


Table 6 Summary of permanent noise monitoring results at the nearest sensitive residential receivers

Measurement period	Measured noise level (15 minute), dB(A)			
	L_{Amax}	L_{A1}	L_{Aeq}	L_{90}
NMT01 (22 Glenelg Court, Wattle Grove)				
4 March 2021 11:00 to 11:15	66	60	54	48
4 March 2021 11:15 to 11:30	67	60	54	50
4 March 2021 11:30 to 11:45	66	61	53	47
4 March 2021 11:45 to 12:00	65	60	55	51
4 March 2021 12:00 to 12:15	74	60	55	50
4 March 2021 12:15 to 12:30	74	62	55	50
4 March 2021 12:30 to 12:45	74	61	55	49
4 March 2021 12:45 to 13:00	66	60	53	47
NMT02 (26 Goodenough Street, Glenfield)				
4 March 2021 11:00 to 13:00	Not available due to maintenance activity			
NMT03 (31 Martindale Court, Wattle Grove)				
4 March 2021 11:00 to 11:15	65	56	49	45
4 March 2021 11:15 to 11:30	76	59	51	45
4 March 2021 11:30 to 11:45	74	56	48	44
4 March 2021 11:45 to 12:00	85	62	57	46
4 March 2021 12:00 to 12:15	63	55	48	45
4 March 2021 12:15 to 12:30	63	56	49	46
4 March 2021 12:30 to 12:45	62	53	48	45
4 March 2021 12:45 to 13:00	64	56	48	45
NMT04 (14 Dunmore Crescent, Casula)				
4 March 2021 11:00 to 11:15	67	63	52	47
4 March 2021 11:15 to 11:30	69	66	55	48
4 March 2021 11:30 to 11:45	68	64	53	50
4 March 2021 11:45 to 12:00	66	63	54	50
4 March 2021 12:00 to 12:15	82	68	57	50
4 March 2021 12:15 to 12:30	75	71	59	50
4 March 2021 12:30 to 12:45	74	63	55	51
4 March 2021 12:45 to 13:00	66	64	54	47

3.3.1 Meteorological conditions

Meteorological conditions for the review period of the permanent noise monitoring station data has been reviewed to ensure they were acceptable in accordance with the NPfI. Data from the MLP meteorological data monitoring station adjacent to Moorebank Avenue, within the MPE site, established in accordance with CoC A54 SSD 7709 has been reviewed. The meteorological conditions experienced during receiver permanent noise monitoring on 4 March 2021 are summarised below:

- During the measurement period at the facility, the equivalent average wind speed was 2 m/s and generally from the NNE. All other measurements were not impacted by excessive wind during any of the measurement periods.
- No rain occurred during any of the measurement periods.
- The temperature during the measurement period ranged between 30˚C and 31˚C, and the cloud conditions were generally clear skies with a few scattered clouds.

3.4 On-site attended operational activity noise measurement results

In order to quantify the noise emissions from on-site activities for the purposes of determining compliance noise levels, attended noise measurements of individual operational items and typical operations were undertaken at WH3B on 2 March, 9 March and 16 March 2021. These noise levels have been used to assist in establishing the source noise levels in the noise model.

During all measurements, the specific noise source being measured was the dominant source. Observations were made of the on-site operations, which have then been reviewed to model 'reasonable' worst-case operational scenarios over the assessment periods. Critical on-site attended measurement results are summarised in Table 7.

The main noise generating activities observed were being undertaken within the warehouse, including forklift operations and noise generated from temporary interior fitout activities. It was understood that the WH3B has not been fully furnished. There are ongoing internal fitout activities which will take place over the next few month during the commencement of operations. However, the type of operations including loading and unloading of products with external and internal forklift operations are not expected to change. As such, the assessed operational scenario is considered conservative.

Table 7 On-site attended noise measurement results

Activity noise sources	Date	Time	Measurement duration (t), sec	Measurement distance (m)	Measured noise levels, dB(A)	
					$L_{Aeq(t)}$	L_{AFmax}
Internal warehouse noise levels (noise breakout)						
Internal noise level at loading dock door (internal sources include electric forklifts, internal fitout activities)	16/3/2021	1:00pm	900	At external roller doors	64	80
Electric Forklift						
Electric forklift 1.5-2 Tonnes, passby[2]	16/3/2021	1:10pm[2]	10	5	58	63
Curtain side trailer truck[1]						
Truck pass-by	3/3/2021	6:00am	10	6	74	78
Truck Idling	3/3/2021	7:00am	60	20	65	67
Mechanical plant						
Office air condenser unit[3]	9/3/2021	12:12pm	40	1	58	58

Note:

1. Attended measurement results for Curtain side trailer trucks were obtained at WH5, as the same type of truck was operated as part of the WH3B activities.
2. Data extracted from the 15-minute internal noise measurement
3. 6 out of 12 condenser units were operating at time of measurement.

3.5 Unattended noise measurements

Unattended noise measurements were undertaken over the period between 2 March and 9 March 2021 at locations adjacent to WH3B on both side of the warehouse. Two main areas of noise-generating operations were identified across the warehouse site, one on the northern side of the warehouse and one on the southern side. The location of the unattended noise loggers is shown in Figure 3. These were selected so that they would capture noise from the main noise-generating areas as part of the typical warehouse operations. A camera unit was setup on the western side boundary fence at WH3B north to assist in gaining a comprehensive understanding of the site operations and vehicle movements.

The purpose of the noise logging at the selected locations was for the following:

- Determine the noise emissions from the facility at a fixed location close enough to quantify on-site sources.
- Determine the long-term background noise levels when operations were not taking place at the site.
- A source for analysis to determine the duration and nature of the different on-site activities through correlation with the Facility activity data.
- Source of validation for the noise model calibration process.

Detailed unattended noise monitoring results are provided in APPENDIX B for 3B North and APPENDIX C for 3B South. The noise model was validated using the unattended noise logger results through comparison against reference activity periods, refer to Section 3.7.3 for noise model calibration.

Figure 3 Unattended noise logger locations and main noise generation areas (imagery: Nearmap, 2021)

3.6 Modelled operational scenarios

3.6.1 Observed operations for modelling

Based upon the on-site attended measurements presented in Section 3.4, the video recording for the facility over the unattended monitoring period presented in Section 3.5, and discussions with WH3B personnel, 'reasonable' worst-case operational assessment scenarios were established and modelled to satisfy the assessment periods under SSD 7628.

The following section details the key observations of each of the noise-generating activities that take place across the warehouse operations.

3.6.1.1 Loading and Unloading operations (WH3B south)

The following data on delivery truck operations was based upon site observations during the attended measurements on 9 March and 16 March 2020, in addition the unattended noise level and audio data during periods when internal truck movement on the hardstand and forklift operations were clearly distinguishable over the period between 2 March and 9 March.

- It was observed on during attended measurements and verified with unattended measurement data, that internal truck movement on the hardstand were typically Curtain Side Trailer Trucks, and that a typical 'in-and-out' cycle time in the facility was on median 20 minutes, with each loading cycle taking approximately 10-15 minutes.

- It was observed during attended noise measurements that the internal truck movements on the hardstand in the WH3B south despatching area move at a relative low speed of approximately 5 km/h.

- No loading and unloading of containers occurred outside of the warehouse on the southside of WH3B.

- Unloading of products from delivery trucks typically would occur within the warehouse with the warehouse doors open. However, due to the current storage capacity of the warehouse prior to the fitout completion, it was observed that a truck would be loaded or unloaded in the external despatch area using an electric forklift.

3.6.1.2 Qube container handling operational area (WH3B north)

- It was observed that one container crane truck would be used to move containers to and from the northern hardstand of the WH3B site boundary, to and from, the MLP terminal area. Using the unattended measurements and concurrent camera during the monitoring it was observed that the container crane truck loading/unloading operations could occur for longer than 15 minutes, and it would operate continuously throughout a 15-minute period when handling containers.

- Impact noise events associated with grabbing and dropping of containers would occur when the container crane truck gripper contacted individual containers as part of handling operations.

- Movements of containers within the WH3B north area can occur at any time throughout the daytime period. It was observed movements typically started from approximately 7:00am. Only three container movements during the monitoring week were observed from the video data, and only one container movement would occur during any one day.

3.6.2 Assessment noise source levels

Source levels for the key noise-generating activities on-site have been established based upon the attended noise measurements (Section 3.4) and unattended noise measurements (Section 3.5) during periods of typical operation. The sound power level inputs presented in Table 8 were used in the operational noise compliance modelling, and adjusted for the duration and frequency of operations (Section 3.6.3).

Table 8 Assessment noise source levels

Site items / operation	Individual activity sound power level (SWL) (L_{Aeq}), dB(A)
WH3B North	
Container Crane Trucks (slow speed manoeuvring within the site boundary)	99
Container movement noise events (L_{AFmax})	107
Container movement noise events (L_{Aeq})[4]	79 $L_{Aeq.15min}$
WH3B South	
Curtain Side Trailer Truck moving with speed less than 20km/h	102
Air brake release (L_{AFmax})	117
Air brake release (L_{Aeq})[4]	78 $L_{Aeq.15min}$
Internal noise breakout	
Internal activities noise[1]	62 $L_{Aeq.15min}$ internal sound pressure level
External roller doors	64 $L_{Aeq.15min}$ internal sound pressure level[3]
Mechanical Plant	
Air condenser unit[2]	70
Other noise sources	
Curtain Side Trailer Truck moving on internal roads within MLP, outside of the WH3B site (typical speed on internal roads of 20 km/h)	102

Notes:

1. Attended measurement shows breakout via WH3B South loading dock door during loading and unloading operations Internal noise levels included internal noise intensive periods when Electric forklifts and general tools were in use.
2. Air condenser units are located on the east façades of the warehouse.
3. Internal noise levels controlled by forklift and internal fitout operations within the warehouse
4. Based upon a 2 second measurement

3.6.3 Reasonable worst-case intrusiveness scenarios (15-minute period)

As the noise limits in CoC B80 are set at 35 dB(A) $L_{Aeq\ 15\ minute}$ for the day, evening and night periods, specific separation of noise intensive periods for each of these time periods has not been undertaken. Instead, it is noted that there are two main areas of noise generation as part of typical warehouse operations, as presented in Figure 3.

In order to assess the operational noise emissions from the warehouse, the 'reasonable' worst-case operations for each of the two main areas of noise generation have been developed, along with the corresponding activities in the other noise-generating areas, in order to review a representative

snapshot of activities from the warehouse operations. Each of the assessment scenarios have been developed from an analysis of the video movement data or attended on-site observations over during the one-week period, in addition to the information detailed in Section 3.6.1. It is noted that the peak periods of noise generating activities for each of the two main areas (northern side of the warehouse and southern side of the warehouse) did not occur concurrently.

A representative scenario has been established to assess a 'reasonable' worst-case scenario for the northern side of the warehouse, which is the WH3B north. A total of three container movements were observed on the video data to occur over the period of one week. The duration of each container delivery operation was approximately 15 minutes or less. During the periods when containers where being moved within WH3B north (Qube container operation area), warehouse roller doors remained closed on the north side of WH3B.

The WH3B south activities were observed to commence from 7:00am, with a peak period of noise intensive activities around the 9:00am to 1:00pm.

Periods representing the 'reasonable' worst-case operations, for each the northern side of the warehouse and southern side of the warehouse, based upon these peak periods of noise intensive activities have been used to assess operational noise emissions. Table 9 details the two 'reasonable' worst-case scenarios (15-minute period), covering the noise intensive periods for the two main areas of noise generation across the site.

As required by CoC B85, all significant noise-generating equipment has been included the assessment modelling, including the key noise-generating mechanical plant. It is noted that the noise contribution from the mechanical plant items serving the office area are included in the modelling, however, they generate minimal contribution to the overall noise levels from site operations, which are controlled by other on-site activities such as truck departures, arrivals and warehouse internal loading and unloading activities. The roof mounted smoke ventilation fans were observed not to be in operation during typically activities onsite.

No onsite noise generating activities were observed during the night period (10:00pm to 7:00am). As such, sources of potential sleep disturbance have not been modelled.

Table 9 Representative 'reasonable' worst-case 15-minute intrusive assessment scenarios

Activity	WH3B North 15-minute assessment period (Qube container area)	WH3B South 15-minute assessment period
WH3B North 15-minute noise intensive period (with container handling taking place)		
Departure	One container crane truck departure from Qube area loaded with 1 container.	No activity
Arrival	One container crane truck arrival at WH3B north (Qube container operational area) loaded with 1 container.	No activity
On-site operations	Container operations: a) Placing one container down b) Removing one empty container from dock 1 on to the container crane truck. All loading activity are occurring inside the warehouse with warehouse doors closed.	*Noise breakout via open warehouse doors.* All loading activity are occurring inside the warehouse with warehouse doors open, two noise generating activities occurring concurrently. a) Forklift movements b) Internal fit out
WH3B South 15-minute noise intensive period		
Departure	No activity	No activity
Arrival	No activity	One Curtain Side Trailer Truck arrives, moves through hardstand area, then turns engine off after parking.
On-site operations	No activity	*Noise breakout via open warehouse doors.* All loading activity is occurring inside the warehouse with warehouse doors open, one noise generating activity occurring at the time. a) Forklift movements
Mechanical plant (All scenarios)		
Warehouse office air conditioning condenser (6 out of 12 units operating)		

3.7 Modelling methodology

3.7.1 Overview of noise modelling

Since ambient noise levels were well above the project noise limit at the nearest residential receivers, and it was not possible to directly measure or estimate the warehouse noise contribution directly, computer noise modelling was used to calculate the operational noise levels from warehouse operations at the nearby noise sensitive receivers.

3.7.2 General modelling assumptions

Modelling and assessment of warehouse noise emissions were determined by modelling the noise sources, receiver locations, existing built structures and topographical features, using CadnaA (version 2020).

The modelling incorporated the worst-case prevailing meteorological conditions, as required by CoC B80, which are wind speeds of up to 3 m/s at 10 metres above ground level for the assessed activities for daytime activities.

The noise predictions are based on the CONCAWE noise prediction algorithms, noting that the nearby noise sensitive receivers are greater 100 metres from the subject site. The CONCAWE environmental noise prediction method is an appropriate method for predicting noise propagation in these circumstances.

The noise prediction model considers:

- Location of noise sources on-site sensitive receiver locations
- Height of noise sources and receivers referenced to digital ground contours within the site and outside the site area
- Noise source levels of individual plant, equipment and internal building noise levels, modelled as either point, line or area noise sources. All noise sources associated with the WH3B operations within the MPE boundary have been included in the noise modelling, including the truck movements outside of the WH3B footprint, along internal MPE roads.
- Separation distances between sources and receivers
- Ground type between sources and receivers (mixed soft/ hard)
- Attenuation from buildings and built structures and topography (natural and purpose built)
- Atmospheric losses and assessment meteorological conditions.

The modelled activities and assumptions for the to the equipment operating and the duration and frequency of operation as part of the 'reasonable' worst-case operational scenarios are described in Section 3.6.3.

3.7.3 Model validation

Following the development of each of the representative modelling scenarios, the noise model outputs were compared against a reference time period of the onsite unattended noise measurement results for the period during which similar activities to the reasonable' worst-case operational scenario were taking place. Validation of the reasonable worst-case on-site activities was undertaken to check the final representative modelling inputs against a period of measured activities. The results of this process are presented in Table 10.

Table 10 Comparison between measured and modelled noise levels

Time period	Logger	Measured noise levels LAeq,15minute (dBA)	Predicted noise levels LAeq,15minute (dBA)	Difference, dB
8:50 am to 9:05 am 4 March 2021[1]	WH3B North	71	69	2
12:00 am to 12:15 am 4 March 2021[2]	WH3B South	59	60	1

Notes:
1. Noise generating activities within the facility were as per Table 9*"3B North 15-minute noise intensive period (With container handling taking place)"*
2. Noise generating activities within the facility were as per Table 9 *"3B South 15-minute noise intensive period"*

The differences between the modelled and the measured noise levels are the result of the following:

- Noise levels at the logger location are dependent upon the specific location of loading activities and which internal loading dock is being used by Curtain Side Trailer Trucks at WH3B South.

- Differences in modelled levels compared with measured noise levels from the noise breakout from internal warehouse activities will depend upon the specific duration and operating times of noise intensive plant/equipment associated with internal loading activities.

- For WH3B south, noise contribution from vehicle movements, which varied in duration, speed and location compared to the logger location throughout the activity, which would result in minor differences in measured noise levels.

The results from the validation of the model demonstrate that it is suitable for determining the compliance noise levels at the nearby receivers for this assessment.

3.8 Noise compliance assessment

Predicted operational compliance noise levels are presented in Table 11 for each of the two compliance assessment scenarios. The noise levels have been predicted to each of the surrounding residential receiver noise catchments, and the highest residential receiver noise level in each catchment area is the reported level in Table 11. It should be noted that this is not necessarily the same receiver location for each assessment scenario.

These noise levels represent the reasonable worst-case intrusiveness operational scenarios (15-minute period) from typical operations of the warehouse. The results in Table 11 and Table 12 show that the predicted noise levels for the $L_{Aeq\ (15\text{-}minute)}$ assessments comply with the overall operational noise limits presented in Table 2.

As the noise levels from the site operations are not audible at the nearby noise sensitive receivers, the noise levels would not be perceived as particularly annoying at the nearby receiver locations as per the NPfI (ie. if the resulting noise level at a receiver location is tonal, low frequency or is intermittent at night). As such, no adjustments in accordance with Fact Sheet C of the NPfI are required.

As no activities typically take place during the night period (10:00pm to 7:00am) when the $L_{A1\ (1\text{-}minute)}$ noise limits presented in Table 2 are applicable. As such no direct assessment has been undertaken as the warehouse operations then satisfy this noise limit.

Table 11 Predicted noise levels - Reasonable 15-minute worst-case scenarios for WH3B north

Noise catchment area/ receiver location	$L_{Aeq\ (15\text{-}minute)}$		Compliance
	Noise limits	Predicted noise levels	
Wattle Grove (NCA 1)	35	28	Yes
Wattle Grove North (NCA 2)	35	<20	Yes
Casula (NCA 3)	35	23	Yes
Glenfield (NCA 4)	35	<20	Yes
All Saints Senior College (S1)	45[1]	<20	Yes
Casula Powerhouse (S2)	45[1]	<20	Yes
Defence Joint Logistics Unit (DJLU) (I2)	70[1]	27	Yes
ABB (I3)	70[1]	<20	Yes

Notes: 1. Noise limits for these receivers are only applicable when the receiver is in use

Table 12 Predicted noise levels - Reasonable 15-minute worst-case scenarios for WH3B south

Noise catchment area/ receiver location	$L_{Aeq\ (15\text{-}minute)}$		Compliance
	Noise limits	Predicted noise levels	
Wattle Grove (NCA 1)	35	21	Yes
Wattle Grove North (NCA 2)	35	<20	Yes
Casula (NCA 3)	35	<20	Yes
Glenfield (NCA 4)	35	<20	Yes
All Saints Senior College (S1)	45[1]	<20	Yes
Casula Powerhouse (S2)	45[1]	<20	Yes
Defence Joint Logistics Unit (DJLU) (I2)	70[1]	25	Yes
ABB (I3)	70[1]	<20	Yes

Notes: 1. Noise limits for these receivers are only applicable when the receiver is in use

The highest modelled noise levels at nearby residential receivers for the WH3B South 15-minute noise intensive period is predicted to be 21 dB(A) $L_{Aeq.15minute}$ at Wattle Grove. For WH3B north, the highest modelled noise level at nearby residential receivers from container unloading activities is predicted to be 28 dB(A) $L_{Aeq.15minute}$ at Wattle Grove (NCA 1).

The noise levels from the two noise generation areas have not been directly combined as part of the assessment, as they did not occur concurrently. The video data showed that container deliveries to WH3B north only occurred three times within the monitoring period, each of 15 minutes or less. As such, this would not be considered a typical operation. As such, the modelled noise levels for the 'reasonable' worst case WH3B North 15-minute noise assessment period will only occur occasionally. It is expected from current operations that peak activities at WH3B north and WH3B south is unlikely to occur, however, in the case that this were to occur the resulting noise levels at Wattle Grove (NCA 1) would only increase by 1 dB(A) to be 29 dB(A) $L_{Aeq.15minute}$.

4 Conclusion

The noise assessment has been undertaken to address the operational noise requirements for the WH3B within the Moorebank Precent East in accordance with the *Operational Noise and Vibration Management Plan, Moorebank Logistics Park – East Precinct* (dated 27 March 2019, Revision 12) (MPE ONVMP), more specifically to address the requirements of Condition of Consent (CoC) B85 in State Significant Development (SSD) 7628.

A review of noise measurements at the nearest residential receivers during period of peak onsite activities determined that site activities were not audible and distinguishable at nearby receivers because of high ambient noise levels from road traffic, rail traffic and construction noise. For this reason, guidance from the NSW EPA Noise Policy for Industry (NPfI) Chapter 7 has been followed in order to use an alternative approach to determine compliance, and compare the site noise emissions with the noise limits.

A combination of on-site and off-site measurements were performed, between 2 March and 9 March 2021. The aim of the measurements was to quantify on-site operational noise levels from the WH3B facility, in order to then predict back to the nearby receivers. Using this approach, noise emissions from the warehouse facility operations have been evaluated using a combination of on-site attended and unattended noise monitoring, combined with noise modelling, to predict the operational noise levels at the nearest sensitive receivers.

Two 'reasonable' worst-case assessment scenarios were established based upon on site unattended noise monitoring and video recordings, in addition to discussions with WH3B personnel and observations made during on-site attended noise measurements. These were used to develop the current 'reasonable' worst case noise intensive periods that occur onsite. These were separated into two main areas of activities, one on the northern side of the warehouse and one on the southern side.

As required by CoC B85, all significant noise-generating equipment was included the assessment modelling, including the key noise-generating mechanical plant. The noise contribution from the mechanical plant items serving the warehouse and office area generate minimal contribution to the overall noise levels from site operations, which are generally controlled by other on-site activities such as truck departures, arrivals and internal warehouse loading and unloading activities.

The model was developed, and validated against the on-site unattended noise monitoring data, during periods with similar operational activities. Using the calibrated noise model, noise levels were predicted to all nearby noise sensitive receiver locations, including the residential receivers in the suburbs of Casula, Glenfield, Wattle Grove and Wattle Grove North. Noise levels were assessed assuming the worst-case prevailing meteorological conditions were present, as required by CoC B80.

The outcome of the compliance noise monitoring and modelling demonstrated that the mechanical plant and other noisy equipment that operate as part of the WH3B operations achieve the noise limits presented SSD 7628 CoC B80.

APPENDIX A Glossary of terminology

The following is a brief description of the technical terms used to describe noise to assist in understanding the technical issues presented.

Adverse weather	Weather effects that enhance noise (that is, wind and temperature inversions) that occur at a site for a significant period of time (that is, wind occurring more than 30% of the time in any assessment period in any season and/or temperature inversions occurring more than 30% of the nights in winter).
Ambient noise	The all-encompassing noise associated within a given environment at a given time, usually composed of sound from all sources near and far.
Assessment period	The period in a day over which assessments are made.
Assessment Point	A point at which noise measurements are taken or estimated. A point at which noise measurements are taken or estimated.
Background noise	Background noise is the term used to describe the underlying level of noise present in the ambient noise, measured in the absence of the noise under investigation, when extraneous noise is removed. It is described as the average of the minimum noise levels measured on a sound level meter and is measured statistically as the A-weighted noise level exceeded for ninety percent of a sample period. This is represented as the L90 noise level (see below).
Decibel [dB]	The units that sound is measured in. The following are examples of the decibel readings of common sounds in our daytime environment:

threshold of hearing	0 dB	The faintest sound we can hear
	10 dB	Human breathing
almost silent	20 dB	
	30 dB	Quiet bedroom or in a quiet national park location
generally quiet	40 dB	Library
	50 dB	Typical office space or ambience in the city at night
moderately loud	60 dB	CBD mall at lunch time
	70 dB	The sound of a car passing on the street
loud	80 dB	Loud music played at home
	90 dB	The sound of a truck passing on the street
very loud	100 dB	Indoor rock band concert
	110 dB	Operating a chainsaw or jackhammer
extremely loud	120 dB	Jet plane take-off at 100m away
threshold of pain	130 dB	
	140 dB	Military jet take-off at 25m away

dB(A)	A-weighted decibels. The A- weighting noise filter simulates the response of the human ear at relatively low levels, where the ear is not as effective in hearing low frequency sounds as it is in 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.
dB(C)	C-weighted decibels. The C-weighting noise filter simulates the response of the human ear at relatively high levels, where the human ear is nearly equally effective at hearing from mid-low frequency (63Hz) to mid-high frequency (4kHz), but is less effective outside these frequencies.

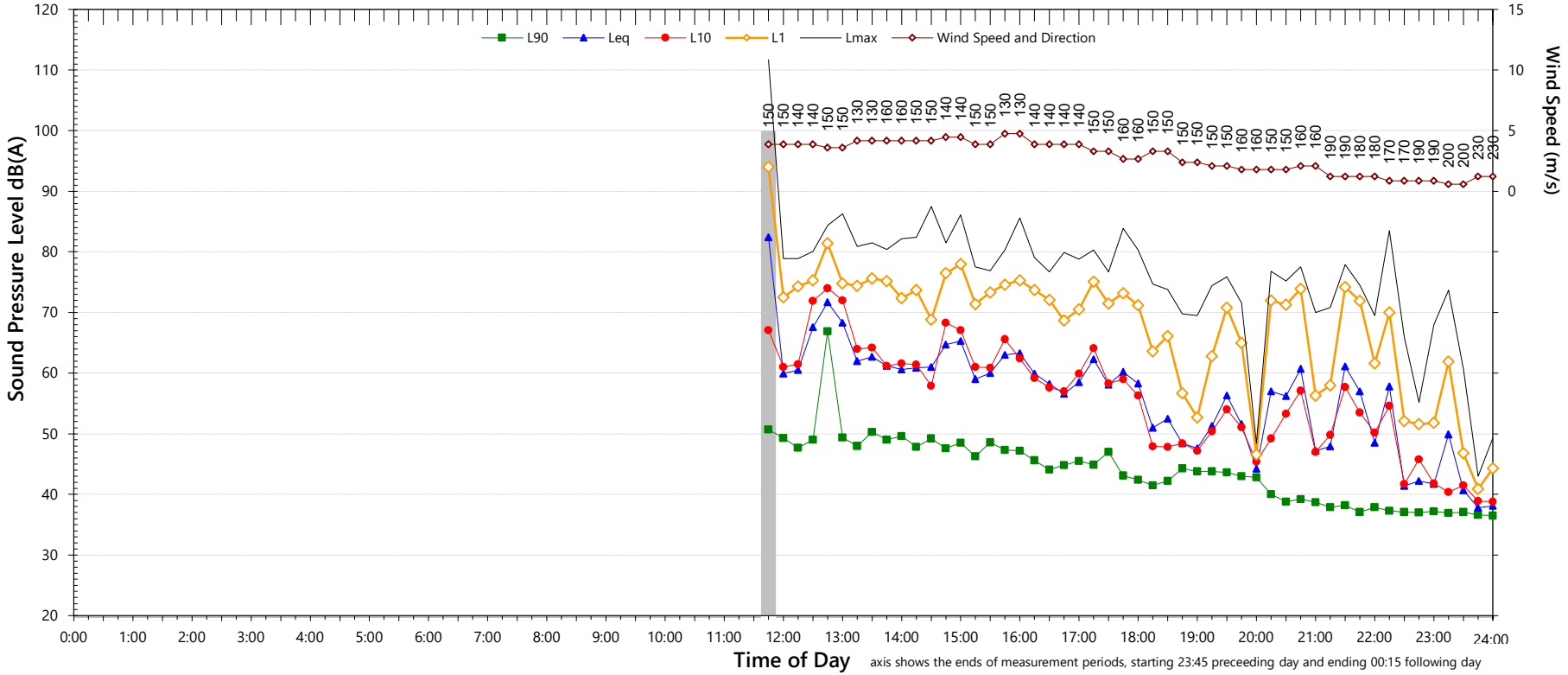
Frequency	Frequency is synonymous to pitch. Sounds have a pitch which is peculiar to the nature of the sound generator. For example, the sound of a tiny bell has a high pitch and the sound of a bass drum has a low pitch. Frequency or pitch can be measured on a scale in units of Hertz or Hz.
Impulsive noise	Having a high peak of short duration or a sequence of such peaks. A sequence of impulses in rapid succession is termed repetitive impulsive noise.
Intermittent noise	The level suddenly drops to that of the background noise several times during the period of observation. The time during which the noise remains at levels different from that of the ambient is one second or more.
L_{Max}	The maximum sound pressure level measured over a given period.
L_{Min}	The minimum sound pressure level measured over a given period.
L_1	The sound pressure level that is exceeded for 1% of the time for which the given sound is measured.
L_{10}	The sound pressure level that is exceeded for 10% of the time for which the given sound is measured.
L_{90}	The level of noise exceeded for 90% of the time. The bottom 10% of the sample is the L90 noise level expressed in units of dB(A).
L_{eq}	The "equivalent noise level" is the summation of noise events and integrated over a selected period of time.
Reflection	Sound wave changed in direction of propagation due to a solid object obscuring its path.
SEL	Sound Exposure Level (SEL) is the constant sound level which, if maintained for a period of 1 second would have the same acoustic energy as the measured noise event. SEL noise measurements are useful as they can be converted to obtain Leq sound levels over any period of time and can be used for predicting noise at various locations.
Sound	A fluctuation of air pressure which is propagated as a wave through air.
Sound absorption	The ability of a material to absorb sound energy through its conversion into thermal energy.
Sound level meter	An instrument consisting of a microphone, amplifier and indicating device, having a declared performance and designed to measure sound pressure levels.
Sound pressure level	The level of noise, usually expressed in decibels, as measured by a standard sound level meter with a microphone.
Sound power level	Ten times the logarithm to the base 10 of the ratio of the sound power of the source to the reference sound power.
Tonal noise	Containing a prominent frequency and characterised by a definite pitch.

APPENDIX B Logger location 1 – WH3B - North side

Unattended Noise Monitoring Results

WH3B - North

Tuesday, 2 March 2021



NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{90}	-	38	32
LAeq	-	55	53

Night Time Maximum Noise Levels			(see note 7)
L_{Max} (Range)	69	to	84
L_{Max} - L_{eq} (Range)	21	to	31

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{eq\ 15\ hr}$ and $L_{eq\ 9\ hr}$	64	55
$L_{eq\ 1hr}$ upper 10 percentile	66	58
$L_{eq\ 1hr}$ lower 10 percentile	55	46

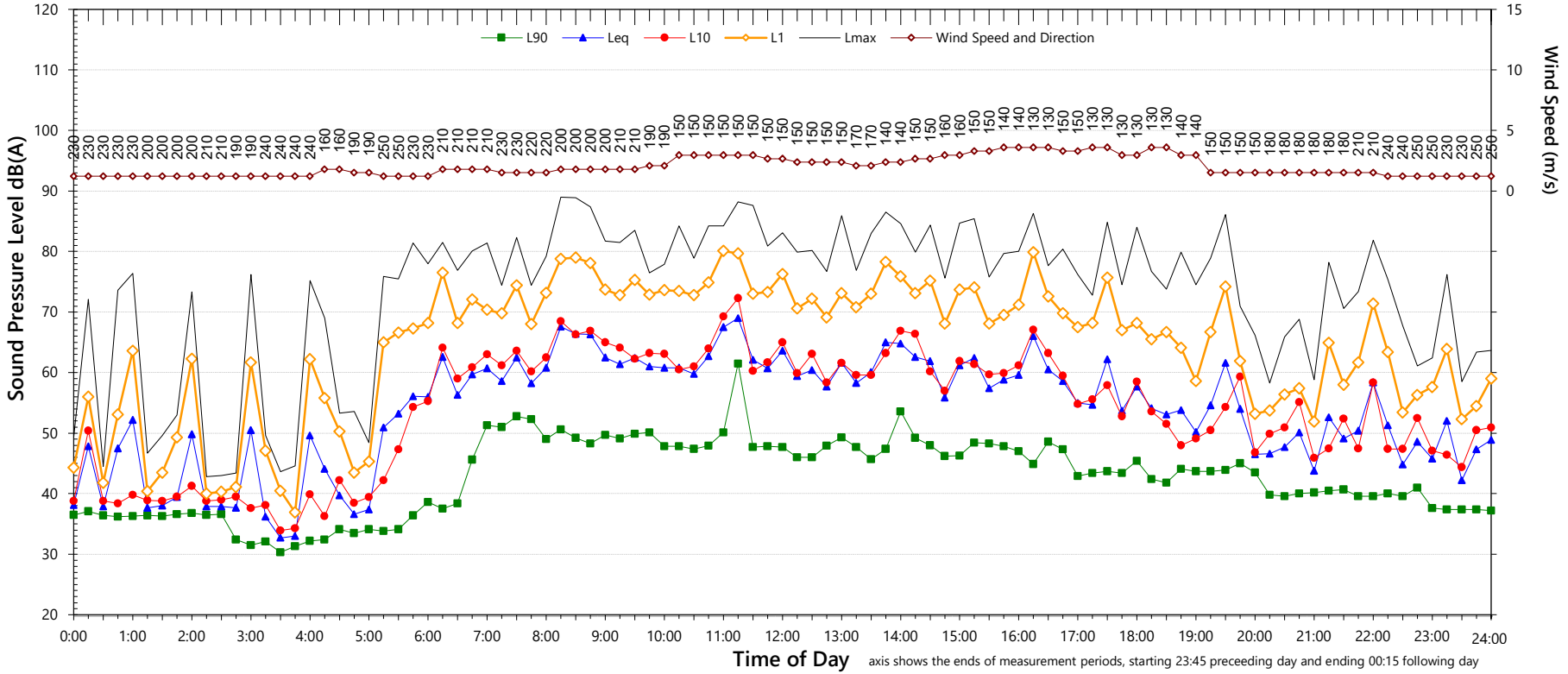
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am til 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. Night time L_{Max} values are shown only where L_{Max} >65dB(A) and where L_{Max}- Leq ≥15dB(A)

Unattended Noise Monitoring Results

WH3B - North

Wednesday, 3 March 2021



NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{90}	45	40	35
LAeq	63	54	58

Night Time Maximum Noise Levels			(see note 7)
L_{Max} (Range)	74	to	89
L_{Max} - L_{eq} (Range)	15	to	30

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{eq\ 15\ hr}$ and $L_{eq\ 9\ hr}$	64	60
$L_{eq\ 1hr}$ upper 10 percentile	67	65
$L_{eq\ 1hr}$ lower 10 percentile	56	47

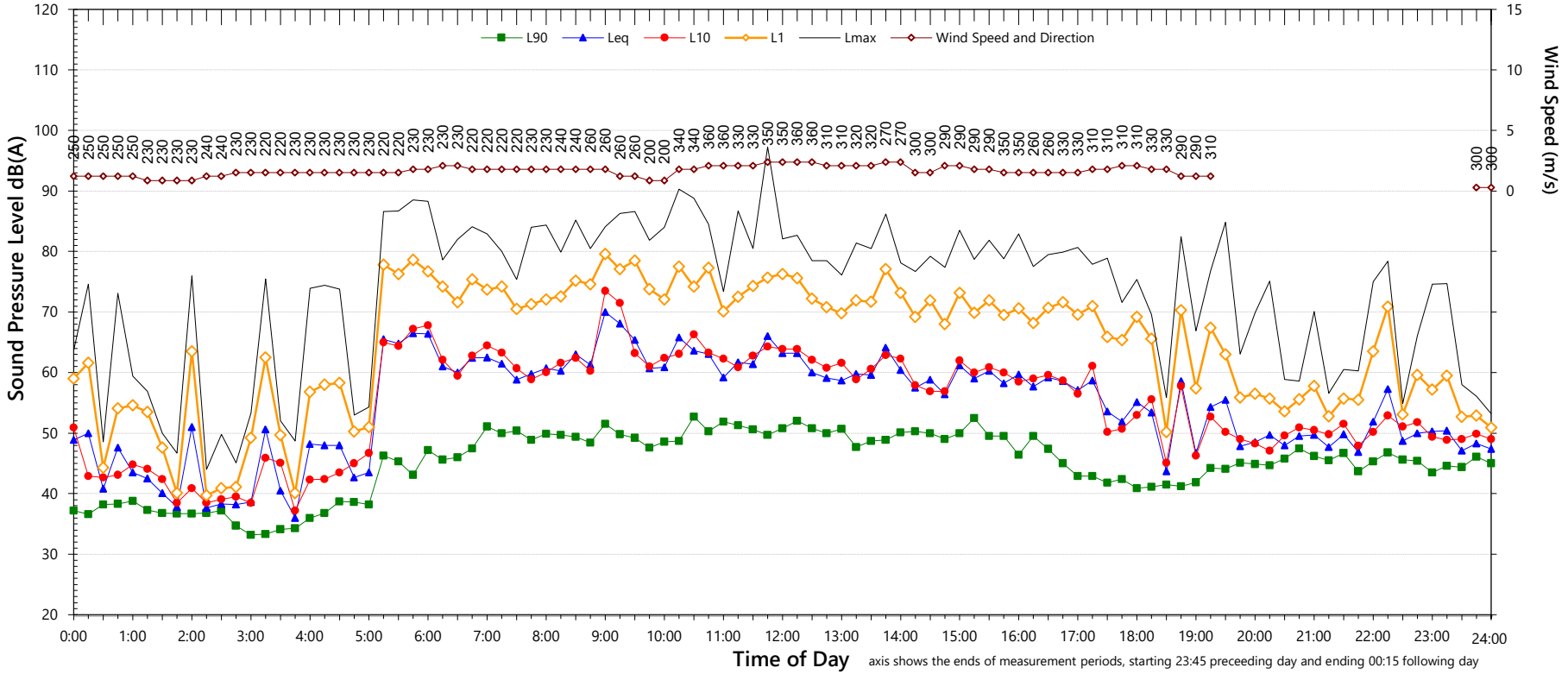
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am til 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. Night time L_{Max} values are shown only where L_{Max} >65dB(A) and where L_{Max}- Leq ≥15dB(A)

Unattended Noise Monitoring Results

WH3B - North

Thursday, 4 March 2021



NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{90}	44	41	40
LAeq	62	52	54

Night Time Maximum Noise Levels			(see note 7)
L_{Max} (Range)	71	to	81
L_{Max} - L_{eq} (Range)	21	to	28

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{eq\ 15\ hr}$ and $L_{eq\ 9\ hr}$	63	56
$L_{eq\ 1hr}$ upper 10 percentile	67	60
$L_{eq\ 1hr}$ lower 10 percentile	53	49

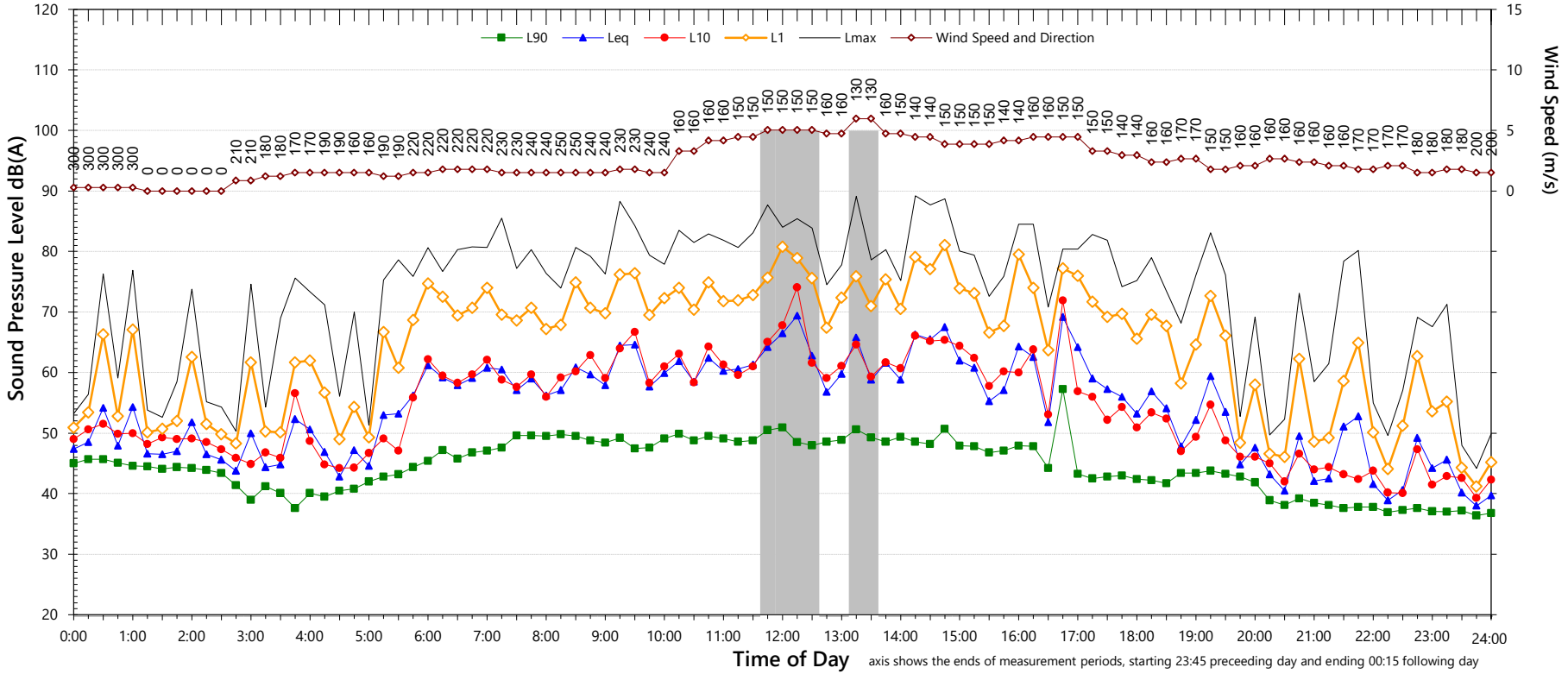
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am til 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. Night time L_{Max} values are shown only where L_{Max} >65dB(A) and where L_{Max}- Leq ≥15dB(A)

Unattended Noise Monitoring Results

WH3B - North

Friday, 5 March 2021



NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{90}	43	38	29
LAeq	62	52	54

Night Time Maximum Noise Levels			(see note 7)
L_{Max} (Range)	67	to	92
L_{Max} - L_{eq} (Range)	24	to	32

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{eq\ 15\ hr}$ and $L_{eq\ 9\ hr}$	63	57
$L_{eq\ 1hr}$ upper 10 percentile	67	60
$L_{eq\ 1hr}$ lower 10 percentile	54	44

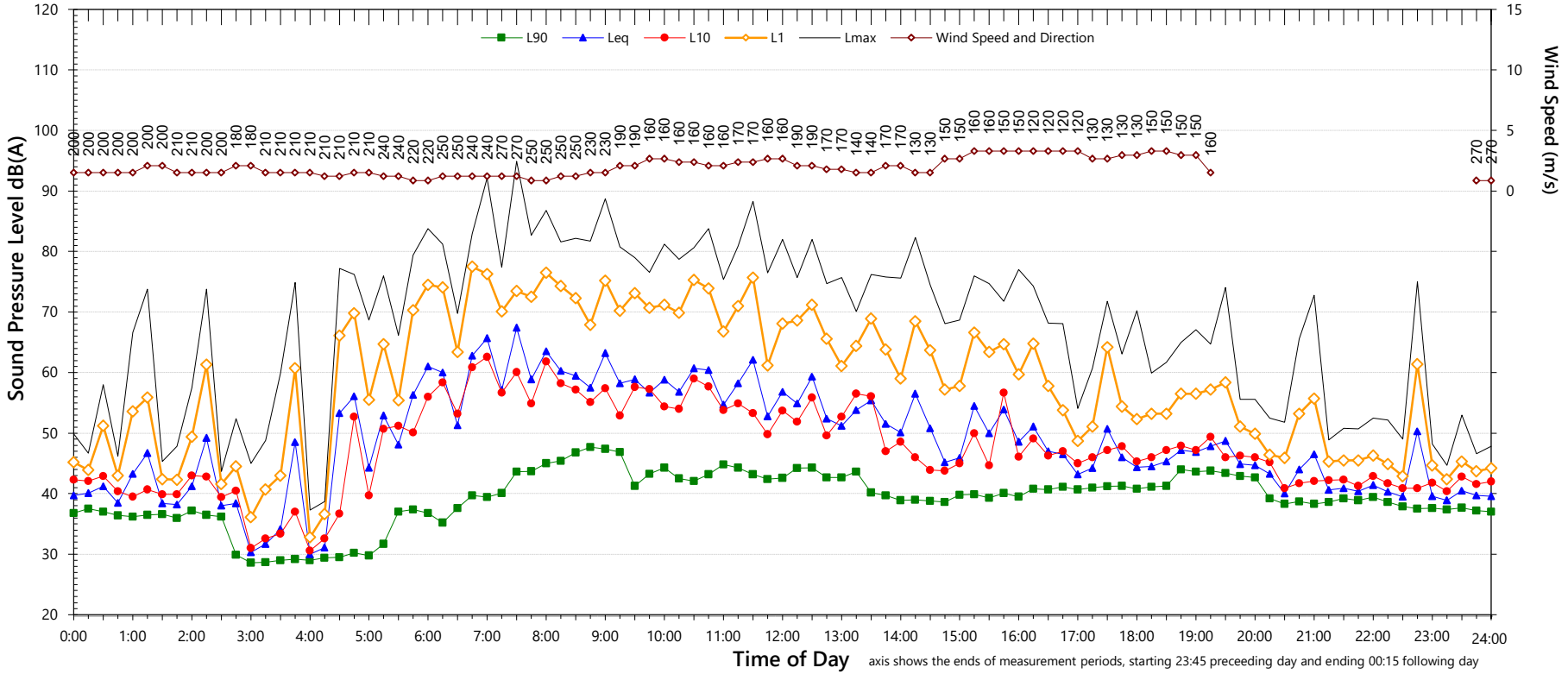
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am til 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. Night time L_{Max} values are shown only where L_{Max} >65dB(A) and where L_{Max}- Leq ≥15dB(A)

Unattended Noise Monitoring Results

WH3B - North

Saturday, 6 March 2021



NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{90}	39	38	32
LAeq	58	45	45

Night Time Maximum Noise Levels			(see note 7)
L_{Max} (Range)	68	to	84
L_{Max} - L_{eq} (Range)	16	to	33

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{eq\ 15\ hr}$ and $L_{eq\ 9\ hr}$	59	48
$L_{eq\ 1hr}$ upper 10 percentile	62	51
$L_{eq\ 1hr}$ lower 10 percentile	47	42

Notes:

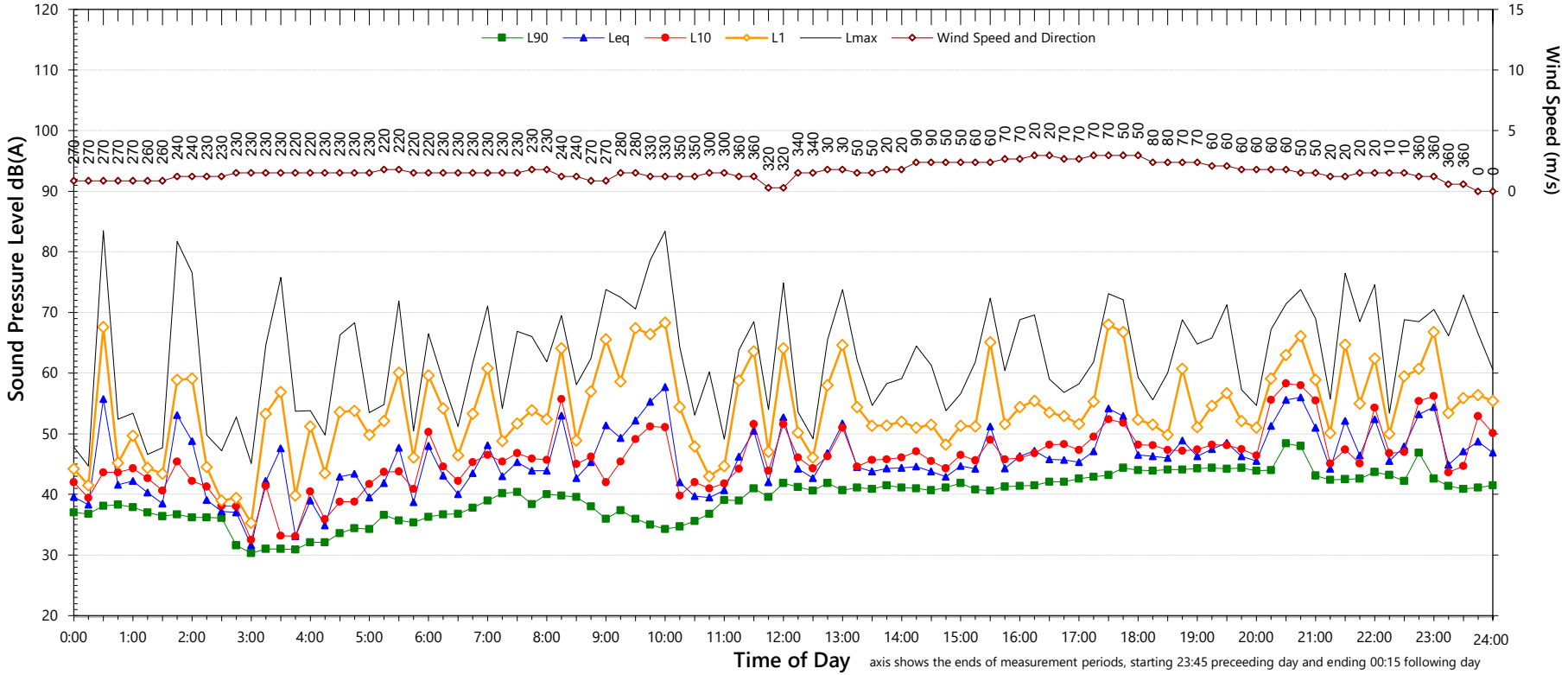
1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am til 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. Night time L_{Max} values are shown only where L_{Max} >65dB(A) and where L_{Max}- Leq ≥15dB(A)

Data File: 2021-03-02_SLM_000_123_Rpt_Report.txt WH3B QTE-26 Logger Graphs Program (r34)

Unattended Noise Monitoring Results

WH3B - North

Sunday, 7 March 2021



NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{90}	36	43	40
LAeq	49	51	53

Night Time Maximum Noise Levels			(see note 7)
L_{Max} (Range)	71	to	84
L_{Max} - L_{eq} (Range)	19	to	30

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{eq\ 15\ hr}$ and $L_{eq\ 9\ hr}$	52	56
$L_{eq\ 1hr}$ upper 10 percentile	56	59
$L_{eq\ 1hr}$ lower 10 percentile	47	47

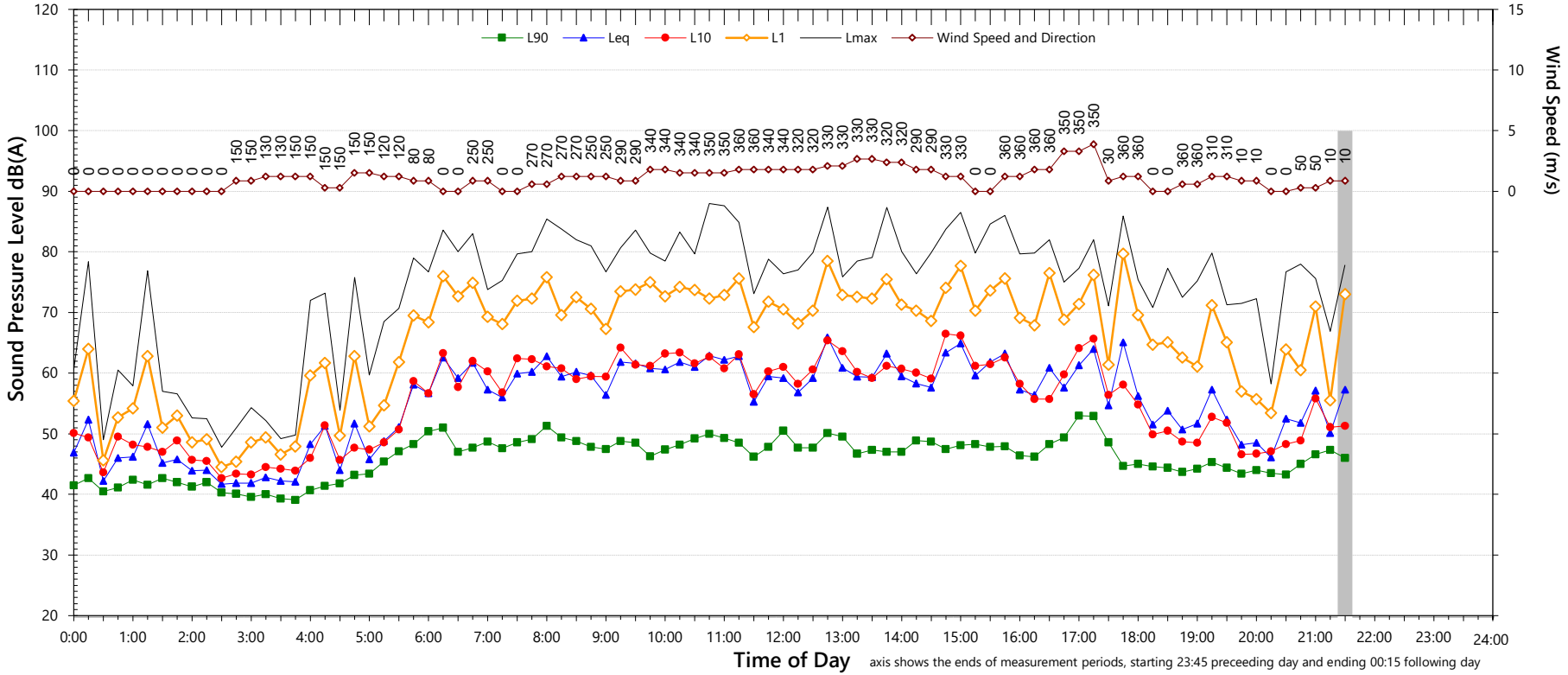
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am til 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. Night time L_{Max} values are shown only where L_{Max} >65dB(A) and where L_{Max}- Leq ≥15dB(A)

Unattended Noise Monitoring Results

WH3B - North

Monday, 8 March 2021



NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{90}	46	-	-
LAeq	61	-	-

Night Time Maximum Noise Levels			(see note 7)
L_{Max} (Range)	-	to	-
L_{Max} - L_{eq} (Range)	-	to	-

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{eq\ 15\ hr}$ and $L_{eq\ 9\ hr}$	63	-
$L_{eq\ 1hr}$ upper 10 percentile	65	-
$L_{eq\ 1hr}$ lower 10 percentile	55	-

Notes:

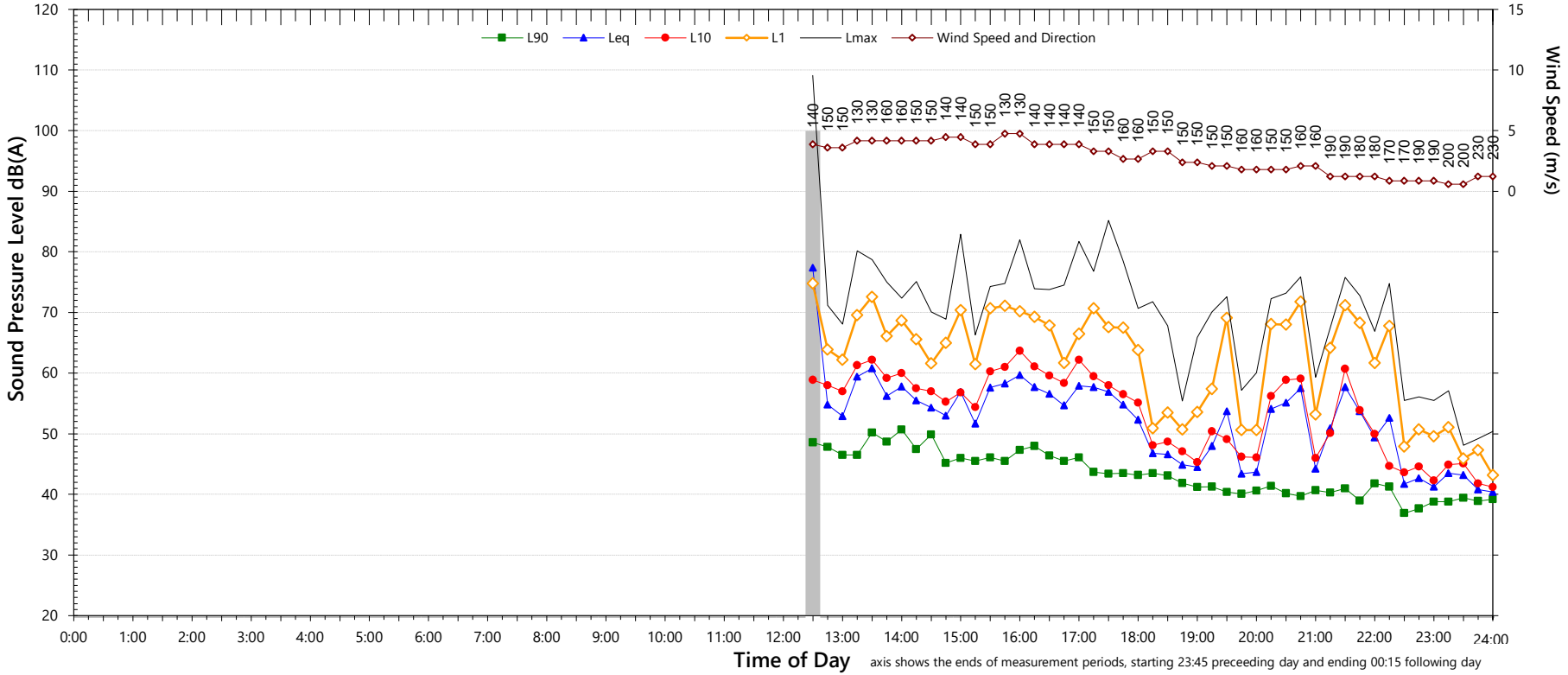
1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am til 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. Night time L_{Max} values are shown only where L_{Max} >65dB(A) and where L_{Max}- Leq ≥15dB(A)

APPENDIX C Logger location 2 – WH3B – South side

Unattended Noise Monitoring Results

WH3B - South

Tuesday, 2 March 2021



NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{90}	-	40	32
LAeq	-	52	48

Night Time Maximum Noise Levels			(see note 7)
L_{Max} (Range)	73	to	75
L_{Max} - L_{eq} (Range)	20	to	27

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{eq\ 15\ hr}$ and $L_{eq\ 9\ hr}$	58	50
$L_{eq\ 1hr}$ upper 10 percentile	60	55
$L_{eq\ 1hr}$ lower 10 percentile	51	39

Notes:

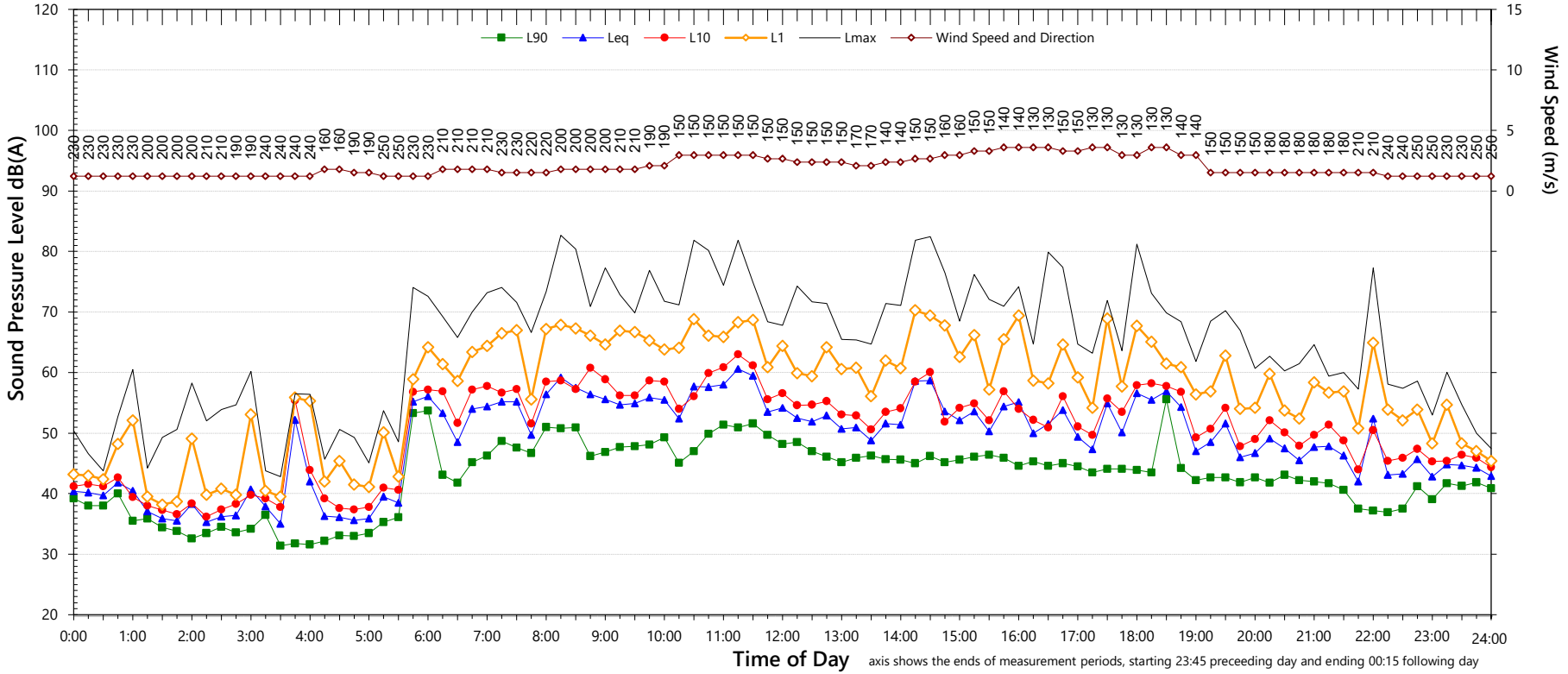
1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am til 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. Night time L_{Max} values are shown only where L_{Max} >65dB(A) and where L_{Max}- Leq ≥15dB(A)

Data File: 2021-03-02_SLM_000_123_Rpt_Report.txt WH3B_Front(r0) QTE-26 Logger Graphs Program (r34)

Unattended Noise Monitoring Results

WH3B - South

Wednesday, 3 March 2021



NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{90}	45	39	35
LAeq	55	51	50

Night Time Maximum Noise Levels			(see note 7)
L_{Max} (Range)	75	to	86
L_{Max} - L_{eq} (Range)	16	to	29

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{eq\ 15\ hr}$ and $L_{eq\ 9\ hr}$	57	52
$L_{eq\ 1hr}$ upper 10 percentile	60	56
$L_{eq\ 1hr}$ lower 10 percentile	51	42

Notes:

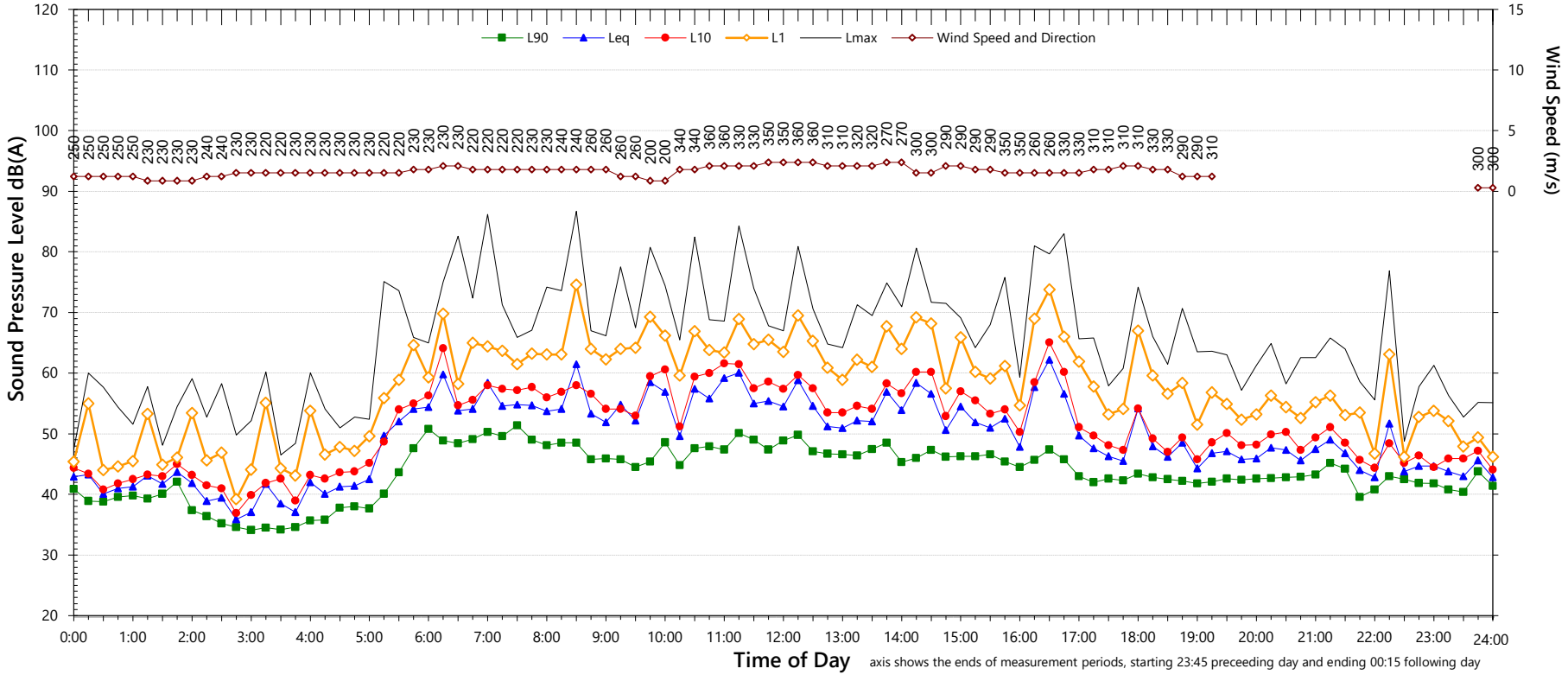
1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am til 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. Night time L_{Max} values are shown only where L_{Max} >65dB(A) and where L_{Max}- Leq ≥15dB(A)

Data File: 2021-03-02_SLM_000_123_Rpt_Report.txt WH3B_Front(r0) QTE-26 Logger Graphs Program (r34)

Unattended Noise Monitoring Results

WH3B - South

Thursday, 4 March 2021



NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{90}	44	41	39
LAeq	56	47	48

Night Time Maximum Noise Levels			(see note 7)
L_{Max} (Range)	72	to	77
L_{Max} - L_{eq} (Range)	16	to	29

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{eq\ 15\ hr}$ and $L_{eq\ 9\ hr}$	57	51
$L_{eq\ 1hr}$ upper 10 percentile	60	55
$L_{eq\ 1hr}$ lower 10 percentile	49	44

Notes:

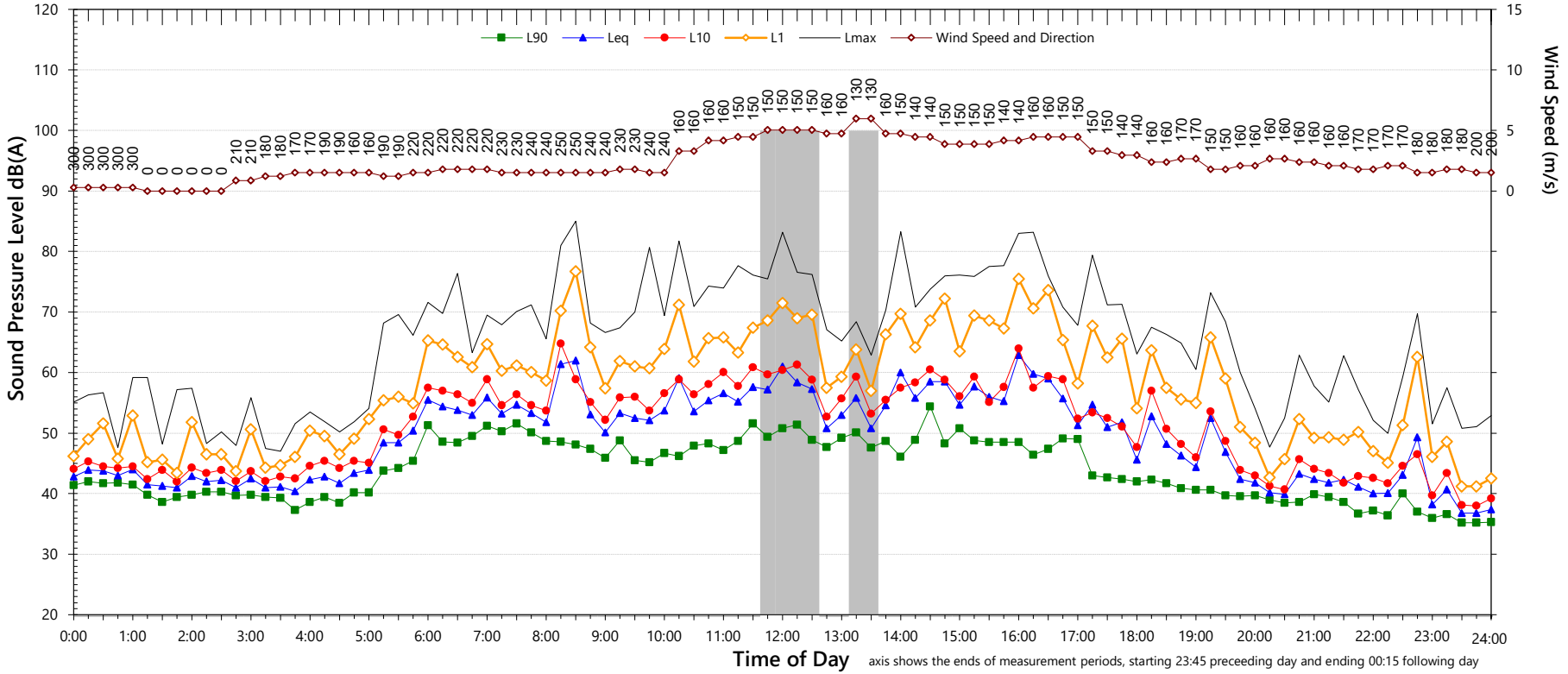
1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am til 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. Night time L_{Max} values are shown only where L_{Max} >65dB(A) and where L_{Max}- Leq ≥15dB(A)

Data File: 2021-03-02_SLM_000_123_Rpt_Report.txt WH3B_Front(r0) QTE-26 Logger Graphs Program (r34)

Unattended Noise Monitoring Results

WH3B - South

Friday, 5 March 2021



NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{90}	45	38	32
LAeq	57	46	50

Night Time Maximum Noise Levels			(see note 7)
L_{Max} (Range)	68	to	84
L_{Max} - L_{eq} (Range)	16	to	27

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{eq\ 15\ hr}$ and $L_{eq\ 9\ hr}$	58	52
$L_{eq\ 1hr}$ upper 10 percentile	61	56
$L_{eq\ 1hr}$ lower 10 percentile	47	41

Notes:

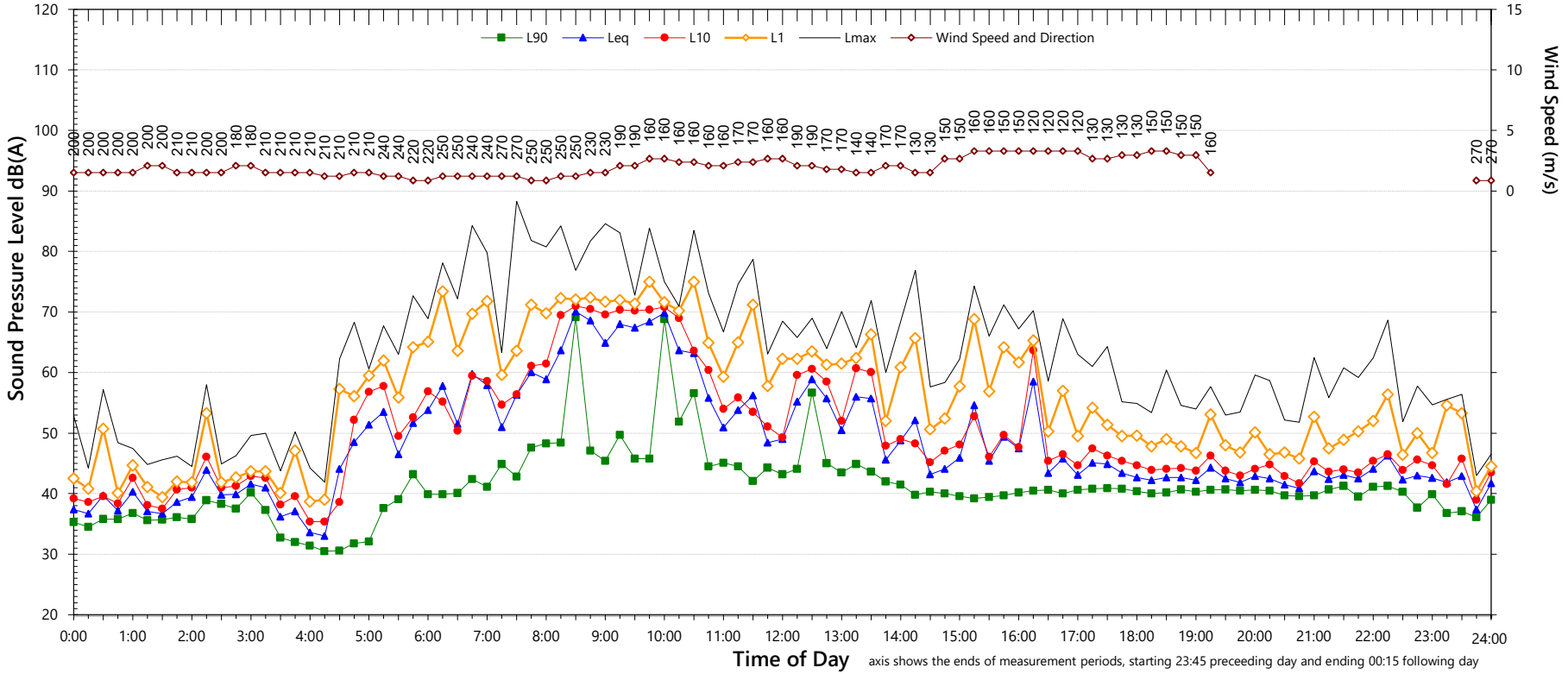
1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am til 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. Night time L_{Max} values are shown only where L_{Max} >65dB(A) and where L_{Max}- Leq ≥15dB(A)

Data File: 2021-03-02_SLM_000_123_Rpt_Report.txt WH3B_Front(r0) QTE-26 Logger Graphs Program (r34)

Unattended Noise Monitoring Results

WH3B - South

Saturday, 6 March 2021



NSW Noise Policy for Industry (Free Field)			
Descriptor	Day[2]	Evening[3]	Night[4 5]
L_{90}	40	40	33
LAeq	62	43	42

Night Time Maximum Noise Levels			(see note 7)
L_{Max} (Range)	69	to	70
L_{Max} - L_{eq} (Range)	17	to	29

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	Day	Night[5]
	7am-10pm	10pm-7am
$L_{eq\ 15\ hr}$ and $L_{eq\ 9\ hr}$	63	44
$L_{eq\ 1hr}$ upper 10 percentile	67	47
$L_{eq\ 1hr}$ lower 10 percentile	45	39

Notes:

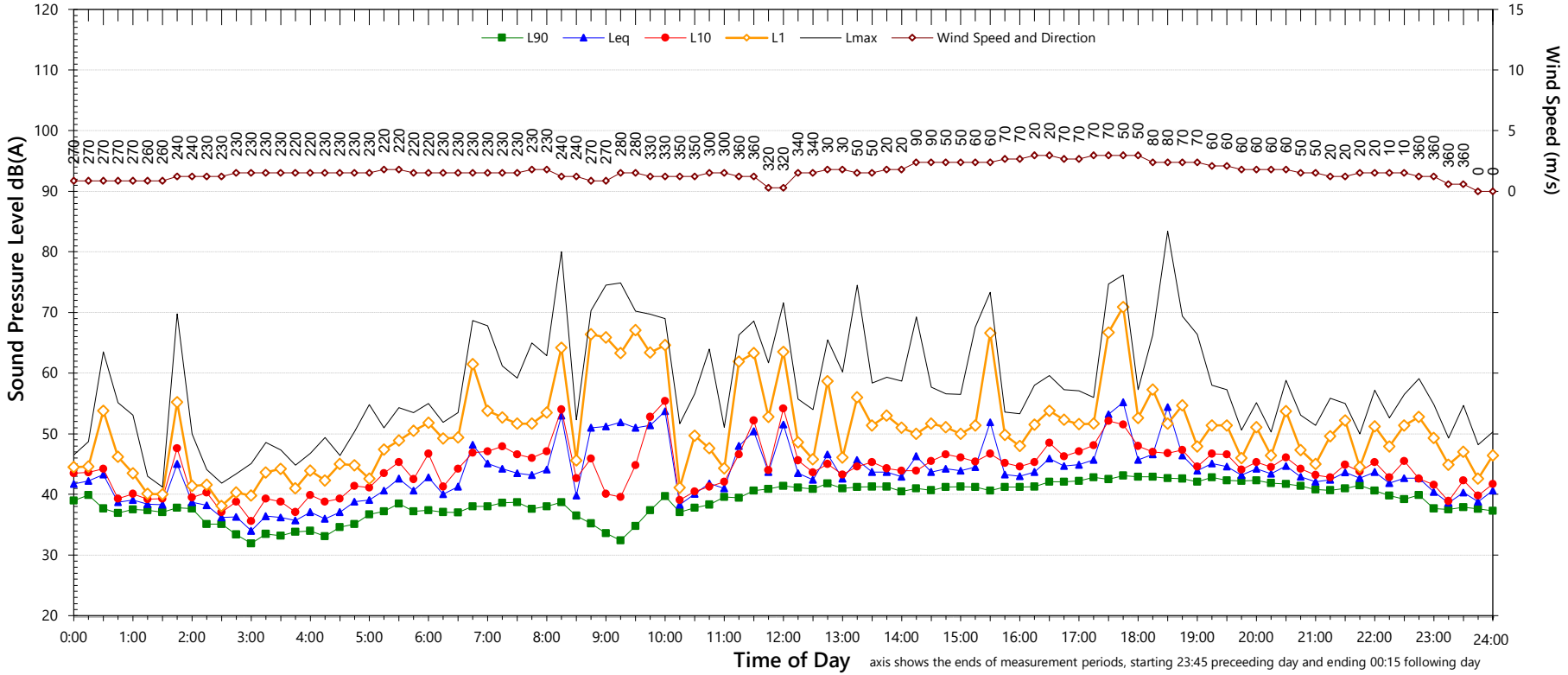
1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am til 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. Night time L_{Max} values are shown only where L_{Max} >65dB(A) and where L_{Max}- Leq ≥15dB(A)

Data File: 2021-03-02_SLM_000_123_Rpt_Report.txt WH3B_Front(r0) QTE-26 Logger Graphs Program (r34)

Unattended Noise Monitoring Results

WH3B - South

Sunday, 7 March 2021



NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{90}	36	41	37
LAeq	48	46	45

Night Time Maximum Noise Levels			(see note 7)
L_{Max} (Range)	67	to	73
L_{Max} - L_{eq} (Range)	15	to	25

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{eq\ 15\ hr}$ and $L_{eq\ 9\ hr}$	50	47
$L_{eq\ 1hr}$ upper 10 percentile	54	51
$L_{eq\ 1hr}$ lower 10 percentile	46	41

Notes:

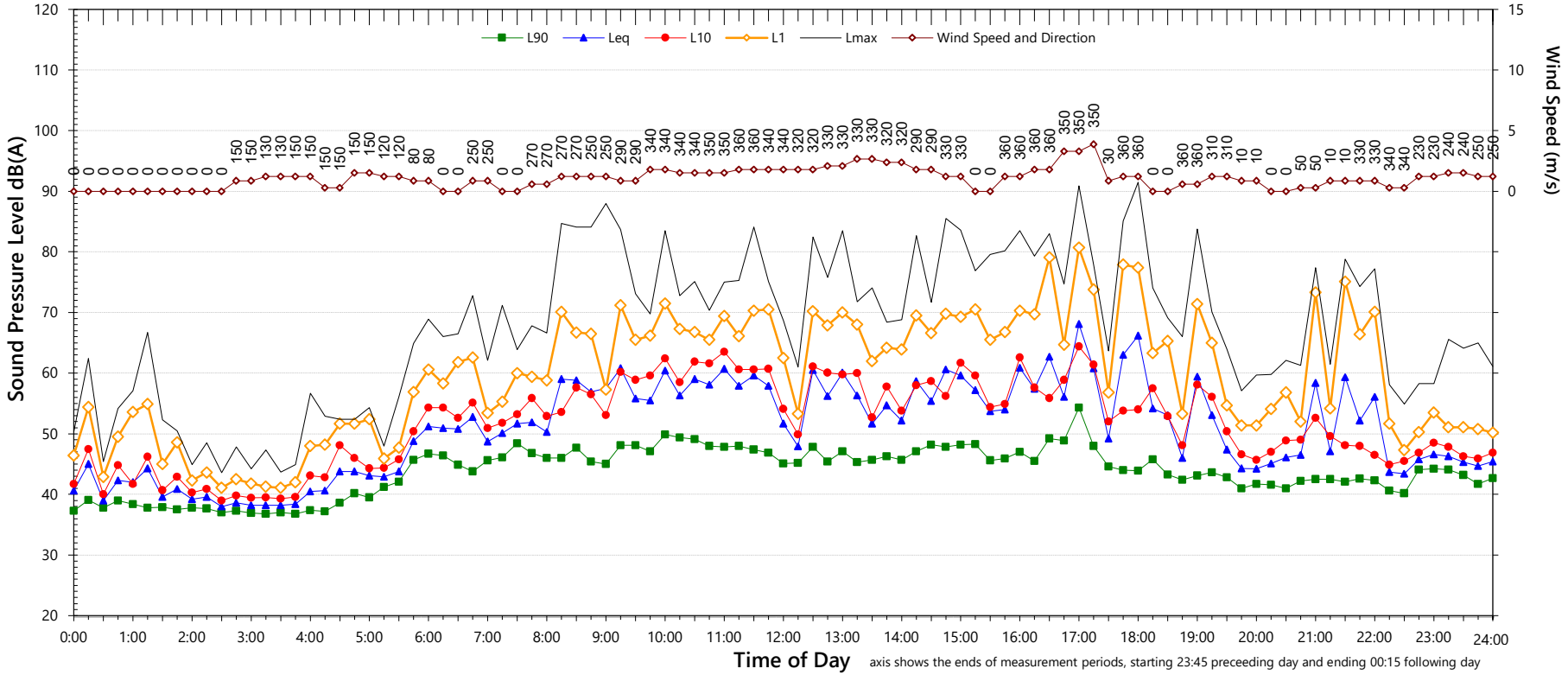
1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am til 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. Night time L_{Max} values are shown only where L_{Max} >65dB(A) and where L_{Max}- Leq ≥15dB(A)

Data File: 2021-03-02_SLM_000_123_Rpt_Report.txt WH3B_Front(r0) QTE-26 Logger Graphs Program (r34)

Unattended Noise Monitoring Results

WH3B - South

Monday, 8 March 2021



NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{90}	45	41	39
LAeq	59	54	49

Night Time Maximum Noise Levels			(see note 7)
L_{Max} (Range)	66	to	74
L_{Max} - L_{eq} (Range)	16	to	27

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{eq\ 15\ hr}$ and $L_{eq\ 9\ hr}$	61	51
$L_{eq\ 1hr}$ upper 10 percentile	64	55
$L_{eq\ 1hr}$ lower 10 percentile	54	45

Notes:

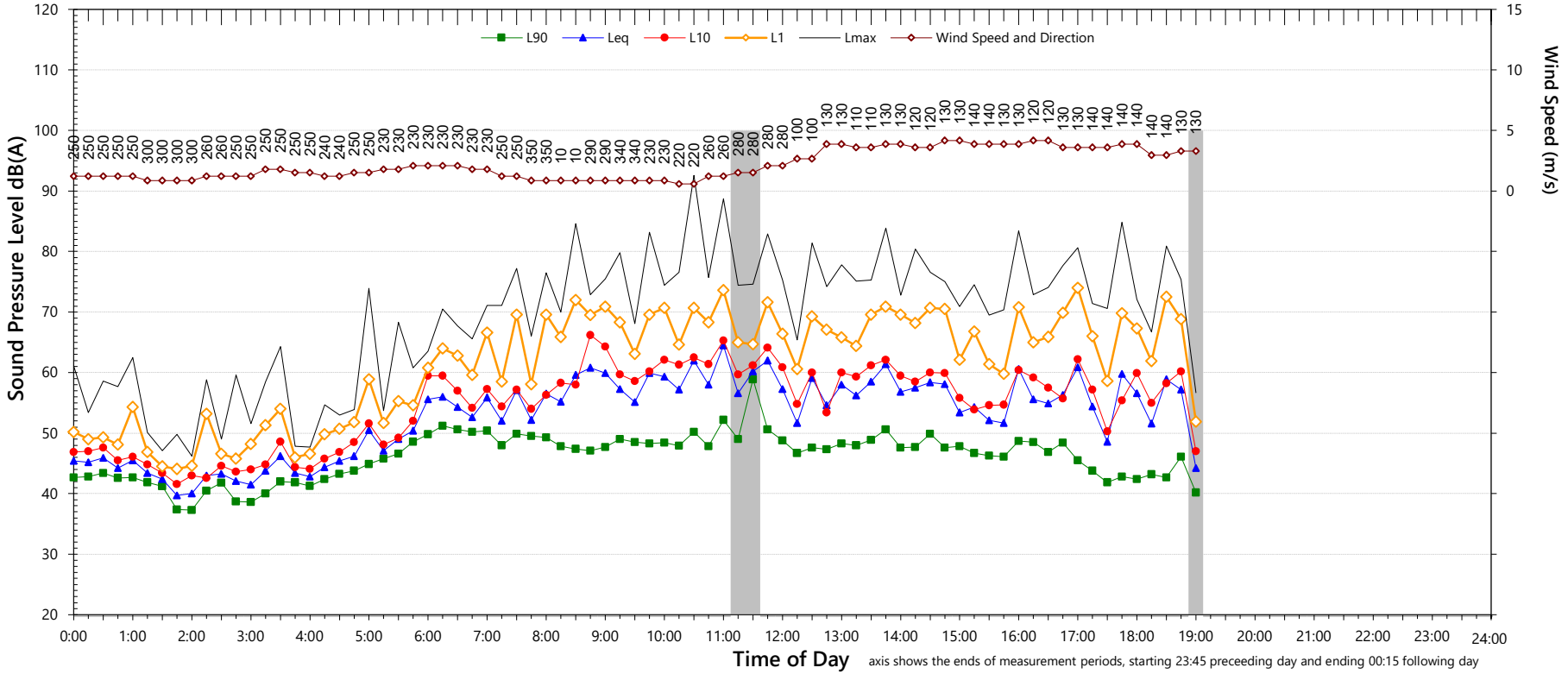
1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am til 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. Night time L_{Max} values are shown only where L_{Max} >65dB(A) and where L_{Max}- Leq ≥15dB(A)

Data File: 2021-03-02_SLM_000_123_Rpt_Report.txt WH3B_Front(r0) QTE-26 Logger Graphs Program (r34)

Unattended Noise Monitoring Results

WH3B - South

Tuesday, 9 March 2021



NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{90}	46	-	-
LAeq	58	-	-

Night Time Maximum Noise Levels			(see note 7)
L_{Max} (Range)	-	to	-
L_{Max} - L_{eq} (Range)	-	to	-

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{eq\ 15\ hr}$ and $L_{eq\ 9\ hr}$	61	-
$L_{eq\ 1hr}$ upper 10 percentile	63	-
$L_{eq\ 1hr}$ lower 10 percentile	59	-

Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am til 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. Night time L_{Max} values are shown only where L_{Max} >65dB(A) and where L_{Max}- Leq ≥15dB(A)

Data File: 2021-03-02_SLM_000_123_Rpt_Report.txt WH3B_Front(r0) QTE-26 Logger Graphs Program (r34)

B.10 Warehouse 4A Noise Monitoring Report

Renzo Tonin & Associates Report TL116-09F02 Warehouse 4A Ops (r1)

RENZO TONIN & ASSOCIATES
inspired to achieve

Acoustics
Vibration
Structural Dynamics

MOOREBANK LOGISTIC PARK - PRECINCT EAST

Warehouse 4A Operational Compliance Measurements

6 April 2021

Qube Property Management Services Pty Ltd c/- Tactical Group

TL116-09F02 Warehouse 4A Ops (r1)

Sydney Melbourne Brisbane Gold Coast Kuwait Singapore
Renzo Tonin & Associates ABN 29 117 462 861
Level 1/418A Elizabeth St SURRY HILLS NSW 2010 | PO Box 877 STRAWBERRY HILLS NSW 2012
P (02) 8218 0500 F (02) 8218 0501 sydney@renzotonin.com.au www.renzotonin.com.au

Document details

Detail	Reference
Doc reference:	TL116-09F02 Warehouse 4A Ops (r1)
Prepared for:	Qube Property Management Services Pty Ltd c/- Tactical Group
Attention:	Cathal McGann

Document control

Date	Revision history	Non-issued revision	Issued revision	Prepared	Instructed	Reviewed / Authorised
06.04.2021	Final	0	1	J. Liang/ A. Leslie	A. Leslie	C. Weber

File Path: R:\AssocSydProjects\TL101-TL150\TL116 cw Moorebank IMT Temporary Noise Monitoring\Task 9 - cw Warehouse Compliance Monitoring\1 Docs\WH4A\TL116-09F02 Warehouse 4A Ops (r1).docx

Important Disclaimers:

The work presented in this document was carried out in accordance with the Renzo Tonin & Associates Quality Assurance System, which is based on Australian/New Zealand Standard AS/NZS ISO 9001.

This document is issued subject to review and authorisation by the suitably qualified and experienced person named in the last column above. If no name appears, this document shall be considered as preliminary or draft only and no reliance shall be placed upon it other than for information to be verified later.

This document is prepared for the particular requirements of our Client referred to above in the 'Document details' which are based on a specific brief with limitations as agreed to with the Client. It is not intended for and should not be relied upon by a third party and no responsibility is undertaken to any third party without prior consent provided by Renzo Tonin & Associates. The information herein should not be reproduced, presented or reviewed except in full. Prior to passing on to a third party, the Client is to fully inform the third party of the specific brief and limitations associated with the commission.

In preparing this report, we have relied upon, and presumed accurate, any information (or confirmation of the absence thereof) provided by the Client and/or from other sources. Except as otherwise stated in the report, we have not attempted to verify the accuracy or completeness of any such information. If the information is subsequently determined to be false, inaccurate or incomplete then it is possible that our observations and conclusions as expressed in this report may change.

We have derived data in this report from information sourced from the Client (if any) and/or available in the public domain at the time or times outlined in this report. The passage of time, manifestation of latent conditions or impacts of future events may require further examination and re-evaluation of the data, findings, observations and conclusions expressed in this report.

We have prepared this report in accordance with the usual care and thoroughness of the consulting profession, for the sole purpose described above and by reference to applicable standards, guidelines, procedures and practices at the date of issue of this report. For the reasons outlined above, however, no other warranty or guarantee, whether expressed or implied, is made as to the data, observations and findings expressed in this report, to the extent permitted by law.

The information contained herein is for the purpose of acoustics only. No claims are made and no liability is accepted in respect of design and construction issues falling outside of the specialist field of acoustics engineering including and not limited to structural integrity, fire rating, architectural buildability and fit-for-purpose, waterproofing and the like. Supplementary professional advice should be sought in respect of these issues.

External cladding disclaimer: No claims are made and no liability is accepted in respect of any external wall and/or roof systems (eg facade / cladding materials, insulation etc) that are: (a) not compliant with or do not conform to any relevant non-acoustic legislation, regulation, standard, instructions or Building Codes; or (b) installed, applied, specified or utilised in such a manner that is not compliant with or does not conform to any relevant non-acoustic legislation, regulation, standard, instructions or Building Codes.

Contents

1 Introduction 5
1.1 Warehouse operations description – WH4A 6
1.1.1 Location 6
1.1.2 Operational activities and facilities and hours of operation 6
1.2 Nearby sensitive receivers 6
2 Summary of noise objectives 9
2.1 Compliance assessment noise requirements 9
2.2 Operational noise limits 9
2.3 Discussion of assessment noise limits 10
3 Measurement methodology and results 12
3.1 Compliance measurement methodology 12
3.2 Instrumentation 13
3.3 Receiver unattended noise measurement results 13
3.3.1 Meteorological conditions 17
3.4 On-site attended operational activity noise measurement results 17
3.5 Unattended noise measurements 18
3.6 Modelled operational scenarios 19
3.6.1 Observed operations for modelling 19
3.6.1.1 Loading and Unloading operations (WH4A north) 19
3.6.1.2 Qube container handling operational area (WH4A south) 20
3.6.2 Assessment noise source levels 20
3.6.3 Reasonable worst-case intrusiveness scenarios (15-minute period) 21
3.7 Modelling methodology 23
3.7.1 Overview of noise modelling 23
3.7.2 General modelling assumptions 23
3.7.3 Model validation 24
3.8 Noise compliance assessment 25
4 Conclusion 27
APPENDIX A Glossary of terminology 28
APPENDIX B Logger location 1 – WH4A - North side 30
APPENDIX C Logger location 2 – WH4A – South side 31

List of tables

Table 1 Noise sensitive receivers and approximate distance from MPE WH4A 7
Table 2 SSD 7628 CoC B80 noise limits, dB(A) 10
Table 3 Noise measurement equipment 13

Table 4 Permanent noise monitoring stations 13
Table 5 Receiver permanent noise monitoring locations 14
Table 6 Summary of permanent noise monitoring results at the nearest sensitive residential receivers 16
Table 7 On-site attended noise measurement results 18
Table 8 Assessment noise source levels 21
Table 9 Representative 'reasonable' worst-case 15-minute intrusive assessment scenarios 23
Table 10 Comparison between measured and modelled noise levels 24
Table 11 Predicted noise levels - Reasonable 15-minute worst-case scenarios for WH4A north 25
Table 12 Predicted noise levels - Reasonable 15-minute worst-case scenarios for WH4A south 26

List of figures

Figure 1 Warehouse location WH4A, MPE precinct and the nearest residential receiver catchments 8
Figure 2 Residential receiver noise monitoring locations NMT01 to NMT04 15
Figure 3 Unattended noise logger locations and main noise generation areas (imagery: Nearmap, 2021) 19

1 Introduction

Renzo Tonin & Associates was engaged by Tactical on behalf of Qube Property Management Services Pty Ltd (QUBE) to undertake an operational noise compliance assessment of the warehouse operations carried out by Warehouse 4A (WH4A) within the Moorebank Precent East (MPE), located within the Moorebank Logistics Park (MLP) at Moorebank, NSW.

The Sydney Intermodal Terminal Alliance (SIMTA) received approval for the construction and operation of Stages 1 and 2 of the MPE Project (SSD 6766 and SSD 7628 respectively), which together comprise the two stages of development under the MPE Concept Approval (MP10_0193). Warehouse operations, including the site that is operated by WH4A fall under the area and activities approved as part of SSD 7628.

This report has been prepared to address the operational noise monitoring requirements outlined in the MPE Operational Noise and Vibration Management Plan[1] (MPE ONVMP) required for the warehouse operations carried out by WH4A. Specifically, this report has been prepared to address the requirements of Condition of Consent (CoC) B85 in State Significant Development (SSD) 7628, as detailed in Section 3.2.2 of the MPE ONVMP.

Appendix A contains a glossary of acoustic terms used in this report.

1 Arcadis & Renzo Tonin & Associates, Operational Noise and Vibration Management Plan for Moorebank Logistics Park – East Precinct, Revision 012, dated 27/3/2020, available https://simta.com.au/wordpress/wp-content/uploads/2020/04/ONVMP_V12_redacted.pdf, accessed 25/3/2021

1.1 Warehouse operations description – WH4A

1.1.1 Location

The MLP is located approximately 27 kilometres south-west of the Sydney Central Business District and approximately 26 kilometres west of Port Botany, within the Liverpool Local Government Area. The MLP is divided into an East Precinct and a West Precinct, located east and west of Moorebank Avenue respectively, as shown in Figure 1.

1.1.2 Operational activities and facilities and hours of operation

Operational activities at WH4A include storage and distribution activities at the position shown in Figure 1. The day to day activities include:

- Receipt and despatch of containers from and to the IMEX terminal
- Loading and unloading of containers
- Storage of products
- Despatching and receiving product to commercial customers using internal equipment such as forklifts
- Internal product moving and loading activities, including use of forklifts
- General office administrative and support functions.

The despatch activities mostly occur from the south side of WH4A, typically between the hours of 9:00am and 6:00pm, however the busiest period of noise-generating activities typically occurs around 9:00am to 11:00am. There are no activities that typically occur during the night period (10:00pm to 7:00am) within the site. The noise-generating vehicle movements associated with the general deliveries and commercial customer activities mostly occur from the northern side of the warehouse. The southern side of the warehouse is the designated area where containers from the IMEX terminal or other sources are transported to and stored for unloading to within the warehouse. These two main areas are shown in Figure 3.

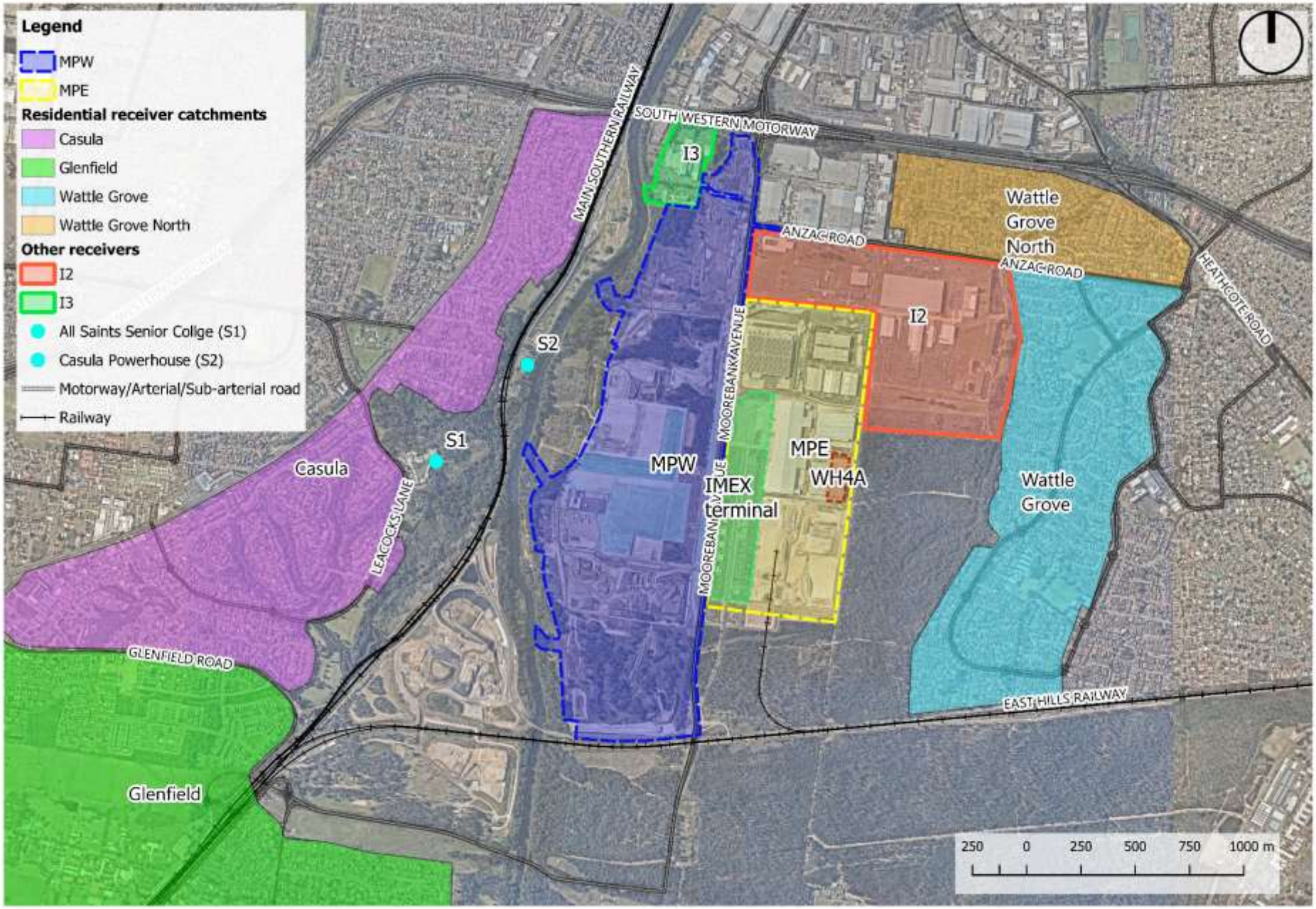
1.2 Nearby sensitive receivers

The potentially most affected residential receivers in the vicinity of the MPE, when noise intensive activities at the WH4A are occurring, are located in the suburbs of Casula, Glenfield, Wattle Grove and Wattle Grove North. A summary of the approximate distance to the nearest residential receiver in the surround noise catchment areas (NCAs) is provided in Table 1. The locations of the NCAs or receivers, are shown in Figure 1.

Table 1 Noise sensitive receivers and approximate distance from MPE WH4A

Sensitive receiver (Noise Catchment Area (NCA) or Receiver ID)	Receiver type	Approximate distance from MPE precinct WH4A, metres
Wattle Grove (NCA 1)	Residential	800
Wattle Grove North (NCA 2)		1,060
Casula (NCA 3)		1,530
Glenfield (NCA 4)		2,530
All Saints Senior College (S1)	Educational	1,720
Casula Powerhouse (S2)		1,380
Defence Joint Logistics Unit (DJLU) (I2)	Industrial	600
ABB (I3)		1,260

Figure 1 Warehouse location WH4A, MPE precinct and the nearest residential receiver catchments



2 Summary of noise objectives

2.1 Compliance assessment noise requirements

The management of operational noise emission from warehouse activities within MPE Stage 2 is outlined in the MPE ONVMP. Specifically, this report has been prepared to address the requirements of CoC B85 in SSD 7628, as detailed in Section 4.1.1 of the MPE ONVMP.

This report includes noise monitoring performed to address the requirements in CoC B85, as detailed in Table 4-1 in Section 4.1.1 of the MPE ONVMP.

The requirements of CoC B85 state:

> *B85 The Applicant must carry out noise monitoring of mechanical plant and other noisy equipment for a minimum period of one week where valid data is collected following occupation of each warehouse. The monitoring program must be carried out by a suitably qualified and experienced person(s) and a Monitoring Report for Mechanical Plant must be submitted to the Secretary within two months of occupation or each tenancy to verify predicted mechanical plant and equipment noise levels.*

CoC B85 requires that the monitored noise levels be compared against the predicted levels reviewed in accordance with CoC B84.

The noise impacts from warehouse operations were assessed as part of the EIS noise and vibration impact assessment (MPE Stage 2 Noise and Vibration Impact Assessment, Wilkinson Murray, Report No. 12186-S2, Version C, 29 November 2016 (MPE Stage 2 N&V assessment)). The individual noise impacts of warehouse operations were not quantified as part of the EIS. As such, noise level predictions for the warehouse activities are not available for verification with CoC B85.

As per Table 4-1 in Section 4.1.1 of the MPE ONVMP, Table 3-20 and Table 3-21 of the MPE ONVMP detail the predicted $L_{Aeq\ 15\ minute}$ intrusiveness and L_{Amax} sleep disturbance noise limit levels respectively for the overall MPE operations (not for individual warehouses).

As such, for the purposes of addressing CoC B85, instead of comparing the facility noise emission against the noise level predicted in accordance with CoC B84, this report is aims to assess the noise levels from the mechanical plant and other noisy equipment that operate within the facility directly against the noise limits presented in Table 5 of condition B80.

2.2 Operational noise limits

The operational noise limits applicable for the warehouse operations within MPE are presented in Table 5 of SSD 7628 CoC B80 and are reproduced in Table 2. These noise limits are as per Table 3-5 of

the MPE ONVMP. The noise limits are applicable not only to all operational noise sources approved under SSD 7628, but are inclusive of operations as part of MPE Stage 1, approval SSD 6766.

The $L_{Aeq(15\ minute)}$ criteria are applicable during the day, evening and night-time periods and the $L_{A1\ (1\ minute)}$ sleep disturbance noise limits at residential receivers are applicable during the night-time period.

The noise limits are applicable under prevailing meteorological conditions of wind speeds of up to 3 m/s at 10 metres above ground level or stability category 'F' temperature inversion conditions.

Table 2 SSD 7628 CoC B80 noise limits, dB(A)

Sensitive receiver	Day [1] $L_{Aeq,\ 15\ minute}$	Evening [1] $L_{Aeq,\ 15\ minute}$	Night [1] $L_{Aeq,\ 15\ minute}$	Night [1] $L_{A1\ (1\ min)}$
Wattle Grove (NCA 1)	35	35	35	52
Wattle Grove North (NCA 2)	35	35	35	52
Casula (NCA 3)	35	35	35	52
Glenfield (NCA 4)	35	35	35	52

Notes:

1. In accordance with the INP, day is the period from 7:00 am to 6:00 pm Monday to Saturday; or 8:00 am to 6:00 pm on Sundays and public holidays; evening is the period from 6:00 pm to 10:00 pm; and night is the remaining periods.
2. To determine compliance with the $L_{Aeq,15\ minute}$ noise limits, noise from the development is to be measured at the most affected point within the residential boundary, or at the most affected point within 30 metres of a dwelling where the dwelling is more than 30 metres from the boundary. Where it can be demonstrated that direct measurement of noise from the project is impractical, the EPA may accept alternative means of determining compliance (see Chapter 7 Noise Policy for Industry - NPfI) The modification factors in Section 4 of the INP must also be applied to the measured noise levels where applicable.
3. To determine compliance with the L_{A1} noise limits, noise from the project is to be measured at 1 metre from the dwelling façade. Where it can be demonstrated that direct measurement of noise from the project is impractical, the EPA may accept alternative means of determining compliance (see Chapter 7 of the NPfI).
4. The noise emission limits identified above apply under meteorological conditions of:

   (i) wind speeds of up to 3 m/s at 10 metres above ground level; or

   (ii) 'F' atmospheric stability class.

2.3 Discussion of assessment noise limits

As noted in Section 2.2, the noise limits detailed in SSD 7628 CoC B80 are applicable not only to all operational noise sources approved under SSD 7628, but are also inclusive of operations as part of the MPE Stage 1 approval for SSD 6766. Importantly, when assessing compliance with the noise limits, the most affected residential receiver for any individual operations will not necessarily be at the same location. Additionally, it is unlikely that the reasonable worst-case noise levels from any individual operations would also occur in the same 15-minute period.

As part of the recent modification application for SSD 7709 Moorebank Precinct West (MPW) – Stage 2, MOD 1 - Building height increase, which was approved 24 December 2020, a review of the applicable operational noise requirements across Moorebank Precinct West (MPW) and Moorebank Precinct East (MPE) was undertaken (Renzo Tonin & Associates document reference TJ741-11F05 (r4), dated 30 June 2020). The review identified that there are number of approval conditions that are applicable across both the MPW and MPE sites for operational noise, and that in the application of these approvals to the site activities, it became apparent that the operational noise requirements were not consistent across the MPE and MPW sites.

Additionally, the review identified that the operational noise limits across MPE and MPW were set substantially below both the noise criteria and the predicted noise levels (even with feasible and reasonable mitigation measures) established during the environmental assessment stages and considering the cumulative operational noise levels from all MPE and MPW operations.

The review recommended that an overall approach for cumulative operational noise management of the Moorebank intermodal terminal precinct (for East and West precinct) for a "whole of complex" approach be adopted, and that consistent noise management objectives for the Moorebank intermodal terminal precinct's operational noise be adopted to cover all operations within MPE and MPW. Appropriate and achievable noise management objectives consistent with EPA's noise policies were also developed in the review.

Following the modification application for SSD 7709 (MOD 1), the submission received from the NSW Environment Protection Authority (NSW EPA) noted the following:

> *However, the current noise limits are set below the predicted noise levels and are not based on the Project Specific Noise Levels (PSNL) derived under the then-applicable Industrial Noise Policy 2000 (now superseded by the Noise Policy for Industry 2017)…. The EPA considers that the resulting noise limits are not achievable for MPW, nor are they achievable for the cumulative MPW and MPE sites.*

Also Liverpool City Council included in their submission:

> *Council considers that site regulation in regard to noise management may be assisted by adopting a precinct approach consistent with the NSW EPA's Noise Policy for Industry (2017)…. Whilst it is acknowledged that current criteria in the Approval may be impracticable, it will be necessary for the Department to consider applying suitable noise limits that are achievable and capable of protecting the amenity and wellbeing of sensitive receivers.*

As such, this operational compliance assessment does not include further quantification of cumulative noise levels, and demonstrates that WH4A operations can achieve the noise limits set out in SSD 7628 CoC B80 in isolation during reasonable worst-case operations.

It is recommended that noise levels from this assessment achieve the required noise limits set out in Table 5 of SSD 7628 CoC B80, and that the site specific noise levels should be considered as part of the operational noise management applicable to the overall Moorebank intermodal terminal precinct.

3 Measurement methodology and results

3.1 Compliance measurement methodology

The Noise Policy for Industry (NPfI) provides guidance in Chapter 7 for monitoring the performance of a noise-generating industrial facility. In Section 7.1.1, the NPfI provides guidance as to how to review noise emissions of a site where the existing ambient noise levels are already high, resulting in the direct quantification of the noise under investigation not being possible via noise measurements at the receiver location. Additionally, the NPfI provides guidance about using noise modelling to review the performance of an industrial operation that is co-located with separate but noise-generating industrial sites impacting the same receiver. To satisfy the requirements of CoC B85, the following noise monitoring and assessment steps have been undertaken:

1. Review of permanent noise monitoring at nearby residential receivers during periods when noise intensive activities were taking place within the WH4A facility to determine if noise levels would allow for quantification of operational noise emissions, by checking if operational noise emissions are audible, distinguishable and quantifiable at the receiver locations during periods of noise intensive on-site activities (Section 3.3).

2. On-site attended monitoring of noise-generating activities to quantify noise emission levels of mechanical plant and other noise-generating activities as part of typical warehouse operations (Section 3.4).

3. Unattended noise monitoring at the WH4A facility for a period of one week, with concurrent video, to identify the reasonable worst-case operational scenarios and periods for each major noise-generating area (Section 3.5).

The review of unattended noise monitoring data measurements in Section 3.3 established that the existing ambient noise levels at the nearest receivers were high and controlled by noise sources outside of MPE in addition to a number of industrial noise-generating facilities being co-located. As such, direct quantification or estimation of operational noise emissions from the warehouse operations at the sensitive receiver locations was not possible. Noise emissions from the WH4A have been evaluated using a combination of on-site attended and unattended noise monitoring, combined with noise modelling, in order to quantify the industrial noise emissions from WH4A operations.

The following steps were undertaken to assess the noise level contributions at the nearby sensitive receivers:

1. Review observations of warehouse operations, in addition to the noise monitoring results and associated video, to then determine the reasonable worst-case operational scenarios.

2. Setup and calibrate the noise model for the reasonable worst-case operational scenarios.

3. Calculate the operational noise levels from the warehouse operations to all nearby receivers and determine the noise level contribution at the property with the highest noise levels within each NCA.

3.2 Instrumentation

A range of noise monitoring equipment was used to undertake the compliance noise monitoring. A summary of measurement equipment and calibration dates is provided in Table 3.

All of the noise monitoring equipment are Class 1 instruments, with calibration certificates current at the time of the measurements. Before and after each series of attended measurements, the calibration of the sound level meters were verified using a reference calibration of 94 dB at 1 kHz. The difference between pre- and post-calibration levels was within 0.5 dB for all measurements.

Table 3 Noise measurement equipment

Monitoring location/ purpose	Equipment	Serial No	Last date calibrated
On-site attended noise measurements	NTi XL2	A2A-16217-E0	05/07/2019
Unattended on-site noise measurements (WH4A North)	NTi XL2	A2A-08520-E0	14/03/2019
Unattended on-site noise measurements (WH4A South)	NTi XL2	A2A-07815-E0	23/12/2020
Field calibration	B&K 4231	3016756	27/11/2020

Four Envirosuite permanent noise monitors are set up at nearest representative residential locations in the community and are labelled NMT01 to NMT04 in Figure 2.

Table 4 Permanent noise monitoring stations

Monitoring location	Description	Equipment	Serial No	Last Date Calibrated
NMT01	Permanent noise monitor	B&K 2250	3025394	12/03/2019
NMT02	Permanent noise monitor	B&K 2250	3025271	12/03/2019
NMT03	Permanent noise monitor	B&K 2250	3025351	12/03/2019
NMT04	Permanent noise monitor	B&K 2250	3025317	12/03/2019

3.3 Receiver unattended noise measurement results

As detailed in Section 1.2, the residential receivers nearest to WH4A are located in the suburbs of Casula, Glenfield, Wattle Grove and Wattle Grove North.

As the most intensive period of operational activities at WH4A typically occurs during the daytime period from 9:00 am, noise monitoring data from the permanent noise monitoring stations have been reviewed for the period between 9:00 am and 11:00 am on 3 March 2021, during which onsite noise intensive activities were confirmed to be taking place. The permanent noise monitoring stations were configured to record audio and undertaken short-term statistical noise measurements. During this measurement period, concurrent unattended noise measurements were undertaken on-site of noise generating activities (see Section 3.4). This assisted to confirm that noise intensive activities were occurring on-site during the reviewed period of permanent noise monitoring data and noise recordings.

A summary of the monitoring locations and the approximate distance to the WH4A is provided in Table 5. These locations along with the noise catchment areas (NCAs) are presented in Figure 2.

Table 5 Receiver permanent noise monitoring locations

Monitoring location ID	Monitoring location (applicable NCA) (see Figure 2)	Approximate distance (m) from WH4A
NMT01	22 Glenelg Court, Wattle Grove (Wattle Grove North – NCA2)	1000
NMT02	26 Goodenough Street, Glenfield (Glenfield – NCA4)	2,400
NMT03	31 Martindale Court, Wattle Grove (Wattle Grove – NCA1)	815
NMT04	14 Dunmore Crescent, Casula (Casula – NCA3)	1,600

The results of the permanent noise monitoring results on 3 March 2021 are presented in Table 6.

The ambient noise levels during the reviewed monitoring period were greater than 48 dB(A) $L_{Aeq\ 15\ minute}$ at all monitoring locations, with corresponding background noise levels no less than 37 dB(A) $L_{A90\ 15\ minute}$ at all monitoring locations. Sample reviewed audio could not clearly distinguish noise levels corresponding to concurrent onsite activities. As such, given that noise levels are expected to be below the overall noise limit of 35 dB(A) $L_{Aeq\ 15\ minute,}$ were not audible and/or distinguishable at nearby receivers because of high ambient noise levels, direct quantification or estimation of operational noise emissions from the warehouse operations at the sensitive receiver locations would not be possible via direct measurement in the presence of the ambient noise level environment. As such, it is appropriate to use the alternative methodology of modelling to determine compliance as detailed in Section 7.1.1 of the NPfI.

Figure 2 Residential receiver noise monitoring locations NMT01 to NMT04

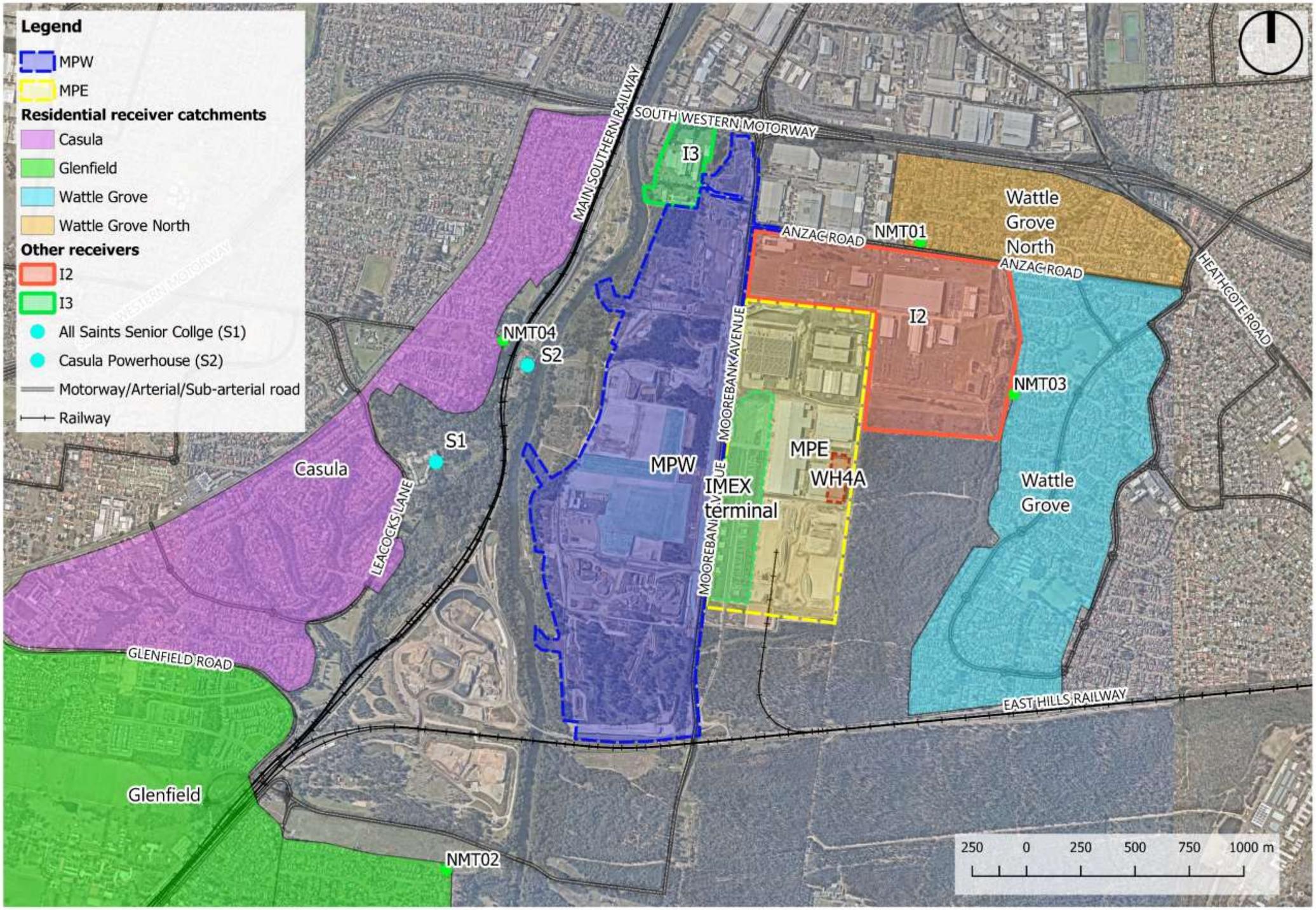


Table 6 Summary of permanent noise monitoring results at the nearest sensitive residential receivers

Measurement period	Measured noise level (15 minute), dB(A)			
	L_{Amax}	L_{A1}	L_{Aeq}	L_{90}
NMT01 (22 Glenelg Court, Wattle Grove)				
03/Mar/21 09:00:00 09:15:00	75	67	55	44
03/Mar/21 09:15:00 09:30:00	64	60	53	43
03/Mar/21 09:30:00 09:45:00	80	61	53	41
03/Mar/21 09:45:00 10:00:00	69	61	53	43
03/Mar/21 10:00:00 10:15:00	64	60	52	44
03/Mar/21 10:15:00 10:30:00	68	60	52	46
03/Mar/21 10:30:00 10:45:00	65	60	52	47
03/Mar/21 10:45:00 11:00:00	74	60	53	47
NMT02 (26 Goodenough Street, Glenfield)				
3 March 2021 9:00 to 11:00	Not available due to maintenance and calibration.			
NMT03 (31 Martindale Court, Wattle Grove)				
03/Mar/21 09:00:00 09:15:00	84	68	56	37
03/Mar/21 09:15:00 09:30:00	87	72	61	39
03/Mar/21 09:30:00 09:45:00	82	65	56	43
03/Mar/21 09:45:00 10:00:00	73	63	54	43
03/Mar/21 10:00:00 10:15:00	68	57	50	43
03/Mar/21 10:15:00 10:30:00	73	63	51	43
03/Mar/21 10:30:00 10:45:00	85	55	52	44
03/Mar/21 10:45:00 11:00:00	63	54	48	44
NMT04 (14 Dunmore Crescent, Casula)				
03/Mar/21 09:00:00 09:15:00	73	65	54	48
03/Mar/21 09:15:00 09:30:00	77	64	55	49
03/Mar/21 09:30:00 09:45:00	68	64	53	49
03/Mar/21 09:45:00 10:00:00	66	63	53	46
03/Mar/21 10:00:00 10:15:00	71	67	55	46
03/Mar/21 10:15:00 10:30:00	74	64	53	45
03/Mar/21 10:30:00 10:45:00	70	66	55	47
03/Mar/21 10:45:00 11:00:00	77	73	60	48

3.3.1 Meteorological conditions

Meteorological conditions for the review period of the permanent noise monitoring station data has been reviewed to ensure they were acceptable in accordance with the NPfI. Data from the MLP meteorological data monitoring station adjacent to Moorebank Avenue, within the MPE site, established in accordance with CoC A54 SSD 7709 has been reviewed. The meteorological conditions experienced during receiver permanent noise monitoring on 3 March 2021 are summarised below:

- During the measurement period at the facility, the equivalent average wind speed was 1.6 m/s and generally from the SSW. All other measurements were not impacted by excessive wind during any of the measurement periods.
- No rain occurred during any of the measurement periods.
- The temperature during the measurement period ranged between 32˚C and 35˚C, and the cloud conditions were generally clear skies with a few scattered clouds.

3.4 On-site attended operational activity noise measurement results

In order to quantify the noise emissions from on-site activities for the purposes of determining compliance noise levels, attended noise measurements of individual operational items and typical operations were undertaken at WH4A on 2 March, 9 March and 16 March 2021. These noise levels have been used to assist in establishing the source noise levels in the noise model.

During all measurements, the specific noise source being measured was the dominant source. Observations were made of the on-site operations, which have then been reviewed to model 'reasonable' worst-case operational scenarios over the assessment periods. Critical on-site attended measurement results are summarised in Table 7.

The main noise generating activities observed were being undertaken within the warehouse, including forklift operations and noise generated from warehouse internal activities.

Table 7 On-site attended noise measurement results

Activity noise sources	Date	Time	Measurement duration (t), sec	Measurement distance (m)	Measured noise levels, dB(A)	
					$L_{Aeq(t)}$	L_{AFmax}
Internal warehouse noise levels (noise breakout)						
Internal noise level at loading dock door (internal sources include forklifts)	2/3/2021	2:30pm	300	At external roller doors	62	80
Forklift						
Forklift 1.5-2 Tonnes, passby	2/3/2021	1:40pm	10	10	62	65
Curtain side trailer truck[1]						
Truck pass-by	3/3/2021	6:00am	10	6	74	78
Truck Idling	3/3/2021	7:00am	60	20	65	67
Mechanical plant						
Office air condenser unit[2]	2/3/2021	1:00pm	300	1	50	51

Note:

1. Attended measurement results for Curtain side trailer trucks were obtained at WH5, as the same type of truck was operated as part of the WH4A activities.
2. 1 out of 12 condenser units were operating at time of measurement.

3.5 Unattended noise measurements

Unattended noise measurements were undertaken over the period between 2 March and 8 March 2021 at locations adjacent to WH4A on both side of the warehouse. Two main areas of noise-generating operations were identified across the warehouse site, one on the northern side of the warehouse and one on the southern side. The location of the unattended noise loggers is shown in Figure 3. These were selected so that they would capture noise from the main noise-generating areas as part of the typical warehouse operations. A camera unit was setup on the northern side boundary fence at WH4A north to assist in gaining a comprehensive understanding of the site operations and vehicle movements.

The purpose of the noise logging at the selected locations was for the following:

- Determine the noise emissions from the facility at a fixed location close enough to quantify on-site sources.
- Determine the long-term background noise levels when operations were not taking place at the site.
- A source for analysis to determine the duration and nature of the different on-site activities through correlation with the Facility activity data.
- Source of validation for the noise model calibration process.

Detailed unattended noise monitoring results are provided in APPENDIX B for WH4A North and APPENDIX C for WH4A South. The noise model was validated using the unattended noise logger results through comparison against reference activity periods, refer to Section 3.7.3 for noise model calibration.

Figure 3 Unattended noise logger locations and main noise generation areas (imagery: Nearmap, 2021)

3.6 Modelled operational scenarios

3.6.1 Observed operations for modelling

Based upon the on-site attended measurements presented in Section 3.4, the video recording for the facility over the unattended monitoring period presented in Section 3.5, and discussions with WH4A personnel, 'reasonable' worst-case operational assessment scenarios were established and modelled to satisfy the assessment periods under SSD 7628.

The following section details the key observations of each of the noise-generating activities that take place across the warehouse operations.

3.6.1.1 Loading and Unloading operations (WH4A north)

The following data related to delivery truck operations was based upon site observations during the attended measurements on 9 March and 16 March 2020, in addition the unattended noise level and audio data recordings during periods when internal truck movements on the hardstand and forklift operations were clearly distinguishable between 2 March and 8 March.

- It was observed during the attended measurements and verified with unattended measurement data, that internal truck movements on the hardstand were typically Curtain Side Trailer Trucks, and that a typical 'in-and-out' cycle time in the facility was on median 20 minutes, with each loading cycle taking approximately 10-15 minutes.

- It was observed during the attended noise measurements that the internal truck movements on the hardstand in the WH4A north despatching area move at a relative low speed of approximately 10 km/h.

- Loading and unloading of containers from Container Crane Trucks occurred outside of the warehouse on the WH4A north. Based on a review of the video and unattended noise data, these operations occurred once per week and are therefore not considered as a typical operation for north WH4A.

- Unloading of products from delivery trucks typically occur within the warehouse, with the warehouse doors open. It was observed that a truck would be loaded or unloaded in the external despatch area using a forklift.

3.6.1.2 Qube container handling operational area (WH4A south)

- It was observed that one combi-lift would be used to move containers to and from the southern hardstand of the WH4A site boundary, to and from, the MLP terminal area. Using the unattended measurements and concurrent video recordings during the monitoring, it was observed that the duration of the combi-lift loading/unloading operations was less than 10 minutes, and operate continuously when handling containers.

- Impact noise events associated with grabbing and dropping of containers would occur when the combi-lift gripper contacted individual containers. Air brake events associated with combi-lift operation would occur during handling operations. This sound power level is adopted in the modelling of potential sleep disturbance events.

- Movements of containers within the WH4A south area can occur at any time throughout the daytime period. It was observed that movements typically started from approximately 7:00am. Only three container movements during the monitoring week were observed in the video recordings, and only one container movement would occur during any one day.

3.6.2 Assessment noise source levels

Source levels for the key noise-generating activities on-site have been established based upon the attended noise measurements (Section 3.4) and unattended noise measurements (Section 3.5) during periods of typical operation. The sound power level inputs presented in Table 8 were used in the operational noise compliance modelling, and adjusted for the duration and frequency of operations (Section 3.6.3).

Table 8 Assessment noise source levels

Site items / operation	Individual activity sound power level (SWL) (L_{Aeq}), dB(A)
WH4A North	
Container Crane Trucks (slow speed manoeuvring within the site boundary)	99
Container movement noise events (L_{AFmax})	107
Container movement noise events (L_{Aeq})[4]	79 $L_{Aeq.15min}$
Curtain Side Trailer Truck moving with speed less than 20km/h	102
Air brake release (L_{AFmax})	117
WH4A South	
Container combi-lift (moving container activity)	103
Container gripping & drop (L_{Amax})	108
Container gripping & drop (L_{Aeq})[4]	81 $L_{Aeq.15min}$
Internal noise breakout	
Internal noise breakout via roof[1]	74
External roller doors[5]	76
Mechanical Plant	
Air condenser unit[2]	70
Other noise sources	
Curtain Side Trailer Truck moving on internal roads within MLP, outside of the WH4A site (typical speed on internal roads of 20 km/h)	102

Notes:

1. Attended measurement shows breakout via WH4A warehouse roof during loading and unloading operations Internal noise levels included internal noise intensive periods when forklifts were in use.
2. Air condenser units are located on the east façades of the warehouse.
3. Internal noise levels controlled by forklift operations within the warehouse.
4. One event assumed in the 15-minute interval.
5. Sound power level for each roller door.

3.6.3 Reasonable worst-case intrusiveness scenarios (15-minute period)

As the noise limits in CoC B80 are set at 35 dB(A) $L_{Aeq\ 15\ minute}$ for the day, evening and night periods, specific separation of noise intensive periods for each of these time periods has not been undertaken. Instead, it is noted that there are two main areas of noise generation as part of typical warehouse operations, as presented in Figure 3.

In order to assess the operational noise emissions from the warehouse, the 'reasonable' worst-case operations for each of the two main areas of noise generation have been developed, along with the corresponding activities in the other noise-generating areas, in order to review a representative snapshot of activities from the warehouse operations. Each of the assessment scenarios have been developed from an analysis of the video movement data or attended on-site observations over during the one-week period, in addition to the information detailed in Section 3.6.1. It is noted that the peak

periods of noise generating activities for each of the two main areas (northern side of the warehouse and southern side of the warehouse) did not occur concurrently.

A representative scenario has been established to assess a 'reasonable' worst-case scenario for the northern side of the warehouse, which is the WH4A north. A total of three container movements were observed on the video data to occur over the period of one week. The duration of each container delivery operation was approximately 10 minutes or less. During the periods when containers where being moved within WH4A south (Qube container operation area), warehouse roller doors remained closed on the south side of WH4A.

The WH4A north activities were observed to commence from 9:00am, with a peak period of noise intensive activities around the 9:00am to 11:00am.

Periods representing the 'reasonable' worst-case operations, for each the northern side of the warehouse and southern side of the warehouse, based upon these peak periods of noise intensive activities have been used to assess operational noise emissions. Table 9 details the two 'reasonable' worst-case scenarios (15-minute period), covering the noise intensive periods for the two main areas of noise generation across the site.

As required by CoC B85, all significant noise-generating equipment has been included the assessment modelling, including the key noise-generating mechanical plant. It is noted that the noise contribution from the mechanical plant items serving the office area are included in the modelling, however, they generate minimal contribution to the overall noise levels from site operations, which are controlled by other on-site activities such as truck departures, arrivals and warehouse internal loading and unloading activities. The roof mounted smoke ventilation fans were not operating during typically activities on-site.

Table 9 Representative 'reasonable' worst-case 15-minute intrusive assessment scenarios

Activity	WH4A South 15-minute assessment period (Qube container area)	WH4A South 15-minute assessment period
WH4A South 15-minute noise intensive period (with container handling taking place)		
Departure	One Combi-lift departure from WH4A south (Qube container operational area) loaded with 1 container.	No activity
Arrival	One Combi-lift arrival at WH4A south (Qube container operational area) loaded with 1 container.	No activity
On-site operations	Container operations: a) Placing one container down	*Noise breakout via open warehouse doors.* All loading activity are occurring inside the warehouse with warehouse doors open, one noise generating activities occurring concurrently. a) Forklift movements
WH4A North 15-minute noise intensive period		
Departure	No activity	One Curtain Side Truck departure from WH4A north.
Arrival	No activity	Two Curtain Side Truck arrive at WH4A north, engine off after parking.
On-site operations	No activity	*Noise breakout via open warehouse doors.* Loading and unloading activities are occurring outside the warehouse with warehouse doors open, one noise generating activity occurring at the time. a) Forklift movements
Mechanical plant (All scenarios)		
Warehouse office air conditioning condenser (12 out of 12 units operating)		

3.7 Modelling methodology

3.7.1 Overview of noise modelling

Since ambient noise levels were well above the project noise limit at the nearest residential receivers, and it was not possible to directly measure or estimate the warehouse noise contribution directly, computer noise modelling was used to calculate the operational noise levels from warehouse operations at the nearby noise sensitive receivers.

3.7.2 General modelling assumptions

Modelling and assessment of warehouse noise emissions were determined by modelling the noise sources, receiver locations, existing built structures and topographical features, using CadnaA (version 2020).

The modelling incorporated the worst-case prevailing meteorological conditions, as required by CoC B80, which are wind speeds of up to 3 m/s at 10 metres above ground level for the assessed activities for daytime activities.

The noise predictions are based on the CONCAWE noise prediction algorithms, noting that the nearby noise sensitive receivers are greater 100 metres from the subject site. The CONCAWE environmental noise prediction method is an appropriate method for predicting noise propagation in these circumstances.

The noise prediction model considers:

- Location of noise sources on-site sensitive receiver locations
- Height of noise sources and receivers referenced to digital ground contours within the site and outside the site area
- Noise source levels of individual plant, equipment and internal building noise levels, modelled as either point, line or area noise sources. All noise sources associated with the WH4A operations within the MPE boundary have been included in the noise modelling, including the truck movements outside of the WH4A footprint, along internal MPE roads.
- Separation distances between sources and receivers
- Ground type between sources and receivers (mixed soft/ hard)
- Attenuation from buildings and built structures and topography (natural and purpose built)
- Atmospheric losses and assessment meteorological conditions.

The modelled activities and assumptions for the to the equipment operating and the duration and frequency of operation as part of the 'reasonable' worst-case operational scenarios are described in Section 3.6.3.

3.7.3 Model validation

Following the development of each of the representative modelling scenarios, the noise model outputs were compared against a reference time period of the onsite unattended noise measurement results for the period during which similar activities to the reasonable' worst-case operational scenario were taking place. Validation of the reasonable worst-case on-site activities was undertaken to check the final representative modelling inputs against a period of measured activities. The results of this process are presented in Table 10.

Table 10 Comparison between measured and modelled noise levels

Time period	Logger	Measured noise levels LAeq,15minute (dBA)	Predicted noise levels LAeq,15minute (dBA)	Difference, dB(A)
10:45 am to 11:00 am 3 March 2021[1]	WH4A North	62	62	< 1
2:50 pm to 3:05 pm 3 March 2021[2]	WH4A South	65	64	1

Notes:
1. Noise generating activities within the facility were as per Table 9 *"4A North 15-minute noise intensive period"*
2. Noise generating activities within the facility were as per Table 9*"4A South 15-minute noise intensive period (With container handling taking place)"*

The predicted noise levels are within the modelling tolerance of 1 dB(A). The results from the validation of the model demonstrate that it is suitable for determining the compliance noise levels at the nearby receivers for this assessment.

3.8 Noise compliance assessment

Predicted operational compliance noise levels are presented in Table 11 and Table 12 for the two reasonable worst-case operational assessment scenarios. The noise levels have been predicted to each of the surrounding residential receiver noise catchments. The highest residential receiver noise level in each catchment area are reported. This is not necessarily the same receiver location for each assessment scenario.

The results in Table 11 and Table 12 show that the predicted noise levels for the $L_{Aeq\ (15\text{-}minute)}$ assessments comply with the overall operational noise limits presented in Table 2.

As the noise levels from the site operations were not audible at the nearby noise sensitive receivers, the noise levels would not be perceived as particularly annoying at the nearby receiver locations as per the NPfI (i.e. if the resulting noise level at a receiver location is tonal, low frequency or is intermittent at night). As such, no adjustments in accordance with Fact Sheet C of the NPfI are required.

During the 7 days monitoring period, only one combi-lift activity at WH4A south was observed during the night period (10:00pm to 7:00am). As such, this is not considered a typical operation for the south WH4A. $L_{A1\ (1\text{-}minute)}$ noise predictions have been performed for this scenario to assess the potential for sleep disturbance impacts (see Table 2 for the relevant assessment criteria). The results in Table 11 and Table 12 show that the predicted $L_{A1\ (1\text{-}minute)}$ noise levels comply with the sleep disturbance noise limits.

Table 11 Predicted noise levels - Reasonable 15-minute worst-case scenarios for WH4A north

Noise catchment area/ receiver location	$L_{Aeq\ (15\text{-}minute)}$		Compliance	$L_{A1(1\text{-}minute)}$		Compliance
	Noise limits	Predicted noise levels		Noise limits	Predicted noise levels	
Wattle Grove (NCA 1)	35	27	Yes	52	34	Yes
Wattle Grove North (NCA 2)	35	< 20	Yes	52	< 20	Yes
Casula (NCA 3)	35	20	Yes	52	< 20	Yes
Glenfield (NCA 4)	35	< 20	Yes	58	< 20	Yes
All Saints Senior College (S1)	45[1]	< 20	Yes	-	N/A	N/A
Casula Powerhouse (S2)	45[1]	21	Yes	-	N/A	N/A
Defence Joint Logistics Unit (DJLU) (I2)	70[1]	31	Yes	-	N/A	N/A
ABB (I3)	70[1]	< 20	Yes	-	N/A	N/A

Note: 1. Noise limits for these receivers are only applicable when the receiver is in use

Table 12 Predicted noise levels - Reasonable 15-minute worst-case scenarios for WH4A south

Noise catchment area/ receiver location	$L_{Aeq\ (15\text{-}minute)}$		Compliance	$L_{A1(1\text{-}minute)}$		Compliance
	Noise limits	Predicted noise levels		Noise limits	Predicted noise levels	
Wattle Grove (NCA 1)	35	28	Yes	52	40	Yes
Wattle Grove North (NCA 2)	35	< 20	Yes	52	< 20	Yes
Casula (NCA 3)	35	< 20	Yes	52	29	Yes
Glenfield (NCA 4)	35	< 20	Yes	58	26	Yes
All Saints Senior College (S1)	45[1]	< 20	Yes	-	N/A	N/A
Casula Powerhouse (S2)	45[1]	< 20	Yes	-	N/A	N/A
Defence Joint Logistics Unit (DJLU) (I2)	70[1]	20	Yes	-	N/A	N/A
ABB (I3)	70[1]	< 20	Yes	-	N/A	N/A

Note: 1. Noise limits for these receivers are only applicable when the receiver is in use

The highest modelled noise levels at nearby residential receivers for the WH4A North 15-minute noise intensive period is predicted to be 27 dB(A) $L_{Aeq.15minute}$ at Wattle Grove. For WH4A north, the highest modelled noise level at nearby residential receivers from container unloading activities is predicted to be 28 dB(A) $L_{Aeq.15minute}$ at Wattle Grove (NCA 1).

The noise levels from the two noise generation areas have not been directly combined as part of the assessment, as they did not occur concurrently. The video data showed that container deliveries to WH4A south only occurred three times within the one-week period, each of 10 minutes or less. As such, this would not be considered a typical operation. As such, the modelled noise levels for the 'reasonable' worst case WH4A North 15-minute noise assessment period will only occur occasionally. It is not expected that peak activities at WH4A north and WH4A south will occur concurrently. In the very unlikely event that peak activities at WH4A north and WH4A south occur concurrently, the resulting noise levels at Wattle Grove (NCA 1) would be 30 dB(A) $L_{Aeq.15minute}$.

4 Conclusion

The noise assessment has been undertaken to address the operational noise requirements for the WH4A within the Moorebank Precent East in accordance with the *Operational Noise and Vibration Management Plan, Moorebank Logistics Park – East Precinct* (dated 27 March 2019, Revision 12) (MPE ONVMP), more specifically to address the requirements of Condition of Consent (CoC) B85 in State Significant Development (SSD) 7628.

A review of noise measurements at the nearest residential receivers during period of peak onsite activities determined that site activities were not audible and distinguishable at nearby receivers because of high ambient noise levels from road traffic, rail traffic and construction noise. For this reason, guidance from the NSW EPA Noise Policy for Industry (NPfI) Chapter 7 has been followed in order to use an alternative approach to determine compliance, and compare the site noise emissions with the noise limits.

A combination of on-site and off-site measurements were performed, between 2 March and 16 March 2021. The aim of the measurements was to quantify on-site operational noise levels from the WH4A facility, in order to then predict back to the nearby receivers. Using this approach, noise emissions from the warehouse facility operations have been evaluated using a combination of on-site attended and unattended noise monitoring, combined with noise modelling, to predict the operational noise levels at the nearest sensitive receivers.

Two 'reasonable' worst-case assessment scenarios were established based upon on site unattended noise monitoring and video recordings, in addition to discussions with WH4A personnel and observations made during on-site attended noise measurements. These were used to develop the current 'reasonable' worst case noise intensive periods that occur onsite. These were separated into two main areas of activities, one on the northern side of the warehouse and one on the southern side.

As required by CoC B85, all significant noise-generating equipment was included the assessment modelling, including the key noise-generating mechanical plant. The noise contribution from the mechanical plant items serving the warehouse and office area generate minimal contribution to the overall noise levels from site operations, which are generally controlled by other on-site activities such as truck departures, arrivals and internal warehouse loading and unloading activities.

The model was developed, and validated against the on-site unattended noise monitoring data, during periods with similar operational activities. Using the calibrated noise model, noise levels were predicted to all nearby noise sensitive receiver locations, including the residential receivers in the suburbs of Casula, Glenfield, Wattle Grove and Wattle Grove North. Noise levels were assessed assuming the worst-case prevailing meteorological conditions were present, as required by CoC B80.

The outcome of the compliance noise monitoring and modelling demonstrated that the mechanical plant and other noisy equipment that operate as part of the WH4A operations achieve the noise limits presented SSD 7628 CoC B80.

APPENDIX A Glossary of terminology

The following is a brief description of the technical terms used to describe noise to assist in understanding the technical issues presented.

Adverse weather	Weather effects that enhance noise (that is, wind and temperature inversions) that occur at a site for a significant period of time (that is, wind occurring more than 30% of the time in any assessment period in any season and/or temperature inversions occurring more than 30% of the nights in winter).
Ambient noise	The all-encompassing noise associated within a given environment at a given time, usually composed of sound from all sources near and far.
Assessment period	The period in a day over which assessments are made.
Assessment Point	A point at which noise measurements are taken or estimated. A point at which noise measurements are taken or estimated.
Background noise	Background noise is the term used to describe the underlying level of noise present in the ambient noise, measured in the absence of the noise under investigation, when extraneous noise is removed. It is described as the average of the minimum noise levels measured on a sound level meter and is measured statistically as the A-weighted noise level exceeded for ninety percent of a sample period. This is represented as the L90 noise level (see below).
Decibel [dB]	The units that sound is measured in. The following are examples of the decibel readings of common sounds in our daytime environment:

threshold of hearing	0 dB	The faintest sound we can hear
	10 dB	Human breathing
almost silent	20 dB	
	30 dB	Quiet bedroom or in a quiet national park location
generally quiet	40 dB	Library
	50 dB	Typical office space or ambience in the city at night
moderately loud	60 dB	CBD mall at lunch time
	70 dB	The sound of a car passing on the street
loud	80 dB	Loud music played at home
	90 dB	The sound of a truck passing on the street
very loud	100 dB	Indoor rock band concert
	110 dB	Operating a chainsaw or jackhammer
extremely loud	120 dB	Jet plane take-off at 100m away
threshold of pain	130 dB	
	140 dB	Military jet take-off at 25m away

dB(A)	A-weighted decibels. The A- weighting noise filter simulates the response of the human ear at relatively low levels, where the ear is not as effective in hearing low frequency sounds as it is in 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.
dB(C)	C-weighted decibels. The C-weighting noise filter simulates the response of the human ear at relatively high levels, where the human ear is nearly equally effective at hearing from mid-low frequency (63Hz) to mid-high frequency (4kHz), but is less effective outside these frequencies.

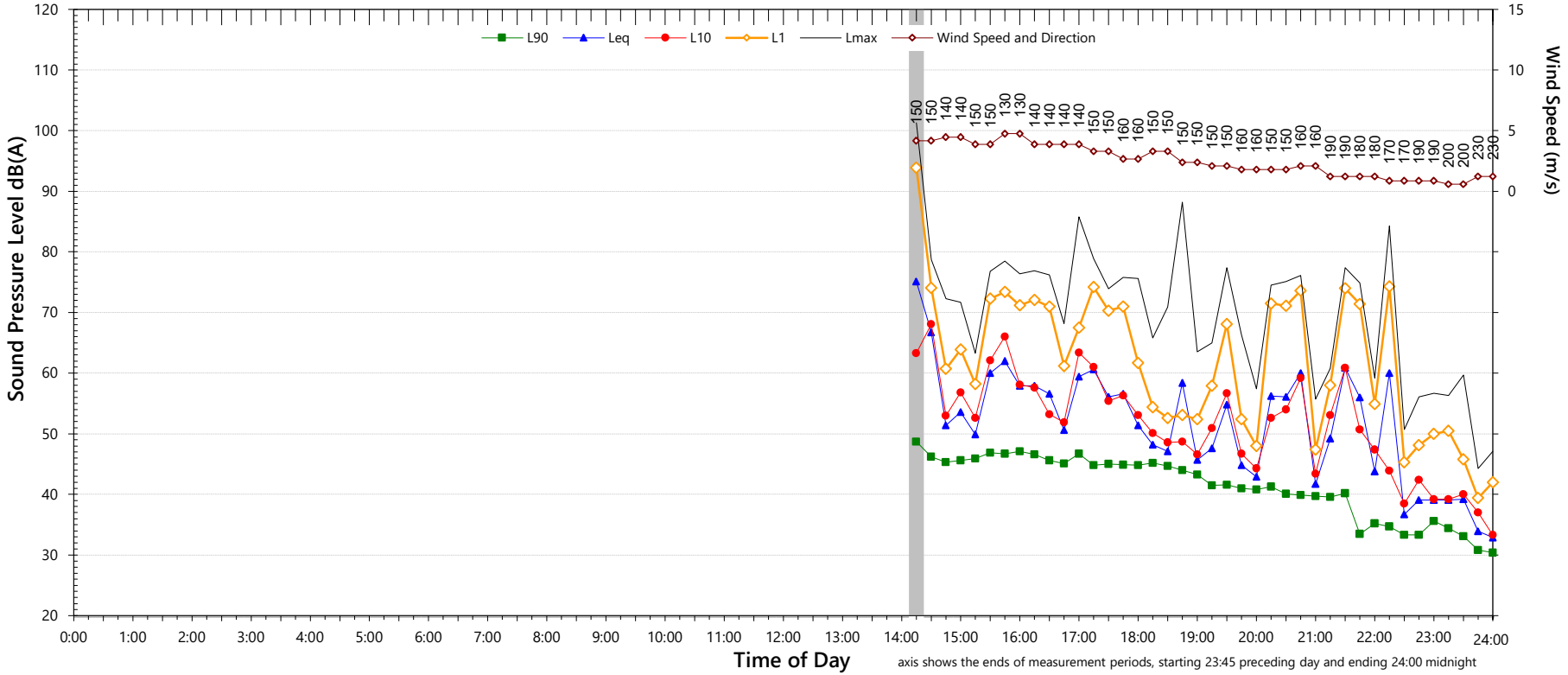
Frequency	Frequency is synonymous to pitch. Sounds have a pitch which is peculiar to the nature of the sound generator. For example, the sound of a tiny bell has a high pitch and the sound of a bass drum has a low pitch. Frequency or pitch can be measured on a scale in units of Hertz or Hz.
Impulsive noise	Having a high peak of short duration or a sequence of such peaks. A sequence of impulses in rapid succession is termed repetitive impulsive noise.
Intermittent noise	The level suddenly drops to that of the background noise several times during the period of observation. The time during which the noise remains at levels different from that of the ambient is one second or more.
L_{Max}	The maximum sound pressure level measured over a given period.
L_{Min}	The minimum sound pressure level measured over a given period.
L_1	The sound pressure level that is exceeded for 1% of the time for which the given sound is measured.
L_{10}	The sound pressure level that is exceeded for 10% of the time for which the given sound is measured.
L_{90}	The level of noise exceeded for 90% of the time. The bottom 10% of the sample is the L90 noise level expressed in units of dB(A).
L_{eq}	The "equivalent noise level" is the summation of noise events and integrated over a selected period of time.
Reflection	Sound wave changed in direction of propagation due to a solid object obscuring its path.
SEL	Sound Exposure Level (SEL) is the constant sound level which, if maintained for a period of 1 second would have the same acoustic energy as the measured noise event. SEL noise measurements are useful as they can be converted to obtain Leq sound levels over any period of time and can be used for predicting noise at various locations.
Sound	A fluctuation of air pressure which is propagated as a wave through air.
Sound absorption	The ability of a material to absorb sound energy through its conversion into thermal energy.
Sound level meter	An instrument consisting of a microphone, amplifier and indicating device, having a declared performance and designed to measure sound pressure levels.
Sound pressure level	The level of noise, usually expressed in decibels, as measured by a standard sound level meter with a microphone.
Sound power level	Ten times the logarithm to the base 10 of the ratio of the sound power of the source to the reference sound power.
Tonal noise	Containing a prominent frequency and characterised by a definite pitch.

APPENDIX B Logger location 1 – WH4A - North side

Unattended Noise Monitoring Results

WH4A - North

Tuesday, 2 March 2021



NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{A90} ABL	-	37	30
L_{Aeq}	-	55	47

Night Time Maximum Noise Levels			(see note 7)
L_{AFMax} (Range)	78	to	84
L_{AFMax} - L_{Aeq} (Range)	15	to	30

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{Aeq\ 15\ hr}$ and $L_{Aeq\ 9\ hr}$	-	50
$L_{Aeq\ 1hr}$ upper 10 percentile	-	55
$L_{Aeq\ 1hr}$ lower 10 percentile	-	37

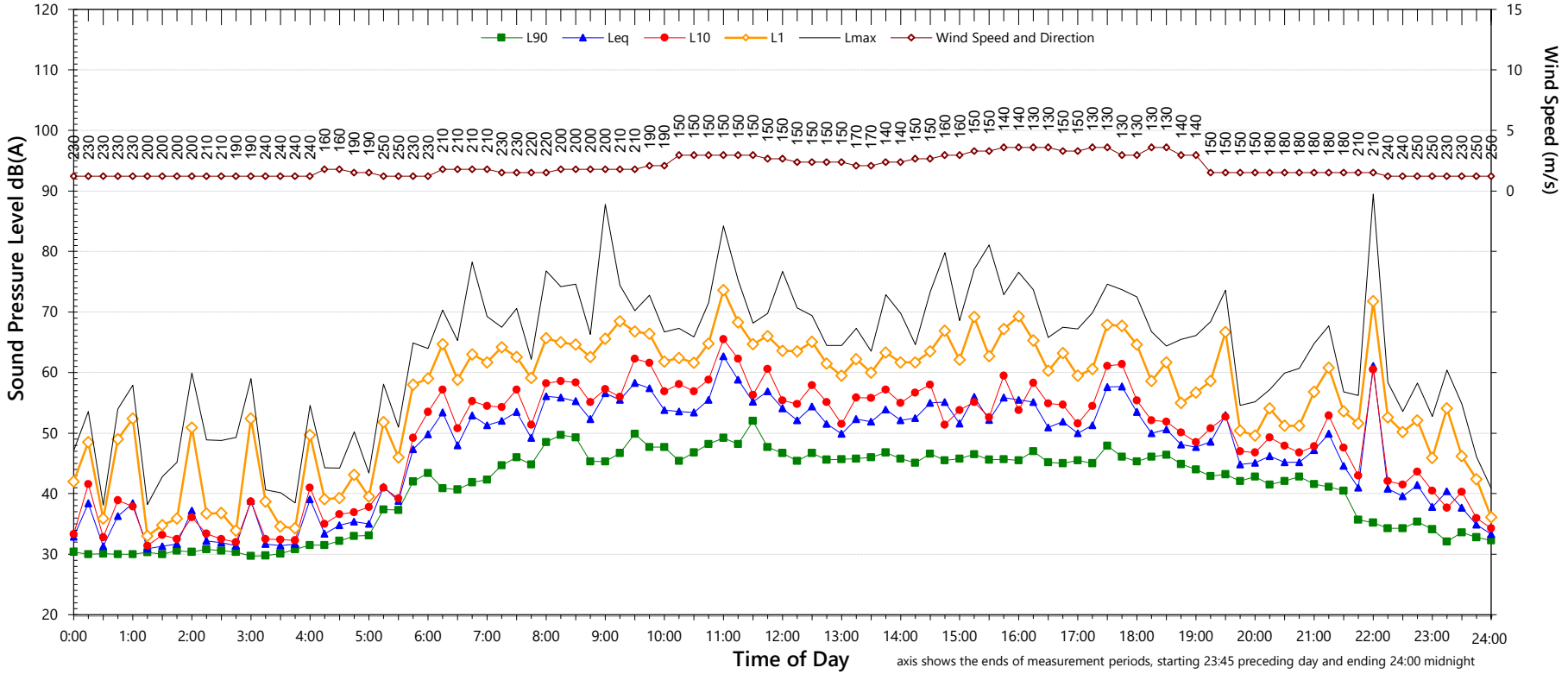
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am till 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. 1-hour values for L_{AFMax} are shown only where L_{AFMax} >65dB(A) and where L_{AFMax}- L_{Aeq} ≥15dB(A)

Unattended Noise Monitoring Results

WH4A - North

Wednesday, 3 March 2021



axis shows the ends of measurement periods, starting 23:45 preceding day and ending 24:00 midnight

NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{A90} ABL	45	38	33
L_{Aeq}	55	52	47

Night Time Maximum Noise Levels			(see note 7)
L_{AFMax} (Range)	73	to	76
L_{AFMax} - L_{Aeq} (Range)	17	to	25

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{Aeq\ 15\ hr}$ and $L_{Aeq\ 9\ hr}$	57	50
$L_{Aeq\ 1hr}$ upper 10 percentile	59	56
$L_{Aeq\ 1hr}$ lower 10 percentile	52	40

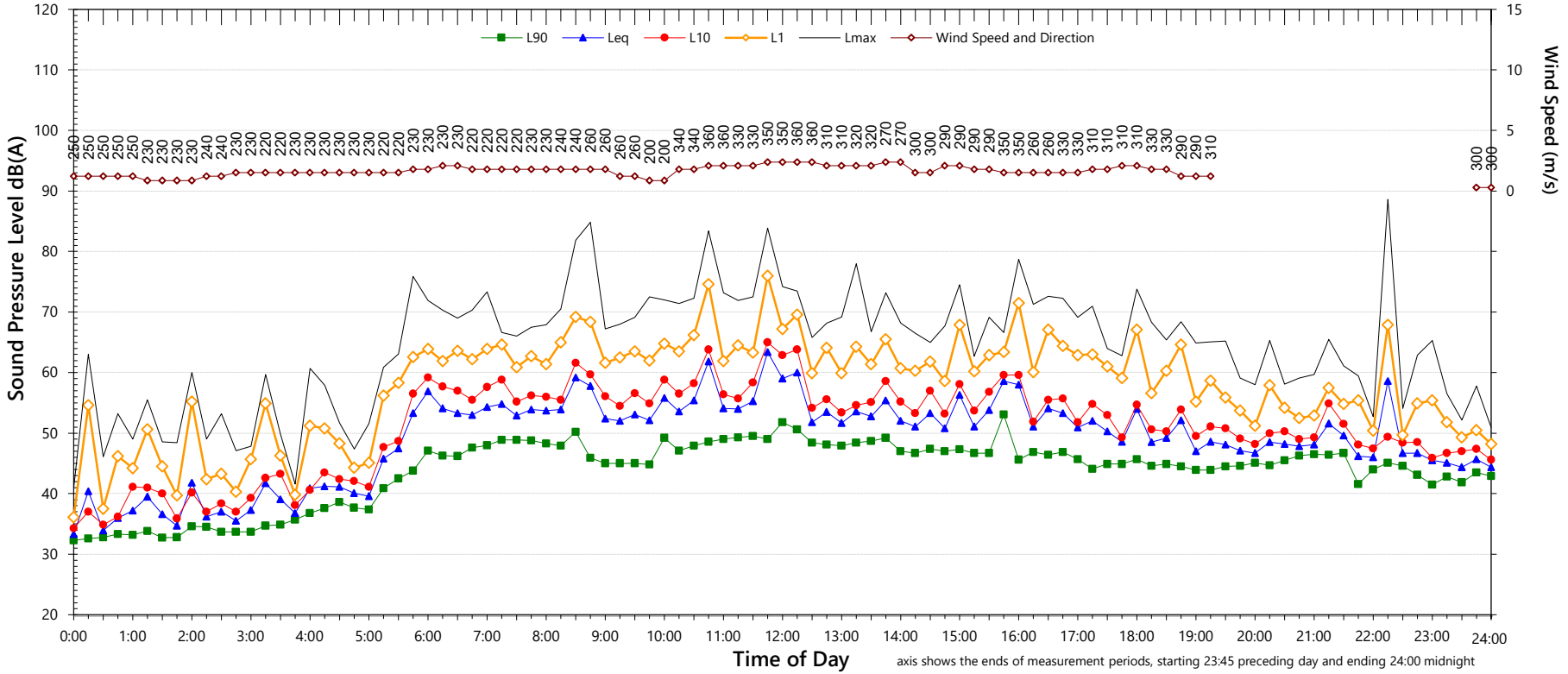
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am till 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. 1-hour values for L_{AFMax} are shown only where L_{AFMax} >65dB(A) and where L_{AFMax}- L_{Aeq} ≥15dB(A)

Unattended Noise Monitoring Results

WH4A - North

Thursday, 4 March 2021



NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{A90} ABL	45	44	39
L_{Aeq}	56	49	49

Night Time Maximum Noise Levels			(see note 7)
L_{AFMax} (Range)	65	to	89
L_{AFMax} - L_{Aeq} (Range)	15	to	35

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{Aeq\ 15\ hr}$ and $L_{Aeq\ 9\ hr}$	57	51
$L_{Aeq\ 1hr}$ upper 10 percentile	60	56
$L_{Aeq\ 1hr}$ lower 10 percentile	51	45

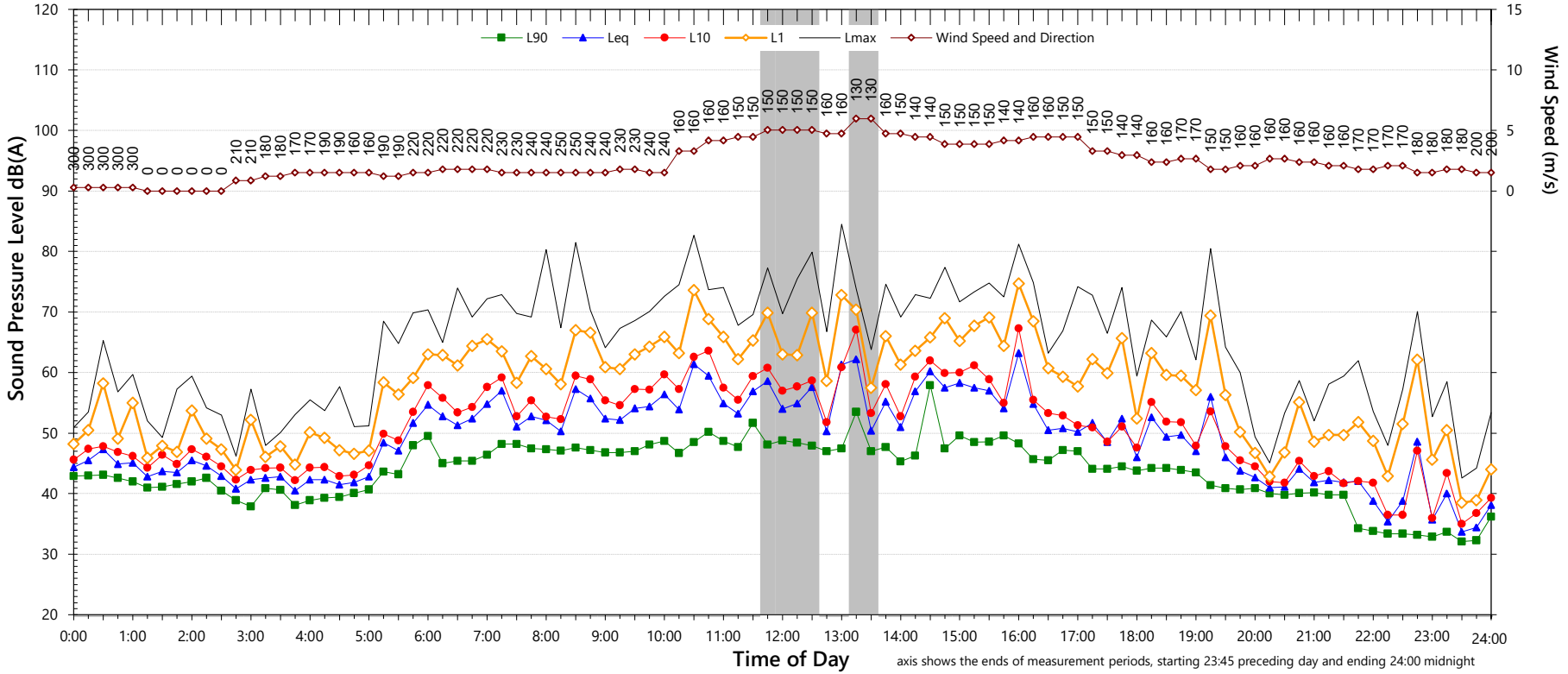
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am till 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. 1-hour values for L_{AFMax} are shown only where L_{AFMax} >65dB(A) and where L_{AFMax}- L_{Aeq} ≥15dB(A)

Unattended Noise Monitoring Results

WH4A - North

Friday, 5 March 2021



NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{A90} ABL	45	37	31
L_{Aeq}	56	48	49

Night Time Maximum Noise Levels			(see note 7)
L_{AFMax} (Range)	68	to	88
L_{AFMax} - L_{Aeq} (Range)	18	to	31

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{Aeq\ 15\ hr}$ and $L_{Aeq\ 9\ hr}$	57	51
$L_{Aeq\ 1hr}$ upper 10 percentile	61	52
$L_{Aeq\ 1hr}$ lower 10 percentile	48	38

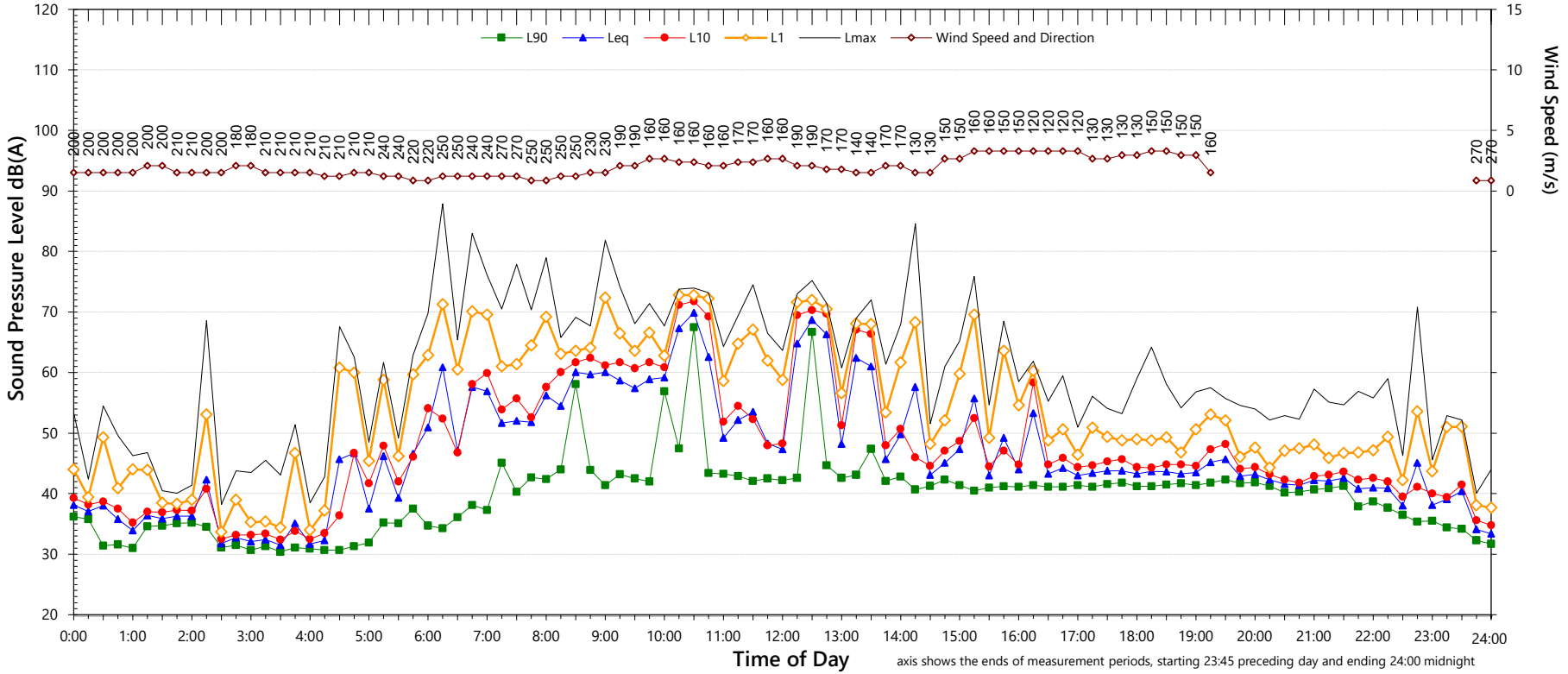
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am till 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. 1-hour values for L_{AFMax} are shown only where L_{AFMax} >65dB(A) and where L_{AFMax}- L_{Aeq} ≥15dB(A)

Unattended Noise Monitoring Results

WH4A - North

Saturday, 6 March 2021



axis shows the ends of measurement periods, starting 23:45 preceding day and ending 24:00 midnight

NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{A90} ABL	41	39	31
L_{Aeq}	60	43	41

Night Time Maximum Noise Levels			(see note 7)
L_{AFMax} (Range)	66	to	77
L_{AFMax} - L_{Aeq} (Range)	15	to	34

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{Aeq\ 15\ hr}$ and $L_{Aeq\ 9\ hr}$	61	43
$L_{Aeq\ 1hr}$ upper 10 percentile	66	46
$L_{Aeq\ 1hr}$ lower 10 percentile	45	37

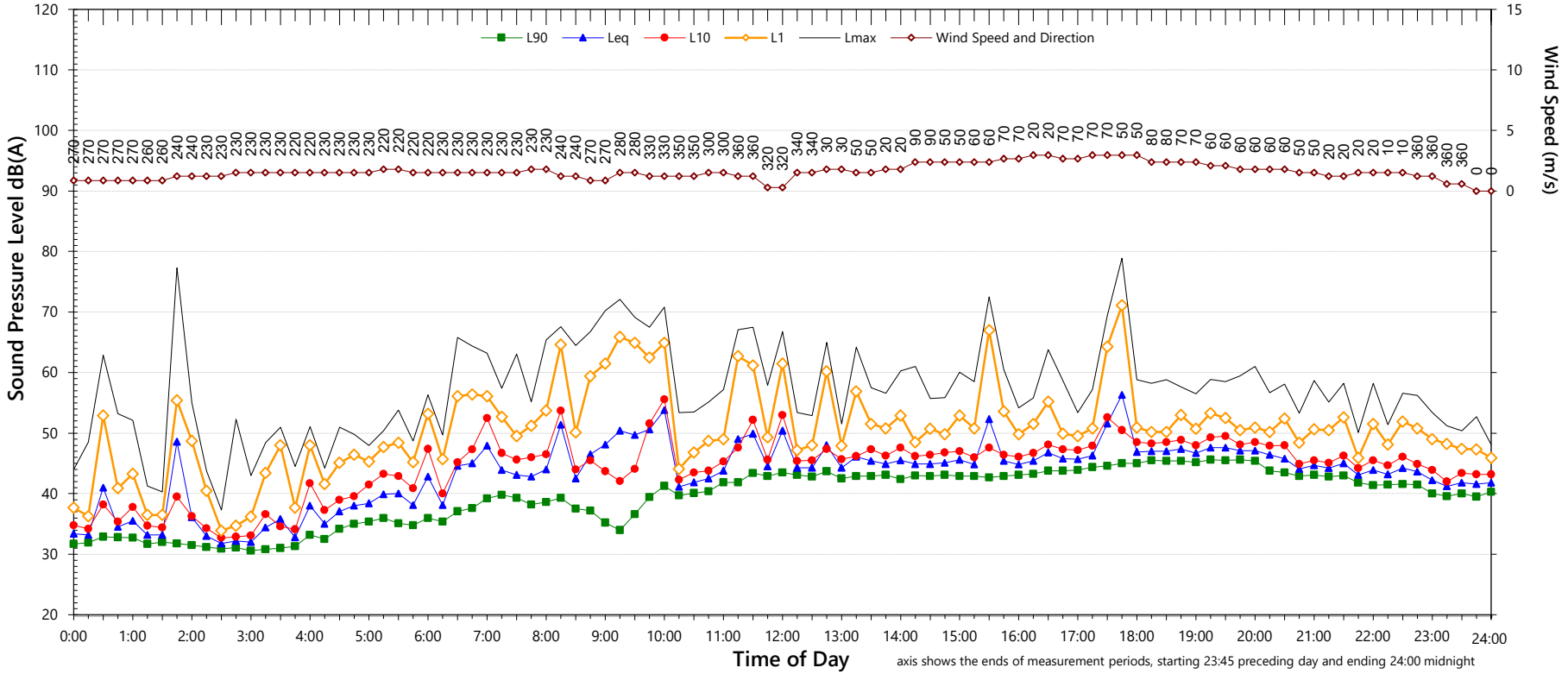
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am till 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. 1-hour values for L_{AFMax} are shown only where L_{AFMax} >65dB(A) and where L_{AFMax}- L_{Aeq} ≥15dB(A)

Unattended Noise Monitoring Results

WH4A - North

Sunday, 7 March 2021



axis shows the ends of measurement periods, starting 23:45 preceding day and ending 24:00 midnight

NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{A90} ABL	37	42	39
L_{Aeq}	48	46	48

Night Time Maximum Noise Levels			(see note 7)
L_{AFMax} (Range)	67	to	71
L_{AFMax} - L_{Aeq} (Range)	17	to	23

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{Aeq\ 15\ hr}$ and $L_{Aeq\ 9\ hr}$	50	51
$L_{Aeq\ 1hr}$ upper 10 percentile	53	55
$L_{Aeq\ 1hr}$ lower 10 percentile	46	44

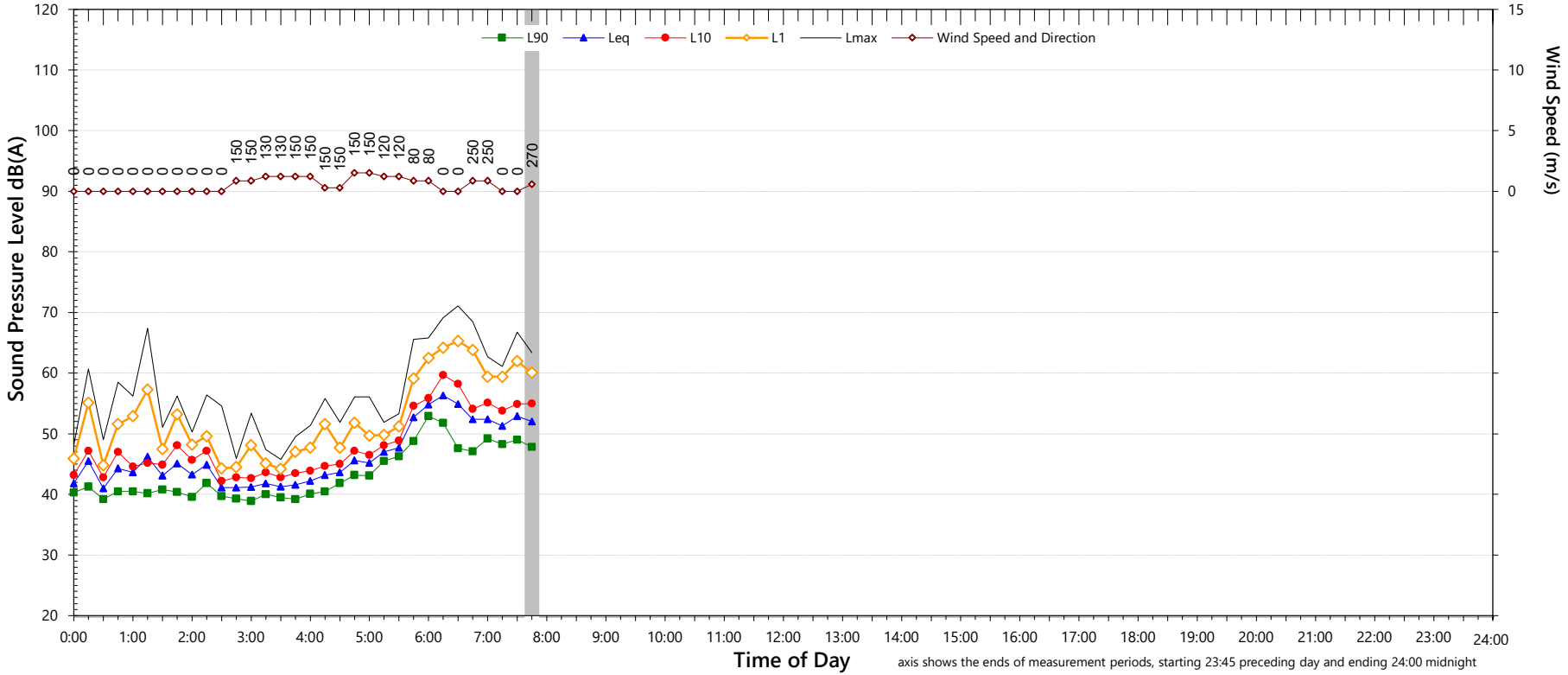
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am till 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. 1-hour values for L_{AFMax} are shown only where L_{AFMax} >65dB(A) and where L_{AFMax}- L_{Aeq} ≥15dB(A)

Unattended Noise Monitoring Results

WH4A - North

Monday, 8 March 2021



NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{A90} ABL	-	-	-
L_{Aeq}	-	-	-

Night Time Maximum Noise Levels			(see note 7)
L_{AFMax} (Range)	-	to	-
L_{AFMax} - L_{Aeq} (Range)	-	to	-

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{Aeq\ 15\ hr}$ and $L_{Aeq\ 9\ hr}$	-	-
$L_{Aeq\ 1hr}$ upper 10 percentile	-	-
$L_{Aeq\ 1hr}$ lower 10 percentile	-	-

Notes:

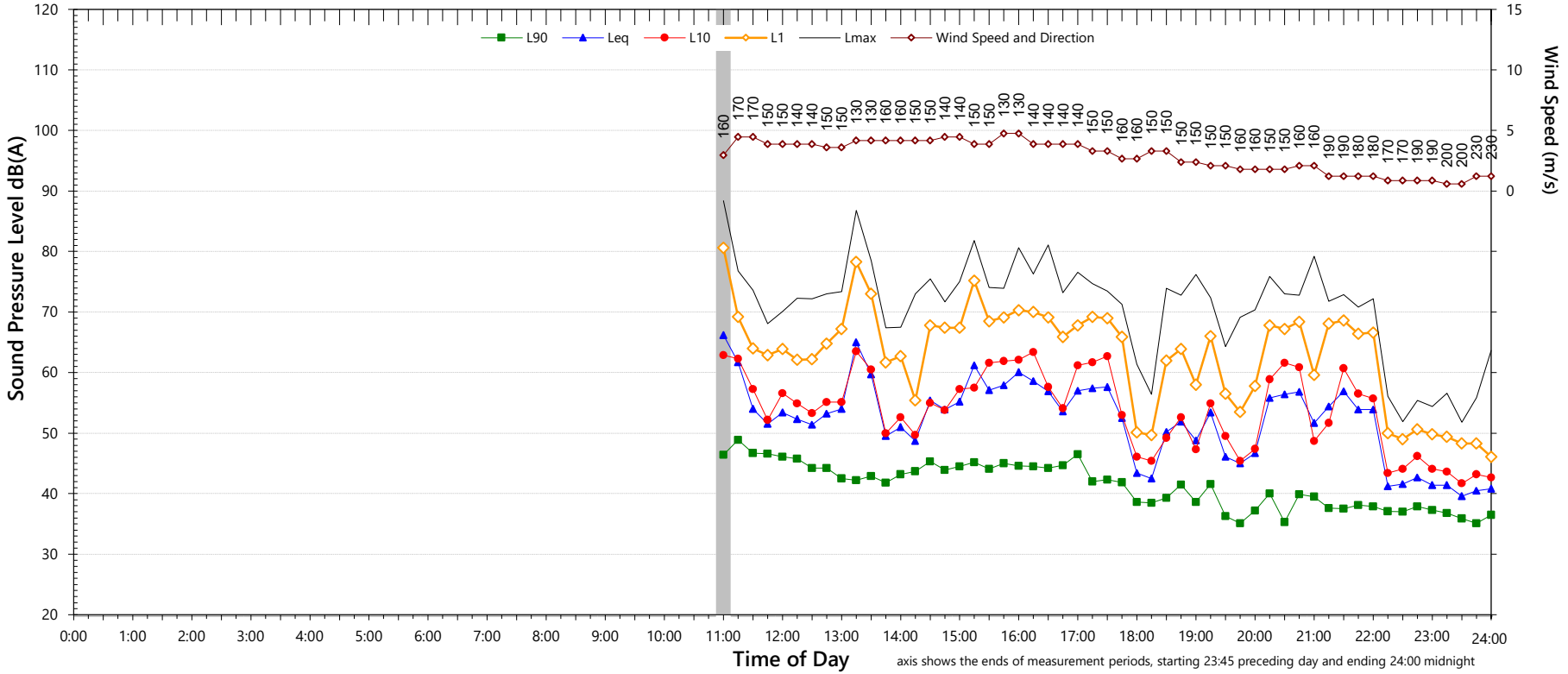
1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am till 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. 1-hour values for L_{AFMax} are shown only where L_{AFMax} >65dB(A) and where L_{AFMax}- L_{Aeq} ≥15dB(A)

APPENDIX C Logger location 2 – WH4A – South side

Unattended Noise Monitoring Results

WH4A - South

Tuesday, 2 March 2021



NSW Noise Policy for Industry (Free Field)			
Descriptor	Day[2]	Evening[3]	Night[4 5]
L_{A90} ABL	-	36	32
L_{Aeq}	-	53	47

Night Time Maximum Noise Levels			(see note 7)
L_{AFMax} (Range)	81	to	81
L_{AFMax} - L_{Aeq} (Range)	15	to	26

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	Day	Night[5]
	7am-10pm	10pm-7am
$L_{Aeq\ 15\ hr}$ and $L_{Aeq\ 9\ hr}$	-	49
$L_{Aeq\ 1hr}$ upper 10 percentile	-	50
$L_{Aeq\ 1hr}$ lower 10 percentile	-	40

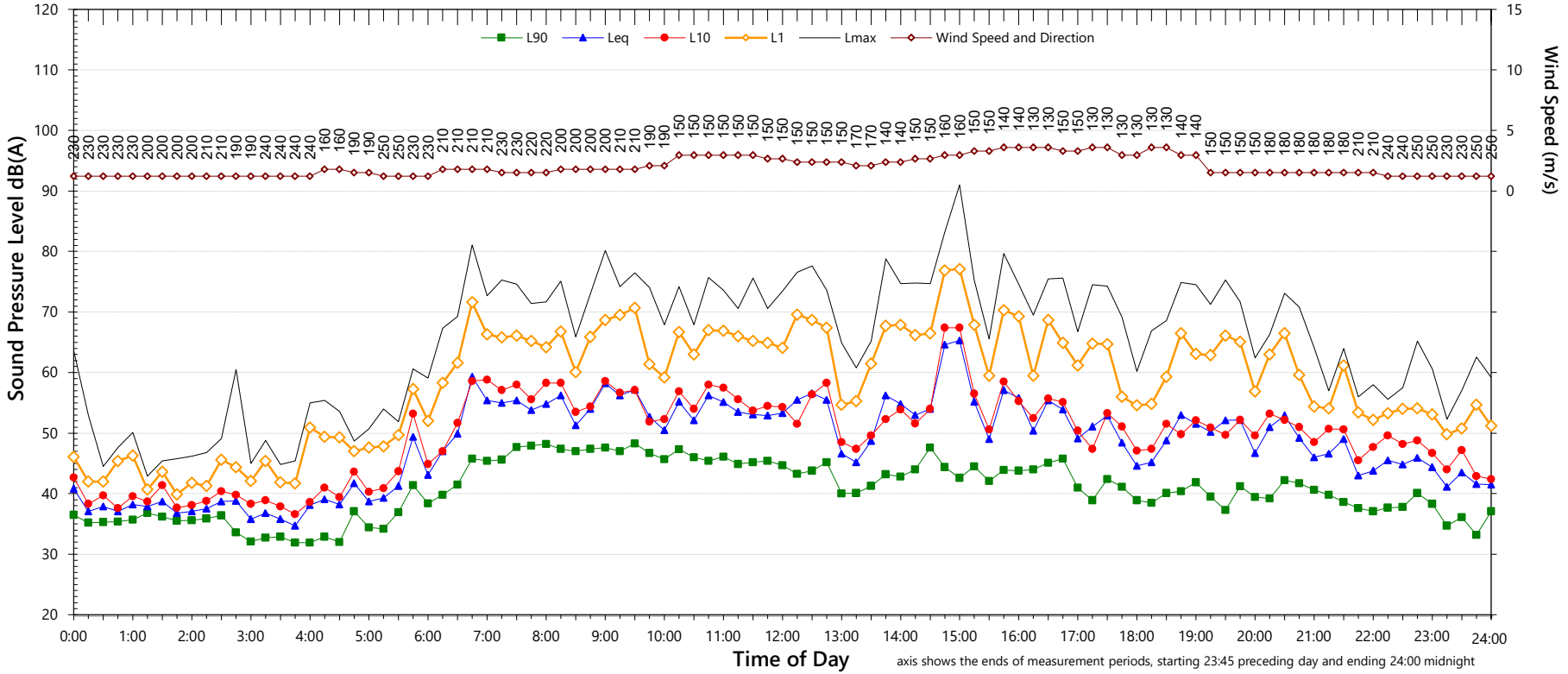
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am till 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. 1-hour values for L_{AFMax} are shown only where L_{AFMax} >65dB(A) and where L_{AFMax}- L_{Aeq} ≥15dB(A)

Unattended Noise Monitoring Results

WH4A - South

Wednesday, 3 March 2021



NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{A90} ABL	41	37	35
L_{Aeq}	56	50	49

Night Time Maximum Noise Levels			(see note 7)
L_{AFMax} (Range)	65	to	79
L_{AFMax} - L_{Aeq} (Range)	20	to	25

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{Aeq\ 15\ hr}$ and $L_{Aeq\ 9\ hr}$	57	51
$L_{Aeq\ 1hr}$ upper 10 percentile	58	52
$L_{Aeq\ 1hr}$ lower 10 percentile	53	44

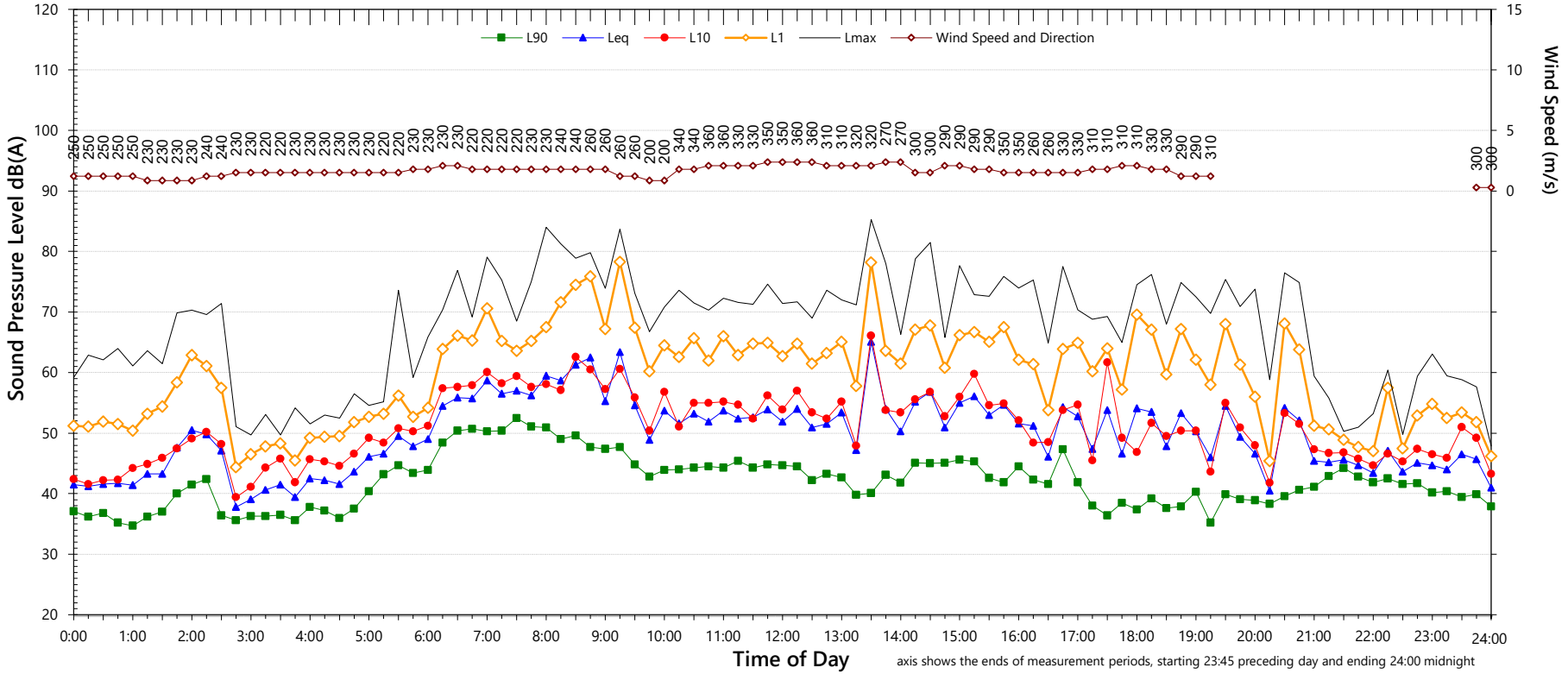
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am till 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. 1-hour values for L_{AFMax} are shown only where L_{AFMax} >65dB(A) and where L_{AFMax}- L_{Aeq} ≥15dB(A)

Unattended Noise Monitoring Results

WH4A - South

Thursday, 4 March 2021



axis shows the ends of measurement periods, starting 23:45 preceding day and ending 24:00 midnight

NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{A90} ABL	40	38	37
L_{Aeq}	56	50	53

Night Time Maximum Noise Levels			(see note 7)
L_{AFMax} (Range)	70	to	83
L_{AFMax} - L_{Aeq} (Range)	16	to	26

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{Aeq\ 15\ hr}$ and $L_{Aeq\ 9\ hr}$	58	55
$L_{Aeq\ 1hr}$ upper 10 percentile	62	54
$L_{Aeq\ 1hr}$ lower 10 percentile	53	43

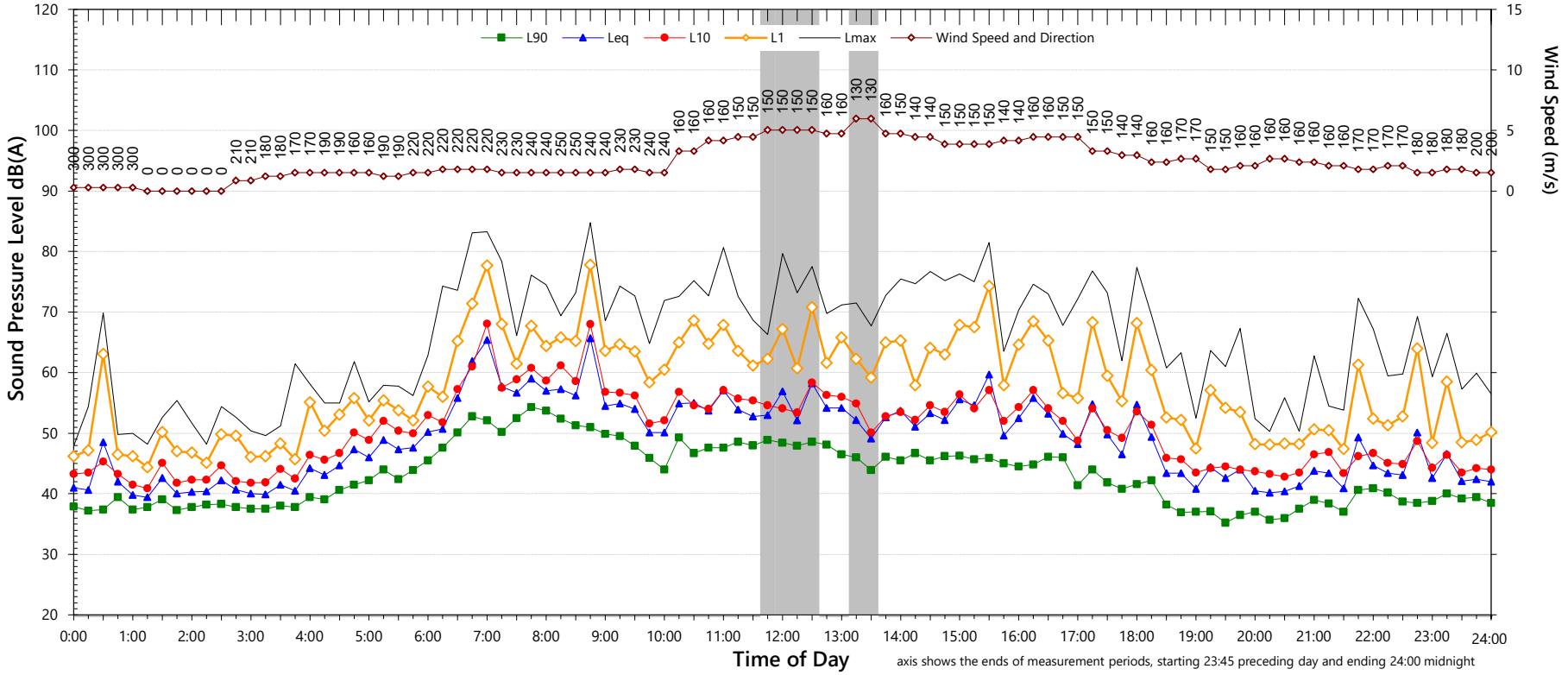
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am till 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. 1-hour values for L_{AFMax} are shown only where L_{AFMax} >65dB(A) and where L_{AFMax}- L_{Aeq} ≥15dB(A)

Unattended Noise Monitoring Results

WH4A - South

Friday, 5 March 2021



NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{A90} ABL	43	36	36
L_{Aeq}	56	44	44

Night Time Maximum Noise Levels			(see note 7)
L_{AFMax} (Range)	67	to	74
L_{AFMax} - L_{Aeq} (Range)	17	to	23

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{Aeq\ 15\ hr}$ and $L_{Aeq\ 9\ hr}$	57	47
$L_{Aeq\ 1hr}$ upper 10 percentile	59	50
$L_{Aeq\ 1hr}$ lower 10 percentile	47	42

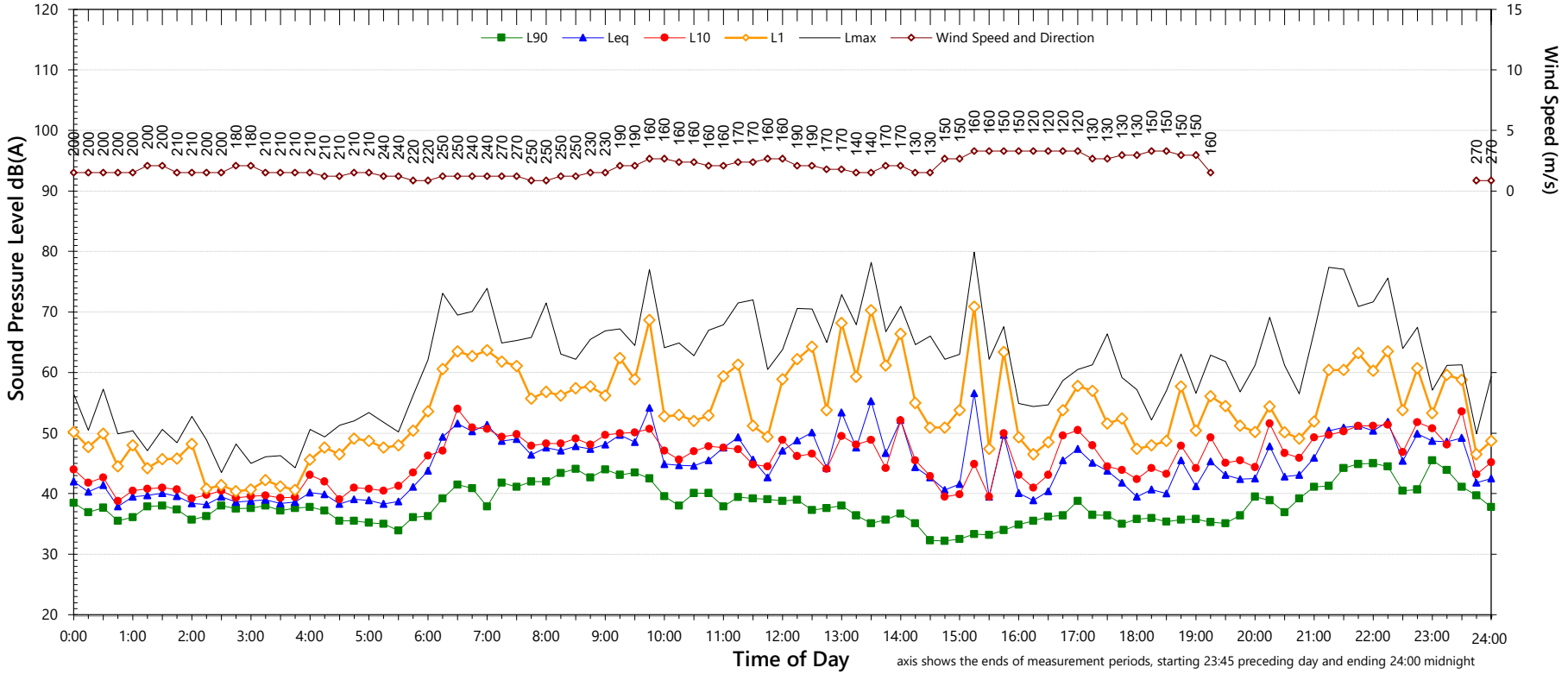
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am till 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. 1-hour values for L_{AFMax} are shown only where L_{AFMax} >65dB(A) and where L_{AFMax}- L_{Aeq} ≥15dB(A)

Unattended Noise Monitoring Results

WH4A - South

Saturday, 6 March 2021



axis shows the ends of measurement periods, starting 23:45 preceding day and ending 24:00 midnight

NSW Noise Policy for Industry (Free Field)			
Descriptor	Day[2]	Evening[3]	Night[4 5]
L_{A90} ABL	34	35	34
L_{Aeq}	49	47	45

Night Time Maximum Noise Levels			(see note 7)
L_{AFMax} (Range)	65	to	76
L_{AFMax} - L_{Aeq} (Range)	18	to	26

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	Day	Night[5]
	7am-10pm	10pm-7am
$L_{Aeq\ 15\ hr}$ and $L_{Aeq\ 9\ hr}$	51	48
$L_{Aeq\ 1hr}$ upper 10 percentile	54	50
$L_{Aeq\ 1hr}$ lower 10 percentile	45	43

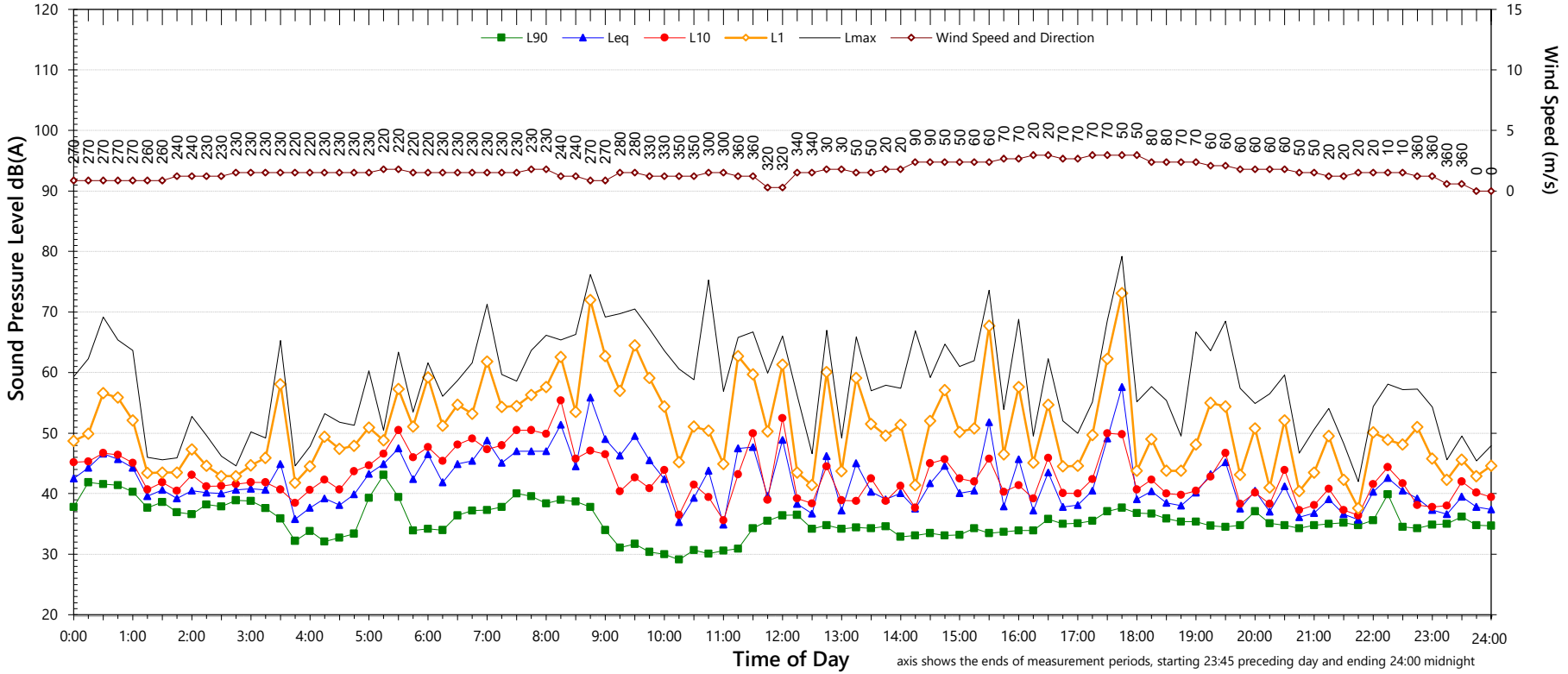
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am till 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. 1-hour values for L_{AFMax} are shown only where L_{AFMax} >65dB(A) and where L_{AFMax}- L_{Aeq} ≥15dB(A)

Unattended Noise Monitoring Results

WH4A - South

Sunday, 7 March 2021



axis shows the ends of measurement periods, starting 23:45 preceding day and ending 24:00 midnight

NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{A90} ABL	31	35	34
L_{Aeq}	47	40	46

Night Time Maximum Noise Levels			(see note 7)
L_{AFMax} (Range)	76	to	77
L_{AFMax} - L_{Aeq} (Range)	16	to	30

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{Aeq\ 15\ hr}$ and $L_{Aeq\ 9\ hr}$	49	48
$L_{Aeq\ 1hr}$ upper 10 percentile	53	50
$L_{Aeq\ 1hr}$ lower 10 percentile	41	39

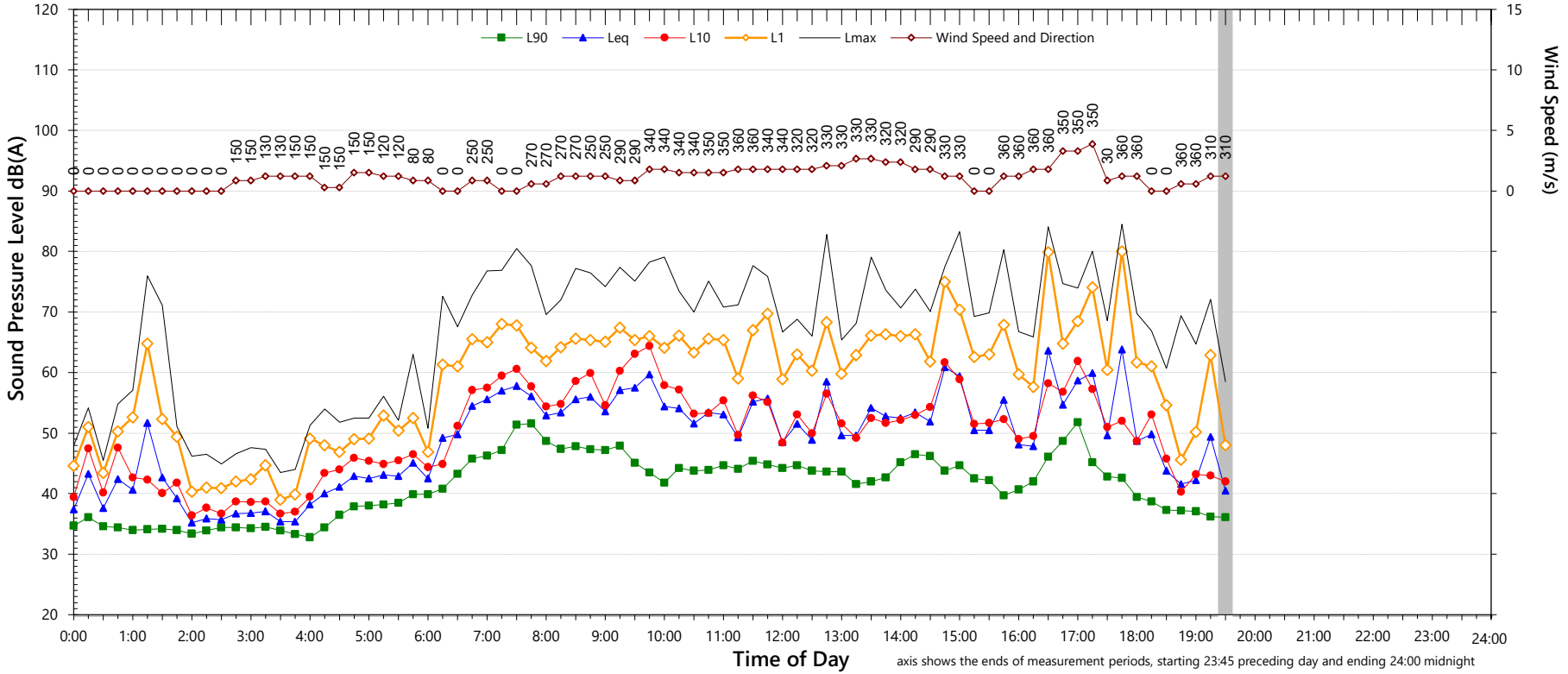
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am till 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. 1-hour values for L_{AFMax} are shown only where L_{AFMax} >65dB(A) and where L_{AFMax}- L_{Aeq} ≥15dB(A)

Unattended Noise Monitoring Results

WH4A - South

Monday, 8 March 2021



NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{A90} ABL	42	-	-
L_{Aeq}	56	-	-

Night Time Maximum Noise Levels			(see note 7)
L_{AFMax} (Range)	-	to	-
L_{AFMax} - L_{Aeq} (Range)	-	to	-

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{Aeq\ 15\ hr}$ and $L_{Aeq\ 9\ hr}$	-	-
$L_{Aeq\ 1hr}$ upper 10 percentile	-	-
$L_{Aeq\ 1hr}$ lower 10 percentile	-	-

Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am till 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. 1-hour values for L_{AFMax} are shown only where L_{AFMax} >65dB(A) and where L_{AFMax}- L_{Aeq} ≥15dB(A)

B.11 Warehouse 5 Noise Monitoring Report

Renzo Tonin & Associates Report TL116-09F03 Warehouse 5 Ops (r1)

RENZO TONIN & ASSOCIATES
inspired to achieve

Acoustics
Vibration
Structural Dynamics

MOOREBANK LOGISTIC PARK - PRECINCT EAST

Warehouse 5 Operational Compliance Measurements

9 April 2021

Qube Property Management Services Pty Ltd c/- Tactical Group

TL116-09F03 Warehouse 5 Ops (r1)

Sydney Melbourne Brisbane Gold Coast Kuwait Singapore
Renzo Tonin & Associates ABN 29 117 462 861
Level 1/418A Elizabeth St SURRY HILLS NSW 2010 | PO Box 877 STRAWBERRY HILLS NSW 2012
P (02) 8218 0500 F (02) 8218 0501 sydney@renzotonin.com.au www.renzotonin.com.au

Document details

Detail	Reference
Doc reference:	TL116-09F03 Warehouse 5 Ops (r1)
Prepared for:	Qube Property Management Services Pty Ltd c/- Tactical Group
Address:	Level 15, 124 Walker Street North Sydney, NSW, 2060
Attention:	Cathal McGann

Document control

Date	Revision history	Non-issued revision	Issued revision	Prepared	Instructed	Reviewed / Authorised
09.04.2021	Final	0	1	J. Liang/ A. Leslie	A. Leslie	C. Weber

File Path: R:\AssocSydProjects\TL101-TL150\TL116 cw Moorebank IMT Temporary Noise Monitoring\Task 9 - cw Warehouse Compliance Monitoring\1 Docs\WH5\TL116-09F03 Warehouse 5 Ops (r1).docx

Important Disclaimers:

The work presented in this document was carried out in accordance with the Renzo Tonin & Associates Quality Assurance System, which is based on Australian/New Zealand Standard AS/NZS ISO 9001.

This document is issued subject to review and authorisation by the suitably qualified and experienced person named in the last column above. If no name appears, this document shall be considered as preliminary or draft only and no reliance shall be placed upon it other than for information to be verified later.

This document is prepared for the particular requirements of our Client referred to above in the 'Document details' which are based on a specific brief with limitations as agreed to with the Client. It is not intended for and should not be relied upon by a third party and no responsibility is undertaken to any third party without prior consent provided by Renzo Tonin & Associates. The information herein should not be reproduced, presented or reviewed except in full. Prior to passing on to a third party, the Client is to fully inform the third party of the specific brief and limitations associated with the commission.

In preparing this report, we have relied upon, and presumed accurate, any information (or confirmation of the absence thereof) provided by the Client and/or from other sources. Except as otherwise stated in the report, we have not attempted to verify the accuracy or completeness of any such information. If the information is subsequently determined to be false, inaccurate or incomplete then it is possible that our observations and conclusions as expressed in this report may change.

We have derived data in this report from information sourced from the Client (if any) and/or available in the public domain at the time or times outlined in this report. The passage of time, manifestation of latent conditions or impacts of future events may require further examination and re-evaluation of the data, findings, observations and conclusions expressed in this report.

We have prepared this report in accordance with the usual care and thoroughness of the consulting profession, for the sole purpose described above and by reference to applicable standards, guidelines, procedures and practices at the date of issue of this report. For the reasons outlined above, however, no other warranty or guarantee, whether expressed or implied, is made as to the data, observations and findings expressed in this report, to the extent permitted by law.

The information contained herein is for the purpose of acoustics only. No claims are made and no liability is accepted in respect of design and construction issues falling outside of the specialist field of acoustics engineering including and not limited to structural integrity, fire rating, architectural buildability and fit-for-purpose, waterproofing and the like. Supplementary professional advice should be sought in respect of these issues.

External cladding disclaimer: No claims are made and no liability is accepted in respect of any external wall and/or roof systems (eg facade / cladding materials, insulation etc) that are: (a) not compliant with or do not conform to any relevant non-acoustic legislation, regulation, standard, instructions or Building Codes; or (b) installed, applied, specified or utilised in such a manner that is not compliant with or does not conform to any relevant non-acoustic legislation, regulation, standard, instructions or Building Codes.

Contents

1 Introduction 5
1.1 Warehouse operations description – WH5 6
1.1.1 Location 6
1.1.2 Operational activities and facilities and hours of operation 6
1.2 Nearby sensitive receivers 6
2 Summary of noise objectives 9
2.1 Compliance assessment noise requirements 9
2.2 Operational noise limits 9
2.3 Discussion of assessment noise limits 10
3 Measurement methodology and results 12
3.1 Compliance measurement methodology 12
3.2 Instrumentation 13
3.3 Receiver unattended noise measurement results 13
3.3.1 Meteorological conditions xvii
3.4 On-site attended operational activity noise measurement results xvii
3.5 Unattended noise measurements xviii
3.6 Modelled operational scenarios xix
3.6.1 Observed operations for modelling xix
3.6.1.1 Loading and Unloading operations (WH5 east) xx
3.6.1.2 Qube container handling operational area (WH5 west) xx
3.6.2 Assessment noise source levels xxi
3.6.3 Reasonable worst-case intrusiveness scenarios (15-minute period) xxii
3.7 Modelling methodology xxiii
3.7.1 Overview of noise modelling xxiii
3.7.2 General modelling assumptions xxiii
3.7.3 Model validation xxiv
3.8 Noise compliance assessment xxv
4 Conclusion xxvii
APPENDIX A Glossary of terminology xxviii
APPENDIX B Logger location 1 – WH5 - West side xxx
APPENDIX C Logger location 2 – WH5 – East side (L1) xxxi
APPENDIX D Logger location 3 – WH5 – East side (L2) xxxii

List of tables

Table 1 Noise sensitive receivers and approximate distance from MPE WH5 7
Table 2 SSD 7628 CoC B80 noise limits, dB(A) 10

Table 3 Noise measurement equipment 13
Table 4 Permanent noise monitoring stations 13
Table 5 Receiver permanent noise monitoring locations 14
Table 6 Summary of permanent noise monitoring results at the nearest sensitive residential receivers xvi
Table 7 On-site attended noise measurement results xviii
Table 8 Assessment noise source levels xxi
Table 9 Representative 'reasonable' worst-case 15-minute intrusive assessment scenarios xxiii
Table 10 Comparison between measured and modelled noise levels xxv
Table 11 Predicted noise levels - Reasonable 15-minute worst-case scenario for WH5 west xxvi
Table 12 Predicted noise levels - Reasonable 15-minute worst-case scenario for WH5 east xxvi

List of figures

Figure 1 Warehouse location WH5, MPE precinct and the nearest residential receiver catchments 8
Figure 2 Residential receiver noise monitoring locations NMT01 to NMT04 15
Figure 3 Unattended noise logger locations and main noise generation areas for WH5 (imagery: Nearmap, 2021) xix

1 Introduction

Renzo Tonin & Associates was engaged by Tactical on behalf of Qube Property Management Services Pty Ltd (QUBE) to undertake an operational noise compliance assessment of the warehouse operations being carried out at Warehouse 5 (WH5) within the Moorebank Precent East (MPE), located within the Moorebank Logistics Park (MLP) at Moorebank, NSW.

The Sydney Intermodal Terminal Alliance (SIMTA) received approval for the construction and operation of Stages 1 and 2 of the MPE Project (SSD 6766 and SSD 7628 respectively), which together comprise the two stages of development under the MPE Concept Approval (MP10_0193). Warehouse operations, including the site that is operated by WH5 fall under the area and activities approved as part of SSD 7628.

This report has been prepared to address the operational noise monitoring requirements outlined in the MPE Operational Noise and Vibration Management Plan[1] (MPE ONVMP) required for the warehouse operations carried out by WH5. Specifically, this report has been prepared to address the requirements of Condition of Consent (CoC) B85 in State Significant Development (SSD) 7628, as detailed in Section 3.2.2 of the MPE ONVMP.

Appendix A contains a glossary of acoustic terms used in this report.

1. 1 Arcadis & Renzo Tonin & Associates, Operational Noise and Vibration Management Plan for Moorebank Logistics Park – East Precinct, Revision 012, dated 27/3/2020, available https://simta.com.au/wordpress/wp-content/uploads/2020/04/ONVMP_V12_redacted.pdf, accessed 25/3/2021

1.1 Warehouse operations description – WH5

1.1.1 Location

The MLP is located approximately 27 kilometres east-west of the Sydney Central Business District and approximately 26 kilometres west of Port Botany, within the Liverpool Local Government Area. The MLP is divided into an East Precinct and a West Precinct, located east and west of Moorebank Avenue respectively, as shown in Figure 1.

1.1.2 Operational activities and facilities and hours of operation

Operational activities at WH5 include storage and distribution activities at the position shown in Figure 1. The day to day activities include:

- Receipt and despatch of containers from and to the IMEX terminal
- Loading and unloading of containers
- Storage of products
- Despatching and receiving commercial products. Deliveries are via trucks, with loading and unloading activities via forklift
- Internal product transferring and moving activities using forklifts
- General office administrative and support functions.

The despatch activities, general deliveries and commercial customer activities mostly occur from the east side of WH5. The western side of the warehouse is the designated area where containers from the IMEX terminal or other sources are transported to and stored for unloading to within the warehouse. These two main areas are shown in Figure 3.

Noise-generating activities typically occur between 6:00am and 6:00pm, however the busiest period is typically between 6:00am and 11:00am. Since the 6:00am to 7:00am period is within the 10:00pm to 7:00am night-time period, the potential for sleep disturbance impacts at nearby residential receivers has been undertaken as part of this report. Activities typically do not occur during the remaining 10:00pm to 6:00am night-time period.

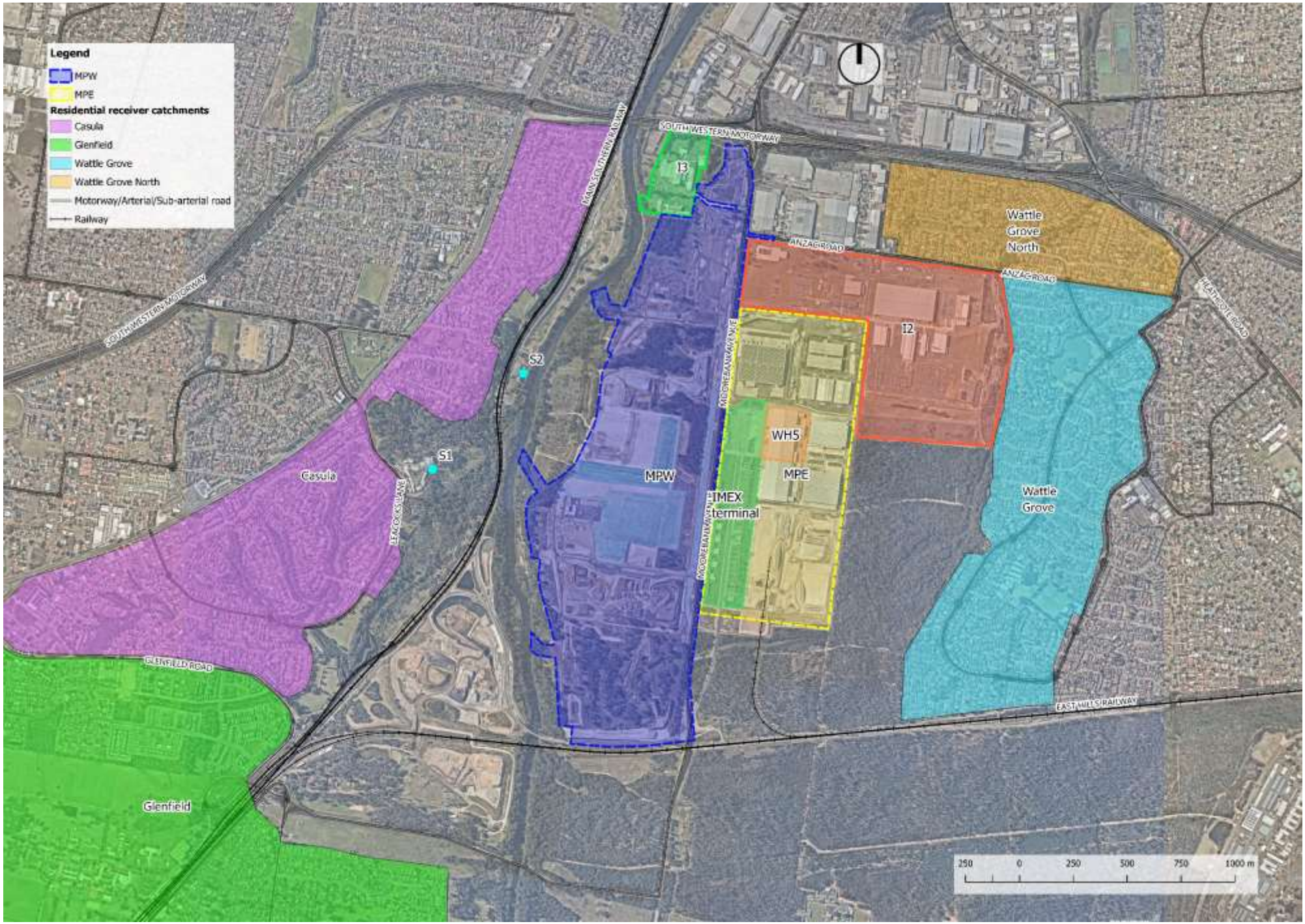
1.2 Nearby sensitive receivers

The potentially most affected residential receivers in the vicinity of the MPE for the WH5 operations, are located in the suburbs of Casula, Glenfield, Wattle Grove and Wattle Grove West. A summary of the approximate distance to the nearest residential receiver in the surround noise catchment areas (NCAs) in addition to nearby other noise receivers is provided in Table 1. The locations of the NCAs or receivers, are shown in Figure 1.

Table 1 Noise sensitive receivers and approximate distance from MPE WH5

Sensitive receiver (Noise Catchment Area (NCA) or Receiver ID)	Receiver type	Approximate distance from MPE precinct WH5, metres
Wattle Grove (NCA 1)	Residential	860
Wattle Grove West (NCA 2)		850
Casula (NCA 3)		1160
Glenfield (NCA 4)		2,430
All Saints Senior College (S1)	Educational	1,530
Casula Powerhouse (S2)		1,145
Defence Joint Logistics Unit (DJLU) (I2)	Industrial	230
ABB (I3)		955

Figure 1 Warehouse location WH5, MPE precinct and the nearest residential receiver catchments



2 Summary of noise objectives

2.1 Compliance assessment noise requirements

The management of operational noise emission from warehouse activities within MPE Stage 2 is outlined in the MPE ONVMP. Specifically, this report has been prepared to address the requirements of CoC B85 in SSD 7628, as detailed in Section 4.1.1 of the MPE ONVMP.

This report includes noise monitoring performed to address the requirements in CoC B85, as detailed in Table 4-1 in Section 4.1.1 of the MPE ONVMP.

The requirements of CoC B85 state:

> *B85 The Applicant must carry out noise monitoring of mechanical plant and other noisy equipment for a minimum period of two weeks where valid data is collected following occupation of each warehouse. The monitoring program must be carried out by a suitably qualified and experienced person(s) and a Monitoring Report for Mechanical Plant must be submitted to the Secretary within two months of occupation or each tenancy to verify predicted mechanical plant and equipment noise levels.*

CoC B85 requires that the monitored noise levels be compared against the predicted levels reviewed in accordance with CoC B84.

The noise impacts from warehouse operations were assessed as part of the EIS noise and vibration impact assessment (MPE Stage 2 Noise and Vibration Impact Assessment, Wilkinson Murray, Report No. 12186-S2, Version C, 29 November 2016 (MPE Stage 2 N&V assessment)). The individual noise impacts of warehouse operations were not quantified as part of the EIS. As such, noise level predictions for the warehouse activities are not available for verification with CoC B85.

As per Table 4-1 in Section 4.1.1 of the MPE ONVMP, Table 3-20 and Table 3-21 of the MPE ONVMP detail the predicted $L_{Aeq\ 15\ minute}$ intrusiveness and $L_{A1\ (1\ minute)}$ \ L_{Amax} sleep disturbance noise limit levels respectively for the overall MPE operations (not for individual warehouses).

As such, for the purposes of addressing CoC B85, instead of comparing the facility noise emission against the noise level predicted in accordance with CoC B84, this report is aims to assess the noise levels from the mechanical plant and other noisy equipment that operate within the facility directly against the noise limits presented in Table 5 of condition B80.

2.2 Operational noise limits

The operational noise limits applicable for the warehouse operations within MPE are presented in Table 5 of SSD 7628 CoC B80 and are reproduced in Table 2. These noise limits are as per Table 3-5 of

the MPE ONVMP. The noise limits are applicable not only to all operational noise sources approved under SSD 7628, but are inclusive of operations as part of MPE Stage 1, approval SSD 6766.

The $L_{Aeq(15\ minute)}$ criteria are applicable during the day, evening and night-time periods and the $L_{A1\ (1\ minute)}$ sleep disturbance noise limits at residential receivers are applicable during the night-time period.

The noise limits are applicable under prevailing meteorological conditions of wind speeds of up to 3 m/s at 10 metres above ground level or stability category 'F' temperature inversion conditions.

Table 2 SSD 7628 CoC B80 noise limits, dB(A)

Sensitive receiver	Day [1] $L_{Aeq,\ 15\ minute}$	Evening [1] $L_{Aeq,\ 15\ minute}$	Night [1] $L_{Aeq,\ 15\ minute}$	Night [1] $L_{A1\ (1\ mininute)}$
Wattle Grove (NCA 1)	35	35	35	52
Wattle Grove West (NCA 2)	35	35	35	52
Casula (NCA 3)	35	35	35	52
Glenfield (NCA 4)	35	35	35	52

Notes:

1. In accordance with the INP, day is the period from 7:00 am to 6:00 pm Monday to Saturday; or 8:00 am to 6:00 pm on Sundays and public holidays; evening is the period from 6:00 pm to 10:00 pm; and night is the remaining periods.
2. To determine compliance with the $L_{Aeq,15\ minute}$ noise limits, noise from the development is to be measured at the most affected point within the residential boundary, or at the most affected point within 30 metres of a dwelling where the dwelling is more than 30 metres from the boundary. Where it can be demonstrated that direct measurement of noise from the project is impractical, the EPA may accept alternative means of determining compliance (see Chapter 7 Noise Policy for Industry - NPfI) The modification factors in Section 4 of the INP must also be applied to the measured noise levels where applicable.
3. To determine compliance with the L_{A1} noise limits, noise from the project is to be measured at 1 metre from the dwelling façade. Where it can be demonstrated that direct measurement of noise from the project is impractical, the EPA may accept alternative means of determining compliance (see Chapter 7 of the NPfI).
4. The noise emission limits identified above apply under meteorological conditions of:

   (i) wind speeds of up to 3 m/s at 10 metres above ground level; or

   (ii) 'F' atmospheric stability class.

2.3 Discussion of assessment noise limits

As noted in Section 2.2, the noise limits detailed in SSD 7628 CoC B80 are applicable not only to all operational noise sources approved under SSD 7628, but are also inclusive of operations as part of the MPE Stage 1 approval for SSD 6766. Importantly, when assessing compliance with the noise limits, the most affected residential receiver for any individual operations will not necessarily be at the same location. Additionally, it is unlikely that the reasonable worst-case noise levels from any individual operations would also occur in the same 15-minute period.

As part of the recent modification application for SSD 7709 Moorebank Precinct West (MPW) – Stage 2, MOD 1 - Building height increase, which was approved 24 December 2020, a review of the applicable operational noise requirements across Moorebank Precinct West (MPW) and Moorebank Precinct East (MPE) was undertaken (Renzo Tonin & Associates document reference TJ741-11F05 (r4), dated 30 June 2020). The review identified that there are number of approval conditions that are applicable across both the MPW and MPE sites for operational noise, and that in the application of these approvals to the site activities, it became apparent that the operational noise requirements were not consistent across the MPE and MPW sites.

Additionally, the review identified that the operational noise limits across MPE and MPW were set substantially below both the noise criteria and the predicted noise levels (even with feasible and reasonable mitigation measures) established during the environmental assessment stages and considering the cumulative operational noise levels from all MPE and MPW operations.

The review recommended that an overall approach for cumulative operational noise management of the Moorebank intermodal terminal precinct (for East and West precinct) for a "whole of complex" approach be adopted, and that consistent noise management objectives for the Moorebank intermodal terminal precinct's operational noise be adopted to cover all operations within MPE and MPW. Appropriate and achievable noise management objectives consistent with EPA's noise policies were also developed in the review.

Following the modification application for SSD 7709 (MOD 1), the submission received from the NSW Environment Protection Authority (NSW EPA) noted the following:

> *However, the current noise limits are set below the predicted noise levels and are not based on the Project Specific Noise Levels (PSNL) derived under the then-applicable Industrial Noise Policy 2000 (now superseded by the Noise Policy for Industry 2017)…. The EPA considers that the resulting noise limits are not achievable for MPW, nor are they achievable for the cumulative MPW and MPE sites.*

Also Liverpool City Council included in their submission:

> *Council considers that site regulation in regard to noise management may be assisted by adopting a precinct approach consistent with the NSW EPA's Noise Policy for Industry (2017)…. Whilst it is acknowledged that current criteria in the Approval may be impracticable, it will be necessary for the Department to consider applying suitable noise limits that are achievable and capable of protecting the amenity and wellbeing of sensitive receivers.*

As such, this operational compliance assessment does not include further quantification of cumulative noise levels, and demonstrates that WH5 operations can achieve the noise limits set out in SSD 7628 CoC B80 in isolation during reasonable worst-case operations.

It is recommended that noise levels from this assessment achieve the required noise limits set out in Table 5 of SSD 7628 CoC B80, and that the site specific noise levels should be considered as part of the operational noise management applicable to the overall Moorebank intermodal terminal precinct.

3 Measurement methodology and results

3.1 Compliance measurement methodology

The Noise Policy for Industry (NPfI) provides guidance in Chapter 7 for monitoring the performance of a noise-generating industrial facility. In Section 7.1.1, the NPfI provides guidance as to how to review noise emissions of a site where the existing ambient noise levels are already high, resulting in the direct quantification of the noise under investigation not being possible via noise measurements at the receiver location. Additionally, the NPfI provides guidance about using noise modelling to review the performance of an industrial operation that is co-located with separate but noise-generating industrial sites impacting the same receiver. To satisfy the requirements of CoC B85, the following noise monitoring and assessment steps have been undertaken:

1. Review of permanent noise monitoring at nearby residential receivers during periods when noise intensive activities were taking place within the WH5 facility to determine if noise levels would allow for quantification of operational noise emissions, by checking if operational noise emissions are audible, distinguishable and quantifiable at the receiver locations during periods of noise intensive on-site activities (Section 3.3).

2. On-site attended monitoring of noise-generating activities to quantify noise emission levels of mechanical plant and other noise-generating activities as part of typical warehouse operations (Section 3.3.1).

3. Unattended noise monitoring at the WH5 facility for a period of two weeks, with concurrent video, to identify the reasonable worst-case operational scenarios and periods for each major noise-generating area (Section 3.5).

The review of unattended noise monitoring data measurements in Section 3.3 established that the existing ambient noise levels at the nearest receivers were high and controlled by noise sources outside of MPE. Additionally, a number of industrial noise-generating facilities are co-located within MPE, which makes it difficult to separate the noise contribution from individual MPE warehouse operations. As such, direct quantification or estimation of operational noise emissions from the warehouse operations at the sensitive receiver locations was not possible. Noise emissions from the WH5 have been evaluated using a combination of on-site attended and unattended noise monitoring, combined with noise modelling, in order to quantify the industrial noise emissions from WH5 operations.

The following steps were undertaken to assess the noise level contributions at the nearby sensitive receivers:

1. Review observations of warehouse operations, in addition to the noise monitoring results and associated video, to then determine the reasonable worst-case operational scenarios.

2. Setup and calibrate the noise model for the reasonable worst-case operational scenarios.

3. Calculate the operational noise levels from the warehouse operations to all nearby receivers and determine the noise level contribution at the property with the highest noise levels within each NCA.

3.2 Instrumentation

A range of noise monitoring equipment was used to undertake the compliance noise monitoring. A summary of measurement equipment and calibration dates is provided in Table 3.

All of the noise monitoring equipment are Class 1 instruments, with calibration certificates current at the time of the measurements. Before and after each series of attended measurements, the calibration of the sound level meters were verified using a reference calibration of 94 dB at 1 kHz. The difference between pre- and post-calibration levels was within 0.5 dB for all measurements.

Table 3 Noise measurement equipment

Monitoring location/ purpose	Equipment	Serial No	Last date calibrated
On-site attended noise measurements	NTi XL2	A2A-16217-E0	05/07/2019
Unattended on-site noise measurements (WH5 West)	NTi XL2	A2A-07073-E0	19/12/2018
Unattended on-site noise measurements (WH5 East – L1)	NTi XL2	A2A-08038-E0	19/01/2021
Unattended on-site noise measurements (WH5 East – L2)	NTi XL2	A2A-16117-E0	5/07/2019
Field calibration	B&K 4231	3016756	27/11/2020

Four Envirosuite permanent noise monitors are set up at nearest representative residential locations in the community and are labelled NMT01 to NMT04 in Figure 2.

Table 4 Permanent noise monitoring stations

Monitoring location	Description	Equipment	Serial No	Last Date Calibrated
NMT01	Permanent noise monitor	B&K 2250	3025394	12/03/2019
NMT02	Permanent noise monitor	B&K 2250	3025271	12/03/2019
NMT03	Permanent noise monitor	B&K 2250	3025351	12/03/2019
NMT04	Permanent noise monitor	B&K 2250	3025317	12/03/2019

3.3 Receiver unattended noise measurement results

As detailed in Section 1.2, the residential receivers nearest to WH5 are located in the suburbs of Casula, Glenfield, Wattle Grove and Wattle Grove West.

The most intensive period of operational activities at WH5 typically occurs during the night-time period from 6:00am to 7:00am and daytime period from 7:00am to 11:00am. As such, noise monitoring data from the permanent noise monitoring stations have been reviewed for the period between 6:00am and 8:00am on 4 March 2021, during which onsite noise intensive activities were confirmed via video and noise monitoring data to be taking place.

The permanent noise monitoring stations were configured to record audio and undertake statistical noise measurements. During the reviewed measurement period, concurrent unattended noise measurements were undertaken on-site (see Section 3.3.1). This assisted to confirm that noise intensive activities were occurring on-site during the reviewed period.

A summary of the monitoring locations and the approximate distance to the WH5 is provided in Table 5. These locations along with the noise catchment areas (NCAs) are presented in Figure 2.

Table 5 Receiver permanent noise monitoring locations

Monitoring location ID	Monitoring location (applicable NCA) (see Figure 2)	Approximate distance (m) from WH5
NMT01	22 Glenelg Court, Wattle Grove (Wattle Grove West – NCA2)	900
NMT02	26 Goodenough Street, Glenfield (Glenfield – NCA4)	2430
NMT03	31 Martindale Court, Wattle Grove (Wattle Grove – NCA1)	920
NMT04	14 Dunmore Crescent, Casula (Casula – NCA3)	1280

The results of the permanent noise monitoring results for the review period of 6:00am and 8:00am on 4 March 2021 are presented in Table 6.

The ambient noise levels during the reviewed monitoring period were greater than 48 dB(A) $L_{Aeq\ 15\ minute}$ at all monitoring locations, with background noise levels over this same period being no less than 42 dB(A) $L_{A90\ 15\ minute}$. Sample reviewed audio of the receiver located permanent monitoring stations could not clearly distinguish noise corresponding to concurrent onsite activities. Noise from concurrent site activities was confirmed through audio from the on-site unattended noise monitor combined with video. As such, given that noise levels are expected to be below the overall noise limit of 35 dB(A) $L_{Aeq\ 15\ minute}$, and were not audible and/or distinguishable at nearby receivers because of high ambient noise levels, direct quantification or estimation of operational noise emissions from the warehouse operations at the sensitive receiver locations was not be possible via direct measurement in the presence of the ambient noise level environment. As such, it is appropriate to use the alternative methodology of modelling to determine compliance as detailed in Section 7.1.1 of the NPfI.

Figure 2 Residential receiver noise monitoring locations NMT01 to NMT04

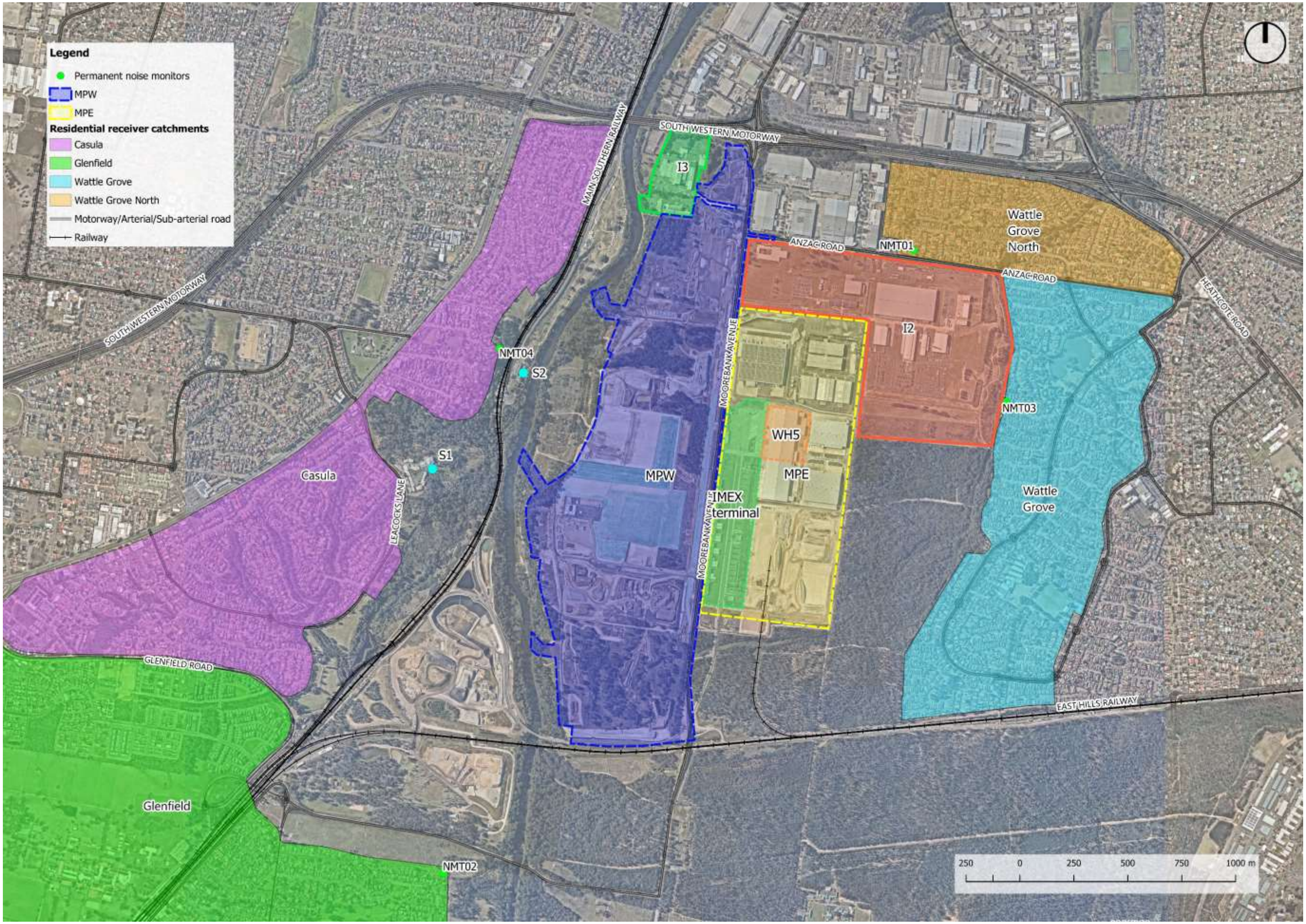


Table 6 Summary of permanent noise monitoring results at the nearest sensitive residential receivers

Measurement period	Measured noise level (15 minute), dB(A)			
	L_{Amax}	L_{A1}	L_{Aeq}	L_{90}
NMT01 (22 Glenelg Court, Wattle Grove)				
04/Mar/21 06:00 - 06:15	66	61	54	48
04/Mar/21 06:15 - 06:30	66	62	55	49
04/Mar/21 06:30 - 06:45	67	63	57	52
04/Mar/21 06:45 - 07:00	78	64	57	50
04/Mar/21 07:00 - 07:15	67	61	55	48
04/Mar/21 07:15 - 07:30	77	62	56	50
04/Mar/21 07:30 - 07:45	69	62	56	48
04/Mar/21 07:45 - 08:00	76	63	57	50
NMT02 (26 Goodenough Street, Glenfield)				
04/Mar/21 6:00 - 8:00	Not available due to maintenance and calibration.			
NMT03 (31 Martindale Court, Wattle Grove)				
04/Mar/21 06:00 - 06:15	56	53	48	45
04/Mar/21 06:15 - 06:30	58	52	48	46
04/Mar/21 06:30 - 06:45	76	61	52	47
04/Mar/21 06:45 - 07:00	81	67	55	48
04/Mar/21 07:00 - 07:15	76	69	57	48
04/Mar/21 07:15 - 07:30	89	77	65	49
04/Mar/21 07:30 - 07:45	92	82	68	47
04/Mar/21 07:45 - 08:00	89	69	63	46
NMT04 (14 Dunmore Crescent, Casula)				
04/Mar/21 06:00 - 06:15	67	63	50	42
04/Mar/21 06:15 - 06:30	73	68	56	43
04/Mar/21 06:30 - 06:45	66	63	51	43
04/Mar/21 06:45 - 07:00	68	65	54	45
04/Mar/21 07:00 - 07:15	68	65	54	47
04/Mar/21 07:15 - 07:30	81	65	57	52
04/Mar/21 07:30 - 07:45	73	70	59	52
04/Mar/21 07:45 - 08:00	80	67	58	51

3.3.1 Meteorological conditions

Meteorological conditions for the review period of the permanent noise monitoring station data has been reviewed to ensure they were acceptable in accordance with the NPfI. Data from the MLP meteorological data monitoring station adjacent to Moorebank Avenue, within the MPE site, established in accordance with CoC A54 SSD 7709 has been reviewed. The meteorological conditions experienced during receiver permanent noise monitoring on 4 March 2021 are summarised below:

- During the measurement period at the facility, the equivalent average wind speed was less than 0.5 m/s and generally from the WNW. All other measurements were not impacted by excessive wind during any of the measurement periods.
- No rain occurred during any of the measurement periods.

The temperature during the measurement period ranged between 17˚C and 25˚C, and the cloud conditions were generally clear skies with a few scattered clouds.

3.4 On-site attended operational activity noise measurement results

In order to quantify the noise emissions from on-site activities for the purposes of determining compliance noise levels, attended noise measurements of individual operational items and typical operations were undertaken at WH5 on 2 March and 9 March 2021. These noise levels have been used to assist in establishing the source levels in the noise model. During all measurements, the specific noise source being measured was the dominant source.

Observations were made of the on-site operations to assist with determining the 'reasonable' worst-case operational scenarios over the assessment periods. Critical on-site attended measurement results are summarised in Table 7.

The main noise generating activities observed were being undertaken externally on the hardstand areas (see Figure 3), which included forklift operations. There was also contribution to noise emissions from internal warehouse activities.

Table 7 On-site attended noise measurement results

Activity noise sources	Date	Time	Measurement duration (t), sec	Measurement distance (m)	Measured noise levels, dB(A)	
					$L_{Aeq(t)}$	L_{AFmax}
Internal warehouse noise levels (noise breakout)						
Internal noise level at loading dock door (internal sources include forklifts)[1]	2/3/2021	2:30pm to 2:45pm	120	At external roller doors	50	60
Forklift						
Forklift 1.5-2 Tonnes	2/3/2021	1:20pm	10	15	62	67
Curtain side trailer truck						
Truck pass-by	2/3/2021	1:30pm	10	20	72	76
Truck idling	2/3/2021	1:30pm	60	20	65	66
Mechanical plant						
Office air condenser unit[2]	9/3/2021	1:00pm	46	1	70	71

Note:

1. Internal noise sources included forklift operations, but were lower than expected due to increased distance. More conservative (higher) noise levels are assumed in the modelling, based on past measurement for WH4A.
2. 3 out of 5 condenser units were operating at time of measurement.

3.5 Unattended noise measurements

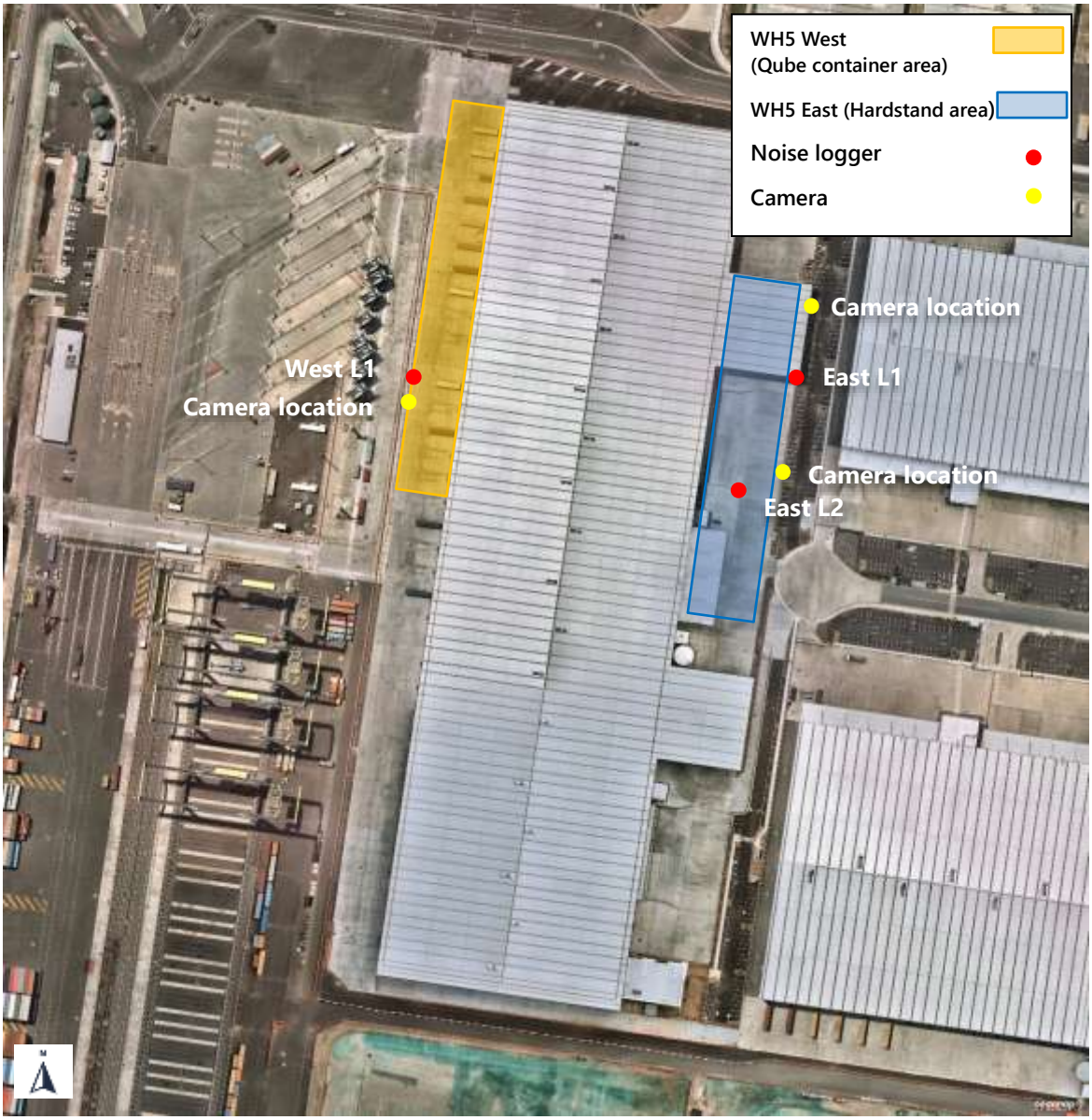
Unattended noise measurements were undertaken over the period between 2 to 16 March 2021 at locations adjacent to WH5 on both side of the warehouse. Two main areas of noise-generating operations were identified across the warehouse site, one on the western side of the warehouse and one on the eastern side. The locations of the unattended noise loggers are shown in Figure 3. These were selected so that they would capture noise from the main noise-generating areas as part of the typical warehouse operations. Camera units were set up on the western and eastern side boundary fences at WH5 to assist in gaining a comprehensive understanding of the site operations and vehicle movements.

The purpose of the noise logging at the selected locations was for the following:

- Determine the noise emissions from the facility at a fixed location close enough to quantify on-site sources.
- Determine the long-term background noise levels when operations were not taking place at the site.
- A source for analysis to determine the duration and nature of the different on-site activities through correlation with the Facility activity data.
- Source of validation for the noise model calibration process.

Detailed unattended noise monitoring results are provided in APPENDIX B for WH5 west and APPENDIX C for WH5 East. The noise model was validated using the unattended noise logger results through comparison against reference activity periods, refer to Section 3.7.3 for noise model calibration.

Figure 3 Unattended noise logger locations and main noise generation areas for WH5 (imagery: Nearmap, 2021)



3.6 Modelled operational scenarios

3.6.1 Observed operations for modelling

Based upon the on-site attended measurements presented in Section 3.4, the video recording for the facility over the unattended monitoring period presented in Section 3.5, and discussions with WH5 personnel, 'reasonable' worst-case operational assessment scenarios were established and modelled to determine site noise emission levels to determine compliance with the requirements of SSD 7628.

The following section details the key observations of each of the noise-generating activities that take place across the warehouse operations.

3.6.1.1 Loading and Unloading operations (WH5 east)

WH5 east was predominately used for loading and unloading of Curtain Side Trailer Trucks via forklift. The following data related to delivery truck operations was based upon site observations during the attended measurements on 2 March and 9 March 2021, in addition to the unattended noise level and audio data recordings during periods between 2 March and 9 March 2021 when truck movements within the warehouse site boundary on the hardstand area and forklift operations were clearly distinguishable.

- It was observed during the attended measurements and video data, that internal truck movements at WH5 East on the hardstand were typically Curtain Side Trailer Trucks, and that a typical 'in-and-out' cycle time in the facility was on median 30 minutes, with each loading cycle taking approximately 15-20 minutes.

- It was observed during the attended noise measurements and video data that the internal truck movements on the hardstand in the WH5 east despatching area move at a relative low speed of approximately 10 km/h.

- The noise intensive period for Curtain Side Trailer truck loading and unloading activities was typically between 6:00am and 11:00am on weekdays at WH5 east, and then the Curtain Side Trailer trucks would leave the facility after being loaded with products.

- Unloading of products from delivery trucks typically occur within the warehouse, with the warehouse doors open. It was observed that a truck would be loaded or unloaded in the external despatch area using a forklift.

- The maximum number of trucks being loaded simultaneously by forklifts was four within the WH5 dispatching area. This was confirmed through analysis of the video data and unattended noise data. As such, the 'reasonable' worst-case would be four loading events occurring concurrently. Air brake noise associated with Curtain Side Trailer truck operations could occur during arrival and departure operations. This forms part of the noise modelling of potential sleep disturbance events.

3.6.1.2 Qube container handling operational area (WH5 west)

WH5 west was predominately used for container delivery operations via combi-lift, which occurred infrequently.

- Movements of containers within the WH5 west area can occur at any time throughout the daytime period. It was observed that movements typically started from approximately 7:00am. Four container movements were observed during the two-week monitoring period, with a maximum of two container movements during any one day.

- It was observed that one combi-lift would be used to move containers to and from the western hardstand of the WH5 site boundary, to and from, the MLP terminal area. Using the unattended

measurements and concurrent video recordings during the monitoring, it was observed that the duration of the combi-lift loading/unloading operations would take less than 5 minutes, but during this period the combi-lift would operate continuously generating noise as part of the container handling operation.

- Impact noise events associated with grabbing and dropping of containers would occur when the combi-lift gripper contacted individual containers. The tonal reversing beeper associated with combi-lift operations would occur during container handling operations.

3.6.2 Assessment noise source levels

Source levels for the key noise-generating activities on-site have been established based upon the attended noise measurements (Section 3.4) and unattended noise measurements (Section 3.5) during periods of typical operation. The sound power level inputs presented in Table 8 were used in the operational noise compliance modelling, and adjusted for the duration and frequency of operations (Section 3.6.3).

Table 8 Assessment noise source levels

Site items / operation	Individual activity sound power level (SWL) (L_{Aeq}), dB(A)
WH5 West	
Curtain Side Trailer Truck moving with speed less than 20km/h	102
Air brake release (L_{AFmax})	117
Trucks idling on site	98
Forklift operations	96
Forklift operations (L_{AFmax})	111
Loading operations (L_{AFmax})	115
WH5 East	
Container combi-lift (moving container activity)	103
Container gripping & drop (L_{Amax})	108
Container gripping & drop (L_{Aeq})[4]	81 $L_{Aeq.15min}$
Container combi-lift reversing with tonal reversing alarm	105
Internal noise breakout	
Internal noise breakout via roof[1]	74
Internal noise breakout via external roller doors[5]	76
Mechanical Plant	
Air condenser unit[2]	80[2]
Other noise sources	
Curtain Side Trailer Truck moving on internal roads within MLP, outside of the WH5 site (typical speed on internal roads of 20 km/h)	102

Site items / operation	Individual activity sound power level (SWL) (L_{Aeq}), dB(A)

Notes:

1. Attended measurement shows breakout via WH5 warehouse roof during loading and unloading operations. Internal noise levels are based on intensive periods when forklifts were in use.
2. Air condenser units are located on the east façades of the warehouse. 5 units are installed onsite. The modelling conservatively assumes that all 5 units are operational..
3. Internal noise levels controlled by forklift operations within the warehouse.
4. One event assumed in the 15-minute interval.
5. Sound power level for the breakout via each roller door

3.6.3 Reasonable worst-case intrusiveness scenarios (15-minute period)

As the noise limits in CoC B80 are set at 35 dB(A) $L_{Aeq\ 15\ minute}$ for the day, evening and night periods, specific separation of noise intensive periods for each of these time periods has not been undertaken. Instead, it is noted that there are two main areas of noise generation as part of typical warehouse operations, as presented in Figure 3.

In order to assess the operational noise emissions from the warehouse, the 'reasonable' worst-case operations for each of the two main areas of noise generation have been developed, along with the corresponding activities in the other noise-generating areas, in order to review a representative snapshot of activities from the warehouse operations. Each of the assessment scenarios have been developed from an analysis of the video movement data or attended on-site observations over during the two week period, in addition to the information detailed in Section 3.6.1. It is noted that the peak periods of noise generating activities for each of the two main areas (western side of the warehouse and eastern side of the warehouse) did not occur concurrently.

For the 'reasonable' worst-case scenario developed for the western side of the warehouse (WH5 west), a total of four container movements were observed on the video data to occur over the period of two weeks. The duration of each container delivery operation was 5 minutes or less. During the periods when containers where being moved within WH5 west (Qube container operation area), warehouse roller doors remained closed on the east side of WH5. As such, even though these activities have been assessed as the 'reasonable' worst-case scenario, it is noted that they occur very infrequently.

Periods representing the 'reasonable' worst-case operations, for each the western side of the warehouse and eastern side of the warehouse, based upon these peak periods of noise intensive activities have been used to assess operational noise emissions. Table 9 details the two 'reasonable' worst-case scenarios (15-minute period), covering the noise intensive periods for the two main areas of noise generation across the site.

As required by CoC B85, all significant noise-generating equipment has been included the assessment modelling, including the key noise-generating mechanical plant. It is noted that the noise contribution from the mechanical plant items serving the office area are included in the modelling, however, they generate minimal contribution to the overall noise levels from site operations, which are controlled by other on-site activities such as truck departures, arrivals and warehouse internal loading and unloading

activities. The roof mounted smoke ventilation fans were observed to not operate as part of typical warehouse activities.

Table 9 Representative 'reasonable' worst-case 15-minute intrusive assessment scenarios

Activity	WH5 West 15-minute assessment period (Qube container area)	WH5 East 15-minute assessment period
WH5 West 15-minute noise intensive period (with container handling taking place)		
Departure	One Combi-lift departure from WH5 west (Qube container operational area) loaded with 1 container.	No activity
Arrival	One Combi-lift arrival at WH5 west (Qube container operational area) ready to remove 1 container.	No activity
On-site operations	Container operations: a) Placing one container down	*Noise breakout via open warehouse doors.* All loading activity are occurring inside the warehouse with warehouse doors open, one noise generating activity occurred at the time. a) Forklift movements
WH5 East 15-minute noise intensive period		
Arrival/departure	No activity	Four Curtain Side Truck arriving or departing WH5 east, engine off after parking.
On-site operations	No activity	*Noise breakout via open warehouse doors.* Loading and unloading activities are occurring outside the warehouse with warehouse doors open, one noise generating activity occurring at the time. a) Forklift movements
Mechanical plant (All scenarios)		
Warehouse office air conditioning condenser units (assumed that 5 out of 5 units could be operating at full capacity)		

3.7 Modelling methodology

3.7.1 Overview of noise modelling

Since ambient noise levels were well above the project noise limit at the nearest residential receivers, and it was not possible to directly measure or estimate the warehouse noise contribution directly, computer noise modelling was used to calculate the operational noise levels from warehouse operations at the nearby noise sensitive receivers.

3.7.2 General modelling assumptions

Modelling and assessment of warehouse noise emissions were determined by modelling the noise sources, receiver locations, existing built structures and topographical features, using CadnaA (version 2020).

The modelling incorporated the worst-case prevailing meteorological conditions, as required by CoC B80, which are wind speeds of up to 3 m/s at 10 metres above ground level for the assessed activities for daytime activities.

The noise predictions have adopted the CONCAWE noise prediction algorithm, noting that the nearby noise sensitive receivers are greater 100 metres from the subject site. The CONCAWE environmental noise prediction method is an appropriate method for predicting noise propagation in these circumstances.

The noise model predictions consider the following:

- Location of noise sources on-site and nearby sensitive receiver locations
- Height of noise sources and receivers referenced to digital ground contours within the site and outside the site area
- Noise source levels of individual plant, equipment and internal building noise levels, modelled as either point, line or area noise sources. All noise sources associated with the WH5 operations within the MPE boundary have been included in the noise modelling, including the truck movements outside of the WH5 footprint, along internal MPE roads.
- Separation distances between sources and receivers
- Ground type between sources and receivers (mixed soft/ hard)
- Attenuation from buildings and built structures and topography (natural and purpose built)
- Atmospheric losses and assessment meteorological conditions.

The modelled activities and assumptions for the to the equipment operating and the duration and frequency of operation as part of the 'reasonable' worst-case operational scenarios are described in Section 3.6.3.

3.7.3 Model validation

Following the development of each of the representative modelling scenarios, the noise model outputs were compared against a reference time period of the onsite unattended noise measurement results for the period during which similar activities to the 'reasonable' worst-case operational scenario were taking place. Validation of the reasonable worst-case on-site activities was undertaken to check the final representative modelling inputs against a period of measured activities. The results of this process are presented in Table 10.

Table 10 Comparison between measured and modelled noise levels

Time period	Logger	Measured noise levels LAeq,15minute (dBA)	Predicted noise levels LAeq,15minute (dBA)	Difference, dB(A)
3:00 pm to 3:15 pm 5 March 2021[1]	WH5 West	52	51	1
6:10 am to 6:25 am 4 March 2021[2]	WH5 East	70	69	1

Notes:
1. Noise generating activities within the facility were as per Table 9 *"WH5 East 15-minute noise intensive period"*
2. Noise generating activities within the facility were as per Table 9"*WH5 West 15-minute noise intensive period (With container handling taking place)"*

The predicted noise levels are within the modelling tolerance of 1 dB(A). The results from the validation of the model demonstrate that it is suitable for determining the compliance noise levels at the nearby receivers for this assessment.

3.8 Noise compliance assessment

Predicted operational compliance noise levels are presented in Table 11 and Table 12 for the two reasonable worst-case operational assessment scenarios. The noise levels have been predicted to each of the surrounding residential receiver noise catchments. The highest residential receiver noise level in each catchment area is reported. This is not necessarily the same receiver location for each assessment scenario.

The results in Table 11 and Table 12 show that the predicted noise levels for the $L_{Aeq\ (15\text{-}minute)}$ and $L_{A1\ (1\text{-}minute)}$ assessments comply with the overall operational noise limits presented in Table 2.

As the noise levels from the site operations were not clearly audible and distinguishable at the nearby noise sensitive receivers, the noise levels would not be perceived as particularly annoying at the nearby receiver locations as per the NPfI (i.e. if the resulting noise level at a receiver location is tonal, low frequency or is intermittent at night). As such, no adjustments in accordance with Fact Sheet C of the NPfI are required.

Table 11 Predicted noise levels - Reasonable 15-minute worst-case scenario for WH5 west

Noise catchment area/ receiver location	$L_{Aeq\ (15\text{-}minute)}$		Compliance	$L_{A1(1\text{-}minute)}$		Compliance
	Noise limits	Predicted noise levels		Noise limits	Predicted noise levels	
Wattle Grove (NCA 1)	35	< 20	Yes	52	N/A[2]	Yes
Wattle Grove West (NCA 2)	35	< 20	Yes	52	N/A[2]	Yes
Casula (NCA 3)	35	25	Yes	52	N/A[2]	Yes
Glenfield (NCA 4)	35	< 20	Yes	58	N/A[2]	Yes
All Saints Senior College (S1)	45[1]	24	Yes	-	N/A	N/A
Casula Powerhouse (S2)	45[1]	25	Yes	-	N/A	N/A
Defence Joint Logistics Unit (DJLU) (I2)	70[1]	20	Yes	-	N/A	N/A
ABB (I3)	70[1]	< 20	Yes	-	N/A	N/A

Note: 1. Noise limits for these receivers are only applicable when the receiver is in use

2. During the 14-day monitoring period, no combi-lift activity at WH5 west was observed during the night-time period (10:00pm to 7:00am). As such, the potential for sleep disturbance impacts from this activity has not been assessed.

Table 12 Predicted noise levels - Reasonable 15-minute worst-case scenario for WH5 east

Noise catchment area/ receiver location	$L_{Aeq\ (15\text{-}minute)}$		Compliance	$L_{A1(1\text{-}minute)}$		Compliance
	Noise limits	Predicted noise levels		Noise limits	Predicted noise levels	
Wattle Grove (NCA 1)	35	25	Yes	52	26	Yes
Wattle Grove West (NCA 2)	35	20	Yes	52	< 20	Yes
Casula (NCA 3)	35	20	Yes	52	< 20	Yes
Glenfield (NCA 4)	35	< 20	Yes	58	< 20	Yes
All Saints Senior College (S1)	45[1]	< 20	Yes	-	N/A	N/A
Casula Powerhouse (S2)	45[1]	21	Yes	-	N/A	N/A
Defence Joint Logistics Unit (DJLU) (I2)	70[1]	28	Yes	-	N/A	N/A
ABB (I3)	70[1]	< 20	Yes	-	N/A	N/A

Note: 1. Noise limits for these receivers are only applicable when the receiver is in use

The highest modelled noise levels at nearby residential receivers for the WH5 west 15-minute noise intensive period is predicted to be 25 dB(A) $L_{Aeq.15minute}$ at Casula (NCA 2). For WH5 east, the highest modelled noise level at nearby residential receivers from loading and unloading activities from forklift is predicted to be 25 dB(A) $L_{Aeq.15minute}$ at Wattle Grove (NCA 1).

The noise levels from the two noise generation areas have not been directly combined as part of the assessment, as they did not occur concurrently. It is not expected that peak activities at WH5 west and WH5 east will occur concurrently. The video data showed that container deliveries to WH5 east only occurred four times within the two week period, each of 5 minute duration or less. As such, this would not be considered a typical operation, as it would occur infrequently... In the very unlikely event that peak activities at WH5 west and WH5 east occur concurrently, the resulting noise levels at Wattle Grove (NCA 1) would be 28 dB(A) $L_{Aeq.15minute}$.

4 Conclusion

The noise assessment has been undertaken to address the operational noise requirements for the WH5 within the Moorebank Precent East in accordance with the *Operational Noise and Vibration Management Plan, Moorebank Logistics Park – East Precinct* (dated 27 March 2019, Revision 12) (MPE ONVMP), more specifically to address the requirements of Condition of Consent (CoC) B85 in State Significant Development (SSD) 7628.

A review of noise measurements at the nearest residential receivers during period of peak onsite activities determined that site activities were not audible and distinguishable at nearby receivers because of high ambient noise levels from road traffic, rail traffic and construction noise. =For this reason, guidance from the NSW EPA Noise Policy for Industry (NPfI) Chapter 7 has been followed in order to use an alternative approach to determine compliance, and compare the site noise emissions with the noise limits.

A combination of on-site and off-site measurements were performed, between 2 to 16 March 2021. The aim of the measurements was to quantify on-site operational noise levels from the WH5 facility, in order to then predict back to the nearby receivers. Using this approach, noise emissions from the warehouse facility operations have been evaluated using a combination of on-site attended and unattended noise monitoring, combined with noise modelling, to predict the operational noise levels at the nearest sensitive receivers.

Two 'reasonable' worst-case assessment scenarios were established based upon on site unattended noise monitoring and video recordings, in addition to discussions with WH5 personnel and observations made during on-site attended noise measurements. These were used to develop the current 'reasonable' worst case noise intensive periods that occur onsite. These were separated into two main areas of activities, one on the western side of the warehouse and one on the eastern side.

As required by CoC B85, all significant noise-generating equipment was included the assessment modelling, including the key noise-generating mechanical plant. The noise contribution from the mechanical plant items serving the warehouse and office area generate minimal contribution to the overall noise levels from site operations, which are generally controlled by other on-site activities such as truck departures, arrivals and internal warehouse loading and unloading activities.

The model was developed, and validated against the on-site unattended noise monitoring data, during periods with similar operational activities. Using the calibrated noise model, noise levels were predicted to all nearby noise sensitive receiver locations, including the residential receivers in the suburbs of Casula, Glenfield, Wattle Grove and Wattle Grove West. Noise levels were assessed assuming the worst-case prevailing meteorological conditions were present, as required by CoC B80.

The outcome of the compliance noise monitoring and modelling demonstrated that the mechanical plant and other noisy equipment that operate as part of the WH5 operations achieve the noise limits presented SSD 7628 CoC B80.

APPENDIX A Glossary of terminology

The following is a brief description of the technical terms used to describe noise to assist in understanding the technical issues presented.

Adverse weather	Weather effects that enhance noise (that is, wind and temperature inversions) that occur at a site for a significant period of time (that is, wind occurring more than 30% of the time in any assessment period in any season and/or temperature inversions occurring more than 30% of the nights in winter).
Ambient noise	The all-encompassing noise associated within a given environment at a given time, usually composed of sound from all sources near and far.
Assessment period	The period in a day over which assessments are made.
Assessment Point	A point at which noise measurements are taken or estimated. A point at which noise measurements are taken or estimated.
Background noise	Background noise is the term used to describe the underlying level of noise present in the ambient noise, measured in the absence of the noise under investigation, when extraneous noise is removed. It is described as the average of the minimum noise levels measured on a sound level meter and is measured statistically as the A-weighted noise level exceeded for ninety percent of a sample period. This is represented as the L90 noise level (see below).
Decibel [dB]	The units that sound is measured in. The following are examples of the decibel readings of common sounds in our daytime environment:

threshold of hearing	0 dB	The faintest sound we can hear
	10 dB	Human breathing
almost silent	20 dB	
	30 dB	Quiet bedroom or in a quiet national park location
generally quiet	40 dB	Library
	50 dB	Typical office space or ambience in the city at night
moderately loud	60 dB	CBD mall at lunch time
	70 dB	The sound of a car passing on the street
loud	80 dB	Loud music played at home
	90 dB	The sound of a truck passing on the street
very loud	100 dB	Indoor rock band concert
	110 dB	Operating a chainsaw or jackhammer
extremely loud	120 dB	Jet plane take-off at 100m away
threshold of pain	130 dB	
	140 dB	Military jet take-off at 25m away

dB(A)	A-weighted decibels. The A- weighting noise filter simulates the response of the human ear at relatively low levels, where the ear is not as effective in hearing low frequency sounds as it is in 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.
dB(C)	C-weighted decibels. The C-weighting noise filter simulates the response of the human ear at relatively high levels, where the human ear is nearly equally effective at hearing from mid-low frequency (63Hz) to mid-high frequency (4kHz), but is less effective outside these frequencies.

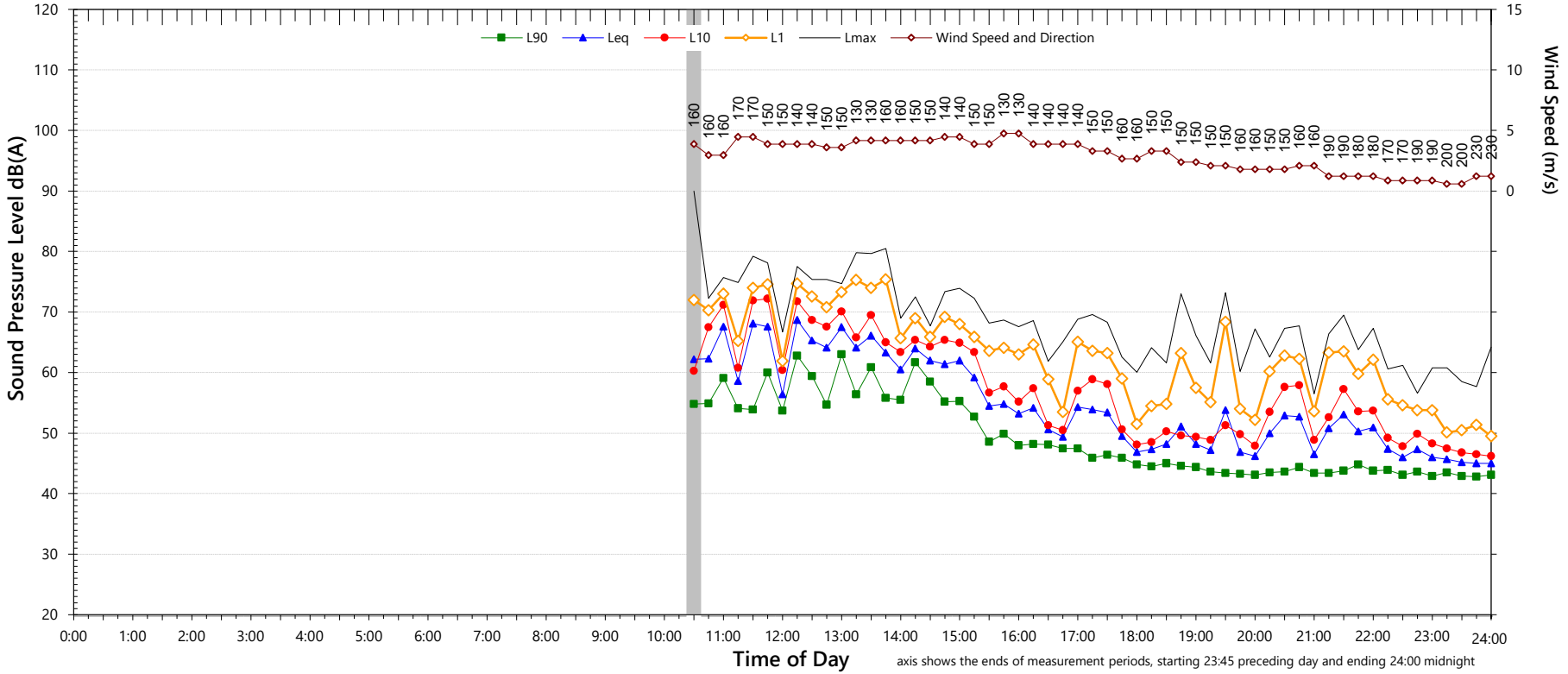
Frequency	Frequency is synonymous to pitch. Sounds have a pitch which is peculiar to the nature of the sound generator. For example, the sound of a tiny bell has a high pitch and the sound of a bass drum has a low pitch. Frequency or pitch can be measured on a scale in units of Hertz or Hz.
Impulsive noise	Having a high peak of short duration or a sequence of such peaks. A sequence of impulses in rapid succession is termed repetitive impulsive noise.
Intermittent noise	The level suddenly drops to that of the background noise several times during the period of observation. The time during which the noise remains at levels different from that of the ambient is one second or more.
L_{Max}	The maximum sound pressure level measured over a given period.
L_{Min}	The minimum sound pressure level measured over a given period.
L_1	The sound pressure level that is exceeded for 1% of the time for which the given sound is measured.
L_{10}	The sound pressure level that is exceeded for 10% of the time for which the given sound is measured.
L_{90}	The level of noise exceeded for 90% of the time. The bottom 10% of the sample is the L90 noise level expressed in units of dB(A).
L_{eq}	The "equivalent noise level" is the summation of noise events and integrated over a selected period of time.
Reflection	Sound wave changed in direction of propagation due to a solid object obscuring its path.
SEL	Sound Exposure Level (SEL) is the constant sound level which, if maintained for a period of 1 second would have the same acoustic energy as the measured noise event. SEL noise measurements are useful as they can be converted to obtain Leq sound levels over any period of time and can be used for predicting noise at various locations.
Sound	A fluctuation of air pressure which is propagated as a wave through air.
Sound absorption	The ability of a material to absorb sound energy through its conversion into thermal energy.
Sound level meter	An instrument consisting of a microphone, amplifier and indicating device, having a declared performance and designed to measure sound pressure levels.
Sound pressure level	The level of noise, usually expressed in decibels, as measured by a standard sound level meter with a microphone.
Sound power level	Ten times the logarithm to the base 10 of the ratio of the sound power of the source to the reference sound power.
Tonal noise	Containing a prominent frequency and characterised by a definite pitch.

APPENDIX B Logger location 1 – WH5 - West side

Unattended Noise Monitoring Results

0

Tuesday, 2 March 2021



NSW Noise Policy for Industry (Free Field)			
Descriptor	Day[2]	Evening[3]	Night[4 5]
L_{A90} ABL	-	43	42
L_{Aeq}	-	50	48

Night Time Maximum Noise Levels			(see note 7)
L_{AFMax} (Range)	70	to	76
L_{AFMax} - L_{Aeq} (Range)	18	to	22

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	Day	Night[5]
	7am-10pm	10pm-7am
$L_{Aeq\ 15\ hr}$ and $L_{Aeq\ 9\ hr}$	-	50
$L_{Aeq\ 1hr}$ upper 10 percentile	-	53
$L_{Aeq\ 1hr}$ lower 10 percentile	-	46

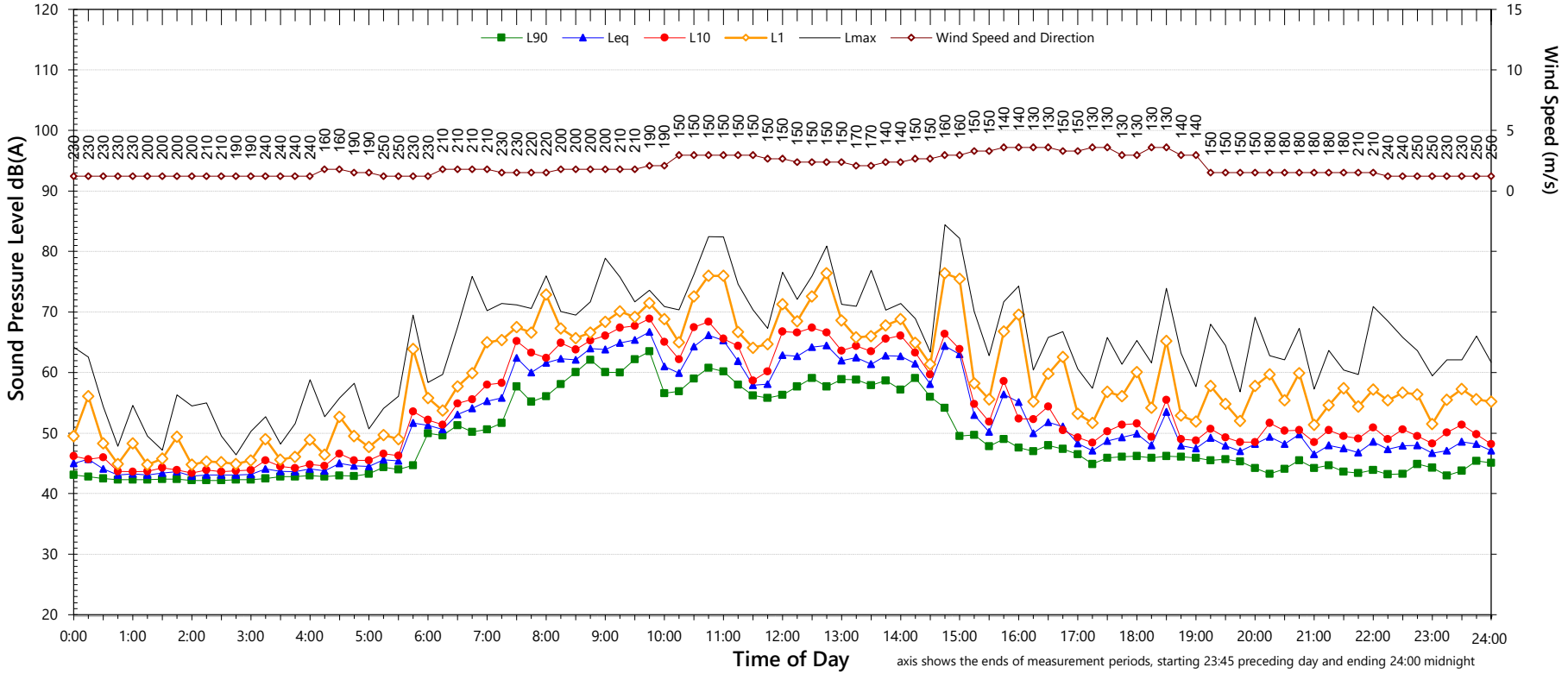
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am till 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. 1-hour values for L_{AFMax} are shown only where L_{AFMax} >65dB(A) and where L_{AFMax}- L_{Aeq} ≥15dB(A)

Unattended Noise Monitoring Results

0

Wednesday, 3 March 2021



axis shows the ends of measurement periods, starting 23:45 preceding day and ending 24:00 midnight

NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{A90} ABL	47	44	44
L_{Aeq}	62	49	51

Night Time Maximum Noise Levels			(see note 7)
L_{AFMax} (Range)	66	to	81
L_{AFMax} - L_{Aeq} (Range)	17	to	23

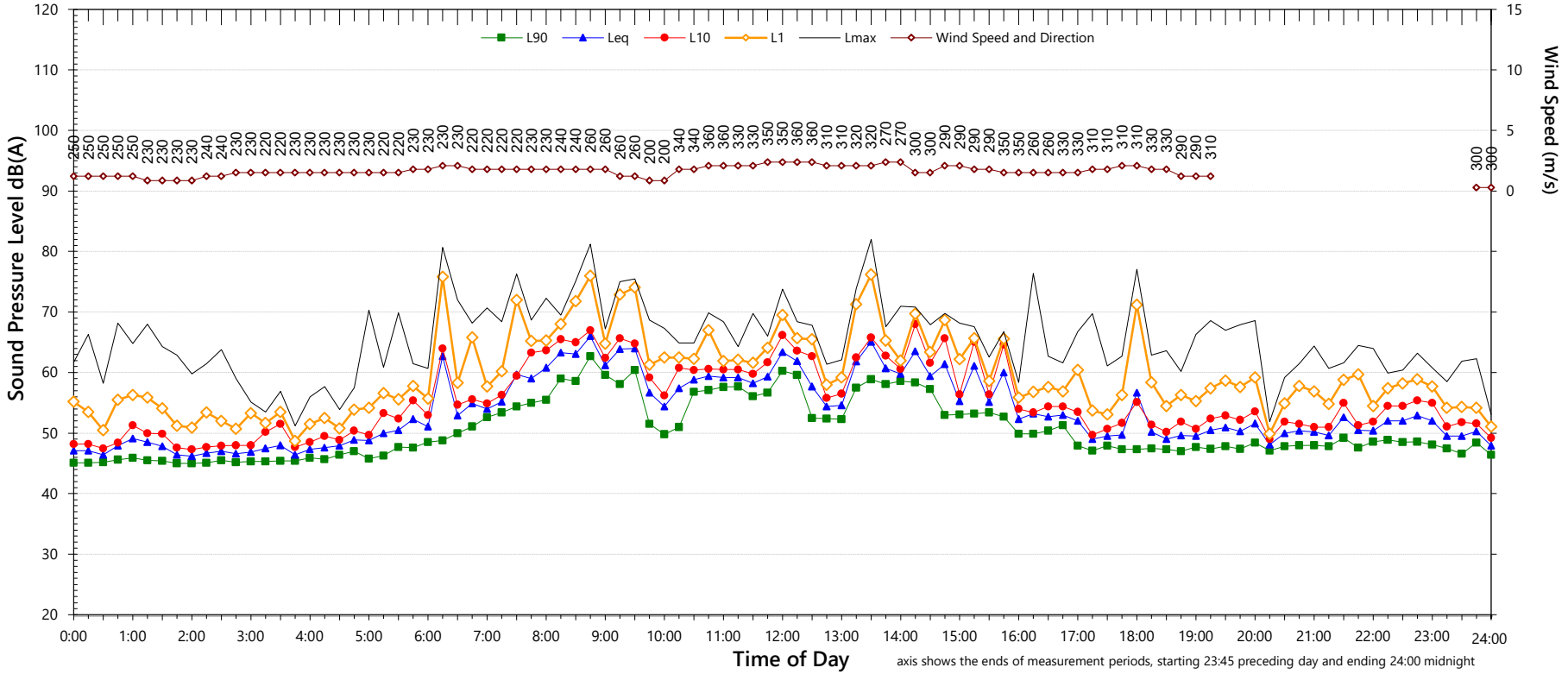
NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{Aeq\ 15\ hr}$ and $L_{Aeq\ 9\ hr}$	63	54
$L_{Aeq\ 1hr}$ upper 10 percentile	67	55
$L_{Aeq\ 1hr}$ lower 10 percentile	51	50

Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am till 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. 1-hour values for L_{AFMax} are shown only where L_{AFMax} >65dB(A) and where L_{AFMax}- L_{Aeq} ≥15dB(A)

Unattended Noise Monitoring Results

0 **Thursday, 4 March 2021**



axis shows the ends of measurement periods, starting 23:45 preceding day and ending 24:00 midnight

NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{A90} ABL	48	47	45
L_{Aeq}	60	50	52

Night Time Maximum Noise Levels			(see note 7)
L_{AFMax} (Range)	72	to	83
L_{AFMax} - L_{Aeq} (Range)	15	to	24

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{Aeq\ 15\ hr}$ and $L_{Aeq\ 9\ hr}$	61	55
$L_{Aeq\ 1hr}$ upper 10 percentile	65	56
$L_{Aeq\ 1hr}$ lower 10 percentile	53	50

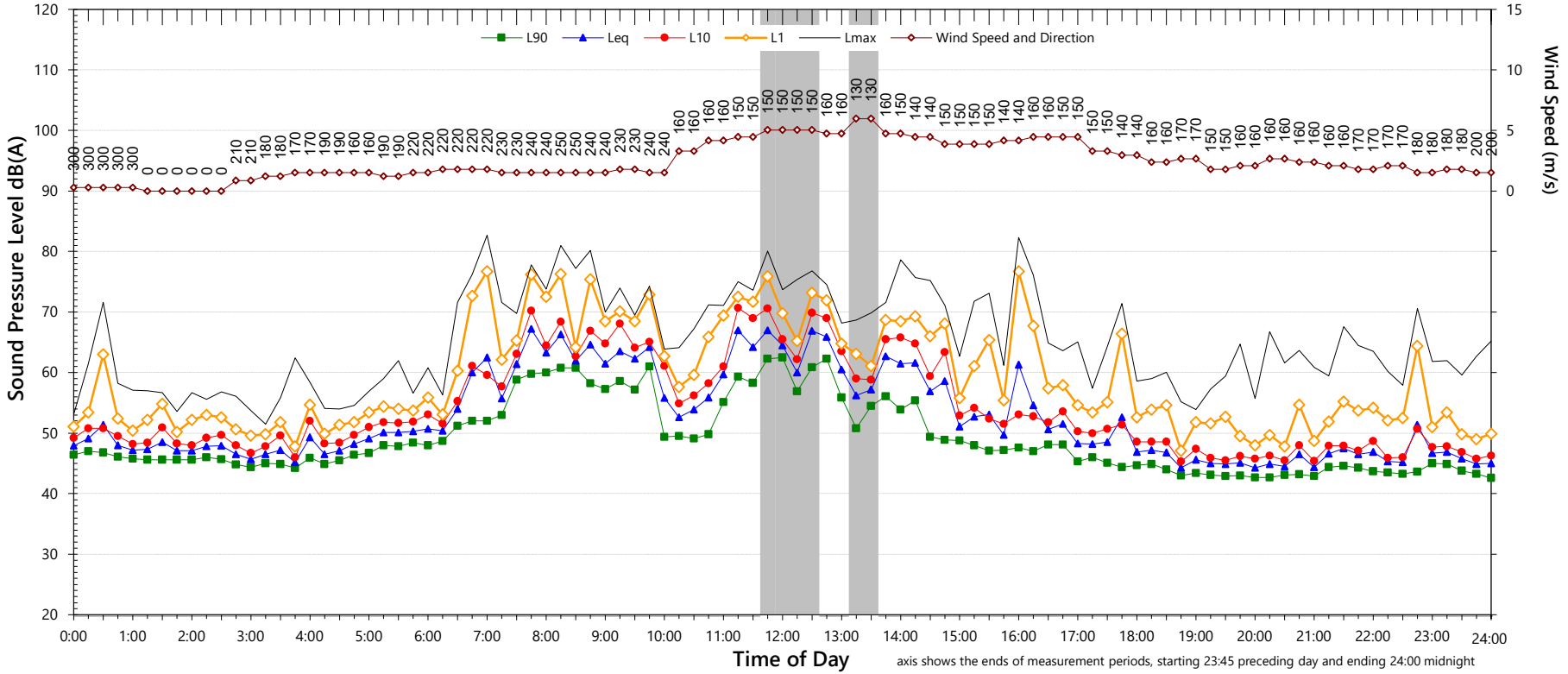
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am till 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. 1-hour values for L_{AFMax} are shown only where L_{AFMax} >65dB(A) and where L_{AFMax}- L_{Aeq} ≥15dB(A)

Unattended Noise Monitoring Results

0

Friday, 5 March 2021



axis shows the ends of measurement periods, starting 23:45 preceding day and ending 24:00 midnight

NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{A90} ABL	46	43	42
L_{Aeq}	61	46	45

Night Time Maximum Noise Levels			(see note 7)
L_{AFMax} (Range)	65	to	71
L_{AFMax} - L_{Aeq} (Range)	18	to	23

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{Aeq\ 15\ hr}$ and $L_{Aeq\ 9\ hr}$	62	48
$L_{Aeq\ 1hr}$ upper 10 percentile	67	51
$L_{Aeq\ 1hr}$ lower 10 percentile	48	46

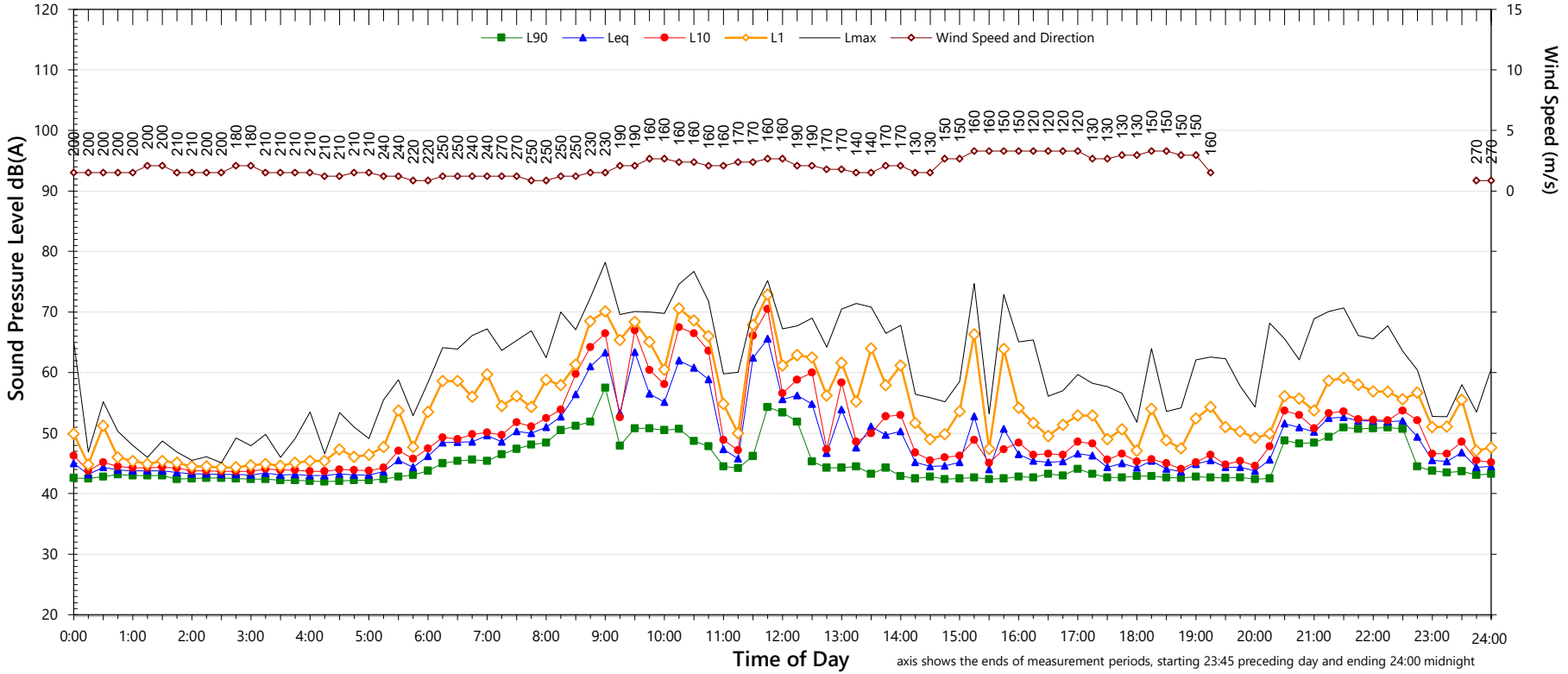
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am till 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. 1-hour values for L_{AFMax} are shown only where L_{AFMax} >65dB(A) and where L_{AFMax}- L_{Aeq} ≥15dB(A)

Unattended Noise Monitoring Results

0

Saturday, 6 March 2021



axis shows the ends of measurement periods, starting 23:45 preceding day and ending 24:00 midnight

NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{A90} ABL	43	43	44
L_{Aeq}	56	49	48

Night Time Maximum Noise Levels			(see note 7)
L_{AFMax} (Range)	65	to	71
L_{AFMax} - L_{Aeq} (Range)	15	to	23

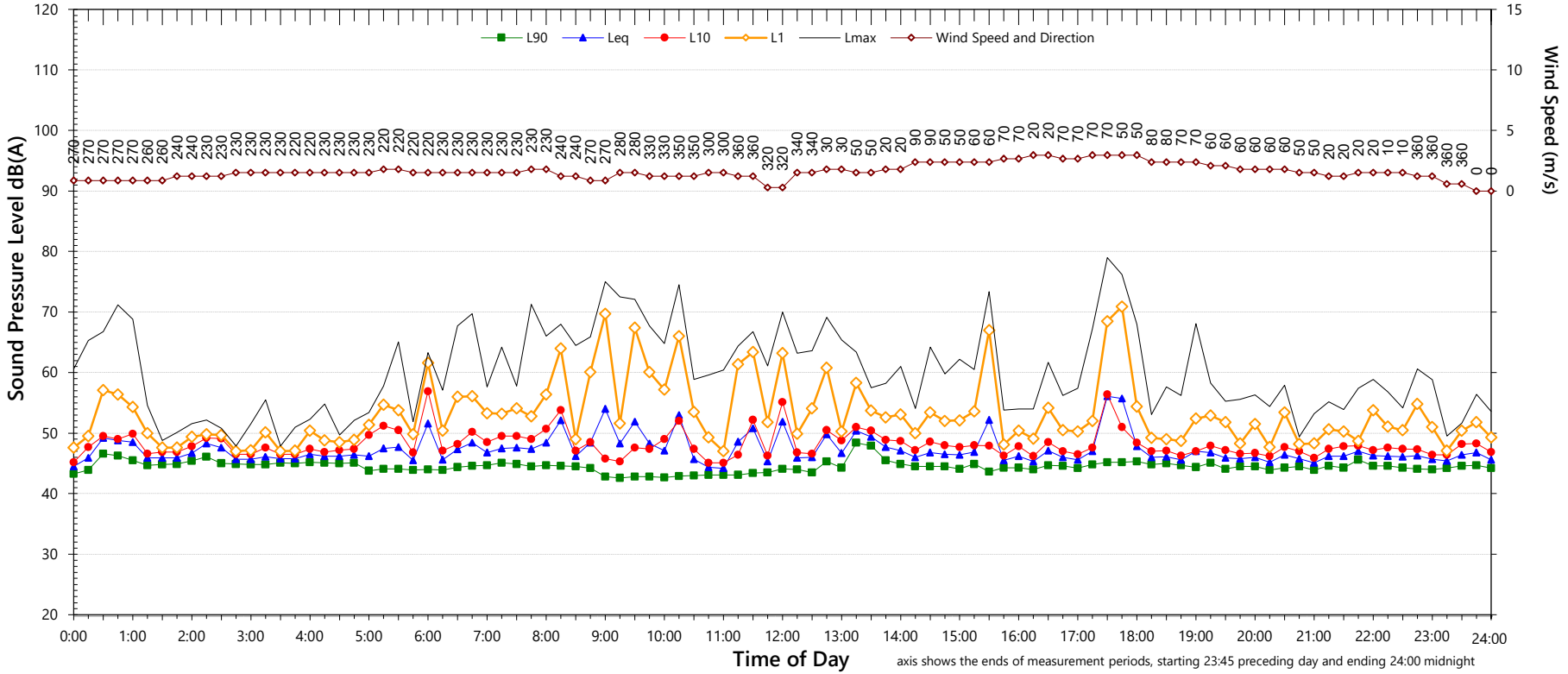
NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{Aeq\ 15\ hr}$ and $L_{Aeq\ 9\ hr}$	58	50
$L_{Aeq\ 1hr}$ upper 10 percentile	62	52
$L_{Aeq\ 1hr}$ lower 10 percentile	47	48

Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am till 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. 1-hour values for L_{AFMax} are shown only where L_{AFMax} >65dB(A) and where L_{AFMax}- L_{Aeq} ≥15dB(A)

Unattended Noise Monitoring Results

0 **Sunday, 7 March 2021**



axis shows the ends of measurement periods, starting 23:45 preceding day and ending 24:00 midnight

NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{A90} ABL	43	44	44
L_{Aeq}	50	46	48

Night Time Maximum Noise Levels			(see note 7)
L_{AFMax} (Range)	67	to	67
L_{AFMax} - L_{Aeq} (Range)	19	to	19

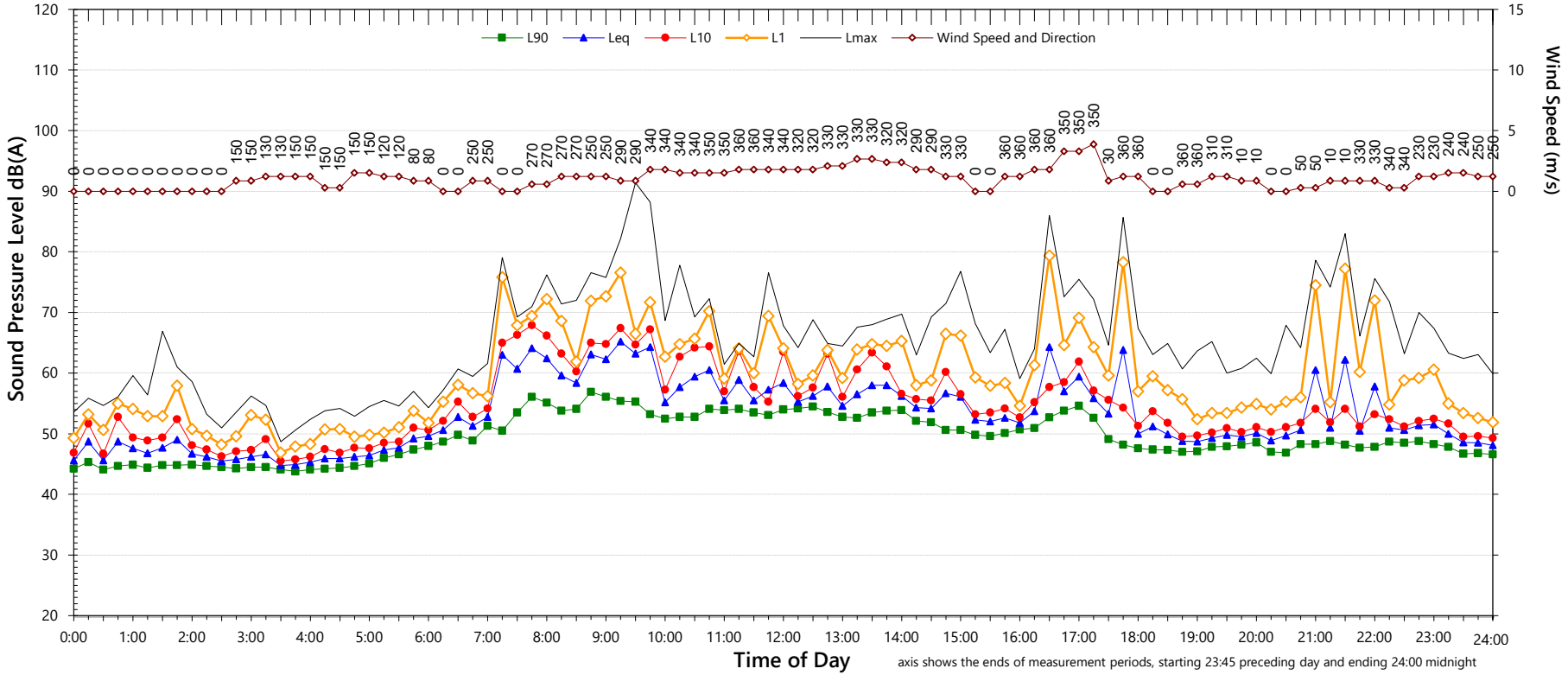
NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{Aeq\ 15\ hr}$ and $L_{Aeq\ 9\ hr}$	51	50
$L_{Aeq\ 1hr}$ upper 10 percentile	53	52
$L_{Aeq\ 1hr}$ lower 10 percentile	49	48

Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am till 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. 1-hour values for L_{AFMax} are shown only where L_{AFMax} >65dB(A) and where L_{AFMax}- L_{Aeq} ≥15dB(A)

Unattended Noise Monitoring Results

0 **Monday, 8 March 2021**



axis shows the ends of measurement periods, starting 23:45 preceding day and ending 24:00 midnight

NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{A90} ABL	50	47	46
L_{Aeq}	60	55	53

Night Time Maximum Noise Levels			(see note 7)
L_{AFMax} (Range)	65	to	80
L_{AFMax} - L_{Aeq} (Range)	15	to	22

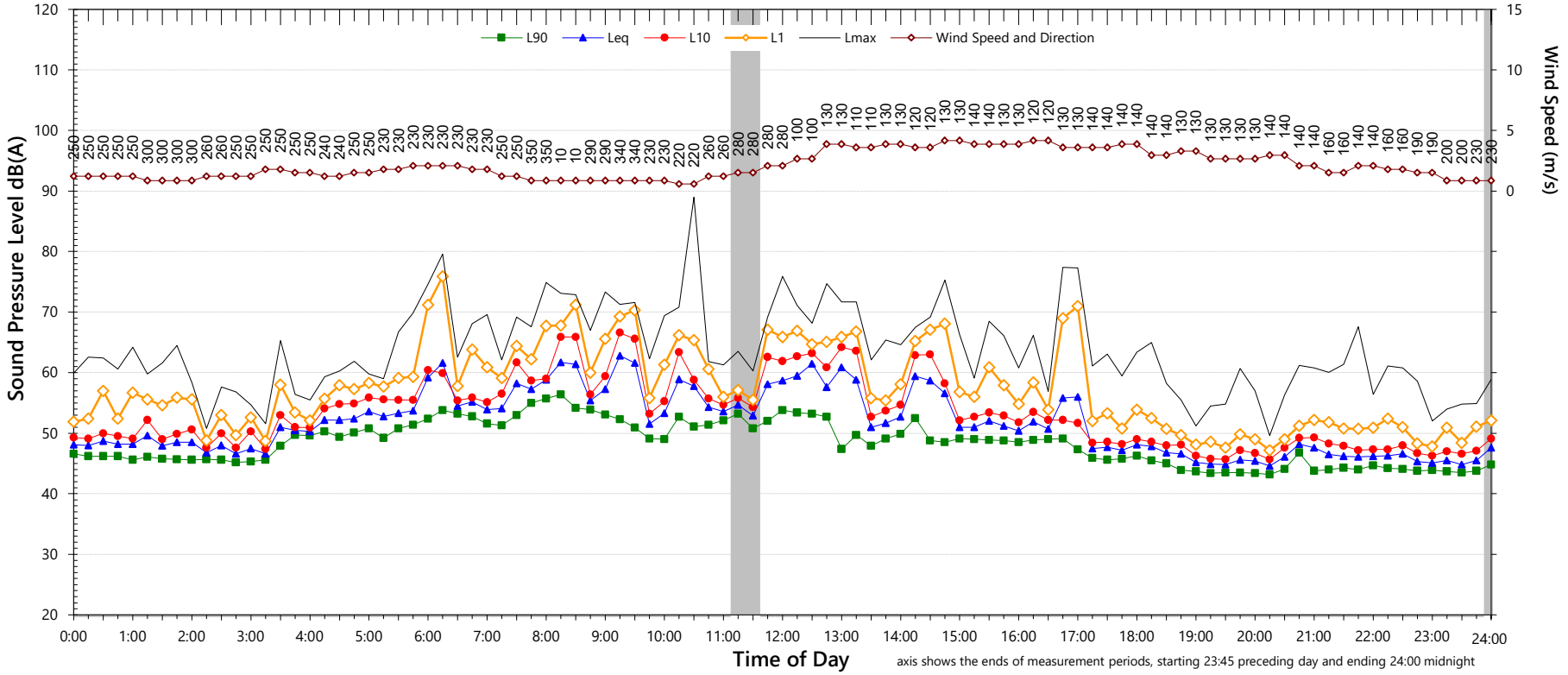
NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{Aeq\ 15\ hr}$ and $L_{Aeq\ 9\ hr}$	61	55
$L_{Aeq\ 1hr}$ upper 10 percentile	65	59
$L_{Aeq\ 1hr}$ lower 10 percentile	53	51

Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am till 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. 1-hour values for L_{AFMax} are shown only where L_{AFMax} >65dB(A) and where L_{AFMax}- L_{Aeq} ≥15dB(A)

Unattended Noise Monitoring Results

0 **Tuesday, 9 March 2021**



axis shows the ends of measurement periods, starting 23:45 preceding day and ending 24:00 midnight

NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{A90} ABL	47	43	-
L_{Aeq}	57	46	-

Night Time Maximum Noise Levels			(see note 7)
L_{AFMax} (Range)	-	to	-
L_{AFMax} - L_{Aeq} (Range)	15	to	15

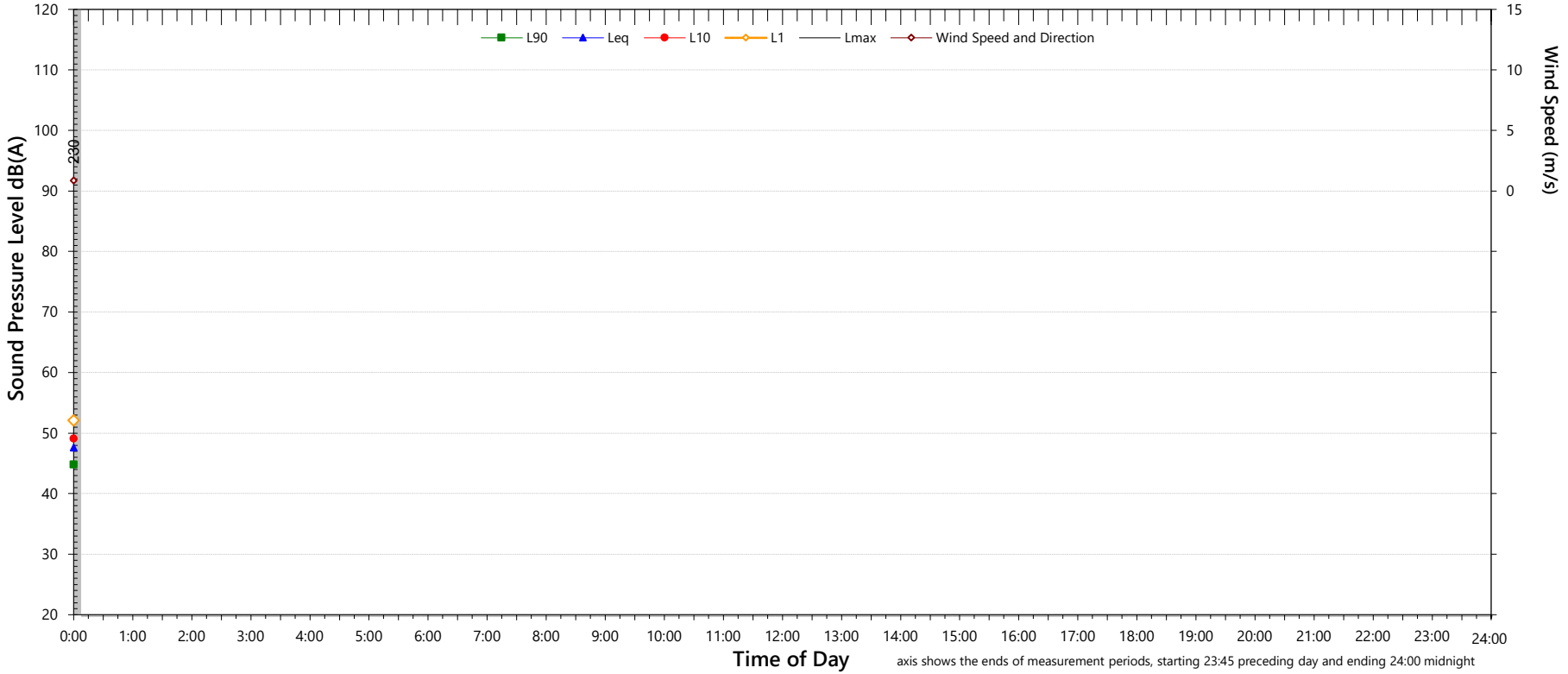
NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{Aeq\ 15\ hr}$ and $L_{Aeq\ 9\ hr}$	58	-
$L_{Aeq\ 1hr}$ upper 10 percentile	62	-
$L_{Aeq\ 1hr}$ lower 10 percentile	49	-

Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am till 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. 1-hour values for L_{AFMax} are shown only where L_{AFMax} >65dB(A) and where L_{AFMax}- L_{Aeq} ≥15dB(A)

Unattended Noise Monitoring Results

0 **Wednesday, 10 March 2021**



NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{A90} ABL	-	-	-
L_{Aeq}	-	-	-

Night Time Maximum Noise Levels			(see note 7)
L_{AFMax} (Range)	-	to	-
L_{AFMax} - L_{Aeq} (Range)	-	to	-

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{Aeq\ 15\ hr}$ and $L_{Aeq\ 9\ hr}$	-	-
$L_{Aeq\ 1hr}$ upper 10 percentile	-	-
$L_{Aeq\ 1hr}$ lower 10 percentile	-	-

Notes:

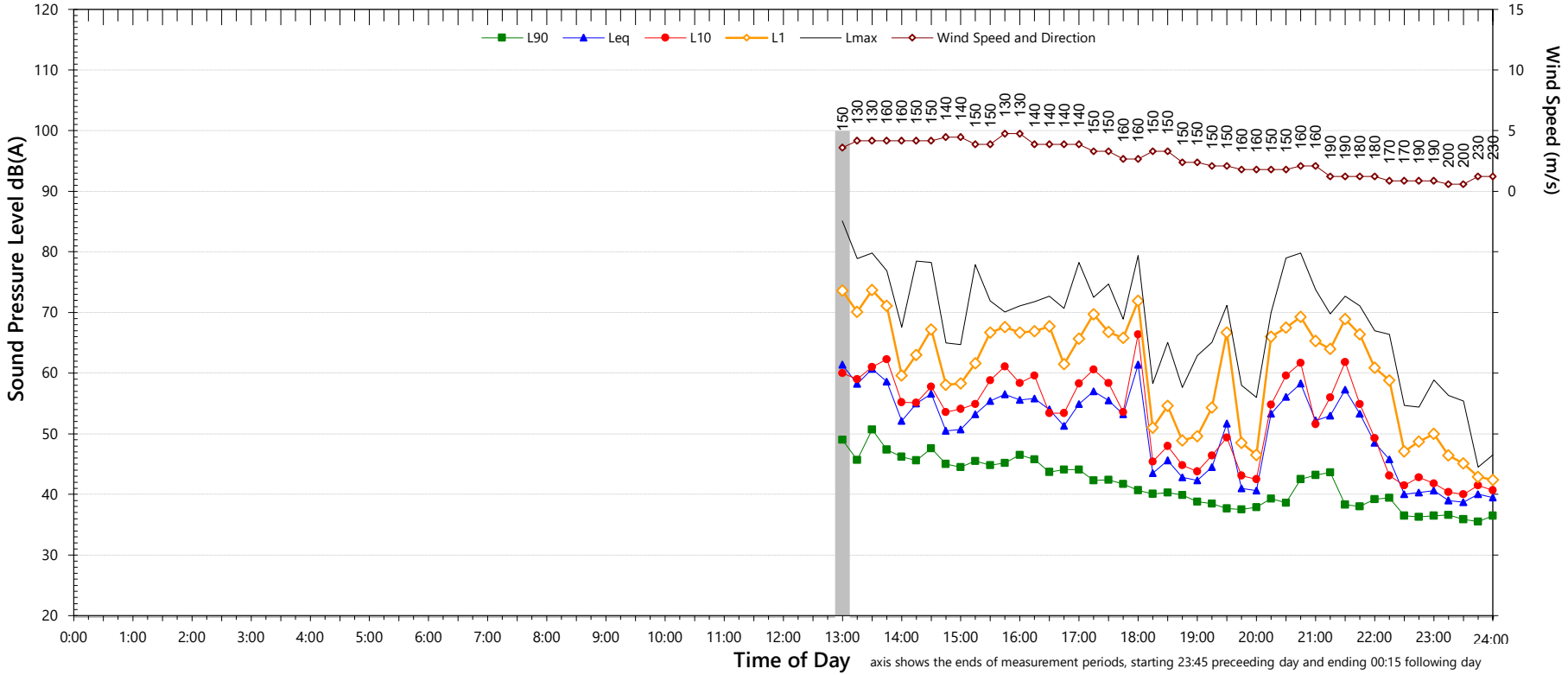
1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am till 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. 1-hour values for L_{AFMax} are shown only where L_{AFMax} >65dB(A) and where L_{AFMax}- L_{Aeq} ≥15dB(A)

APPENDIX C Logger location 2 – WH5 – East side (L1)

Unattended Noise Monitoring Results

WH5 East L1

Tuesday, 2 March 2021



NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{90}	-	38	34
LAeq	-	52	53

Night Time Maximum Noise Levels			(see note 7)
L_{Max} (Range)	66	to	95
L_{Max} - L_{eq} (Range)	15	to	34

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{eq\ 15\ hr}$ and $L_{eq\ 9\ hr}$	58	56
$L_{eq\ 1hr}$ upper 10 percentile	60	52
$L_{eq\ 1hr}$ lower 10 percentile	49	40

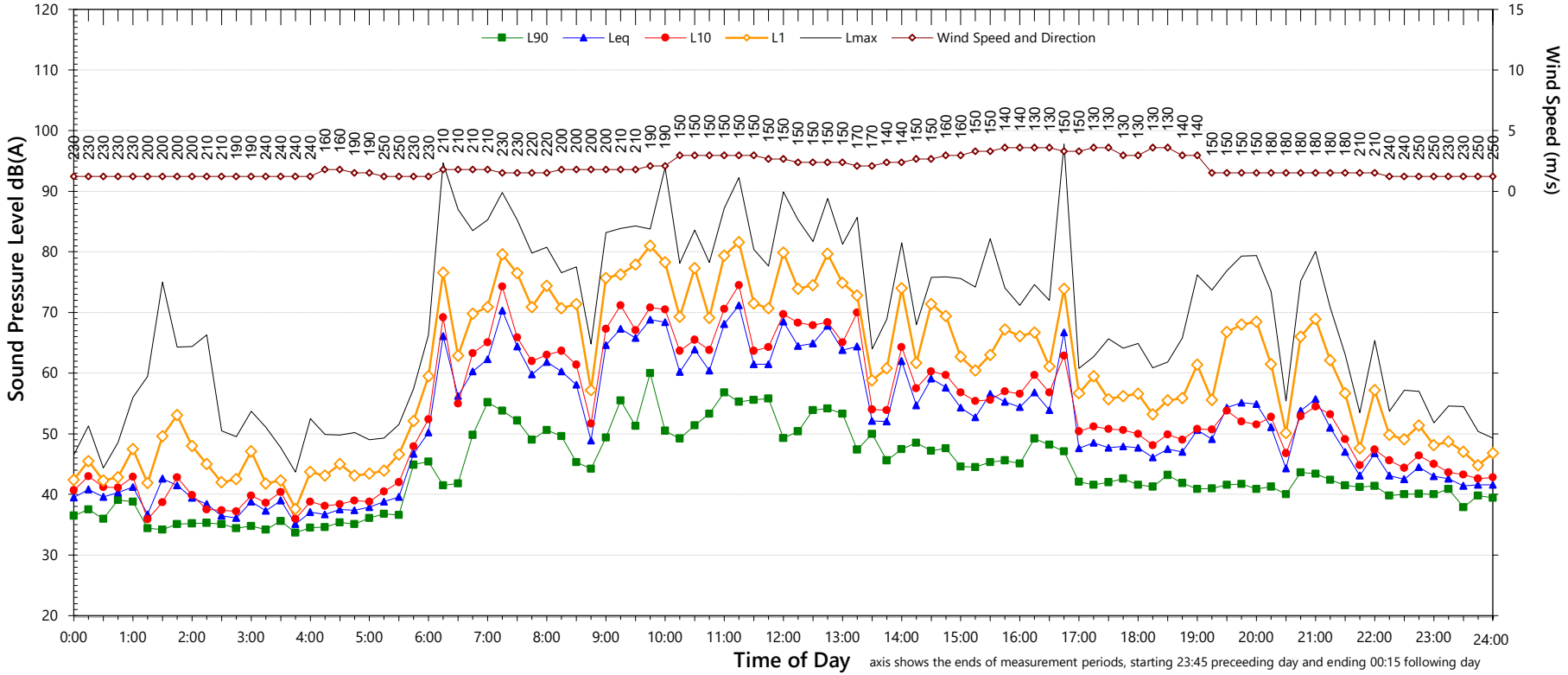
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am til 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. Night time L_{Max} values are shown only where L_{Max} >65dB(A) and where L_{Max}- Leq ≥15dB(A)

Unattended Noise Monitoring Results

WH5 East L1

Wednesday, 3 March 2021



NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{90}	43	41	34
LAeq	64	51	60

Night Time Maximum Noise Levels			(see note 7)
L_{Max} (Range)	66	to	92
L_{Max} - L_{eq} (Range)	16	to	26

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{eq\ 15\ hr}$ and $L_{eq\ 9\ hr}$	65	63
$L_{eq\ 1hr}$ upper 10 percentile	69	56
$L_{eq\ 1hr}$ lower 10 percentile	51	41

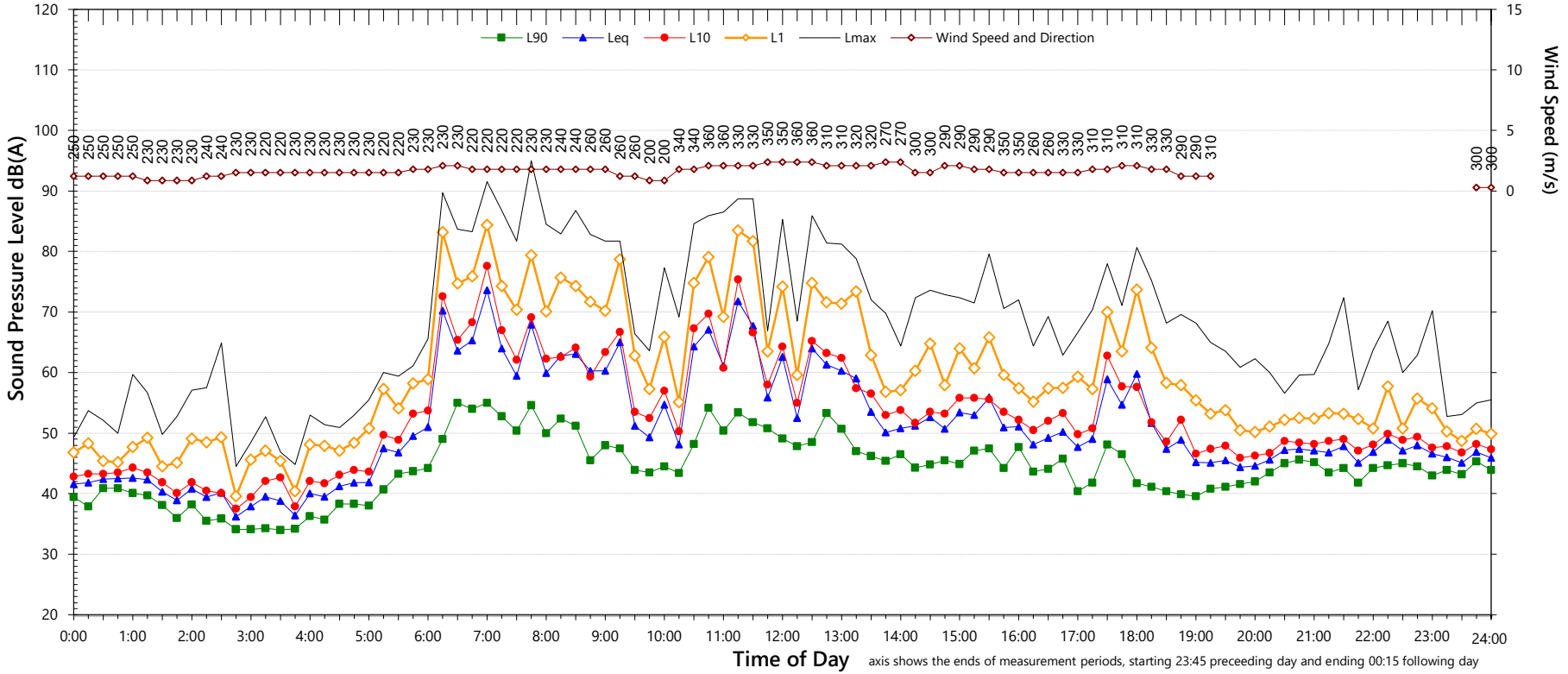
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am til 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. Night time L_{Max} values are shown only where L_{Max} >65dB(A) and where L_{Max}- Leq ≥15dB(A)

Unattended Noise Monitoring Results

WH5 East L1

Thursday, 4 March 2021



NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{90}	44	40	39
LAeq	62	47	58

Night Time Maximum Noise Levels			(see note 7)
L_{Max} (Range)	70	to	90
L_{Max} - L_{eq} (Range)	16	to	24

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{eq\ 15\ hr}$ and $L_{eq\ 9\ hr}$	63	60
$L_{eq\ 1hr}$ upper 10 percentile	66	55
$L_{eq\ 1hr}$ lower 10 percentile	49	46

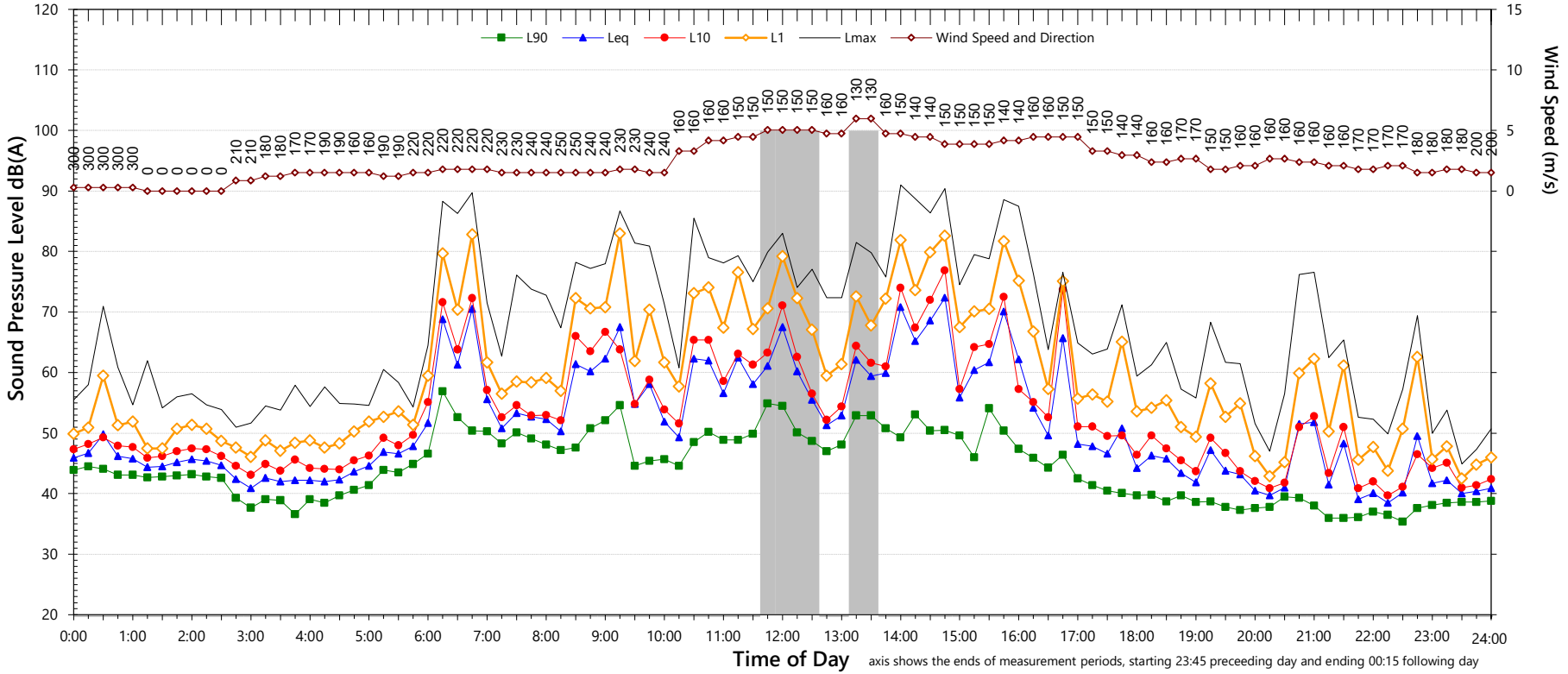
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am til 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. Night time L_{Max} values are shown only where L_{Max} >65dB(A) and where L_{Max}- Leq ≥15dB(A)

Unattended Noise Monitoring Results

WH5 East L1

Friday, 5 March 2021



NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{90}	42	36	35
LAeq	63	46	59

Night Time Maximum Noise Levels			(see note 7)
L_{Max} (Range)	69	to	95
L_{Max} - L_{eq} (Range)	20	to	28

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{eq\ 15\ hr}$ and $L_{eq\ 9\ hr}$	64	62
$L_{eq\ 1hr}$ upper 10 percentile	70	67
$L_{eq\ 1hr}$ lower 10 percentile	47	40

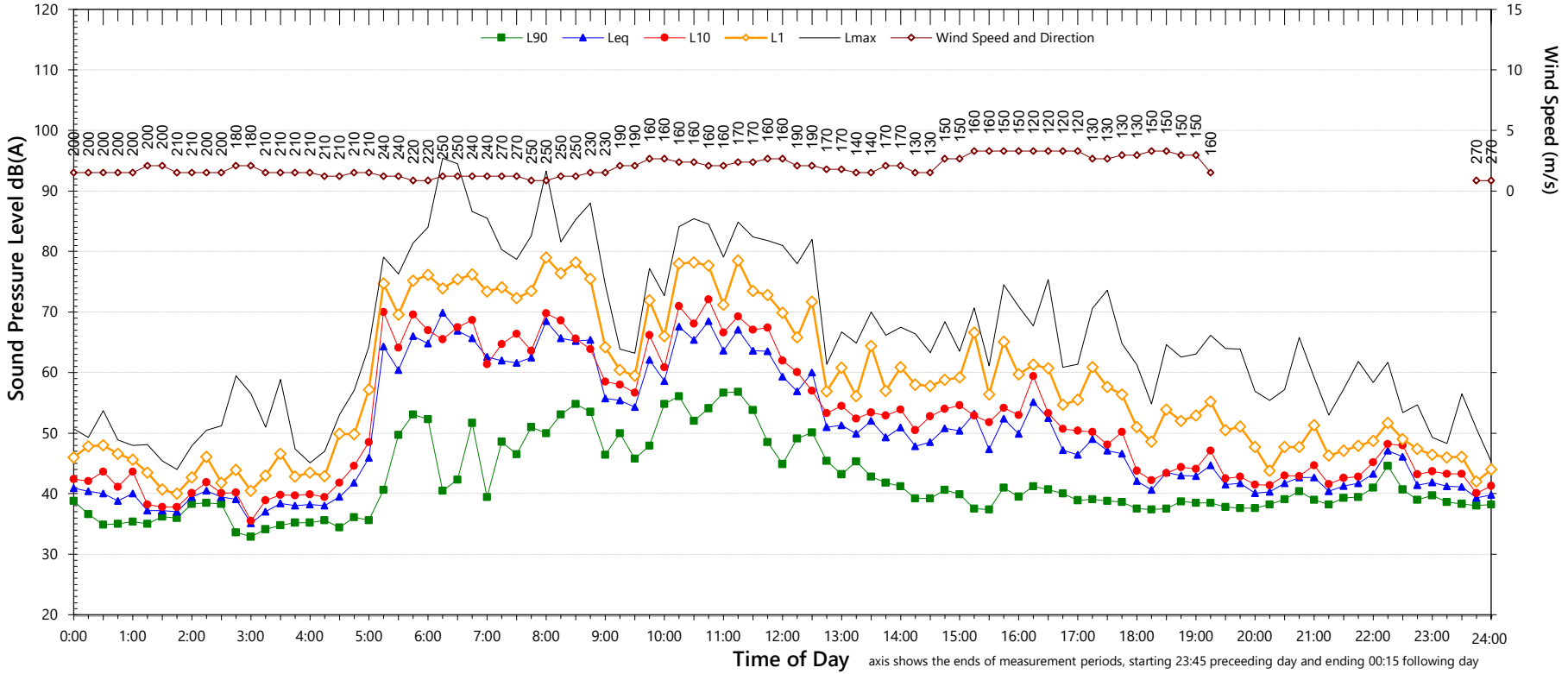
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am til 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. Night time L_{Max} values are shown only where L_{Max} >65dB(A) and where L_{Max}- Leq ≥15dB(A)

Unattended Noise Monitoring Results

WH5 East L1

Saturday, 6 March 2021



axis shows the ends of measurement periods, starting 23:45 preceeding day and ending 00:15 following day

NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{90}	39	38	36
LAeq	61	42	42

Night Time Maximum Noise Levels			(see note 7)
L_{Max} (Range)	67	to	70
L_{Max} - L_{eq} (Range)	16	to	27

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{eq\ 15\ hr}$ and $L_{eq\ 9\ hr}$	62	44
$L_{eq\ 1hr}$ upper 10 percentile	67	47
$L_{eq\ 1hr}$ lower 10 percentile	45	43

Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am til 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. Night time L_{Max} values are shown only where L_{Max} >65dB(A) and where L_{Max}- Leq ≥15dB(A)

Data File: 2021-03-02_SLM_000_123_Rpt_Report.txt

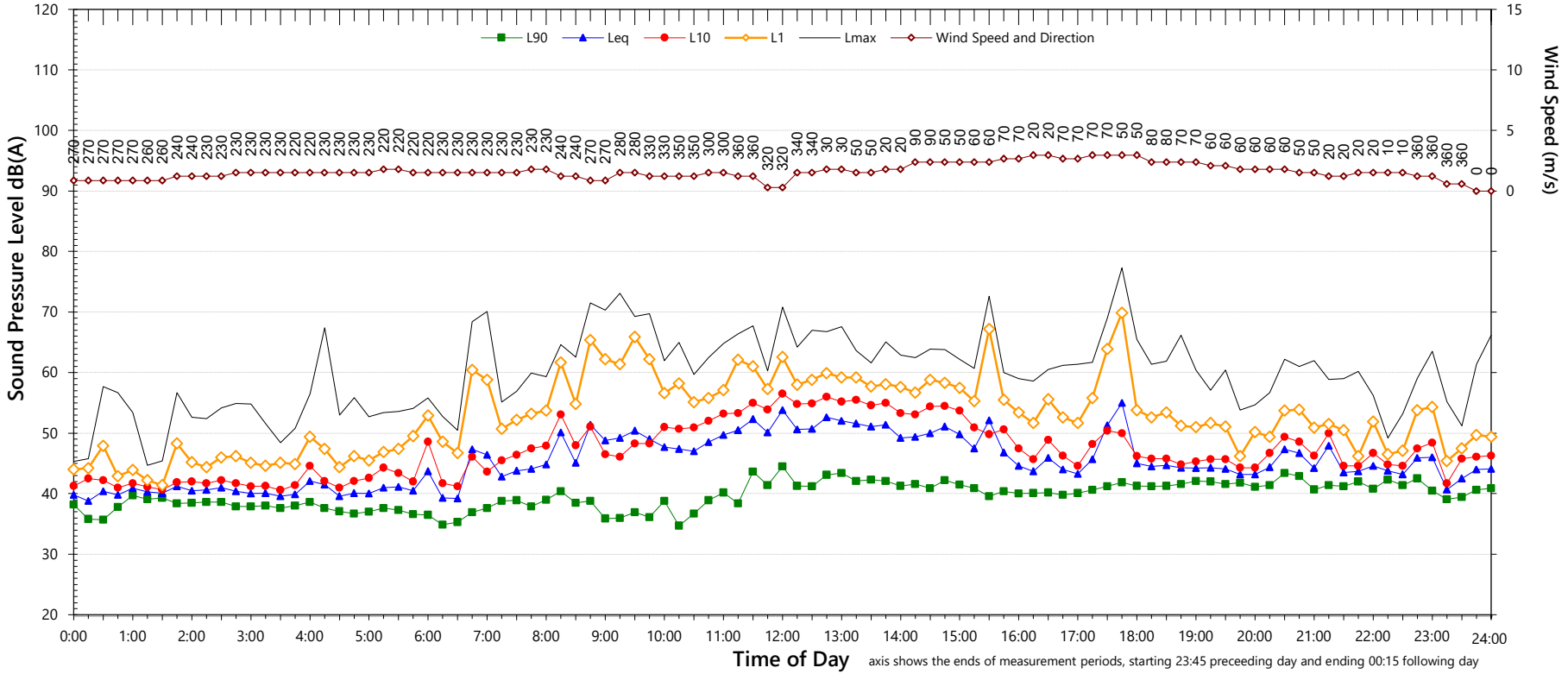
WH5 East L1(r0)

QTE-26 Logger Graphs Program (r34)

Unattended Noise Monitoring Results

WH5 East L1

Sunday, 7 March 2021



axis shows the ends of measurement periods, starting 23:45 preceeding day and ending 00:15 following day

NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{90}	37	41	39
LAeq	50	45	48

Night Time Maximum Noise Levels			(see note 7)
L_{Max} (Range)	66	to	81
L_{Max} - L_{eq} (Range)	15	to	26

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{eq\ 15\ hr}$ and $L_{eq\ 9\ hr}$	51	51
$L_{eq\ 1hr}$ upper 10 percentile	54	53
$L_{eq\ 1hr}$ lower 10 percentile	47	44

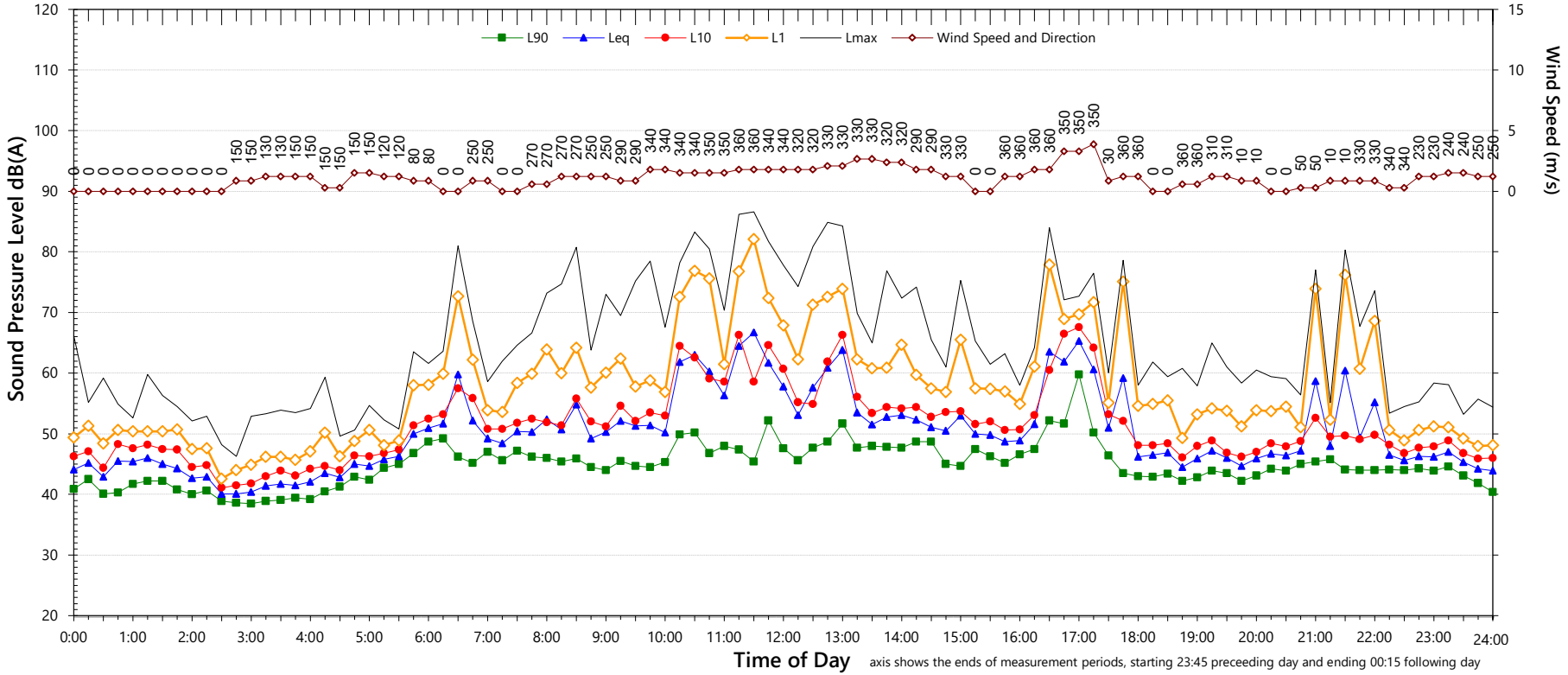
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am til 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. Night time L_{Max} values are shown only where L_{Max} >65dB(A) and where L_{Max}- Leq ≥15dB(A)

Unattended Noise Monitoring Results

WH5 East L1

Monday, 8 March 2021



NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{90}	45	43	40
LAeq	59	52	57

Night Time Maximum Noise Levels			(see note 7)
L_{Max} (Range)	90	to	90
L_{Max} - L_{eq} (Range)	15	to	25

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{eq\ 15\ hr}$ and $L_{eq\ 9\ hr}$	60	59
$L_{eq\ 1hr}$ upper 10 percentile	64	56
$L_{eq\ 1hr}$ lower 10 percentile	50	46

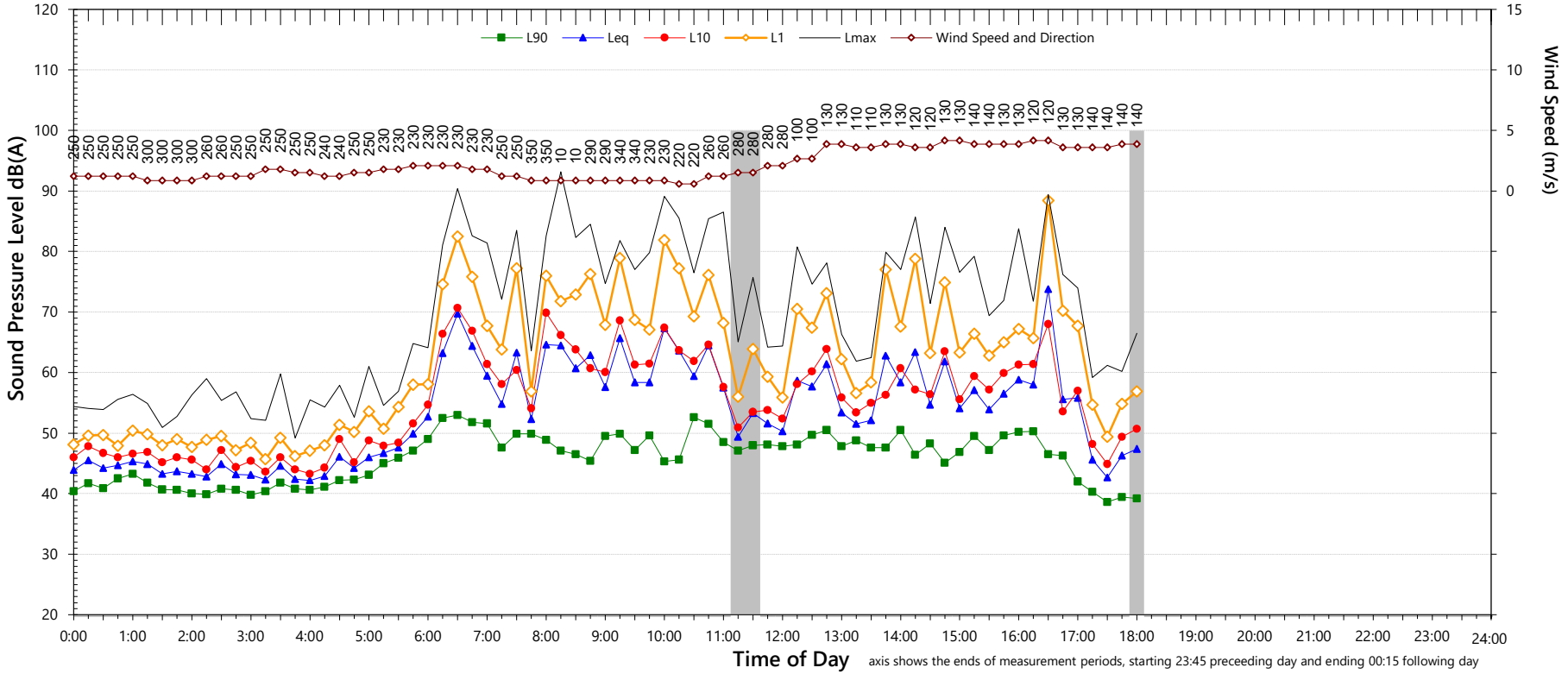
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am til 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. Night time L_{Max} values are shown only where L_{Max} >65dB(A) and where L_{Max}- Leq ≥15dB(A)

Unattended Noise Monitoring Results

WH5 East L1

Tuesday, 9 March 2021



NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{90}	45	-	-
LAeq	62	-	-

Night Time Maximum Noise Levels			(see note 7)
L_{Max} (Range)	-	to	-
L_{Max} - L_{eq} (Range)	-	to	-

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{eq\ 15\ hr}$ and $L_{eq\ 9\ hr}$	65	-
$L_{eq\ 1hr}$ upper 10 percentile	67	-
$L_{eq\ 1hr}$ lower 10 percentile	53	-

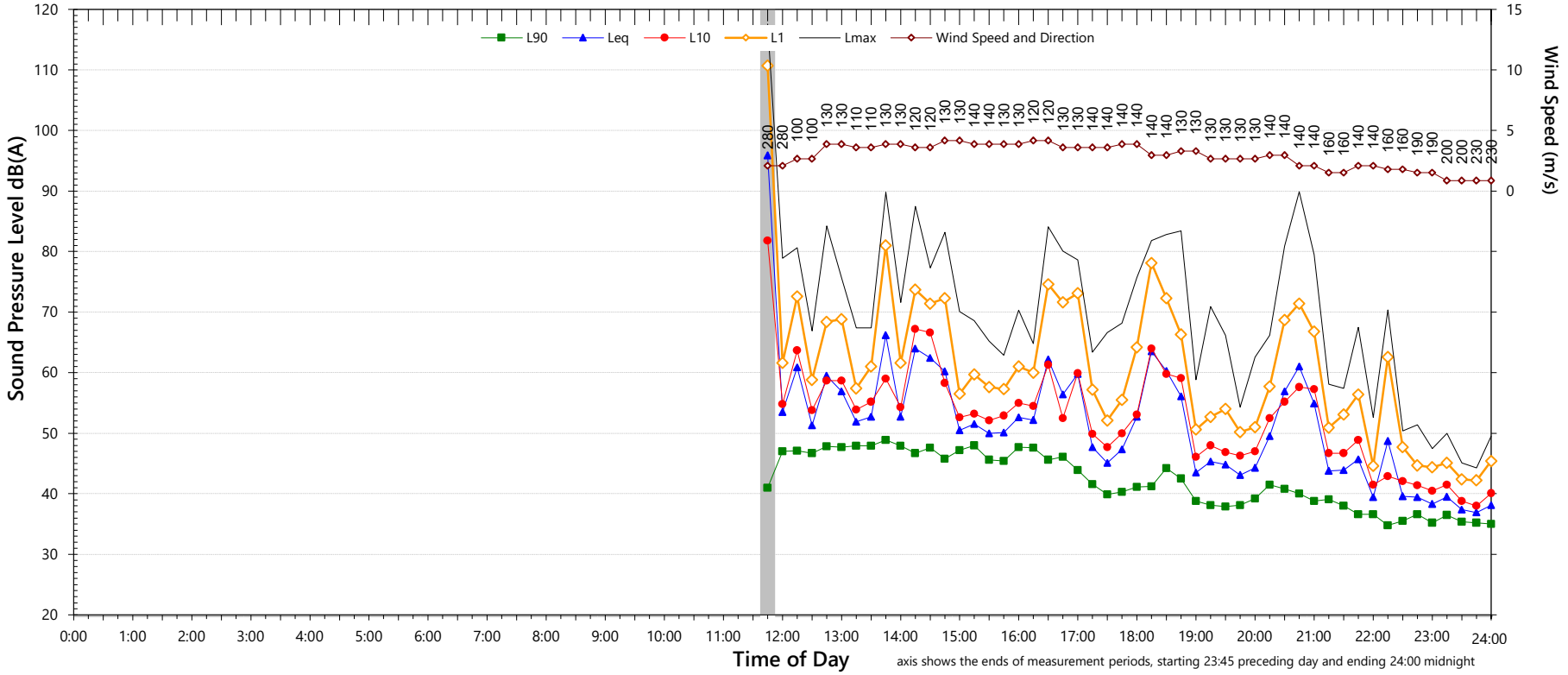
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am til 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. Night time L_{Max} values are shown only where L_{Max} >65dB(A) and where L_{Max}- Leq ≥15dB(A)

APPENDIX D Logger location 3 – WH5 – East side (L2)

Unattended Noise Monitoring Results

0 **Tuesday, 9 March 2021**



NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{A90} ABL	-	37	35
L_{Aeq}	-	56	52

Night Time Maximum Noise Levels			(see note 7)
L_{AFMax} (Range)	68	to	88
L_{AFMax} - L_{Aeq} (Range)	17	to	27

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{Aeq\ 15\ hr}$ and $L_{Aeq\ 9\ hr}$	-	54
$L_{Aeq\ 1hr}$ upper 10 percentile	-	52
$L_{Aeq\ 1hr}$ lower 10 percentile	-	39

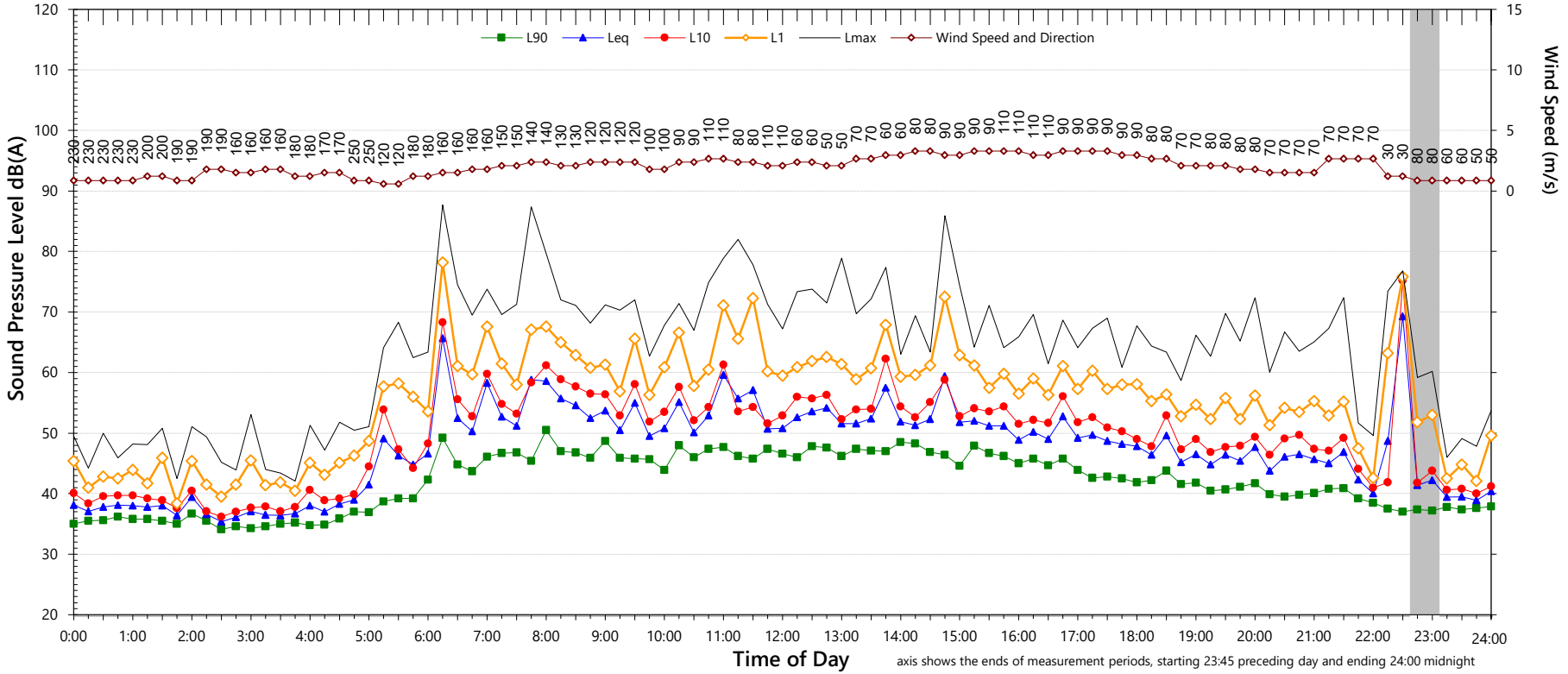
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am till 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. 1-hour values for L_{AFMax} are shown only where L_{AFMax} >65dB(A) and where L_{AFMax}- L_{Aeq} ≥15dB(A)

Unattended Noise Monitoring Results

0

Wednesday, 10 March 2021



axis shows the ends of measurement periods, starting 23:45 preceding day and ending 24:00 midnight

NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{A90} ABL	44	39	36
L_{Aeq}	54	46	60

Night Time Maximum Noise Levels			(see note 7)
L_{AFMax} (Range)	72	to	96
L_{AFMax} - L_{Aeq} (Range)	18	to	28

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{Aeq\ 15\ hr}$ and $L_{Aeq\ 9\ hr}$	55	62
$L_{Aeq\ 1hr}$ upper 10 percentile	58	69
$L_{Aeq\ 1hr}$ lower 10 percentile	48	41

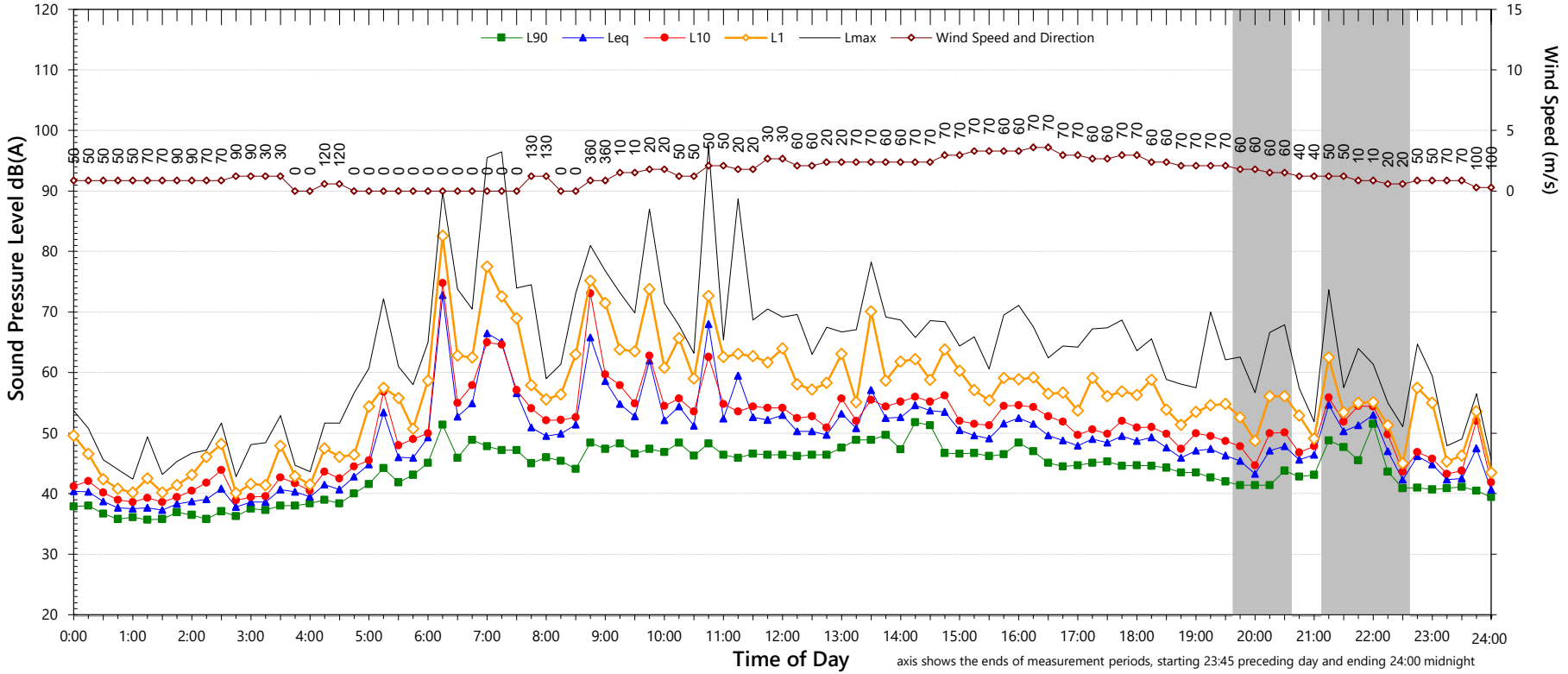
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am till 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. 1-hour values for L_{AFMax} are shown only where L_{AFMax} >65dB(A) and where L_{AFMax}- L_{Aeq} ≥15dB(A)

Unattended Noise Monitoring Results

0

Thursday, 11 March 2021



axis shows the ends of measurement periods, starting 23:45 preceding day and ending 24:00 midnight

NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{A90} ABL	45	-	38
L_{Aeq}	57	-	45

Night Time Maximum Noise Levels			(see note 7)
L_{AFMax} (Range)	69	to	69
L_{AFMax} - L_{Aeq} (Range)	19	to	20

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{Aeq\ 15\ hr}$ and $L_{Aeq\ 9\ hr}$	-	-
$L_{Aeq\ 1hr}$ upper 10 percentile	-	-
$L_{Aeq\ 1hr}$ lower 10 percentile	-	-

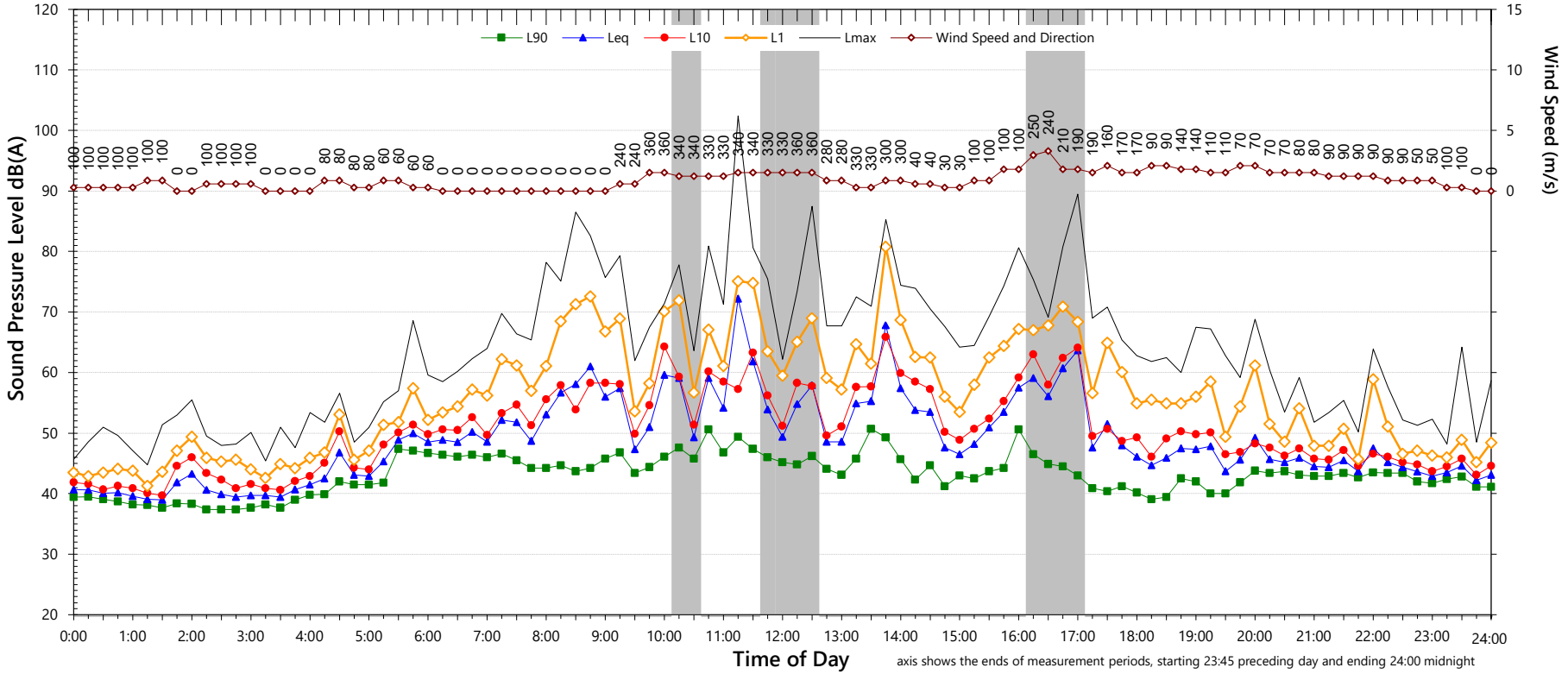
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am till 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. 1-hour values for L_{AFMax} are shown only where L_{AFMax} >65dB(A) and where L_{AFMax}- L_{Aeq} ≥15dB(A)

Unattended Noise Monitoring Results

0

Friday, 12 March 2021



axis shows the ends of measurement periods, starting 23:45 preceding day and ending 24:00 midnight

NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{A90} ABL	-	40	39
L_{Aeq}	-	46	52

Night Time Maximum Noise Levels			(see note 7)
L_{AFMax} (Range)	75	to	89
L_{AFMax} - L_{Aeq} (Range)	16	to	32

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{Aeq\ 15\ hr}$ and $L_{Aeq\ 9\ hr}$	61	54
$L_{Aeq\ 1hr}$ upper 10 percentile	64	60
$L_{Aeq\ 1hr}$ lower 10 percentile	48	44

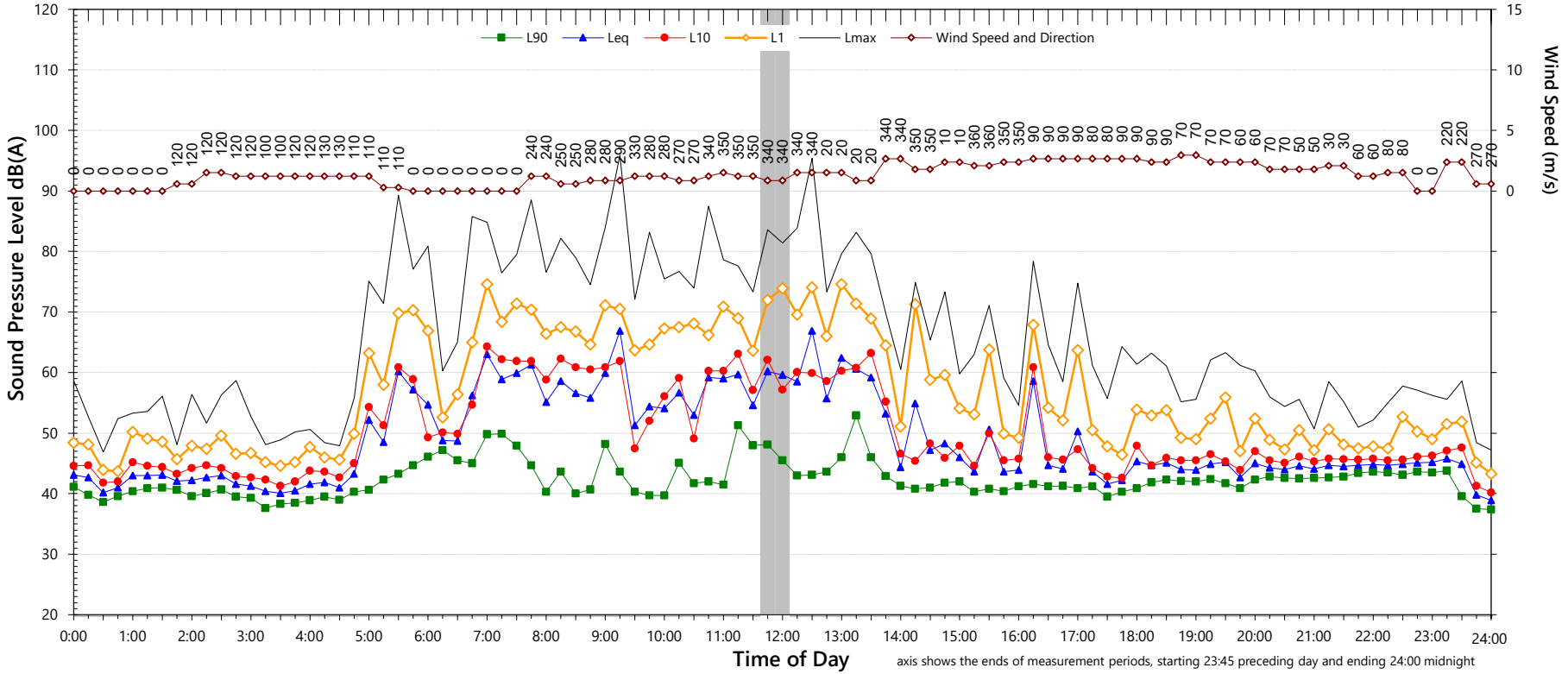
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am till 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. 1-hour values for L_{AFMax} are shown only where L_{AFMax} >65dB(A) and where L_{AFMax}- L_{Aeq} ≥15dB(A)

Unattended Noise Monitoring Results

0

Saturday, 13 March 2021



NSW Noise Policy for Industry (Free Field)			
Descriptor	Day[2]	Evening[3]	Night[4 5]
L_{A90} ABL	40	42	-
L_{Aeq}	58	44	-

Night Time Maximum Noise Levels			(see note 7)
L_{AFMax} (Range)	-	to	-
L_{AFMax} - L_{Aeq} (Range)	15	to	18

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	Day	Night[5]
	7am-10pm	10pm-7am
$L_{Aeq\ 15\ hr}$ and $L_{Aeq\ 9\ hr}$	59	-
$L_{Aeq\ 1hr}$ upper 10 percentile	63	-
$L_{Aeq\ 1hr}$ lower 10 percentile	47	-

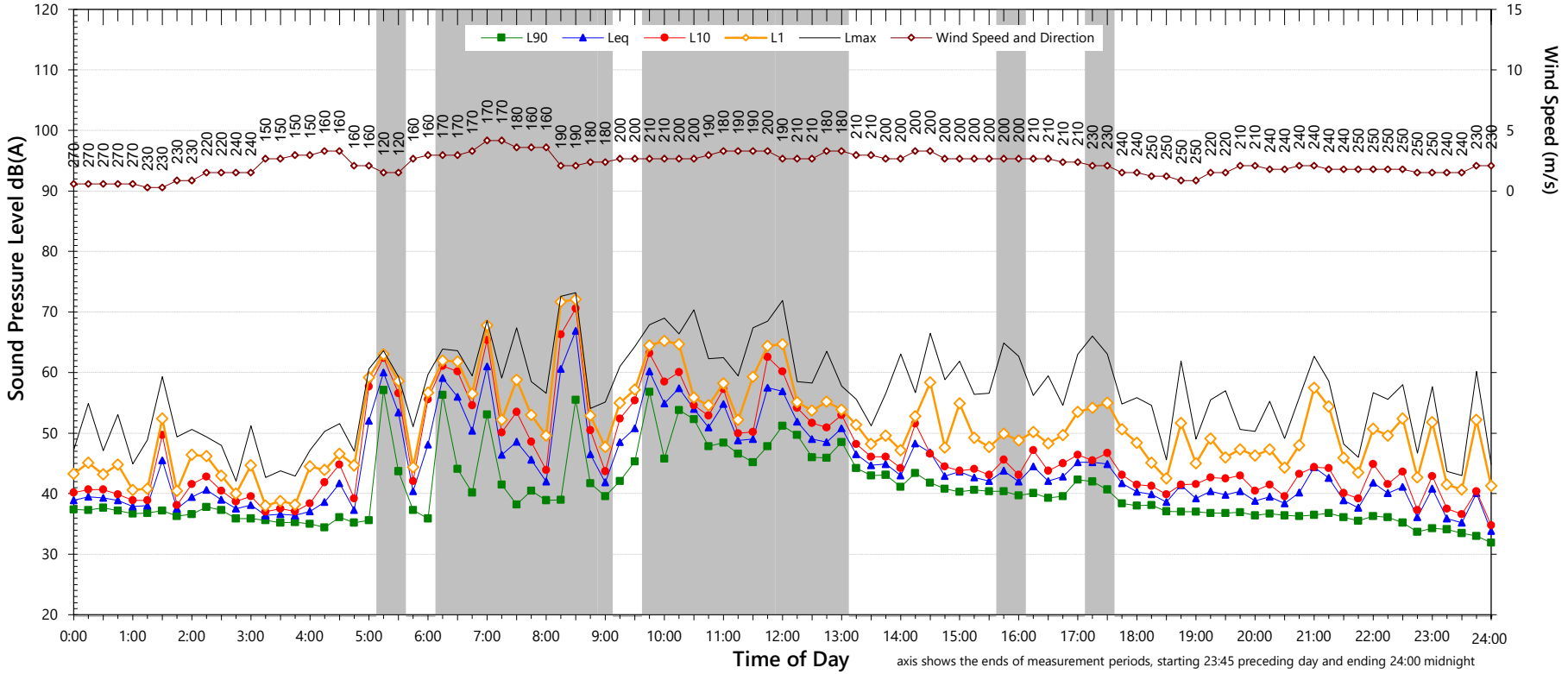
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am till 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. 1-hour values for L_{AFMax} are shown only where L_{AFMax} >65dB(A) and where L_{AFMax}- L_{Aeq} ≥15dB(A)

Unattended Noise Monitoring Results

0

Sunday, 14 March 2021



NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{A90} ABL	-	36	31
L_{Aeq}	-	40	49

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{Aeq\ 15\ hr}$ and $L_{Aeq\ 9\ hr}$	-	52
$L_{Aeq\ 1hr}$ upper 10 percentile	-	50
$L_{Aeq\ 1hr}$ lower 10 percentile	-	36

Night Time Maximum Noise Levels			(see note 7)
L_{AFMax} (Range)	68	to	85
L_{AFMax} - L_{Aeq} (Range)	18	to	28

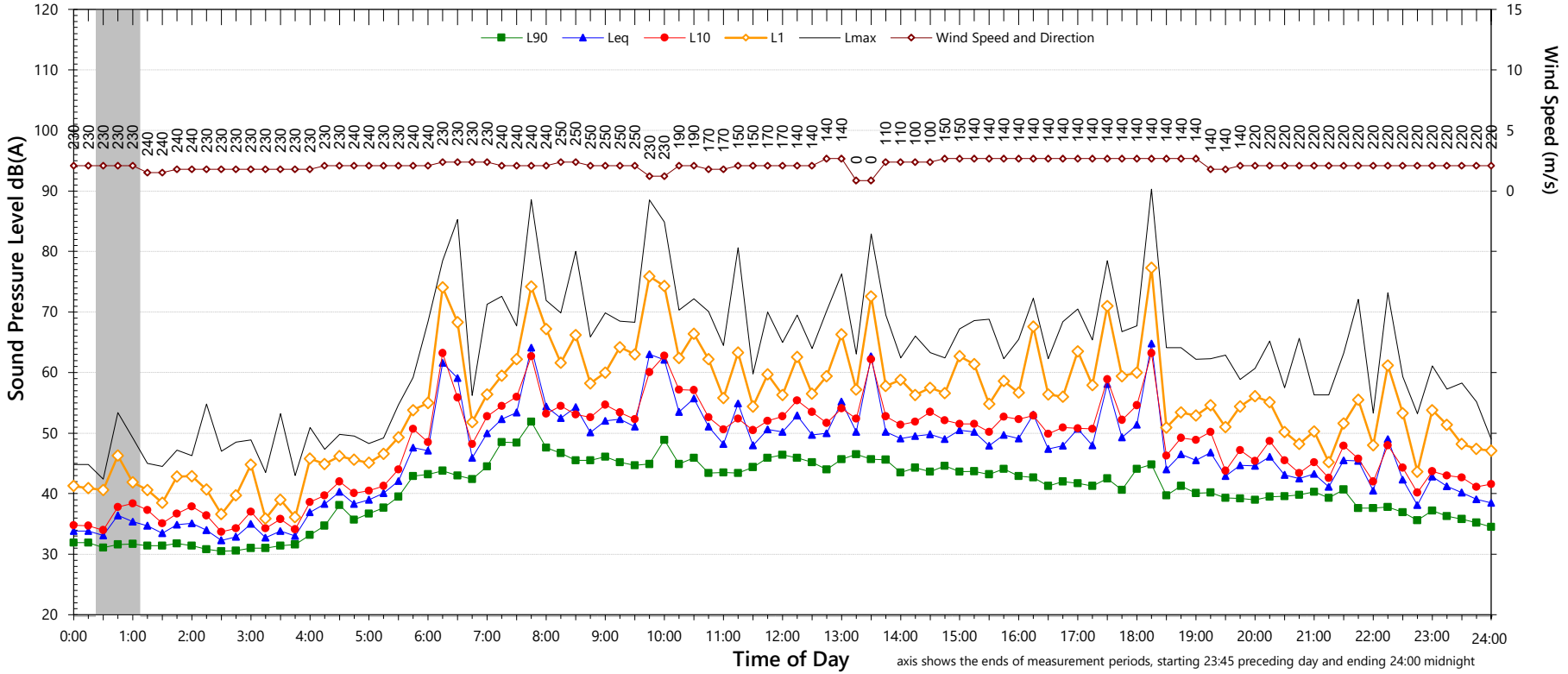
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am till 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. 1-hour values for L_{AFMax} are shown only where L_{AFMax} >65dB(A) and where L_{AFMax}- L_{Aeq} ≥15dB(A)

Unattended Noise Monitoring Results

0

Monday, 15 March 2021



NSW Noise Policy for Industry (Free Field)			
Descriptor	Day[2]	Evening[3]	Night[4 5]
L_{A90} ABL	42	38	32
L_{Aeq}	55	53	43

Night Time Maximum Noise Levels			(see note 7)
L_{AFMax} (Range)	72	to	73
L_{AFMax} - L_{Aeq} (Range)	16	to	28

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	Day	Night[5]
	7am-10pm	10pm-7am
$L_{Aeq\ 15\ hr}$ and $L_{Aeq\ 9\ hr}$	57	46
$L_{Aeq\ 1hr}$ upper 10 percentile	62	48
$L_{Aeq\ 1hr}$ lower 10 percentile	47	39

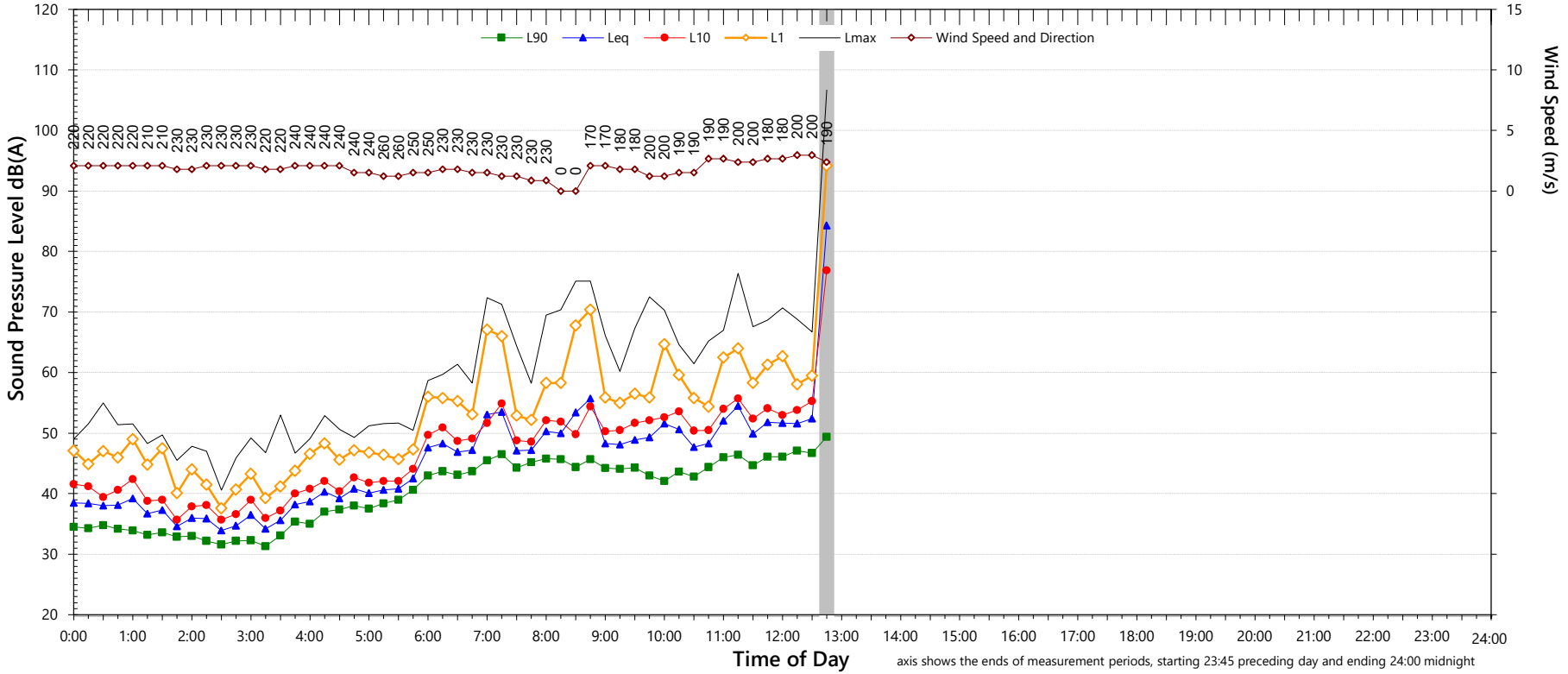
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am till 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. 1-hour values for L_{AFMax} are shown only where L_{AFMax} >65dB(A) and where L_{AFMax}- L_{Aeq} ≥15dB(A)

Unattended Noise Monitoring Results

0

Tuesday, 16 March 2021



axis shows the ends of measurement periods, starting 23:45 preceding day and ending 24:00 midnight

NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{A90} ABL	-	-	-
L_{Aeq}	-	-	-

Night Time Maximum Noise Levels			(see note 7)
L_{AFMax} (Range)	-	to	-
L_{AFMax} - L_{Aeq} (Range)	-	to	-

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{Aeq\ 15\ hr}$ and $L_{Aeq\ 9\ hr}$	-	-
$L_{Aeq\ 1hr}$ upper 10 percentile	-	-
$L_{Aeq\ 1hr}$ lower 10 percentile	-	-

Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am till 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. 1-hour values for L_{AFMax} are shown only where L_{AFMax} >65dB(A) and where L_{AFMax}- L_{Aeq} ≥15dB(A)

B.12 Existing Levels of Rail Noise and Residential Receivers (2017-2018)

Renzo Tonin & Associates Report TJ741-04F03 Existing Levels of Rail Noise (r3)

RENZO TONIN & ASSOCIATES
inspired to achieve

Acoustics
Vibration
Structural Dynamics

MOOREBANK INTERMODAL TERMINAL PROJECT

Measurement of Existing Levels of Rail Noise (2018) per Condition 3C

16 July 2019

Tactical Group

TJ741-04F03 Existing Levels of Rail Noise (r3).docx

35 1982-2017 ACOUSTIC ENGINEERING EXCELLENCE

Sydney Melbourne Brisbane Gold Coast Kuwait
Renzo Tonin & Associates ABN 29 117 462 861
Level 1/418A Elizabeth St SURRY HILLS NSW 2010 | PO Box 877 STRAWBERRY HILLS NSW 2012
P (02) 8218 0500 F (02) 8218 0501 sydney@renzotonin.com.au www.renzotonin.com.au

aaac Association of Australian Acoustical Consultants

Document details

Detail	Reference
Doc reference:	TJ741-04F03 Existing Levels of Rail Noise (r3).docx
Prepared for:	Tactical Group
Address:	
Attention:	Ian Irwin

Document control

Date	Revision history	Non-issued revision	Issued revision	Prepared	Instructed	Authorised
15.02.2019	Draft Report	0	1	T. Braunstein	C. Weber	
16.07.2019	Final	2	3	T. Braunstein	C. Weber	C. Weber

Important Disclaimer:

The work presented in this document was carried out in accordance with the Renzo Tonin & Associates Quality Assurance System, which is based on Australian Standard / NZS ISO 9001.

This document is issued subject to review and authorisation by the Team Leader noted by the initials printed in the last column above. If no initials appear, this document shall be considered as preliminary or draft only and no reliance shall be placed upon it other than for information to be verified later.

This document is prepared for the particular requirements of our Client referred to above in the 'Document details' which are based on a specific brief with limitations as agreed to with the Client. It is not intended for and should not be relied upon by a third party and no responsibility is undertaken to any third party without prior consent provided by Renzo Tonin & Associates. The information herein should not be reproduced, presented or reviewed except in full. Prior to passing on to a third party, the Client is to fully inform the third party of the specific brief and limitations associated with the commission.

In preparing this report, we have relied upon, and presumed accurate, any information (or confirmation of the absence thereof) provided by the Client and/or from other sources. Except as otherwise stated in the report, we have not attempted to verify the accuracy or completeness of any such information. If the information is subsequently determined to be false, inaccurate or incomplete then it is possible that our observations and conclusions as expressed in this report may change.

We have derived data in this report from information sourced from the Client (if any) and/or available in the public domain at the time or times outlined in this report. The passage of time, manifestation of latent conditions or impacts of future events may require further examination and re-evaluation of the data, findings, observations and conclusions expressed in this report.

We have prepared this report in accordance with the usual care and thoroughness of the consulting profession, for the sole purpose described above and by reference to applicable standards, guidelines, procedures and practices at the date of issue of this report. For the reasons outlined above, however, no other warranty or guarantee, whether expressed or implied, is made as to the data, observations and findings expressed in this report, to the extent permitted by law.

The information contained herein is for the purpose of acoustics only. No claims are made and no liability is accepted in respect of design and construction issues falling outside of the specialist field of acoustics engineering including and not limited to structural integrity, fire rating, architectural buildability and fit-for-purpose, waterproofing and the like. Supplementary professional advice should be sought in respect of these issues.

Contents

1 Introduction 1
2 Monitoring locations and dates 2
2.1 88 Leacocks Lane, Casula (Glenfield Farm) 4
2.2 15 Slessor Road, Casula 6
2.3 11 Goodenough Street, Glenfield 7
2.4 19 Wallcliffe Court, Wattle Grove 9
3 Measurement methodology 11
3.1 Details of noise survey and measurement equipment 11
3.2 Site features and observations 11
3.3 Weather observations 12
3.4 Measurement parameters and data analysis 12
4 Measurement results 14
4.1 Overall noise levels 14
4.2 Rail noise contributions 14
5 Conclusions 16
APPENDIX A Glossary of terminology 17
APPENDIX B Daily train noise levels at nearest receiver 19
Measurements at 88 Leacocks Lane 19
Measurements at 15 Slessor Road 21
Measurements at 11 Goodenough Street 22
Measurements at 19 Wallcliffe Court 23
APPENDIX C Long-term 15-minute noise level results 24
APPENDIX D Distance Attenuation – 19 Wallcliffe Court 25

List of tables

Table 2-1 Noise measurement locations and dates 4
Table 3-1 Measurement Equipment 11
Table 4-1 Summary of measured ambient L_{Aeq} noise levels - facade reflected (weekly average) 14
Table 4-2 Summary of measured train passby noise levels - facade reflected (weekly average) 16
Table 5-1 88 Leacocks Lane (Glenfield Farm): Daily number of identified passenger and freight trains on track 19
Table 5-2 88 Leacocks Lane (Glenfield Farm): L_{Aeq} noise levels – at nearest residence – facade reflected 19
Table 5-3 15 Slessor Road: Daily number of identified passenger and freight trains on track 21
Table 5-4 15 Slessor Road: L_{Aeq} noise levels – at nearest residence – facade reflected 21
Table 5-5 19 Wallcliffe Court: Daily number of identified passenger and freight trains on track 23
Table 5-6 19 Wallcliffe Court: L_{Aeq} noise levels – at logger location 64 m from rail – facade reflected 23

Table 5-7 19 Wallcliffe Court – Distance attenuation measurement results 25

List of figures

Figure 2-1 Track diagram 2
Figure 2-2 Noise measurement locations 3
Figure 2-3 88 Leacocks Lane, Casula (Glenfield Farm) - Noise Measurement Location 5
Figure 2-4 Leacocks Lane, Casula – Noise Measurement Equipment 5
Figure 2-5 15 Slessor Road, Casula - Noise Measurement Locations 6
Figure 2-6 15 Slessor Road, Casula – Unattended Noise Measurement Equipment 7
Figure 2-7 11 Goodenough Street, Glenfield – Noise Measurement Location 8
Figure 2-8 11 Goodenough Street, Glenfield – Noise Measurement Equipment 8
Figure 2-9 19 Wallcliffe Court, Wattle Grove - Noise Measurement Locations 9
Figure 2-10 19 Wallcliffe Court, Wattle Grove - Noise Measurement Equipment 10
Figure 5-1 19 Wallcliffe Court – Distance attenuation measurement results 25

1 Introduction

The Moorebank Intermodal Terminal (IMT) involves the development of intermodal freight terminal facilities at Moorebank in south-west Sydney, linked by rail to Port Botany and the interstate rail network. The Project includes the IMT, a rail link connecting the IMT to the Southern Sydney Freight Line (SSFL) and road entry and exit points along Moorebank Avenue.

An Environmental Impact Statement (EIS) for the IMT was prepared and exhibited in 2014. Following the preparation of a Submissions Report and a Supplementary Response to Submissions Report in 2015, the project was approved by the NSW Planning Assessment Commission in 2016. Construction works commenced in 2017.

The final approval for the Moorebank IMT[1] includes conditions which relate to operational noise from freight trains.

This report has been prepared to establish the existing levels of rail noise in accordance with the Rail Infrastructure Noise Guideline (RING). This information will form part of the Rail Noise Management Plan for the Moorebank IMT. The requirements of Mitigation Measure 3C are copied verbatim below. This report addresses the scope shown in **bold** font.

> *3C. A Rail Noise Management Plan (RNMP) (or equivalent) will be prepared prior to operation of the Proposal. The RNMP will include procedures for the application of friction modifiers to the Rail link and measurement and reporting of subsequent rail noise levels should be documented in a Rail Noise Management Plan (RNMP) (or equivalent) to be prepared prior to the operation of the proposal.* **During preparation of the RNMP, background rail noise monitoring will be undertaken to establish existing levels of rail noise levels in accordance with the RING.** *The RNMP will prescribe mitigation measures where modelling predicts and/or operational monitoring shows an exceedance attributable to the Proposal that RING prescribes as a trigger level.*

The work documented in this report was carried out in accordance with the Renzo Tonin & Associates Quality Assurance System, which is based on Australian Standard / NZS ISO 9001. Appendix A contains a glossary of acoustic terms used in this report.

[1] State Significant Development (SSD) Approval 6766, Minister for Planning, 12 December 2016

2 Monitoring locations and dates

Attended and unattended noise measurements have been undertaken to establish the existing levels of rail noise at four locations near the Moorebank IMT development site. These locations are to the west, south-west, south and east of the IMT. The four measurement locations are considered representative of the residential areas potentially most impacted by freight trains accessing the IMT.

Long-term unattended measurements to the west (Glenfield Farm) were undertaken over a 2-week period in August 2017. Additional long-term unattended measurements to the south-west, south and east were undertaken over a 2-week period between 27 November and 10 December 2018. Attended measurements were conducted at each location to confirm the relative contribution of rail traffic and other extraneous noise influencing the measurement results.

A diagram of the track layout is provided in Figure 2-1. Existing rail traffic in the vicinity of the IMT consists of passenger services on the East Hills and Main South Lines and freight traffic on the Southern Sydney Freight Line (SSFL) and Main South Line. The East Hills Line diverges from the Main South Line north of Glenfield Station. At this point the Up track is on viaduct and the Down track is at-grade. Freight trains generally travel on the SSFL north of Glenfield, with occasional freight services on the Main South Line. The SSFL continues north on viaduct from Glenfield for approximately 2 km before returning to grade.

A map of the noise measurement locations in relation to the existing rail lines and IMT is provided in Figure 2-2. The noise measurement periods are summarised in Table 2-1.

Figure 2-1 Track diagram

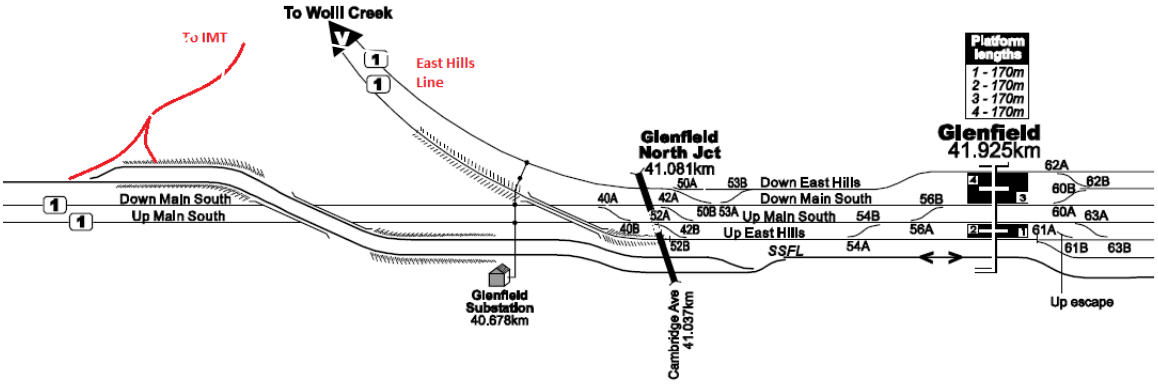


Figure 2-2 Noise measurement locations

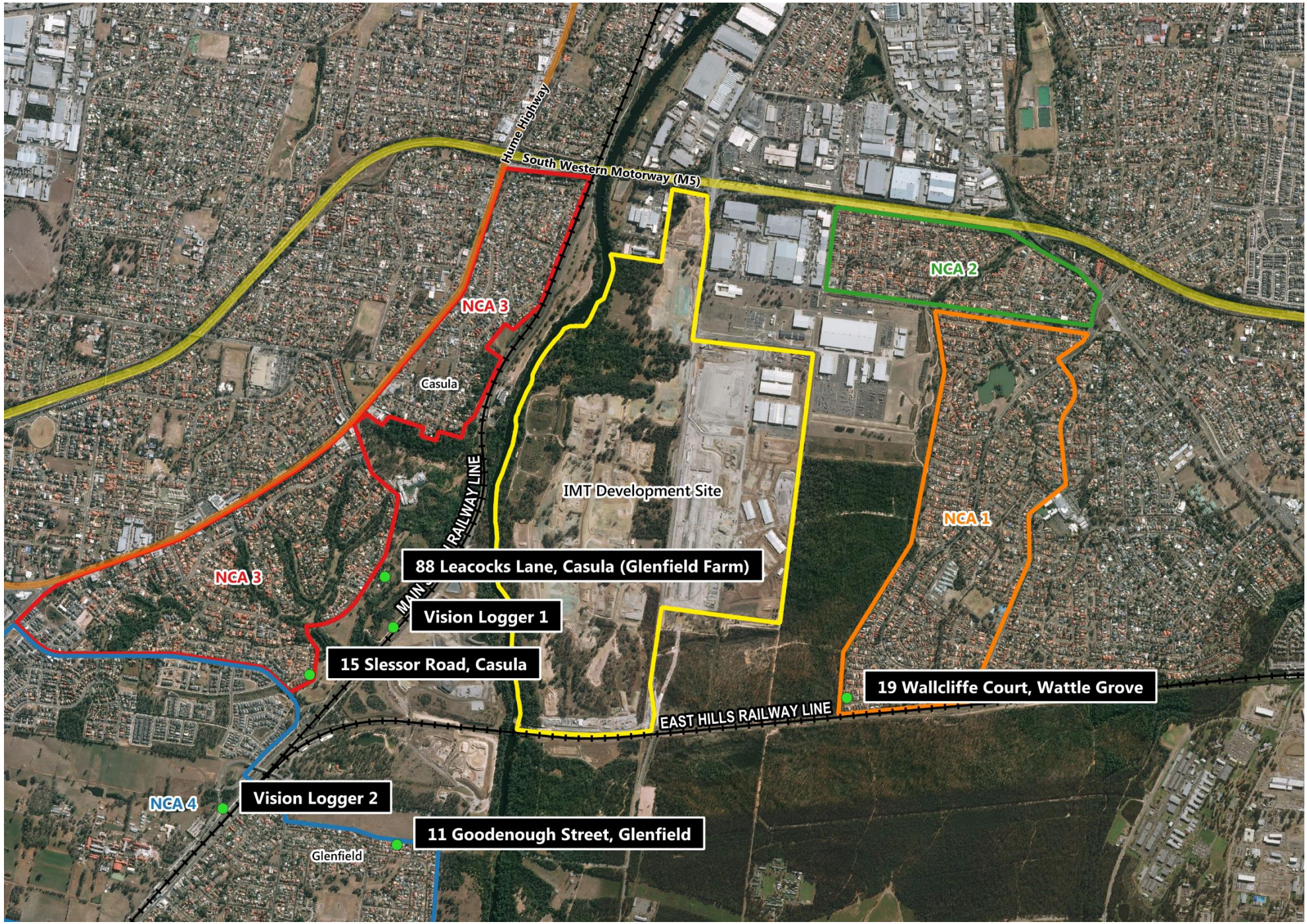


Table 2-1 Noise measurement locations and dates

Location	Direction from the IMT	Unattended measurement period	Attended measurement period
88 Leacocks Lane, Casula (Glenfield Farm)[1]	West[1]	01/08/2017 – 13/08/2017[1]	01/08/2018[1]
15 Slessor Road, Casula	West	27/11/2018 – 10/12/2018	10/12/2018
11 Goodenough Street, Glenfield	South	27/11/2018 – 10/12/2018	10/12/2018
Public area adjacent to 19 Wallcliffe Court, Wattle Grove	East	27/11/2018 – 10/12/2018	10/12/2018

Note: 1. Measurements conducted as part of an expert report prepared by Dr Renzo Tonin (ref 2)

2.1 88 Leacocks Lane, Casula (Glenfield Farm)

Noise measurements to the west of the IMT development site at 88 Leacocks Lane or "Glenfield Farm" were conducted as part of an expert report by Dr Renzo Tonin[2]. Long-term unattended monitoring was conducted between 1 August and 13 August 2017. The noise logger was placed in the rear yard overlooking the Glenfield Waste Facility. The logger was positioned approximately 207 m from the nearest track and 18 m from the nearest façade of the main house. The microphone was at a height of 1.5 m above the local ground level. Attended monitoring was conducted at the same location.

A map of the measurement location is shown in Figure 2-3. A picture of the noise logger and the attended monitoring equipment is provided in Figure 2-4.

[2] Qube Holdings Limited & Minister for Planning ats Residents Against Intermodal Development Moorebank Incorporated – Site: Moorebank Avenue, Moorebank NSW | L&EC Proceedings No 2017/81889 | Expert Report in Acoustics of Renzo Tonin

Figure 2-3 88 Leacocks Lane, Casula (Glenfield Farm) - Noise Measurement Location

Figure 2-4 Leacocks Lane, Casula – Noise Measurement Equipment

2.2 15 Slessor Road, Casula

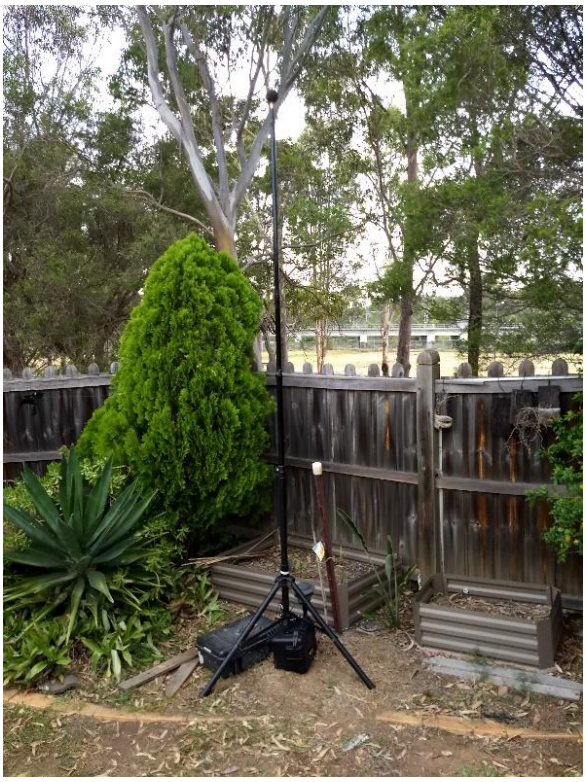
Noise measurements to the south west of the IMT development site were taken at 15 Slessor Road. For long-term unattended monitoring, the noise logger was placed in a position clear of obstructions within the property boundary, approximately 1.3 m from the boundary fence facing the rail corridor and 6.5 m from the nearest façade of the residence. The logger was positioned approximately 132 m from the nearest track. The microphone was placed on an extension pole at a height of 3.2 m above ground (approximately 1 m above the top of the boundary fence).

Attended monitoring was conducted adjacent to the rail corridor in the public near 15 Slessor Road. The microphone was positioned approximately 21 m from the freight viaduct at a height of 1.5 m above the local ground level.

A map of the unattended and attended monitoring locations is shown in Figure 2-5. A picture of the noise logger position is provided in Figure 2-6.

Figure 2-5 15 Slessor Road, Casula - Noise Measurement Locations

Figure 2-6 15 Slessor Road, Casula – Unattended Noise Measurement Equipment



2.3 11 Goodenough Street, Glenfield

Noise measurements to the south of the IMT development site were taken at 11 Goodenough Street. For long-term unattended monitoring, the noise logger was placed in a position clear of obstructions near the property boundary facing the rail corridor. The logger was positioned approximately 620 m from the nearest track and 8 m from the nearest façade of the residence. The microphone was at a height of 1.5 m above the local ground level. Attended monitoring was conducted using the same logger at the same location.

A map of the measurement location is shown in Figure 2-7. A picture of the noise logger used for both unattended and attended measurements is provided in Figure 2-8.

Figure 2-7 11 Goodenough Street, Glenfield – Noise Measurement Location

Figure 2-8 11 Goodenough Street, Glenfield – Noise Measurement Equipment

2.4 19 Wallcliffe Court, Wattle Grove

Noise measurements to the east of the IMT development site were taken at 19 Wallcliffe Court. The unattended monitor was positioned on public land, adjacent to 19 Wallcliffe Court, as access to the residence could not be obtained at the time of installation. The unattended noise logger was positioned approximately 64 m from the nearest track, 23 m from the nearest façade of the residence, and the microphone was 1.5 m above the local ground level. The southern façade of the residence at 19 Wallcliffe Court is 85 m from the nearest track.

Attended measurements were conducted at three positions for the purposes of determining the rate at which noise levels reduce with increasing distance from the East Hills Line. Microphone distances were 26 m from the nearest track (near 30 Wallcliffe Circuit) at a height of 3.2 m, 64 m from the nearest track (unattended logger location) at a height of 1.5 m and 146 m from the nearest track (near 14 Somercotes Circuit) at a height of 1.5 m.

A map of measurement locations is shown in Figure 2-9. Pictures of the noise logger and attended measurement equipment are provided in Figure 2-10.

Figure 2-9 19 Wallcliffe Court, Wattle Grove - Noise Measurement Locations

Figure 2-10 19 Wallcliffe Court, Wattle Grove - Noise Measurement Equipment

3 Measurement methodology

3.1 Details of noise survey and measurement equipment

At each monitoring location, unattended measurement equipment consisted of one RTA Technology noise logger which comprises an NTi Audio XL2 Type 1 sound level meter. Attended measurement equipment also consisted of RTA Technology noise loggers. The calibration of each instrument was verified prior and subsequent to measurements using a Bruel and Kjaer Type 4231 calibrator. In all cases, no significant drift [less than 0.5 dB(A)] in calibration level was observed. Microphones were fitted with windscreens for the entire duration of measurements.

All instrumentation complies with IEC 61672 (parts 1-3) '*Electroacoustics - Sound Level Meters*' and IEC 60942 '*Electroacoustics - Sound calibrators*' and carries current NATA certification.

Table 3-1 Measurement Equipment

Location	Instrument	Make	Model	Serial Number	Last Calibrated
88 Leacocks Lane, Casula (Glenfield Farm)	RTA Technology Noise Logger (RTA 07_018)	NTi	XL2	A2A-12698-E0	22 May 2017
15 Slessor Road, Casula	RTA Technology Noise Logger (RTA 05_006)	NTi	XL2	A2A-04313-D1	20 May 2017
Public area adjacent to 19 Wallcliffe Court, Wattle Grove	RTA Technology Noise Logger (RTA 07_017)	NTi	XL2	A2A-12143-E0	10 March 2017
11 Goodenough Street, Glenfield	RTA Technology Noise Logger (RTA 06_010)	NTi	XL2	A2A-05811-E0	31 Oct 2018
Attended measurements, Park Near 15 Slessor Road, Casula	RTA Technology Noise Logger (RTA 06_010)	NTi	XL2	A2A-05811-E0	31 Oct 2018
Attended measurements, Public area adjacent to 19 Wallcliffe Court, Wattle Grove 26 m from rail	RTA Technology Noise Logger (RTA 05_006)	NTi	XL2	A2A-04313-D1	20 May 2017
Attended measurements, Public area adjacent to 19 Wallcliffe Court, Wattle Grove 64 m from rail	RTA Technology Noise Logger (RTA 07_017)	NTi	XL2	A2A-12143-E0	10 March 2017
Attended measurements, Public area adjacent to 19 Wallcliffe Court, Wattle Grove 146 m from rail	RTA Technology Noise Logger (RTA 06_010)	NTi	XL2	A2A-05811-E0	31 Oct 2018
Attended and Unattended measurement locations	Type 1 Sound Level Meter Calibrator	Bruel & Kjaer	Type 4231	3017534	27 July 2018

3.2 Site features and observations

During set up of the noise loggers and attended measurements, observations of any site features and/or audible characteristics potentially influencing the measurement results were made.

88 Leacocks Lane, Casula (Glenfield Farm)

At 88 Leacocks Lane, noise from passenger and freight train operations on the Main South Line and SSFL was audible. During the day period, noise levels during train passby events were frequently influenced by extraneous noise sources, including noise from birds, sheep, aircraft and equipment operating at the Glenfield Waste Plant.

15 Slessor Road, Casula

At 15 Slessor Road, noise from passenger and freight train operations on the Main South Line and SSFL was audible. Other noise sources included road traffic noise from Glenfield Road and natural noise sources.

11 Goodenough Street, Glenfield

At 11 Goodenough Street, noise emissions were primarily influenced by road traffic noise on Cambridge Avenue, construction noise, aircraft noise and birds. Train passbys were not audible during the day period. During night periods, passbys were occasionally audible (usually freight trains on the Main South Line and SSFL).

19 Wallcliffe Court, Wattle Grove

At the monitoring location adjacent to 19 Wallcliffe Court, all train passbys were passenger rail services on the East Hills Line and were clearly audible. Other noise sources included noise from natural noise sources and construction noise.

3.3 Weather observations

Weather conditions during the noise surveys was based on Bureau of Meteorology results and observations from the noise logging audio and spectra. Weather data from the weather station at Holsworthy Aerodrome was used to assist in identifying periods for data exclusion. Any periods impacted by excessive wind (> 5 m/s) or heavy rain were excluded from the analysis.

3.4 Measurement parameters and data analysis

For long-term monitoring at each location, each noise logger was set up to measure the L_{Aeq} and $L_{Amax,fast}$ noise levels in consecutive 1 second intervals throughout the survey period, and also the statistical noise levels in each 15-minute interval.

For each train passby event, the time period for the noise measurement was determined on the basis of the procedure described in Section 6.6.3 of International Standard ISO3095:2013, whereby the measurement commences when the noise level is at least 10 dB lower than when the front of the train is opposite the microphone and concludes when the noise level is at least 10 dB lower than when the end of the train is opposite the microphone.

Train passbys were identified using the NTi Data Explorer software. This was used to produce a summary of the $L_{Aeq(passby)}$, SEL (L_{AE}) and $L_{Amax,fast}$ noise levels for each passby. For each train passby, the train type (passenger or freight) was determined based on the passby duration and time lapse photography captured from two vision loggers (refer Figure 2-2). The noise measurement results were used to calculate the $L_{Aeq(15hour)}$, $L_{Aeq(9hour)}$ and $L_{AFmax,95\%}$ noise levels for each day and night period for passenger and freight trains.

4 Measurement results

4.1 Overall noise levels

The measurement of overall noise levels was undertaken based on the procedure documented in the NSW Noise Policy for Industry (EPA 2017)[3]. The long-term noise levels were established based on the measured noise levels in consecutive 15-minute intervals after removing weather-affected periods and other extraneous noise. The long-term noise levels include noise contributions from all ambient sources near the monitoring locations, including road traffic noise, rail noise and natural sources. The noise contribution from rail traffic only (refer Section 4.2) will be less than the ambient noise levels from all sources in Table 4-1.

A graphical summary of the 15-minute noise measurement results at each location is provided in APPENDIX C.

Table 4-1 Summary of measured ambient L_{Aeq} noise levels - facade reflected (weekly average)

Location	Measured Daytime (7am to 10 pm) $L_{Aeq(15hour)}$ Noise Levels, dB(A)[2]	Measured Night-time (10pm to 7 am) $L_{Aeq(9hour)}$ Noise Levels, dB(A)[2]
88 Leacocks Lane (Glenfield Farm)	60[1]	55[1]
15 Slessor Road	57	54
11 Goodenough Street	54	50
19 Wallcliffe Court	55	51

Note: 1. Measurements conducted as part of an expert report by Dr Renzo Tonin (Ref 2)

Note: 2. The measured noise levels include noise contributions from all ambient sources near the monitoring locations, including road traffic noise, rail noise and natural sources.

4.2 Rail noise contributions

At each monitoring location, the $L_{Aeq(passby)}$, SEL (L_{AE}) and $L_{Amax,fast}$ noise levels were determined for each train passby as described in Section 3.4. The procedure in Clause 3.4.1.1 of the Rail Infrastructure Noise Guideline (EPA, 2013) was used, together with the number of train passbys during the day and night periods to calculate the $L_{Aeq(15hour)}$ daytime, $L_{Aeq(9hour)}$ night-time and $L_{Amax,95\%}$ noise levels from train passbys.

A summary of the measurement results for each train passby is provided in a spreadsheet format as a separate deliverable.

[3] NSW EPA Noise Policy for Industry – Fact Sheet B: Measurement procedures for determining background noise, 2017

The measurement results for each passby include the following information:

- Date
- Start time of the train passby
- Train type (Passenger or Freight)
- Measurement duration (between approximate 10 dB down points before and after passby)
- SEL (L_{AE}) noise measurement
- L_{AFmax} noise measurement

The $L_{Aeq(15hour)}$ daytime, $L_{Aeq(9hour)}$ night-time and $L_{AFmax,95\%}$ noise levels were calculated at the façade of the four receiver locations for passenger and freight trains separately.

A summary of the daily noise contributions from each train type is provided in APPENDIX B. The weekly logarithmic average L_{Aeq} noise levels (weekday average). This is considered to represent the noise levels associated with the reasonable maximum use, or the 'worst-case' typical day per the requirements of Table Note 9 in the RING. The L_{Aeq} and highest daily $L_{AFmax,95\%}$ noise levels are summarised in Table 4-2.

At 11 Goodenough Street, rail noise was not audible during the equipment setup or attended monitoring. Review of the noise logger data revealed four detectable freight train passbys with L_{AFmax} levels between 47 dB(A) and 52 dB(A) and one detectable passenger train passby with L_{AFmax} of 42 dB(A). All detectable passbys occurred between 12:00 am (midnight) and 3:00 am when background noise levels were lowest.

Table 4-2 Summary of measured train passby noise levels - facade reflected (weekly average)

Location	Measured Daytime Noise Level (7am to 10 pm) $L_{Aeq(15hour)}$, dB(A)			Measured Night-time Noise Level (10pm to 7 am) $L_{Aeq(9hour)}$, dB(A)			Measured $L_{AFmax,95\%}$ (highest daily) Noise Level, dB(A)		
	Passenger	Freight	Total	Passenger	Freight	Total	Passenger	Freight	Total
88 Leacocks Ln	54	52	56	48	50	52	76	85	-
15 Slessor Rd	50	52	54	47	51	52	72	80	-
11 Goodenough St	The noise contribution from existing passenger and freight trains is negligible at this locality. The highest LAmax noise level from freight trains not influenced by ambient noise was 52 dB(A).								
30 Wallcliffe Ct (26 m from rail)	61[3]	n/a	61[3]	58[3]	n/a	58[3]	85[3]	n/a	85[3]
19 Wallcliffe Ct Logger Location (64 m from rail)	53	n/a	53	49	-	49	77	n/a	77
14 Somercotes Ct (146 m from rail)	46[3]	n/a	46[3]	43[3]	n/a	43[3]	69[3]	n/a	69[3]

Note: 1. Measurements conducted as part of a report by Dr Renzo Tonin (Ref 2).

2. Passenger train noise not included.

3. Distance attenuation determined from attended measurements (refer Appendix D).

5 Conclusions

Unattended noise monitoring was undertaken at four representative locations to the west, south west, south and east of the Moorebank IMT development site for a period of 2-weeks at each location.

Rail noise contributions have been calculated at the façade of the representative receivers, consistent with the requirements of the RING. Noise levels have been separately quantified for passenger and freight trains. The weekly average L_{Aeq} and highest daily $L_{AFmax,95\%}$ noise levels at the façade of the nearest residence to each monitoring location is provided in Table 4-2.

APPENDIX A Glossary of terminology

The following is a brief description of the technical terms used to describe noise to assist in understanding the technical issues presented.

Adverse weather	Weather effects that enhance noise (that is, wind and temperature inversions) that occur at a site for a significant period of time (that is, wind occurring more than 30% of the time in any assessment period in any season and/or temperature inversions occurring more than 30% of the nights in winter).
Ambient noise	The all-encompassing noise associated within a given environment at a given time, usually composed of sound from all sources near and far.
Assessment period	The period in a day over which assessments are made.
Assessment point	A point at which noise measurements are taken or estimated. A point at which noise measurements are taken or estimated.
Background noise	Background noise is the term used to describe the underlying level of noise present in the ambient noise, measured in the absence of the noise under investigation, when extraneous noise is removed. It is described as the average of the minimum noise levels measured on a sound level meter and is measured statistically as the A-weighted noise level exceeded for ninety percent of a sample period. This is represented as the L90 noise level (see below).
Decibel [dB]	The units that sound is measured in. The following are examples of the decibel readings of every day sounds: 0dB The faintest sound we can hear 30dB A quiet library or in a quiet location in the country 45dB Typical office space. Ambience in the city at night 60dB CBD mall at lunch time 70dB The sound of a car passing on the street 80dB Loud music played at home 90dB The sound of a truck passing on the street 100dB The sound of a rock band 115dB Limit of sound permitted in industry 120dB Deafening
dB(A)	A-weighted decibels. The A- weighting noise filter simulates the response of the human ear at relatively low levels, where the ear is not as effective in hearing low frequency sounds as it is in 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.
dB(C)	C-weighted decibels. The C-weighting noise filter simulates the response of the human ear at relatively high levels, where the human ear is nearly equally effective at hearing from mid-low frequency (63Hz) to mid-high frequency (4kHz), but is less effective outside these frequencies.
Frequency	Frequency is synonymous to pitch. 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.
Impulsive noise	Having a high peak of short duration or a sequence of such peaks. A sequence of impulses in rapid succession is termed repetitive impulsive noise.
Intermittent noise	The level suddenly drops to that of the background noise several times during the period of observation. The time during which the noise remains at levels different from that of the ambient is one second or more.
$L_{Aeq(15hour)}$	The "equivalent A-weighted noise level" is the summation of noise events integrated over the 15 hour daytime period.

$L_{Aeq(9hour)}$	The "equivalent A-weighted noise level" is the summation of noise events integrated over the 9 hour night-time period.
$L_{AFmax,95\%}$	The 95th percentile LAFmax level for train passbys (i.e. the LAFmax level not exceeded by 95% of passbys). The LAFmax level is the maximum A-weighted, fast response sound pressure level measured over a given period
L_{Max}	The maximum sound pressure level measured over a given period.
L_{Min}	The minimum sound pressure level measured over a given period.
L_1	The sound pressure level that is exceeded for 1% of the time for which the given sound is measured.
L_{10}	The sound pressure level that is exceeded for 10% of the time for which the given sound is measured.
L_{90}	The level of noise exceeded for 90% of the time. The bottom 10% of the sample is the L90 noise level expressed in units of dB(A).
L_{eq}	The "equivalent noise level" is the summation of noise events and integrated over a selected period of time.
Reflection	Sound wave changed in direction of propagation due to a solid object obscuring its path.
SEL	Sound Exposure Level (SEL) is the constant sound level which, if maintained for a period of 1 second would have the same acoustic energy as the measured noise event. SEL noise measurements are useful as they can be converted to obtain Leq sound levels over any period of time and can be used for predicting noise at various locations.
Sound	A fluctuation of air pressure which is propagated as a wave through air.
Sound absorption	The ability of a material to absorb sound energy through its conversion into thermal energy.
Sound level meter	An instrument consisting of a microphone, amplifier and indicating device, having a declared performance and designed to measure sound pressure levels.
Sound pressure level	The level of noise, usually expressed in decibels, as measured by a standard sound level meter with a microphone.
Sound power level	Ten times the logarithm to the base 10 of the ratio of the sound power of the source to the reference sound power.
Tonal noise	Containing a prominent frequency and characterised by a definite pitch.

APPENDIX B Daily train noise levels at nearest receiver

Measurements at 88 Leacocks Lane

Table 5-1 88 Leacocks Lane (Glenfield Farm): Daily number of identified passenger and freight trains on track

Date	Day	Daytime (7am to 10 pm)			Night-time (7am to 10 pm)		
		Passenger	Freight	Total	Passenger	Freight	Total
1/08/2017	Tue	120[1]	15[1]	135[1]	34	10	44
2/08/2017	Wed	172	16	188	33	13	46
3/08/2017	Thur	146[2]	19[2]	165[2]	2[2]	7[2]	9[2]
4/08/2017	Fri	Note 3	21	21	Note 3	6	6
5/08/2017	Sat	Note 3	14	14	Note 3	10	10
6/08/2017	Sun	Note 3	13	13	Note 3	10	10
7/08/2017	Mon	Note 3	17	17	Note 3	11	11
8/08/2017	Tue	Note 3	21	21	Note 3	12	12
9/08/2017	Wed	Note 3	15	15	Note 3	13	13
10/08/2017	Thur	Note 3	21	21	Note 3	18	18
11/08/2017	Fri	Note 3	24	24	Note 3	8	8
12/08/2017	Sat	Note 3	20	20	Note 3	12	12
13/08/2017	Sun	Note 3	2[1]	2[1]	Note 3	-[1]	-[1]

Note: 1. Incomplete data set due to start/end time of unattended measurements
2. Incomplete data due to weather events (passbys excluded)
3. Passenger train noise not included in detailed analysis

Table 5-2 88 Leacocks Lane (Glenfield Farm): L_{Aeq} noise levels – at nearest residence – facade reflected

Date	Day	Daytime (7am to 10 pm) $L_{Aeq(15hour)}$			Night-time (7am to 10 pm) $L_{Aeq(9hour)}$			$L_{AFmax,95\%}$		
		Passenger	Freight	Total	Passenger	Freight	Total	Passenger	Freight	Total
1/08/2017	Tue	53.9[1]	49.4[1]	55.2[1]	48.0	49.0	51.5	73.2	78.1	-
2/08/2017	Wed	54.0	50.0	55.5	47.1	48.1	50.6	74.0	74.5	-
3/08/2017	Thur	54.3[1]	51.3[1]	56.1[1]	Weather affected			76.3	79.9	-
4/08/2017	Fri	54.0[3]	50.9	50.9[3]	47.6[3]	48.1	50.9	-	80.3	-
5/08/2017	Sat	Note 4	48.5	-	Note 4	49.8	-	-	77.2	-
6/08/2017	Sun	Note 4	48.5	-	Note 4	50.0	-	-	85.3	-
7/08/2017	Mon	54.0[3]	49.2	45.3	47.6[3]	49.8	51.9	-	75.4	-
8/08/2017	Tue	54.0[3]	54.3	57.2	47.6[3]	51.9	53.2	-	80.4	-
9/08/2017	Wed	54.0[3]	50.1	55.5	47.6[3]	51.4	52.9	-	80.7	-
10/08/2017	Thur	54.0[3]	51.7	56.0	47.6[3]	50.8	52.5	-	83.2	-
11/08/2017	Fri	54.0[3]	52.3	56.3	47.6[3]	48.7	51.2	-	83.7	-
12/08/2017	Sat	Note 4	49.4	-	Note 4	50.8	-	-	73.1	-

Date	Day	Daytime (7am to 10 pm) $L_{Aeq(15hour)}$			Night-time (7am to 10 pm) $L_{Aeq(9hour)}$			$L_{AFmax,95\%}$		
		Passenger	Freight	Total	Passenger	Freight	Total	Passenger	Freight	Total
13/08/2017	Sun	Note 4	39.3[1]	-				-	-	-
Overall		54.0	51.5	56.0	47.6	49.9	51.9	76.3	85.3	-

Note: 1. Due to incomplete data set, calculated noise levels have been normalised to the number of passbys observed on Wed 2/8/2017
2. Incomplete data due to weather events (passbys excluded)
3. Passenger train noise level analysis not undertaken for these days and is assumed to be the same as the values measured on Wed 2/8/2017
4. Passenger train noise analysis not undertaken for Saturday and Sunday but is expected to be lower than the measured noise levels on weekdays
5. Grey shading indicates excluded data for overall noise calculations

Measurements at 15 Slessor Road

Table 5-3 15 Slessor Road: Daily number of identified passenger and freight trains on track

Date	Day	Daytime (7am to 10 pm)			Night-time (7am to 10 pm)		
		Passenger	Freight	Total	Passenger	Freight	Total
27/11/2018	Tue	183[1]	23[1]	206[1]	47[2]	14[2]	61[2]
28/11/2018	Wed	38[2]	5[2]	43[2]	84	15	99
29/11/2018	Thur	246	32	278	85	19	104
30/11/2018	Fri	231	36	267	81	9	90
1/12/2018	Sat	151	28	179	91	10	101
2/12/2018	Sun	78[2]	5[2]	83[2]	69	18	87
3/12/2018	Mon	228	22	250	86	13	99
4/12/2018	Tue	252	18	270	85	14	99
5/12/2018	Wed	242	21	263	81[2]	14[2]	95[2]
6/12/2018	Thur	247	22	269	79	10	89
7/12/2018	Fri	229	29	258	74	10	84
8/12/2018	Sat	144	19	163	81	11	92
9/12/2018	Sun	154	14	168	85	9	94
10/12/2018	Mon	251	21	272	3[1]	0[1]	3[1]

Note: 1. Incomplete data set due to start/end time of unattended measurements
2. Incomplete data due to weather events (passbys excluded)

Table 5-4 15 Slessor Road: L_{Aeq} noise levels – at nearest residence – facade reflected

Date	Day	Daytime (7am to 10 pm) $L_{Aeq(15hour)}$			Night-time (7am to 10 pm) $L_{Aeq(9hour)}$			$L_{AFmax,95\%}$		
		Passenger	Freight	Total	Passenger	Freight	Total	Passenger	Freight	Total
27/11/2018	Tue	48.7[1]	51.3[1]	53.2[1]	44.1[2]	49.6[2]	50.7[2]	68.8[1,2]	77.0[1,2]	72.8[1,2]
28/11/2018	Wed	42.3[2]	42.4[2]	45.3[2]	47.4	52.8	53.9	69.0[2]	77.6[2]	73.1[2]
29/11/2018	Thur	50.8	53.6	55.5	48.2	52.2	53.7	71.3	80.3	74.6
30/11/2018	Fri	49.2	51.7	53.6	46.8	49.3	51.3	70.6	77.3	73.3
1/12/2018	Sat	47.5	50.4	52.2	46.9	49.3	51.2	68.4	76.0	-
2/12/2018	Sun	43.5[2]	42.1[2]	45.8[2]	46.4	51.0	52.3	70.2[2]	78.0[2]	-
3/12/2018	Mon	48.0	49.5	51.8	47.6	50.5	52.3	69.5	78.9	-
4/12/2018	Tue	50.3	51.1	53.8	47.0	49.9	51.7	71.1	77.9	-
5/12/2018	Wed	50.0	52.0	54.1	46.9[2]	51.3[2]	52.7[2]	69.7[2]	79.8[2]	-
6/12/2018	Thur	50.0	52.6	54.5	47.9	50.7	52.5	70.7	80.4	-
7/12/2018	Fri	50.3	51.1	53.7	46.2	48.6	50.6	71.6	77.4	-
8/12/2018	Sat	47.6	50.6	52.4	47.3	50.5	52.2	69.1	78.7	-
9/12/2018	Sun	47.8	49.0	51.4	47.1	48.5	50.9	68.9	77.3	-
10/12/2018	Mon	49.7	50.3	53.0	-	-	-	69.0[1]	78.1[1]	-
Overall		49.9	51.7	53.9	47.4	50.8	52.4	71.6	80.4	-

Note: 1. Incomplete data due to start/end of recording
2. Incomplete data due to weather events (passbys excluded)
3. Grey shading indicates excluded data for overall noise calculations

Measurements at 11 Goodenough Street

Refer Section 4.2

Measurements at 19 Wallcliffe Court

Table 5-5 19 Wallcliffe Court: Daily number of identified passenger and freight trains on track

Date	Day	Daytime (7am to 10 pm)			Night-time (7am to 10 pm)		
		Passenger	Freight	Total	Passenger	Freight	Total
27/11/2018	Tue	107[1]	-[1]	107[1]	26[2]	-[2]	26[2]
28/11/2018	Wed	22[2]	-[2]	22[2]	43	-	43
29/11/2018	Thur	157	-	157	46	-	46
30/11/2018	Fri	158	-	158	49	-	49
1/12/2018	Sat	124	-	124	49	-	49
2/12/2018	Sun	61[2]	-[2]	61[2]	39	-	39
3/12/2018	Mon	152	-	152	45	-	45
4/12/2018	Tue	162	-	162	48	-	48
5/12/2018	Wed	162	-	162	46[2]	-[2]	46[2]
6/12/2018	Thur	156	-	156	51	-	51
7/12/2018	Fri	162	-	162	48	-	48
8/12/2018	Sat	121	-	121	48	-	48
9/12/2018	Sun	124	-	124	44	-	44
10/12/2018	Mon	158	-	158	-[1]	-[1]	-[1]

Note: 1. Incomplete data set due to start/end time of unattended measurements
2. Incomplete data due to weather events (passbys excluded)

Table 5-6 19 Wallcliffe Court: L_{Aeq} noise levels – at logger location 64 m from rail – facade reflected

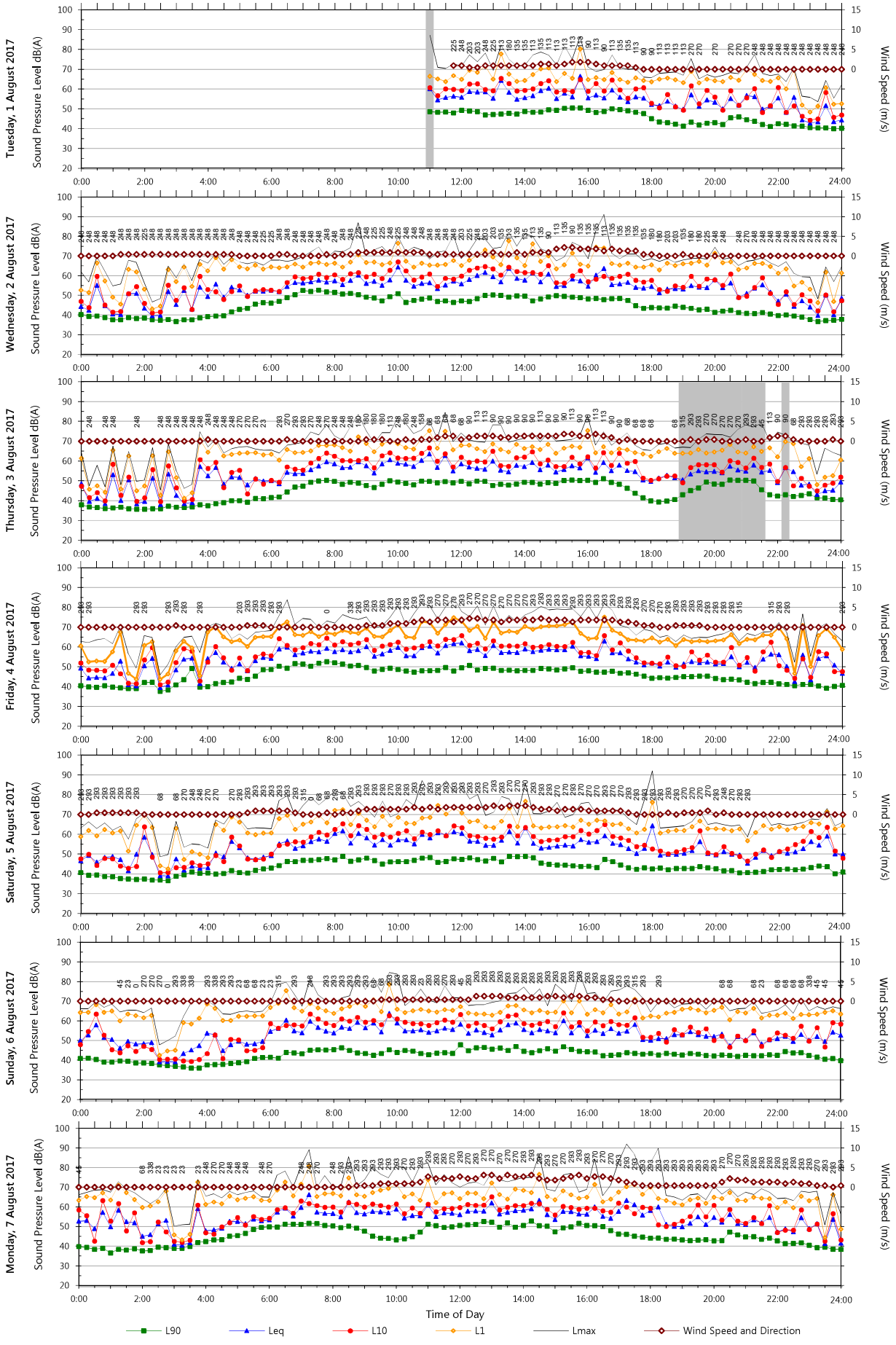
Date	Day	Daytime (7am to 10 pm) $L_{Aeq(15hour)}$			Night-time (7am to 10 pm) $L_{Aeq(9hour)}$			$L_{Afmax,95\%}$		
		Passenger	Freight	Total	Passenger	Freight	Total	Passenger	Freight	Total
27/11/2018	Tue	50.0[1]	-	-	45.6[2]	-	-	74.9[1,2]	-	-
28/11/2018	Wed	45.0[2]	-	-	50.1	-	-	76.4[2]	-	-
29/11/2018	Thur	53.6	-	-	49.5	-	-	76.5	-	-
30/11/2018	Fri	52.5	-	-	49.1	-	-	75.3	-	-
1/12/2018	Sat	50.2	-	-	49.1	-	-	74.6	-	-
2/12/2018	Sun	47.9[2]	-	-	48.9	-	-	75.5[2]	-	-
3/12/2018	Mon	51.9	-	-	50.0	-	-	76.0	-	-
4/12/2018	Tue	52.9	-	-	48.5	-	-	75.7	-	-
5/12/2018	Wed	52.7	-	-	48.4[2]	-	-	75.5[2]	-	-
6/12/2018	Thur	52.0	-	-	50.0	-	-	75.2	-	-
7/12/2018	Fri	51.7	-	-	48.6	-	-	74.9	-	-
8/12/2018	Sat	49.1	-	-	48.6	-	-	74.4	-	-
9/12/2018	Sun	50.0	-	-	48.4	-	-	73.9	-	-
10/12/2018	Mon	52.2	-	-	-	-	-	75.4[1]	-	-
Overall		52.5	-	-	49.4			76.5		

Note: 1. Incomplete data due to start/end of recording
2. Incomplete data due to weather events (passbys excluded)
3. Grey shading indicates excluded data for overall noise calculations

APPENDIX C Long-term 15-minute noise level results

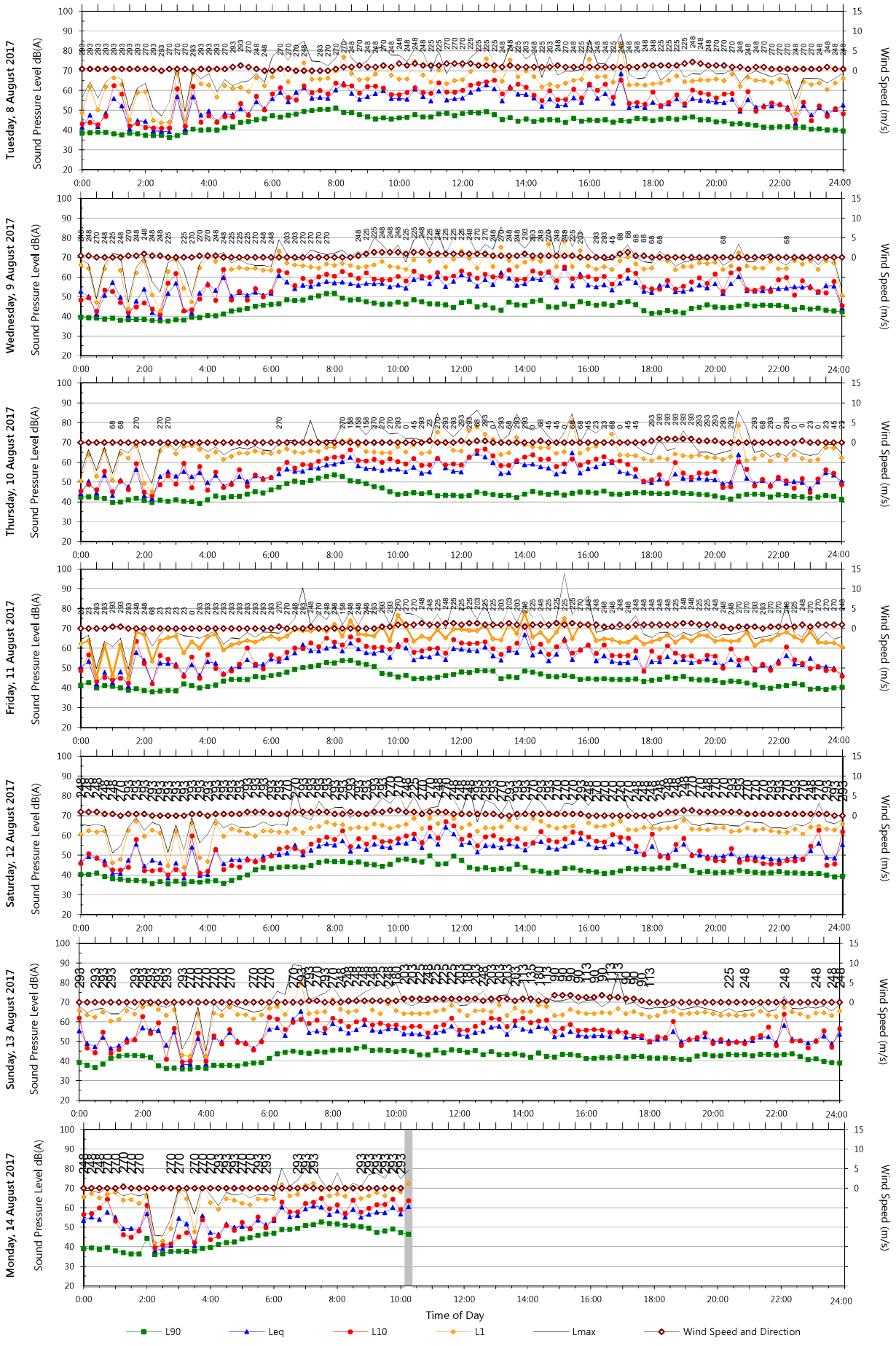
Unattended Monitoring Results

Location: L11 - 88 Leacocks Lane, Casula



Data File: 2017-08-01_SLM_000_123_Rpt_Report.txt

Template: QTE-26 (rev 16) Logger Graphs Program

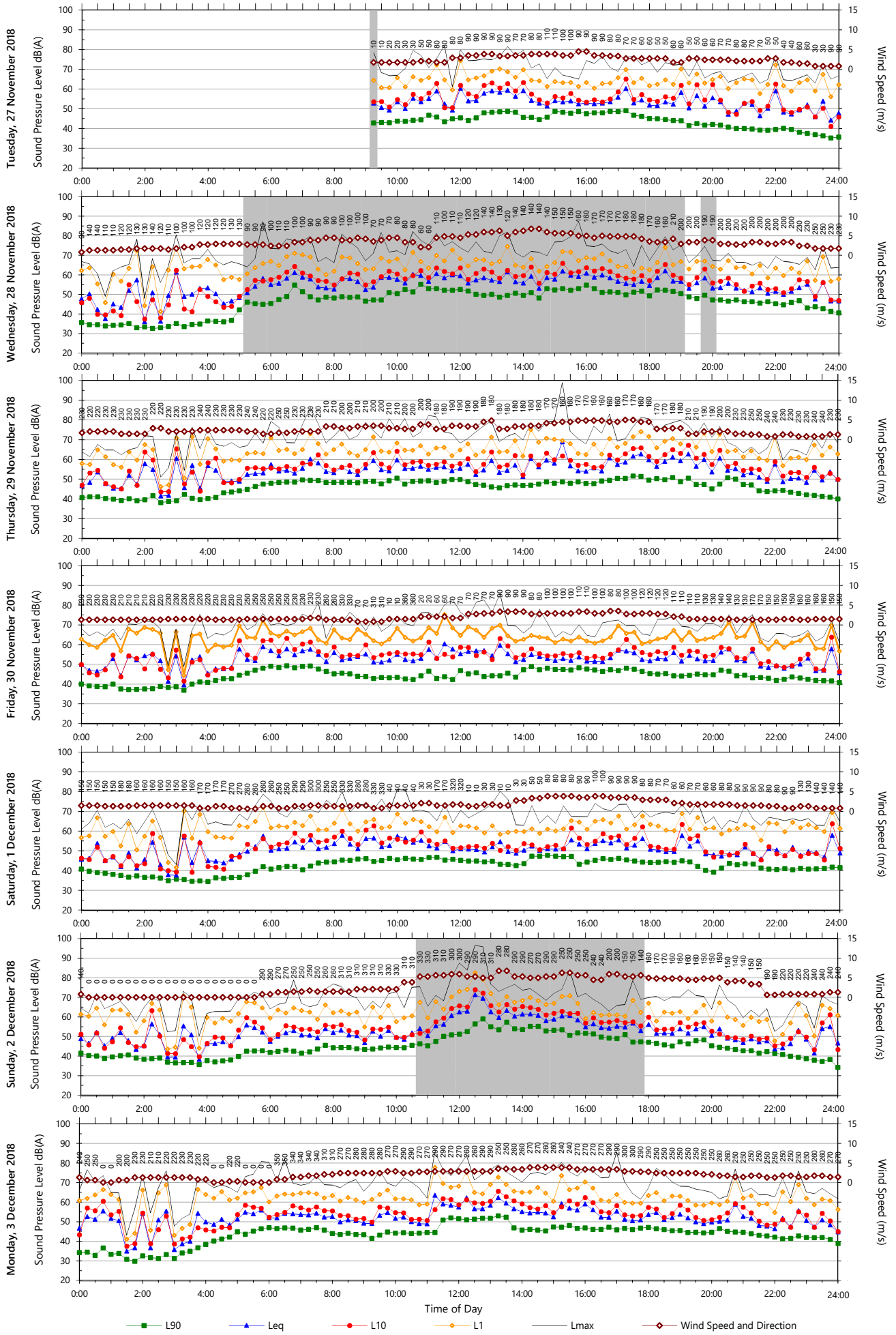


Data File: 2017-08-01_SLM_000_123_Rpt_Report.txt

Template: QTE-26 (rev 16) Logger Graphs Program

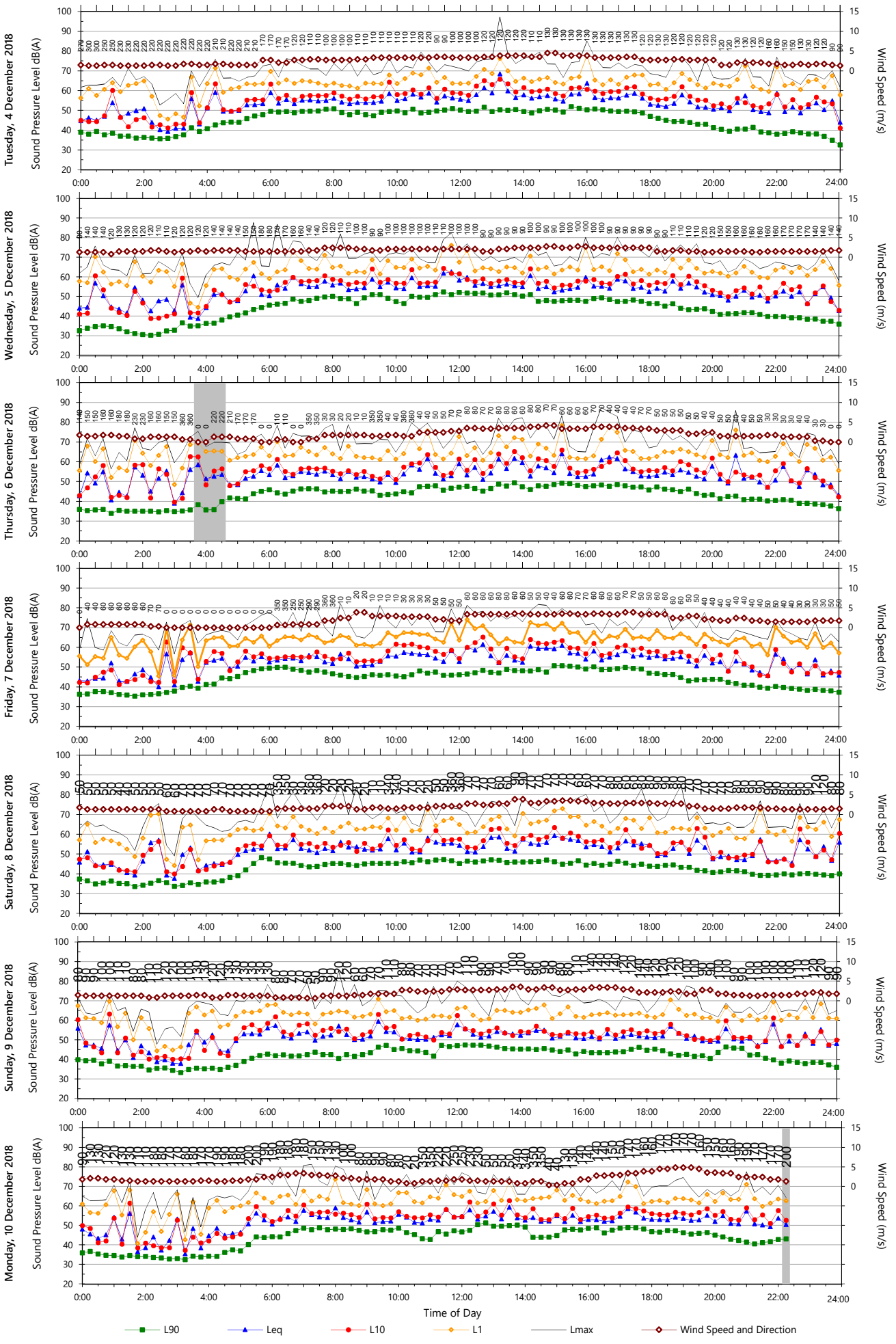
Unattended Monitoring Results

Location: 15 Slessor Road, Casula



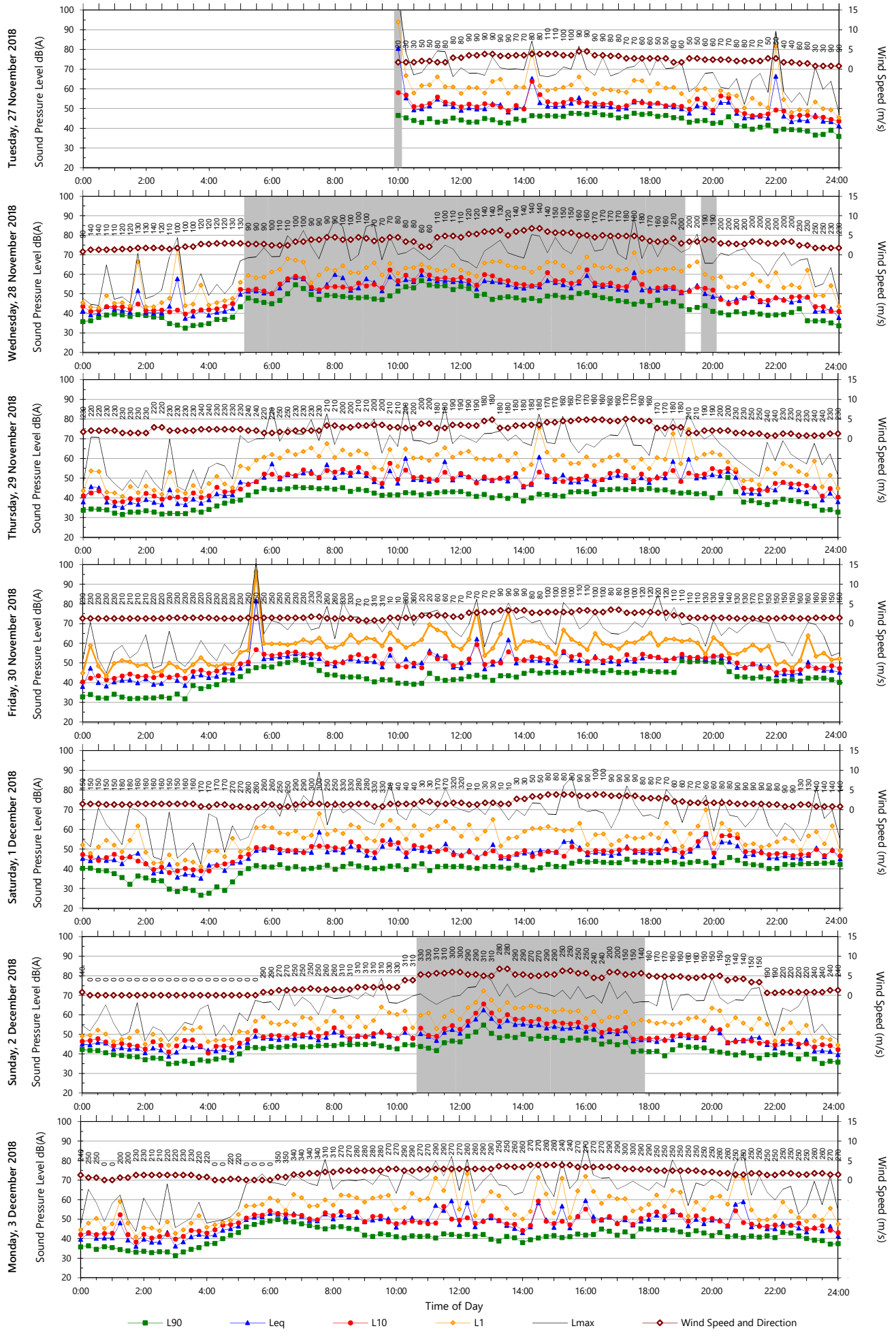
Data File: 2018-11-27_SLM_000_123_Rpt_Report.txt

Template: QTE-26 (rev 23) Logger Graphs Program



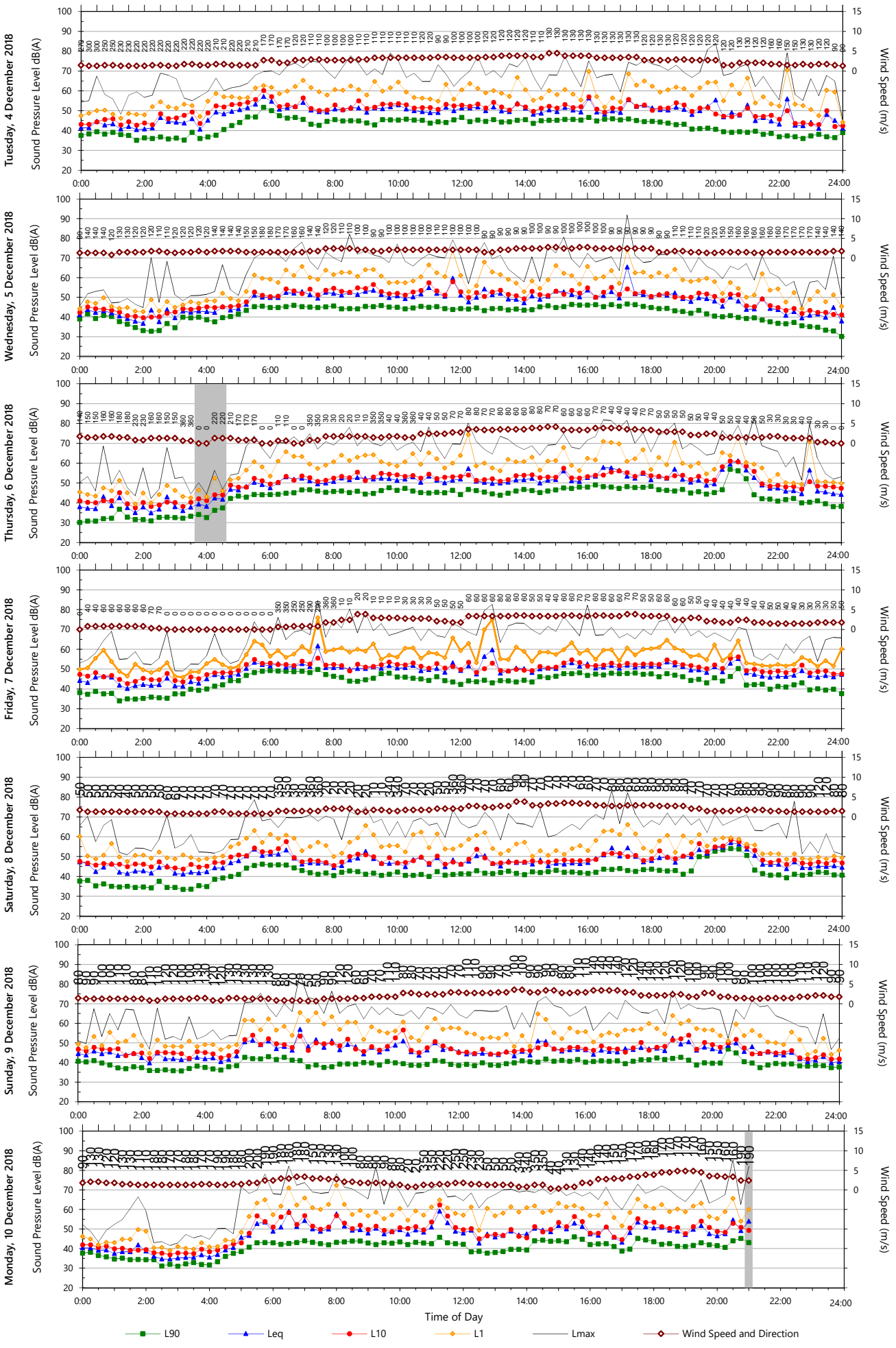
Data File: 2018-11-27_SLM_000_123_Rpt_Report.txt

Template: QTE-26 (rev 23) Logger Graphs Program



Data File: 2018-11-27_SLM_000_123_Rpt_Report.txt

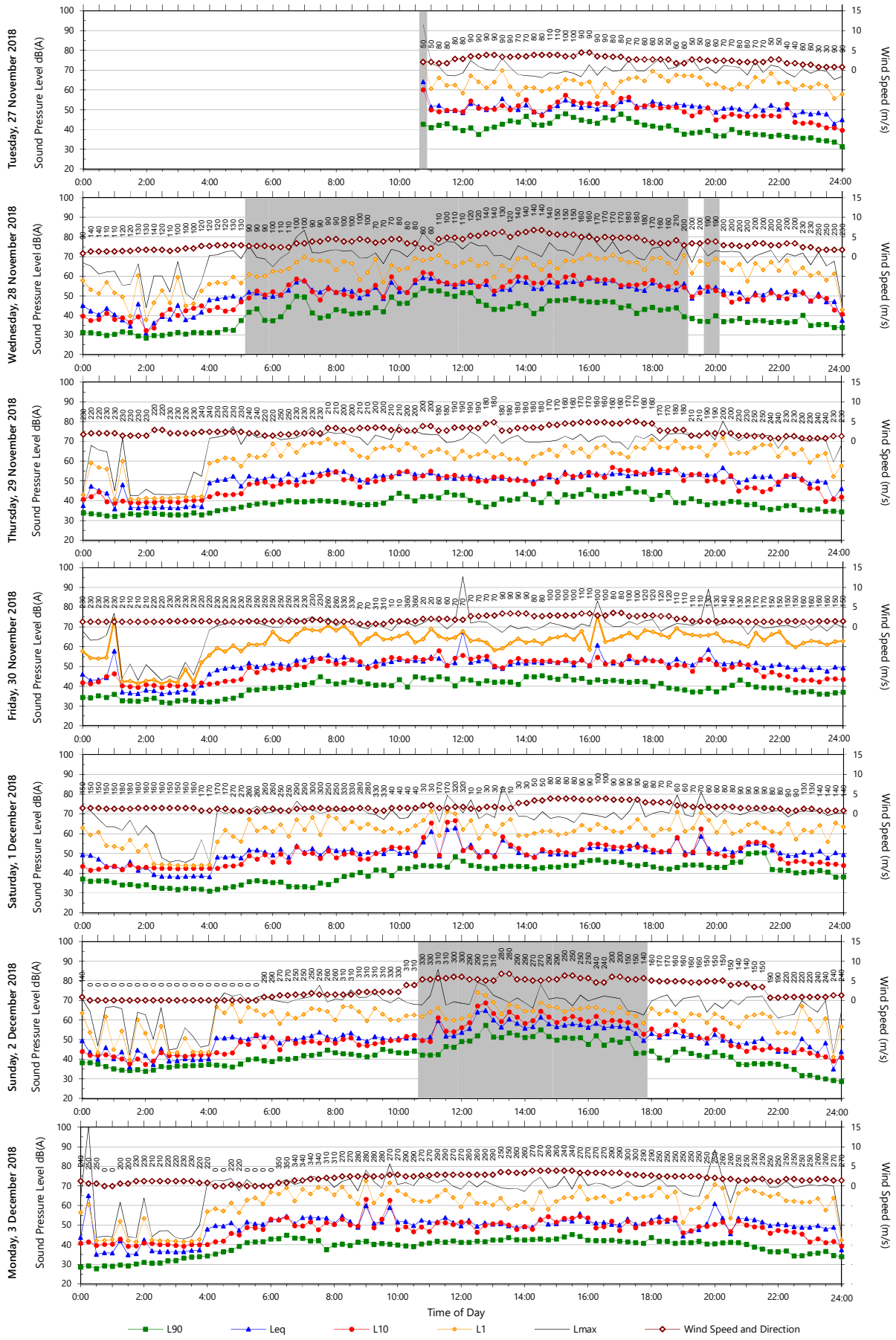
Template: QTE-26 (rev 23) Logger Graphs Program



Data File: 2018-11-27_SLM_000_123_Rpt_Report.txt

Template: QTE-26 (rev 23) Logger Graphs Program

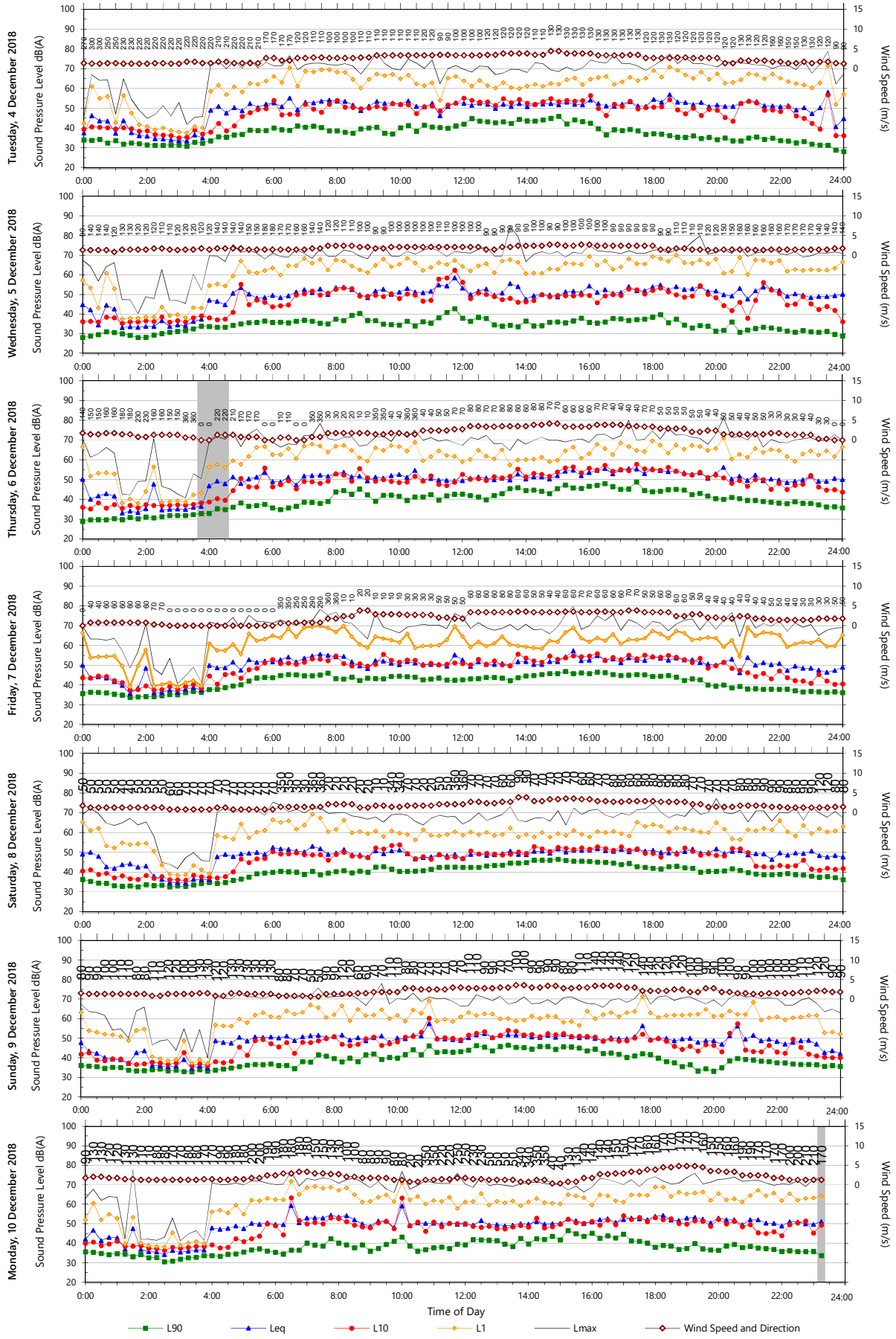
Unattended Monitoring Results **Location: Public area adjacent to 19 Wallcliffe Court, Wattle Grove**



Data File: 2018-11-27_SLM_001_123_Rpt_Report.txt

Template: QTE-26 (rev 23) Logger Graphs Program

Unattended Monitoring Results **Location: Public area adjacent to 19 Wallcliffe Court, Wattle Grove**



Data File: 2018-11-27_SLM_001_123_Rpt_Report.txt

Template: QTE-26 (rev 23) Logger Graphs Program

APPENDIX D Distance Attenuation – 19 Wallcliffe Court

Attended measurements were conducted at three positions for the purposes of determining the rate at which noise levels reduce with increasing distance from the East Hills Line.

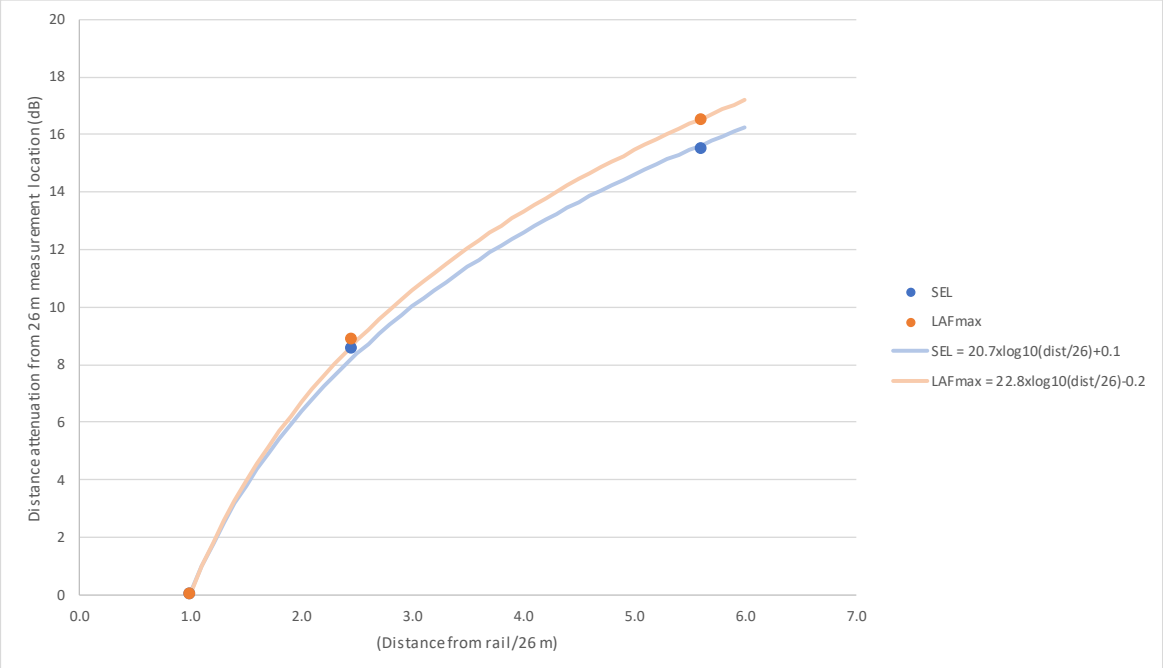
In the area near 19 Wallcliffe Court, attended measurements were conducted at three locations with increasing distance from the rail (see Figure 2-9) to determine the rate at which noise levels reduce with increasing distance from the East Hills Line.

The attended measurements were conducted on 10 December between 23:20 and 00:15 during 5 representative train passbys. A summary of the logarithmic average SEL noise levels and average L_{AFmax} noise levels is provided in Figure 5-1.

Table 5-7 19 Wallcliffe Court – Distance attenuation measurement results

Distance from Rail	Logarithmic average SEL noise level, dB(A)	SEL noise level reduction compared with near location, dB(A)	Average L_{AFmax} Noise Level, dB(A)	L_{Amax} noise level reduction compared with near location, dB(A)
26 m	82.3	0	74.7	0
64 m	73.8	8.6	65.9	8.9
146 m	66.8	15.5	58.2	16.5

Figure 5-1 19 Wallcliffe Court – Distance attenuation measurement results



B.13 Rail Noise Levels at Glenfield Farm (2020)

Renzo Tonin & Associates Report TL116-05F05 Rail Link Noise Monitoring (r1)

RENZO TONIN & ASSOCIATES
inspired to achieve

Acoustics
Vibration
Structural Dynamics

MOOREBANK INTERMODAL TERMINAL PROJECT

Rail Link Noise Monitoring per Approval Condition G7B of SSD 6766

15 September 2020

Tactical Group

TL116-05F05 Rail Link Noise Monitoring (r1).docx

35 1982-2017 ACOUSTIC ENGINEERING EXCELLENCE

Sydney Melbourne Brisbane Gold Coast Kuwait Singapore
Renzo Tonin & Associates ABN 29 117 462 861
Level 1/418A Elizabeth St SURRY HILLS NSW 2010 | PO Box 877 STRAWBERRY HILLS NSW 2012
P (02) 8218 0500 F (02) 8218 0501 sydney@renzotonin.com.au www.renzotonin.com.au

aaac Association of Australian Acoustical Consultants

Document details

Detail	Reference
Doc reference:	TL116-05F05 Rail Link Noise Monitoring (r1).docx
Prepared for:	Tactical Group
Address:	Level 15, 124 Walker Street North Sydney NSW 2060
Attention:	Richard Mason

Document control

Date	Revision history	Non-issued revision	Issued revision	Prepared	Instructed	Reviewed / Authorised
19.08.2020	First Issue	0	1	J. Liang	C. Weber	C. Weber

Important Disclaimers:

The work presented in this document was carried out in accordance with the Renzo Tonin & Associates Quality Assurance System, which is based on Australian/New Zealand Standard AS/NZS ISO 9001.

This document is issued subject to review and authorisation by the suitably qualified and experienced person named in the last column above. If no name appears, this document shall be considered as preliminary or draft only and no reliance shall be placed upon it other than for information to be verified later.

This document is prepared for the particular requirements of our Client referred to above in the 'Document details' which are based on a specific brief with limitations as agreed to with the Client. It is not intended for and should not be relied upon by a third party and no responsibility is undertaken to any third party without prior consent provided by Renzo Tonin & Associates. The information herein should not be reproduced, presented or reviewed except in full. Prior to passing on to a third party, the Client is to fully inform the third party of the specific brief and limitations associated with the commission.

In preparing this report, we have relied upon, and presumed accurate, any information (or confirmation of the absence thereof) provided by the Client and/or from other sources. Except as otherwise stated in the report, we have not attempted to verify the accuracy or completeness of any such information. If the information is subsequently determined to be false, inaccurate or incomplete then it is possible that our observations and conclusions as expressed in this report may change.

We have derived data in this report from information sourced from the Client (if any) and/or available in the public domain at the time or times outlined in this report. The passage of time, manifestation of latent conditions or impacts of future events may require further examination and re-evaluation of the data, findings, observations and conclusions expressed in this report.

We have prepared this report in accordance with the usual care and thoroughness of the consulting profession, for the sole purpose described above and by reference to applicable standards, guidelines, procedures and practices at the date of issue of this report. For the reasons outlined above, however, no other warranty or guarantee, whether expressed or implied, is made as to the data, observations and findings expressed in this report, to the extent permitted by law.

The information contained herein is for the purpose of acoustics only. No claims are made and no liability is accepted in respect of design and construction issues falling outside of the specialist field of acoustics engineering including and not limited to structural integrity, fire rating, architectural buildability and fit-for-purpose, waterproofing and the like. Supplementary professional advice should be sought in respect of these issues.

External cladding disclaimer: No claims are made and no liability is accepted in respect of any external wall and/or roof systems (eg facade / cladding materials, insulation etc) that are: (a) not compliant with or do not conform to any relevant non-acoustic legislation, regulation, standard, instructions or Building Codes; or (b) installed, applied, specified or utilised in such a manner that is not compliant with or does not conform to any relevant non-acoustic legislation, regulation, standard, instructions or Building Codes.

Contents

1 Introduction 1
2 Timing of night-time noise survey 3
3 Noise monitoring locations 4
4 Summary of rail movements 6
5 Measurement methodology 8
5.1 Details of noise survey and measurement equipment 8
5.2 Measurement parameters and data analysis 8
6 Summary of existing rail noise levels 10
7 Intermodal Terminal rail link noise levels 11
7.1 Noise levels adjacent Glenfield Farm 11
7.2 Noise levels adjacent new rail link (15 m) 11
8 Conclusion 13
APPENDIX A Glossary of terminology 14

List of tables

Table 1 Summary of monitoring equipment 8
Table 2 Summary of existing passenger and freight train noise levels at Glenfield Farm (2017) - facade reflected 10
Table 3 Summary of Intermodal Terminal freight train noise levels adjacent Glenfield Farm (2020) - facade reflected 11
Table 4 Summary of near-field Intermodal Terminal freight train noise levels – reference distance of 15 m 12

List of figures

Figure 1 Glenfield Farm, equivalent noise measurement location and Intermodal Terminal rail link 5
Figure 2 Measurement location adjacent Glenfield Farm 5
Figure 3 Rail network schematic 6
Figure 4 Summary of weekly night-time train passbys on new Intermodal Terminal rail link 7

1 Introduction

The Moorebank Intermodal Terminal involves the development of intermodal freight terminal facilities at Moorebank in south-west Sydney, linked by rail to Port Botany and the interstate rail network. The Project includes a new rail link, connecting the Intermodal Terminal to the Southern Sydney Freight Line (SSFL).

This report has been prepared to determine if current noise levels from train movements on the new rail link comply with noise limit in State Significant Development (SSD) Approval SSD 6766. The requirements of condition G7B are copied verbatim below.

> *G7B. The Applicant shall:*
>
> *(a) not less than three months and not more than twelve months from commencement of operation, engage an appropriately qualified and experienced acoustic engineer to undertake a night-time noise survey at Glenfield Farm (or an equivalent location if access is denied).*
>
> *(b) the noise survey shall be conducted in accordance with the EPA's Rail Infrastructure Noise Guideline 2013 to determine:*
>
> > *(i) the contribution of any new rail traffic travelling to and from the development; and,*
> >
> > *(ii) the increase in the total rail traffic noise level caused by any new rail traffic to and from the development.*
>
> *(c) the noise survey shall be conducted for not less than 12 contiguous days in the winter months (July, August or September).* [Note that this should be June, July and August]
>
> *(d) if as a result of the noise survey there is a sustained increase in the total rail traffic noise level due to the noise level from rail traffic travelling to and from the development of more than 2dB(A) for more than 30% of nights surveyed, the Applicant shall:*
>
> *within twelve months, construct a noise barrier along the relevant sections of rail link in accordance with the specifications provided by an appropriately qualified and experienced acoustic engineer so as to limit the increase in the total rail traffic noise level at Glenfield Farm caused by any new rail traffic to and from the development to not exceed 2dB(A).*
>
> *(e) the report of the noise survey including the results and recommendations shall be provided to the Secretary.*

The existing level of rail traffic noise prior to construction of the new rail link is documented in Renzo Tonin & Associates Report TJ741-04F03 (*Moorebank Intermodal Terminal Project - Measurement of Existing Levels of Rail Noise (2018) per Condition 3C*, dated 16 July 2019).

Renzo Tonin & Associates is a member firm of the Association of Australian Acoustical Consultants (AAAC). The work documented in this report was carried out in accordance with the Renzo Tonin & Associates Quality Assurance System, which is based on Australian Standard / NZS ISO 9001.

Appendix A contains a glossary of acoustic terms used in this report.

2 Timing of night-time noise survey

Approval Condition G7B requires that the timing of the noise measurements to be performed:

- not less than three months from the commencement of operations;
- not more than twelve months from the commencement of operations;
- for not less than 12 contiguous days in the winter months

The commencement of rail operations on the new rail link occurred in November 2019 (spring). Noise compliance measurement are therefore required to be performed in winter 2020.

Noise monitoring was performed over 22 contiguous days between 13 August and 4 September 2020 in accordance with the above requirements. Due to the small number of train movements on the rail link during night-time periods, the monitoring was extended beyond the minimum requirement, including four days in spring.

3 Noise monitoring locations

Approval Condition G7B requires night-time measurements to be performed at Glenfield Farm (or an equivalent location if access is denied).

Permission was sought from the resident of the Glenfield Farm to perform the required noise monitoring in accordance with Approval Condition G7B. As permission was denied, an equivalent location in the publicly accessible area immediately north of the Glenfield Farm was selected. The alternative location has an equivalent noise exposure to the rail link and is positioned at the same distance from the nearest track.

The location of the Glenfield Farm and equivalent noise measurement location in relation to the new rail link is provided in Figure 1. A picture of the attended measurement location is provided in Figure 2.

At the alternative measurement location, there was no secure location to perform unattended noise measurements over a contiguous noise monitoring period of two or more weeks. In lieu of performing unattended noise monitoring, the following approach was adopted:

- Attended noise measurements were performed at the equivalent noise monitoring location during night-time periods when QUBE advised that a freight train movement on the new rail link was proposed to occur (to or from the Intermodal Terminal).
- Contiguous unattended noise measurements were performed at a position adjacent to the new rail link between 13 August and 4 September 2020 to capture all passby events. The noise monitoring data at this location can be referred to in the event that freight train movements occur outside the advised schedule and are not captured by the attended measurements.

The unattended noise measurements adjacent the new rail link were performed at two locations. The measurements at Unattended Location 1 were performed between 13 and 28 August. The unattended noise logger was moved to an alternative position (Unattended Location 2) between 28 August and 4 September, to determine if there was any change in the source noise characteristics. The unattended noise measurement positions are shown in Figure 1.

Figure 1 Glenfield Farm, equivalent noise measurement location and Intermodal Terminal rail link

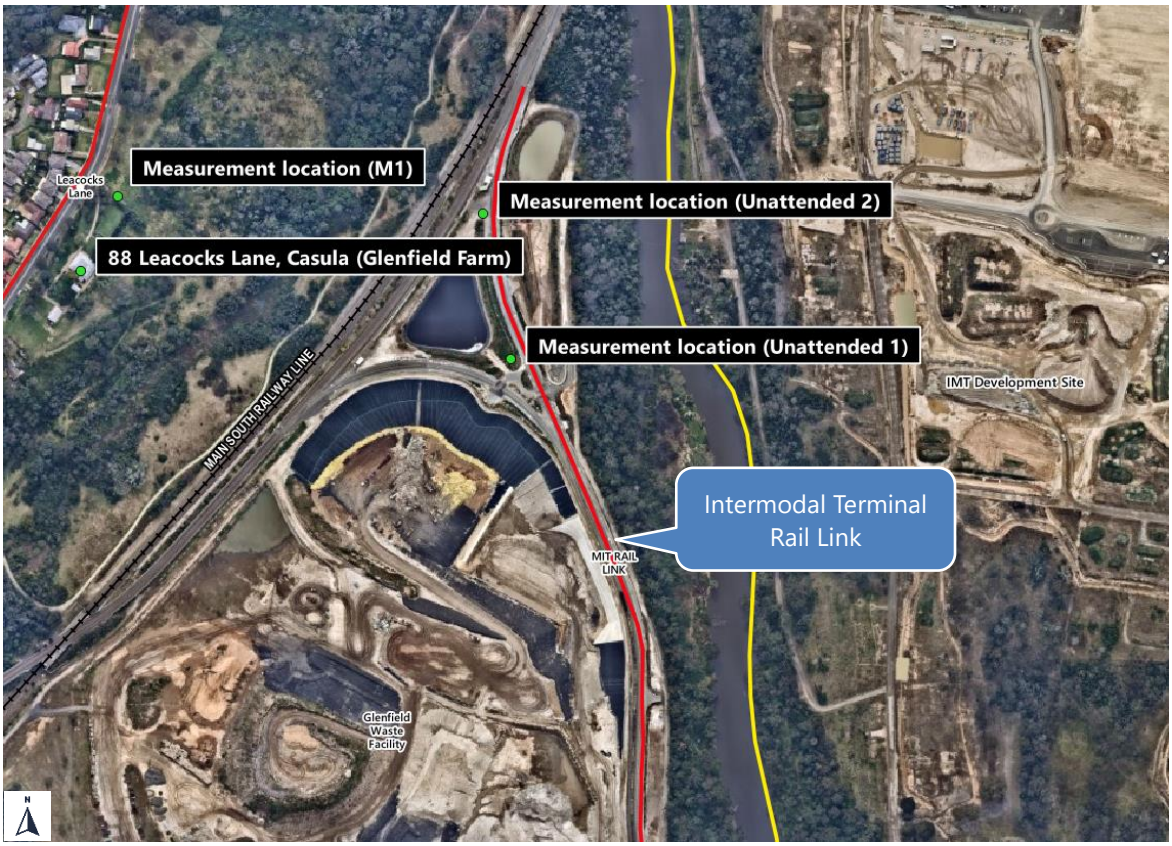
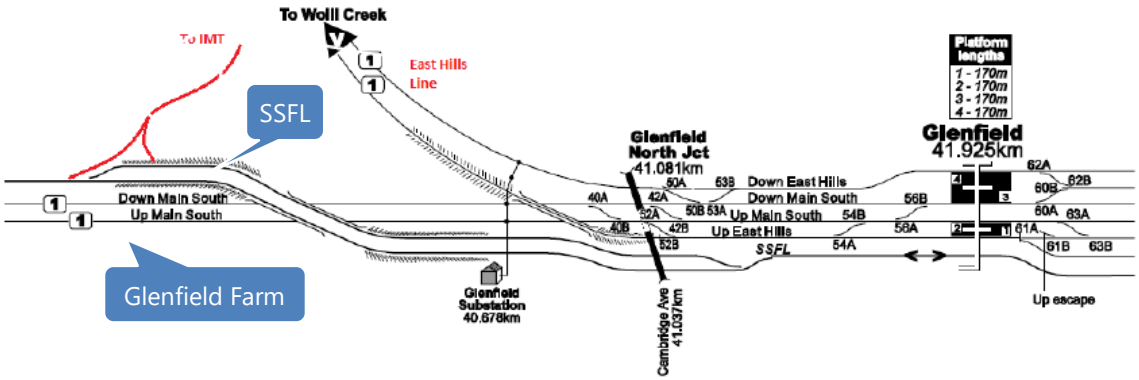


Figure 2 Measurement location adjacent Glenfield Farm

4 Summary of rail movements

A rail network schematic is provided in Figure 3 and illustrates the approximate location of Glenfield Farm in relation to the Intermodal Terminal rail link, the existing Southern Sydney Freight Line (SSFL), the Main South Line and the East Hills Line.

Figure 3 Rail network schematic



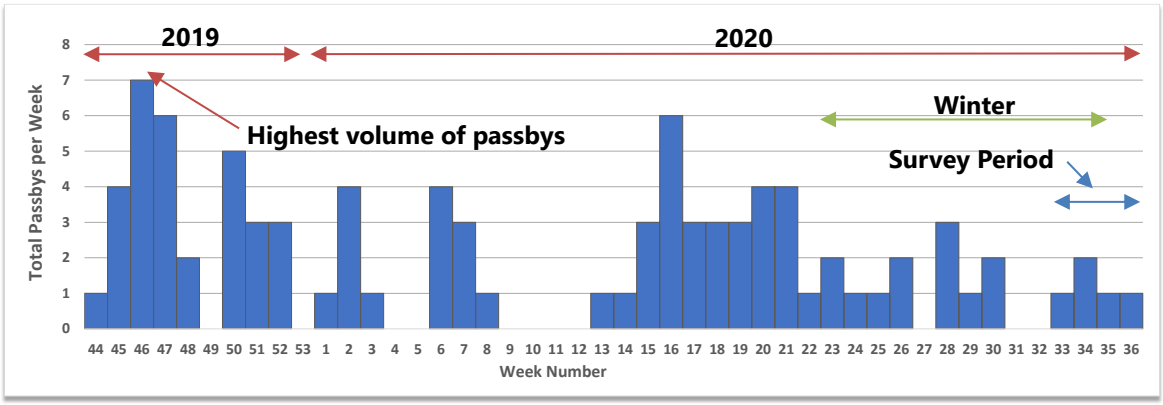
The East Hills Line is an electric passenger train only line. The Main South Line includes electric passenger trains, diesel passenger trains and diesel freight trains. The SSFL includes diesel freight trains only. These existing lines carry frequent rail traffic during the daytime and night-time periods.

The Intermodal Terminal rail link includes diesel freight trains only, operating to and from the Intermodal Terminal. The commencement of rail operations occurred in November 2019 and includes movements during the daytime (7am to 10pm) and night-time (10pm to 7am) periods. A summary of the number of night-time train movements per week on the new rail link, between November 2019 and September 2020, is shown in Figure 4. These movements have been derived from the permanent rail noise monitoring system results. The following observations are noted:

- The highest number of night-time passbys per week since the commencement of operations was seven. This occurred during week 46 of 2019 (week ending Sunday 3 November)
- The average number of night-time passbys since the commencement of operations was two per week
- There are eleven weeks where no night-time rail movements occurred to or from the Intermodal Terminal
- During the 22 day survey period in this report, there was a total of five train movements to or from the Intermodal Terminal. This corresponds to an average of less than two train movements per week and is representative of the average number of train movements during the winter period.

Approval Condition G7B requires the construction of a noise barrier if there is a sustained increase in total rail traffic noise levels greater than 2 dB(A) for more than 30% of nights surveyed. This equates to a noise increase greater than 2 dB(A) for two or more nights per week.

Figure 4 Summary of weekly night-time train passbys on new Intermodal Terminal rail link



5 Measurement methodology

Approval Condition G7B requires the noise survey to be conducted in accordance with the EPA's *Rail Infrastructure Noise Guideline* (RING, 2013) to determine the noise contribution from new rail traffic travelling to and from the Intermodal Terminal, and the total increase in rail traffic noise.

The measurement methodology in the following sections is consistent with the requirements in Section 3.4 (measuring existing levels of rail noise and vibration), of the RING.

5.1 Details of noise survey and measurement equipment

The equipment used for noise measurements comprised NTi Audio Type XL2 precision sound level analysers, which are class 1 instruments having and accuracy suitable for field and laboratory use. All instruments were calibrated prior to and subsequent to each measurement using a Bruel & Kjaer Type 4231 calibrator. No significant drift in calibration was observed.

All instrumentation complies with IEC 61672 (parts 1-3) '*Electroacoustics - Sound Level Meters*' and IEC 60942 '*Electroacoustics - Sound calibrators*' and carry current NATA certification (or if less than 2 years old, manufacturers certification). For all measurements, the microphone was positioned at a height of 1.5 m above ground level.

A summary of the equipment used in the noise surveys is provided in Table 1.

Table 1 Summary of monitoring equipment

Instrument	Make	Model	Serial Number	Last Calibrated
Sound level meter / analyser	NTi	XL2	A2A-07815-E0	09 Nov 2018
			A2A-08520-E0	14 Mar 2019
			A2A-02386-D2	08 July 2019
			A2A-13529-E0	20 Dec 2019
Field Calibrator	Bruel & Kjaer	Type 4231	3017534	30 June 2020
			1821397	7 Aug 2020
			2677710	16 Mar 2020

5.2 Measurement parameters and data analysis

For the attended measurement, the sound level meter was set up to measure the L_{AFmax} and single event sound exposure level (SEL) noise levels for each train passby.

The time period of train passbys measurements was determined using the procedure described in Section 6.6.3 of International Standard ISO3095:2013, whereby the measurement commences when the noise level is at least 10 dB lower than when the front of the train is opposite the microphone and

concludes when the noise level is at least 10 dB lower than when the end of the train is opposite the microphone.

The procedure in Clause 3.4.1.1 of the RING was used, together with the number of train passbys during night-time periods to calculate the $L_{Aeq(9hour)}$ night-time noise levels from train passbys on the new rail link.

For the unattended noise measurements adjacent the new rail link, the sound level meter was set up to record the L_{AFmax} and SEL noise levels in consecutive 1-second intervals. The measurement results were post-processed to identify train passby events on the new rail link and to determine the L_{AFmax} and SEL noise levels for each night-time train passby. The near-field noise measurement results were normalised to a reference measurement distance of 15 m.

6 Summary of existing rail noise levels

Approval Condition G7B requires the construction of a noise barrier if there is a sustained increase in total rail traffic noise levels greater than 2 dB(A). This increase is based on the total rail noise levels in the absence of the new rail link.

The existing level of rail noise at the Glenfield Farm is documented in Renzo Tonin & Associates Report TJ741-04F03 (*Moorebank Intermodal Terminal Project - Measurement of Existing Levels of Rail Noise (2018) per Condition 3C*, dated 16 July 2019). This is based on measurements performed over a 2-week period in August 2017. A summary of the measurement results is provided in Table 2.

Table 2 Summary of existing passenger and freight train noise levels at Glenfield Farm (2017) - facade reflected

Date	Night-time (7am to 10 pm) $L_{Aeq(9hour)}$, dB(A)			$L_{AFmax,95\%}$, dB(A)		
	Passenger	Freight	Total	Passenger	Freight	Total
1/08/2017	48.0	49.0	51.5	73.2	78.1	-
2/08/2017	47.1	48.1	50.6	74.0	74.5	-
3/08/2017	Weather affected			76.3	79.9	-
4/08/2017	47.6[1]	48.1	50.9	-	80.3	-
5/08/2017	Note 2	49.8	-	-	77.2	-
6/08/2017	Note 2	50.0	-	-	85.3	-
7/08/2017	47.6[1]	49.8	51.9	-	75.4	-
8/08/2017	47.6[1]	51.9	53.2	-	80.4	-
9/08/2017	47.6[1]	51.4	52.9	-	80.7	-
10/08/2017	47.6[1]	50.8	52.5	-	83.2	-
11/08/2017	47.6[1]	48.7	51.2	-	83.7	-
12/08/2017	Note 2	50.8	-	-	73.1	-
Overall	**47.6**	**49.9**	**51.9**	**76.3**	**85.3**	**-**

Note: 1. Passenger train noise level analysis not undertaken for these days and is assumed to be the same as the values measured on Wed 2/8/2017
2. Passenger train noise analysis not undertaken for Saturday and Sunday but is expected to be lower than the measured noise levels on weekdays
3. Grey shading indicates excluded data for overall noise calculations
4. All noise levels are facade corrected

The results in the above table indicate that the overall $L_{Aeq(9hour)}$ noise levels from existing passenger and freight train passbys is 52 dB(A). The $L_{AFmax,95\%}$ noise level from existing freight trains is 85 dB(A).

7 Intermodal Terminal rail link noise levels

7.1 Noise levels adjacent Glenfield Farm

During the 22 day measurement period between 13 August and 4 September 2020, there were five freight train movements to or from the Intermodal Terminal. For three of these passby events, attended noise measurements were performed at the measurement location adjacent Glenfield Farm.

A summary of the noise measurement results is provided in Table 3.

Table 3 Summary of Intermodal Terminal freight train noise levels adjacent Glenfield Farm (2020) - facade reflected

Date / time	Measured SEL noise level, dB(A)	Night-time (7am to 10 pm) $L_{Aeq(9hour)}$, dB(A)	Measured $L_{AFmax,95\%}$, dB(A)
	Intermodal Terminal Freight	Intermodal Terminal Freight	Intermodal Terminal Freight
15/08/2020 1:40 am	81	36	69
17/08/2020 06:42 am	Train not captured as arrived early		
22/08/2020 02:05 am	74	29	63
27/08/2020 02:10 am	Train not captured as arrived two hours late		
04/09/2020 04:33 am	73	28	63

Note: 1. All noise levels are facade corrected

The results in the above table show that the measured $L_{Aeq(9hour)}$ noise levels were between 28-36 dB(A) for the three train passby events measured, compared with an existing $L_{Aeq(9hour)}$ noise level of 52 dB(A). For current operations, the maximum increase in rail noise levels during the night-time period is calculated to be 0.1 dB(A), compared with the 2 dB(A) allowance in Approval Condition G7B.

For noise levels to increase by 2 dB(A) or more at the Glenfield Farm noise monitoring position, an SEL noise level of 95 dB(A) is required (assuming one train per night). The maximum measured SEL of 81 dB(A) is 14 dB(A) below this requirement.

The results in the above table show that the measured L_{AFmax} noise levels were between 63-69 dB(A) for the three train passby events measured. It can be seen that L_{AFmax} noise levels from train passbys on the new rail link are well below the existing L_{AFmax} noise levels in Table 2.

7.2 Noise levels adjacent new rail link (15 m)

A summary of the noise measurement results adjacent the new rail link, normalised to a reference measurement distance of 15 m is provided in Table 4.

Table 4 Summary of near-field Intermodal Terminal freight train noise levels – reference distance of 15 m

Date / time	Measured SEL noise level, dB(A)	Measured $L_{AFmax,95\%}$, dB(A)
	Intermodal Terminal Freight	Intermodal Terminal Freight
15/08/2020 1:40 am	94	87
17/08/2020 06:42 am	95	93
22/08/2020 02:05 am	100	93
27/08/2020 02:10 am	86	82
04/09/2020 04:33 am	95	92

The measurement results in the above table show that the passby noise levels for the freight trains on 17/08/2020 and 27/08/2020, which were not captured at the measurement location adjacent Glenfield Farm, are consistent with the remaining noise measurement results. On this basis, it is concluded that the two train passbys that were not captured at the measurement location adjacent Glenfield Farm are likely to have similar measurement results to the other three train passbys that were captured.

8 Conclusion

This report has been prepared to determine if current noise levels from train movements on the new rail link comply with noise limit in State Significant Development (SSD) Approval SSD 6766. Specifically, noise measurements have been performed at a location adjacent the Glenfield Farm to determine if the overall noise increase from train passbys on the Moorebank Intermodal Terminal Rail Link are generating a sustained noise level increase of more than 2 dB(A).

Noise monitoring was performed over 22 contiguous days between 13 August and 4 September 2020. During this period, a total of five freight trains travelled on the new rail link to or from the Intermodal Terminal.

The measured $L_{Aeq(9hour)}$ noise levels during the 10pm to 7am night-time period varied between 28-36 dB(A), compared with a total rail noise level of 52 dB(A) from existing train operations.

For current operations on the Moorebank Intermodal Terminal Rail Link, the maximum increase in overall rail noise levels was 0.1 dB(A) compared with the 2 dB(A) allowance in Approval Condition G7B. The maximum SEL passby noise level on the new rail link was 14 dB(A) lower than the required level to generate an overall noise increase of 2 dB(A) or more.

On this basis, the measured noise levels comply with the requirements in the Approval Condition and the construction of a noise barrier along relevant sections of rail link is not required.

APPENDIX A Glossary of terminology

The following is a brief description of the technical terms used to describe noise to assist in understanding the technical issues presented.

Adverse weather	Weather effects that enhance noise (that is, wind and temperature inversions) that occur at a site for a significant period of time (that is, wind occurring more than 30% of the time in any assessment period in any season and/or temperature inversions occurring more than 30% of the nights in winter).
Ambient noise	The all-encompassing noise associated within a given environment at a given time, usually composed of sound from all sources near and far.
Assessment period	The period in a day over which assessments are made.
Assessment Point	A point at which noise measurements are taken or estimated. A point at which noise measurements are taken or estimated.
Background noise	Background noise is the term used to describe the underlying level of noise present in the ambient noise, measured in the absence of the noise under investigation, when extraneous noise is removed. It is described as the average of the minimum noise levels measured on a sound level meter and is measured statistically as the A-weighted noise level exceeded for ninety percent of a sample period. This is represented as the L90 noise level (see below).
Decibel [dB]	The units that sound is measured in. The following are examples of the decibel readings of common sounds in our daytime environment:

threshold of hearing	0 dB	The faintest sound we can hear
	10 dB	Human breathing
almost silent	20 dB	
	30 dB	Quiet bedroom or in a quiet national park location
generally quiet	40 dB	Library
	50 dB	Typical office space or ambience in the city at night
moderately loud	60 dB	CBD mall at lunch time
	70 dB	The sound of a car passing on the street
loud	80 dB	Loud music played at home
	90 dB	The sound of a truck passing on the street
very loud	100 dB	Indoor rock band concert
	110 dB	Operating a chainsaw or jackhammer
extremely loud	120 dB	Jet plane take-off at 100m away
threshold of pain	130 dB	
	140 dB	Military jet take-off at 25m away

dB(A)	A-weighted decibels. The A- weighting noise filter simulates the response of the human ear at relatively low levels, where the ear is not as effective in hearing low frequency sounds as it is in 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.
dB(C)	C-weighted decibels. The C-weighting noise filter simulates the response of the human ear at relatively high levels, where the human ear is nearly equally effective at hearing from mid-low frequency (63Hz) to mid-high frequency (4kHz), but is less effective outside these frequencies.

Frequency	Frequency is synonymous to pitch. 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.
Impulsive noise	Having a high peak of short duration or a sequence of such peaks. A sequence of impulses in rapid succession is termed repetitive impulsive noise.
Intermittent noise	The level suddenly drops to that of the background noise several times during the period of observation. The time during which the noise remains at levels different from that of the ambient is one second or more.
L_{Max}	The maximum sound pressure level measured over a given period.
L_{Min}	The minimum sound pressure level measured over a given period.
L_1	The sound pressure level that is exceeded for 1% of the time for which the given sound is measured.
L_{10}	The sound pressure level that is exceeded for 10% of the time for which the given sound is measured.
L_{90}	The level of noise exceeded for 90% of the time. The bottom 10% of the sample is the L90 noise level expressed in units of dB(A).
L_{eq}	The "equivalent noise level" is the summation of noise events and integrated over a selected period of time.
Reflection	Sound wave changed in direction of propagation due to a solid object obscuring its path.
SEL	Single Event Sound Exposure Level (SEL) is the constant sound level which, if maintained for a period of 1 second would have the same acoustic energy as the measured noise event. SEL noise measurements are useful as they can be converted to obtain Leq sound levels over any period of time and can be used for predicting noise at various locations.
Sound	A fluctuation of air pressure which is propagated as a wave through air.
Sound absorption	The ability of a material to absorb sound energy through its conversion into thermal energy.
Sound level meter	An instrument consisting of a microphone, amplifier and indicating device, having a declared performance and designed to measure sound pressure levels.
Sound pressure level	The level of noise, usually expressed in decibels, as measured by a standard sound level meter with a microphone.
Sound power level	Ten times the logarithm to the base 10 of the ratio of the sound power of the source to the reference sound power.
Tonal noise	Containing a prominent frequency and characterised by a definite pitch.

B.14 Curve Noise Monitoring Report

Renzo Tonin Report TL116-02F02 Curve noise monitoring report (r1)

RENZO TONIN & ASSOCIATES
inspired to achieve

Acoustics
Vibration
Structural Dynamics

MOOREBANK INTERMODAL TERMINAL RAIL LINK

Curve Noise Monitoring Report

6 March 2020

Tactical

TL116-02F02 Curve noise monitoring report (r1).docx

35 1982-2017 ACOUSTIC ENGINEERING EXCELLENCE

Sydney Melbourne Brisbane Gold Coast Kuwait Singapore
Renzo Tonin & Associates ABN 29 117 462 861
Level 1/418A Elizabeth St SURRY HILLS NSW 2010 | PO Box 877 STRAWBERRY HILLS NSW 2012
P (02) 8218 0500 F (02) 8218 0501 sydney@renzotonin.com.au www.renzotonin.com.au

aaac Association of Australian Acoustical Consultants

Document details

Detail	Reference
Doc reference:	TL116-02F02 Curve noise monitoring report (r1).docx
Prepared for:	Tactical
Attention:	Bob Stoddard

Document control

Date	Revision history	Non-issued revision	Issued revision	Prepared	Instructed	Authorised
24.02.2020	Draft	0	1	L Woolf	H Puckeridge	C Weber

Important Disclaimer:

The work presented in this document was carried out in accordance with the Renzo Tonin & Associates Quality Assurance System, which is based on Australian Standard / NZS ISO 9001.

This document is issued subject to review and authorisation by the Team Leader noted by the initials printed in the last column above. If no initials appear, this document shall be considered as preliminary or draft only and no reliance shall be placed upon it other than for information to be verified later.

This document is prepared for the particular requirements of our Client referred to above in the 'Document details' which are based on a specific brief with limitations as agreed to with the Client. It is not intended for and should not be relied upon by a third party and no responsibility is undertaken to any third party without prior consent provided by Renzo Tonin & Associates. The information herein should not be reproduced, presented or reviewed except in full. Prior to passing on to a third party, the Client is to fully inform the third party of the specific brief and limitations associated with the commission.

In preparing this report, we have relied upon, and presumed accurate, any information (or confirmation of the absence thereof) provided by the Client and/or from other sources. Except as otherwise stated in the report, we have not attempted to verify the accuracy or completeness of any such information. If the information is subsequently determined to be false, inaccurate or incomplete then it is possible that our observations and conclusions as expressed in this report may change.

We have derived data in this report from information sourced from the Client (if any) and/or available in the public domain at the time or times outlined in this report. The passage of time, manifestation of latent conditions or impacts of future events may require further examination and re-evaluation of the data, findings, observations and conclusions expressed in this report.

We have prepared this report in accordance with the usual care and thoroughness of the consulting profession, for the sole purpose described above and by reference to applicable standards, guidelines, procedures and practices at the date of issue of this report. For the reasons outlined above, however, no other warranty or guarantee, whether expressed or implied, is made as to the data, observations and findings expressed in this report, to the extent permitted by law.

The information contained herein is for the purpose of acoustics only. No claims are made and no liability is accepted in respect of design and construction issues falling outside of the specialist field of acoustics engineering including and not limited to structural integrity, fire rating, architectural buildability and fit-for-purpose, waterproofing and the like. Supplementary professional advice should be sought in respect of these issues.

Contents

1 Introduction 1
2 Methodology 2
2.1 Monitoring locations and equipment 2
2.2 Friction modifiers 3
2.3 Weather observations 4
2.4 Measurement parameters and analysis 4
3 Results 6
3.1 Rail noise levels 6
3.2 Effect of friction modifiers 7
4 Discussions 9
5 Conclusion 10
APPENDIX A Glossary of terminology 11
APPENDIX B Noise monitoring locations 14
APPENDIX C Detailed passby and noise event results 20

List of tables

Table 1 Measurement equipment 2
Table 2 Overall passby noise levels at 15m reference distance – all passbys 6
Table 3 Overall passby noise levels at 15m reference distance and percentage of passbys affected by squealing, flanging and braking events 6
Table 4 Passby noise levels at 15m reference distance before and after installation of new friction modifiers on Curve 1 and between Curves 3 and 4 7

List of figures

Figure 1 Curves along the Intermodal Terminal Rail Link 2
Figure 2 Existing friction modifier installed on Curve 1 3
Figure 3 Example of a passby and associated events analysed using NTI Data Explorer Software 5
Figure 4 Overall L_{AFmax} passby noise levels at 15m reference distance before and after the installation of new friction modifiers on Curve 1 and between Curves 3 and 4 7
Figure 5 Duration of wheel squeal noise events before and after the installation of new friction modifiers on Curve 1 and between Curves 3 and 4 8

1 Introduction

Renzo Tonin & Associates was engaged by Tactical to monitor rail noise levels on curves along the Moorebank Intermodal Terminal rail link. Noise levels from freight train passbys were monitored at six curve locations between 27 September 2019 and 16 December 2019.

Two rail friction modifier systems were installed on the rail link on 22 November 2019. The noise monitoring results were analysed to quantify the overall rail noise levels and squealing noise events that occurred during the passbys. 13 passbys were analysed for the period before installation of the rail friction modifier systems and a further 16 passbys were analysed afterwards. The results before and after the installation of the friction modifiers have been compared to quantify the effectiveness of the systems.

A description of technical acoustic terms used within this report is provided in Appendix A.

The work documented in this report was carried out in accordance with the Renzo Tonin & Associates Quality Assurance System, which is based on Australian Standard / NZS ISO 9001. Appendix A contains a glossary of acoustic terms used in this report.

2 Methodology

Continuous unattended noise monitoring was performed at the six curves along the Moorebank Intermodal Terminal (MIMT) Rail Link. The designation of each curve along the rail link is presented in Figure 1. Details of the measurement equipment are provided in Table 1 with the location of the noise logger at each curve shown in APPENDIX B. All locations selected had an unobstructed view of the rail line and no significant reflective objects nearby.

2.1 Monitoring locations and equipment

Figure 1 Curves along the Intermodal Terminal Rail Link

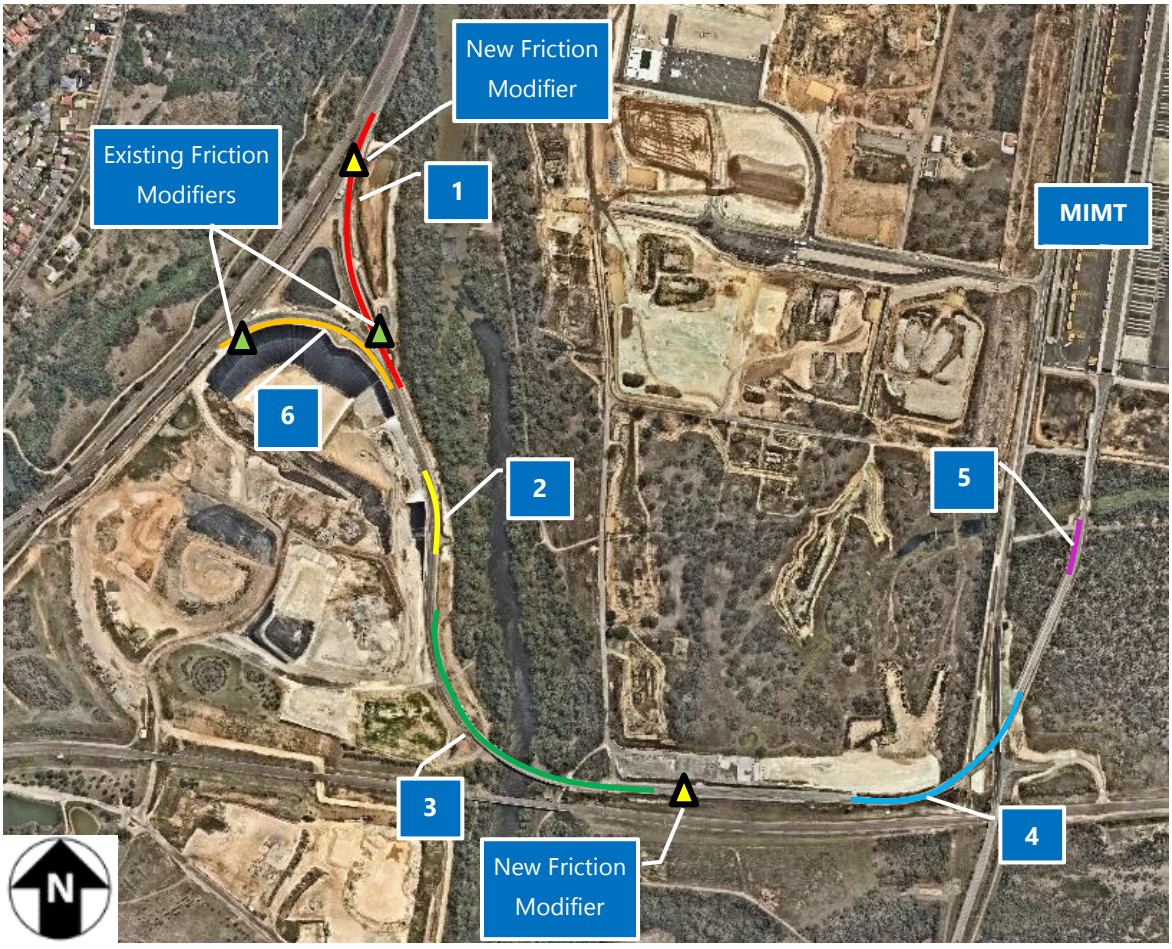


Table 1 Measurement equipment

Location	Curve radius (m)	Curve length (m)	Chainage	Distance to near track centreline (m)	Noise logger	Serial number	Last calibrated
Curve 1	275	214	39.580 km	8.2	NTi XL2	RTA07-021	20/12/2019
Curve 2	260	56	40.390 km	3.1	NTi XL2	RTA07-018	01/05/2019
Curve 3	245	280	40.345 km	7.4	NTi XL2	RTA07-020	14/12/2017
Curve 4	200	243	41.470 km	8.0	NTi XL2	RTA07-017	15/02/2019

Location	Curve radius (m)	Curve length (m)	Chainage	Distance to near track centreline (m)	Noise logger	Serial number	Last calibrated
Curve 5	200	52	41.870 km	3.3	NTi XL2	RTA07-008	14/03/2019
Curve 6	160	297	40.087 km	5.7	NTi XL2	RTA07-022	20/12/2019

The noise loggers used were NTi XL2 precision sound level analysers which are Class 1 instruments having accuracy suitable for field and laboratory use. The noise loggers were calibrated prior and subsequent to the measurements using a Brüel & Kjær Type 4231 calibrator. No significant drift in calibration was observed. All instrumentation complies with IEC 61672 (parts 1–3) '*Electroacoustics - Sound Level Meters*' and IEC 60942 '*Electroacoustics - Sound calibrators*' and carry current NATA certification (or if less than 2 years old, manufacturers certification).

2.2 Friction modifiers

Two existing friction modifiers were in operation for the duration of monitoring, positioned on the MIMT North Track at Chainage 39.840 km on the MIMT South Track at Chainage 39.580 km (shown as green triangles in Figure 1). Lubrication was manually applied to both rails along Curve 4 on 13 September 2019. Two new friction modifiers were installed on 23 November 2019 on the MIMT North track at Chainage 39.611 km and 41.000 km, both on the Up rail (shown as yellow triangles in Figure 1). One of the installed friction modifiers is shown in Figure 2.

Figure 2 Existing friction modifier installed on Curve 1

2.3 Weather observations

Weather conditions during each train passby were based on measurement data from the nearest Bureau of Meteorology weather station at Holsworthy Military Airfield. Passbys during any periods impacted by excessive wind (> 18 km/h) or heavy rain were checked to determine if weather events contributed to noise levels during the passby. For all passbys it was found that weather events did not adversely affect the passby noise results.

2.4 Measurement parameters and analysis

The XL2 noise loggers were set up to measure the L_{Aeq}, $L_{Amax,fast}$ and L_{AE} noise levels in consecutive 0.1 second intervals throughout the measurement period. The loggers also recorded noise levels in one-third octave centre frequency bands between 10 Hz and 20 kHz.

Train passbys were identified manually using the NTi Data Explorer software and verified with the passbys recorded from the temporary G7a passby noise monitoring results. Train passbys affected by other extraneous noise sources and safety devices such as horns were excluded from the results.

In accordance with the requirements of International Standard ISO 3095:2013 *Acoustics - Railway applications - Measurement of noise emitted by railbound vehicles*, measurements were commenced as the train noise rose above the ambient level and concluded when the train noise returned to the ambient level.

All passbys were processed using the NTi Data Explorer software to manually identify the following types of noise events:

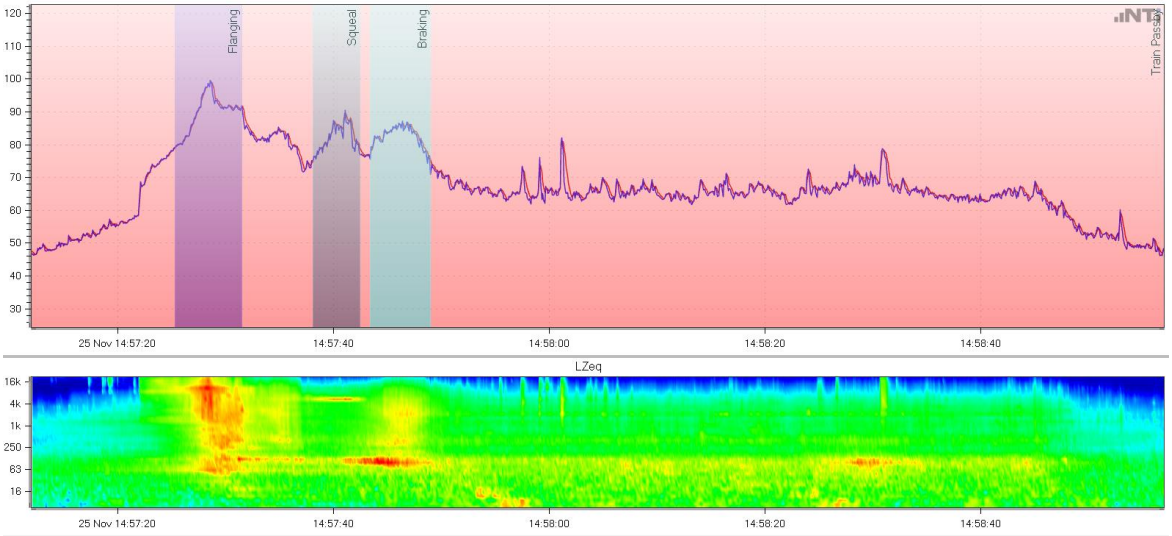
- Squealing - high frequency tonal noise events due to wheel squeal on curved sections
- Flanging – mid to high frequency noise events due to wheel flange and rail gauge face contact
- Braking – low frequency noise events due to the rubbing of brake components

An example of a passby marked up with squealing, flanging and braking events is shown in Figure 3.

Due to an absence of passbys, this report does not include noise measurement results for Curve 6.

Analysis of the noise measurement data was performed in accordance with ISO 3095 *Measurement of noise emitted by railbound vehicles* and the NSW EPA *Rail Infrastructure Noise Guideline* (RING). The measured noise levels were normalised to a reference distance of 15 m.

Figure 3 Example of a passby and associated events analysed using NTI Data Explorer Software



3 Results

3.1 Rail noise levels

Using the NTI Data Explorer software, the maximum A-weighted sound pressure level (L_{AFmax}) and the A -weighted sound exposure level (L_{AE}) were obtained for each passby. Using this data, the $L_{AFma,95\%}$, and average L_{AE} levels for all passbys were calculated, normalised to a reference distance of 15 m. The results for each curve monitoring location are presented in Table 2.

Both the $L_{AFma,95\%}$, and L_{AE} noise levels were slightly higher on Curves 1, 3 and 4. These are longer curves, compared to Curves 2 and 5, which are short.

Table 2 Overall passby noise levels at 15m reference distance – all passbys

Curve	Average passby L_{AE} dB(A)	Passby $L_{AFmax,95\%}$ dB(A)
1	102	104
2	101	101
3	103	106
4	105	104
5	102	101

The $L_{AFma,95\%}$, and average L_{AE} noise levels for squealing, flanging and braking events were calculated, normalised to a reference distance of 15 m. The percentage of passbys that experienced at least one of these types of events was calculated. The results for each curve monitoring location are presented in Table 3.

The noise levels and occurrence of flanging events were highest, followed by squealing events and then braking.

Table 3 Overall passby noise levels at 15m reference distance and percentage of passbys affected by squealing, flanging and braking events

Curve	Squealing event dB(A)			Flanging event dB(A)			Braking event dB(A)		
	L_{AE}	$L_{AFmax,95\%}$	% of passbys	L_{AE}	$L_{AFmax,95\%}$	% of passbys	L_{AE}	$L_{AFmax,95\%}$	% of passbys
1	95	98	31%	100	103	50%	90	85	4%
2	98	99	17%	100	101	48%	92	89	14%
3	97	100	38%	100	102	73%	88	85	12%
4	99	100	45%	102	103	66%	-	-	0%
5	94	93	38%	101	101	48%	80	71	7%

Curve 4, which is the longest curve, had the highest noise levels and occurrence of wheel squeal. In contrast Curve 2 has the lowest occurrence of wheel squeal and Curve 5 had the lowest noise levels. Flanging noise levels were consistent for all curve monitoring locations and featured in least half of all passbys. Brake noise was caused by outbound trains on Curve 3 and inbound trains on Curves 2 and 5.

Detailed results for each passby and noise event are presented in APPENDIX C.

3.2 Effect of friction modifiers

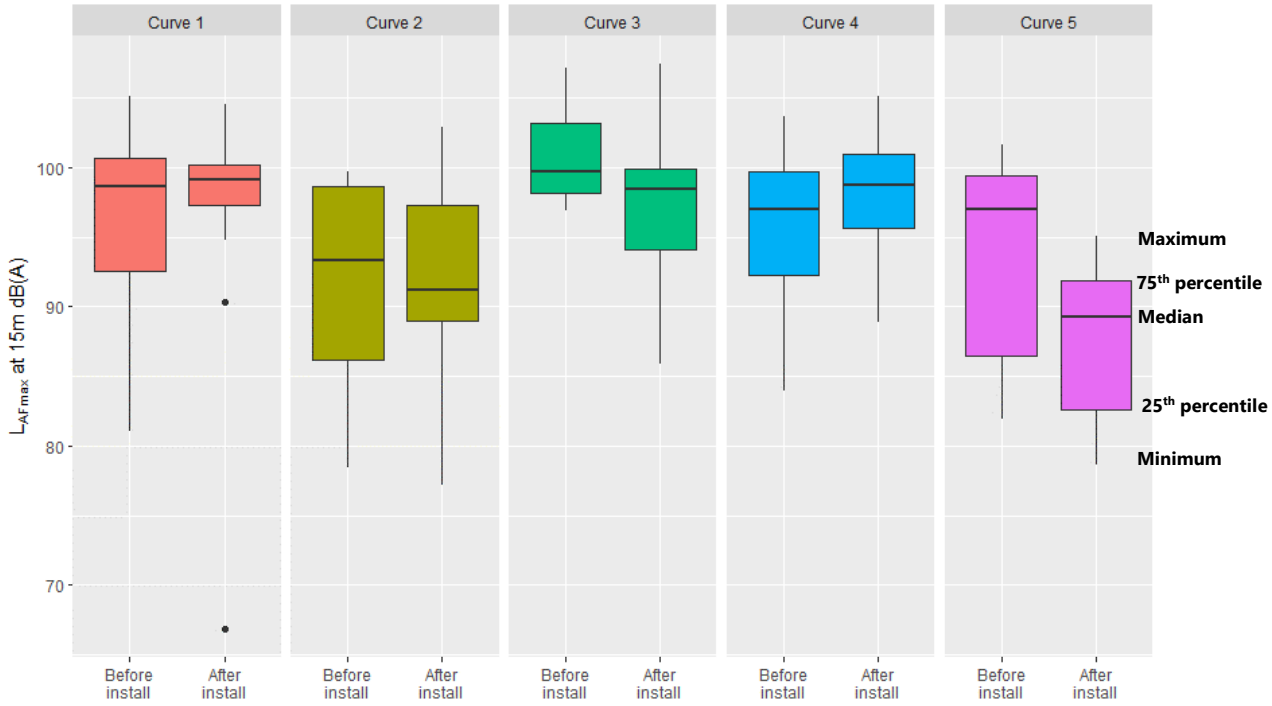
The noise levels at each curve were compared before and after the installation of two new friction modifiers. The distance normalised L_{AE} and L_{AFmax} levels are presented in Table 4 and the statistical distribution of the L_{AFmax} levels is shown in Figure 4.

The results do not show a significant reduction in noise levels after the implementation of the new friction modifiers. The change in median noise levels before and after installation was generally within 2 dB. Similarly, the noise levels and occurrence of wheel squeal events did not significantly reduce after the installation of the friction modifiers.

Table 4 Passby noise levels at 15m reference distance before and after installation of new friction modifiers on Curve 1 and between Curves 3 and 4

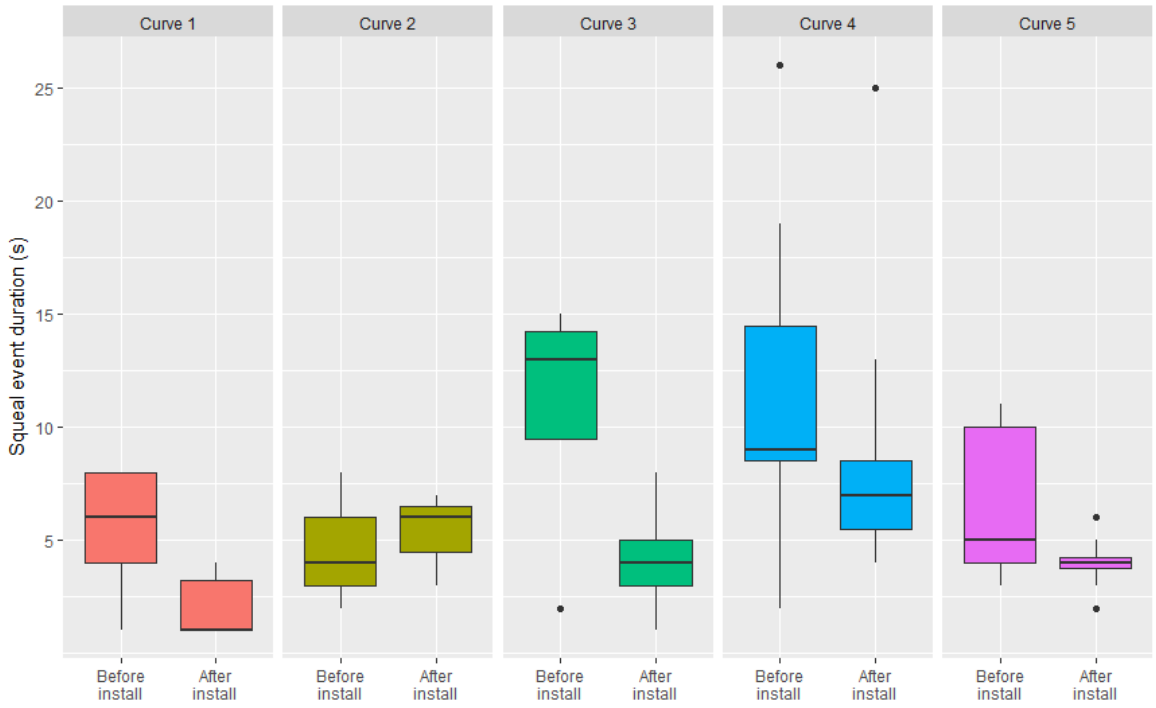
Curve	Median passby L_{AE} dB(A)		Median passby L_{AFmax} dB(A)	
	Before installation	After installation	Before installation	After installation
1	100	102	99	99
2	100	99	93	91
3	104	102	100	98
4	104	104	97	99
5	105	97	97	89

Figure 4 Overall L_{AFmax} passby noise levels at 15m reference distance before and after the installation of new friction modifiers on Curve 1 and between Curves 3 and 4



The duration of squealing events was found to be reduced after installation of the friction modifiers. The duration of squealing events was reduced at all locations except Curve 2 (which experienced the lowest rate of wheel squealing before and after installation).

Figure 5 Duration of wheel squeal noise events before and after the installation of new friction modifiers on Curve 1 and between Curves 3 and 4



4 Discussions

There was no significant difference in the rail noise levels at the five monitored curves and all measured noise levels were within a range of ±5 dB.

The results demonstrate that wheel squeal is not a dominant source of noise on the curves of the MIMT Rail Link. The measured noise levels and rate of occurrence of squealing events shows that squealing noise did not contribute significantly to the overall L_{Aeq} and L_{AFmax} noise levels. Rail passby noise levels were controlled by wagon wheel-rail noise, locomotive noise and flanging noise. Between 48% and 73% of passbys experienced flanging noise and in many cases, flanging noise controlled the overall L_{AFmax} noise levels. Flanging noise was particularly evident on the locomotives, leading to high L_{AFmax} noise levels that included both flanging and engine noise.

Of the 29 passbys analysed, there was only one passby that experienced wheel squeal with a L_{AFmax} noise level greater than 120 dB(A) at 1.2 m from the near track (TfNSW's criteria for a "severe squeal event"[1]).

The occurrence and severity of flanging and squealing events was slightly higher on Curves 1, 3 and 4 which are greater than 250 m long, compared to Curves 2 and 5 which are less than 100 m long.

There was no significant reduction in the overall rail noise levels after the installation of two new friction modifiers. A significant reduction in overall passby noise levels would not be expected as the dominant noise sources are wagon wheel-rail noise and locomotive noise, which are unaffected by the application of a friction modifier.

Squealing or flanging noise did not reduce after the installation of the new friction modifiers. However, the duration of squealing events was reduced at four of the five monitoring locations after the installation of two new friction modifiers. Note that the noise levels of wheel squeal events were already relatively low prior to the installation of the new systems. The friction modifiers may have been ineffective in reducing the noise levels and occurrence of wheel squeal and flanging because the lubricant was not being adequately spread along the rail and/or the systems were only applying the lubricant to one rail of the track.

No clear relationship was found between the measured noise levels or occurrence of squealing and weather conditions or time of day.

[1] Jiang J., Hanson D. & Dowell B., Wheel Squeal: Insights from Wayside Condition Monitoring, TfNSW, IWRN 12

5 Conclusion

This report presents the results of unattended noise monitoring conducted adjacent to the six curves on the Moorebank Intermodal Terminal rail link. Noise monitoring results from freight train passbys entering and leaving the terminal were analysed to quantify the overall noise levels and occurrences of wheel squeal, flanging and braking. The overall rail noise and squeal events were compared before and after the installation of two rail friction modifier systems to evaluate the effectiveness of the systems.

Wheel squeal did not contribute significantly to the overall passby noise levels and only one passby experienced severe squealing. Rail passby noise levels are controlled by wagon wheel-rail noise, locomotive noise and flanging noise.

The results of the unattended monitoring indicate that there is little variation in overall rail noise levels or squealing noise levels with the installation of the friction modifier systems. The new systems may have been effective in reducing the duration of squealing events.

APPENDIX A Glossary of terminology

The following provides a brief description of the technical terms used within this report to assist in understanding the technical issues presented.

Technical Term	Description
Attenuation	A reduction in amplitude of noise or vibration due to increasing distance or other means such as noise barriers, materials or mitigation measures.
Adverse weather	Weather effects that enhance noise (that is, wind and temperature inversions) that occur at a site for a significant period (that is, wind occurring more than 30% of the time in any assessment period in any season and/or temperature inversions occurring more than 30% of the nights in winter).
Airborne noise	Noise that propagates through the air between source and receiver. Most relevant for noise from surface railway tracks or stationary facilities.
Alignment	The position of the railway tracks in three dimensions along their length.
Ambient noise	The all-encompassing noise within a given environment at a given time, usually composed of sound from all sources near and far.
Assessment period	The period in a day over which assessments are made. Assessment periods may be daytime, evening, night-time, 24-hour or busiest 1-hour period (when in use). Time periods associated with each assessment period are defined in the relevant section of this report and differ for rail operations and stationary facilities.
Assessment point	A point at which noise or vibration measurements are taken or calculated.
Background noise	Background noise is the term used to describe the underlying level of noise present in the ambient noise, measured in the absence of the noise under investigation, when extraneous noise is removed. It is described as the average of the minimum noise levels measured on a sound level meter and is measured statistically as the A-weighted noise level exceeded for ninety percent of a sample period. This is represented as the L_{90} noise level (see below).
Braking noise	Noise due to the rubbing of brake components of a rail vehicle
Chainage	Refers to the distance, along the railway tracks, from Central Station, usually given in kilometres or metres. Down direction refers to trains travelling away from Central Station. Up direction refers to trains travelling towards Central Station.
Decibel [dB]	A unit of measure commonly used to express noise and vibration. For sound, a reference level of 20 µPa is used. For vibration, a variety of reference levels are used. Vibration levels in this report use a reference level of 1 nm/s for vibration velocity and 1 $\mu m/s^2$ for vibration acceleration.

Technical Term	Description
dB(A)	A-weighted decibels. 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 following are examples of the decibel readings of every day sounds: 0dB(A) The faintest sound we can hear 30dB(A) A quiet library or in a quiet location in the country 45dB(A) Typical office space. Ambience in the city at night 60dB(A) CBD mall at lunch time 70dB(A) The sound of a car passing on the street 80dB(A) Loud music played at home 90dB(A) The sound of a truck passing on the street 100dB(A) The sound of a rock band 115dB(A) Limit of sound permitted in industry 120dB(A) Deafening
EIS	Environmental Impact Statement
EPA	NSW Environmental Protection Authority
FEM	Finite element modelling
Flanging noise	Mid to high frequency noise due to contact between wheel flanges of a rail vehicle and the rail gauge face
Frequency	Frequency is synonymous to pitch. 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.
GIS	Geographic Information System
HV	High Voltage
HVAC	Heating, Ventilation and Air-conditioning equipment
RING	Rail Noise Infrastructure Guideline
Impulsive noise or vibration	Having a high peak of short duration or a sequence of such peaks. A sequence of impulses in rapid succession is termed repetitive impulsive noise or vibration.
INP	NSW Industrial Noise Policy
Intermittent noise or vibration	The level suddenly drops to that of the background noise several times during the period of observation. The time during which the noise or vibration remains at levels different from that of the ambient is one second or more.
LAE	The A-weighted Sound Exposure Level (or SEL) is the constant sound level which, if maintained for a period of 1 second would have the same acoustic energy as the measured noise event. SEL noise measurements are useful as they can be converted to obtain Leq sound levels over any time period and can be used for predicting noise at various locations.
L_{Max}	The maximum sound pressure level measured over a given period.
L_{Min}	The minimum sound pressure level measured over a given period.
L_1	The sound pressure level that is exceeded for 1% of the time for which the given sound is measured.
L_{10}	The sound pressure level that is exceeded for 10% of the time for which the given sound is measured.
L_{90}	The level of noise exceeded for 90% of the time. The bottom 10% of the sample is the L90 noise level expressed in units of dB(A).
L_{eq}	The "equivalent noise level" is the summation of noise events and integrated over a selected period of time.

Technical Term	Description
$L_{eq(9h)}$	Equivalent noise level for the 9 hour night-time period, defined as 10pm to 7am.
$L_{eq(15h)}$	Equivalent noise level for the 15 hour daytime period, defined as 7am to 10pm.
LEP	Local environmental plan
LGA	Local government area
MEP	Mechanical and electrical plant
NCA	Noise catchment area
ONVR	Operational Noise and Vibration Review
RBL	Rating background level
Reflection	Sound wave changed in direction of propagation due to a solid object obscuring its path.
Receiver	A location or dwelling that is exposed to noise and/or vibration. A sensitive receiver refers to a building that has noise and/or vibration criteria that is required to be met.
SEL	Sound Exposure Level (SEL) is the constant sound level which, if maintained for a period of 1 second would have the same acoustic energy as the measured noise event. SEL noise measurements are useful as they can be converted to obtain Leq sound levels over any time period and can be used for predicting noise at various locations.
SI Unit	Units adopted as a standard for International use, for example, metres for distance, seconds for time, kilogram for mass, etc.
Sound	A fluctuation of air pressure which is propagated as a wave through air
Sound absorption	The ability of a material to absorb sound energy through its conversion into thermal energy
Sound level meter	An instrument consisting of a microphone, amplifier and indicating device, having a declared performance and designed to measure sound pressure levels
Sound pressure level	The level of noise, usually expressed in decibels, as measured by a standard sound level meter with a microphone
Sound power level	Ten times the logarithm to the base 10 of the ratio of the sound power of the source to the reference sound power
Source	Point from which noise and/or vibration is emitted
SSI	State Significant Infrastructure
TfNSW	Transport for NSW
Tonal noise	Containing a prominent frequency and characterised by a definite pitch
Track form	Consists of the rails, fasteners, sleepers, bed and foundations of the railway tracks
Wheel squeal	High frequency tonal noise that may occur when a rail vehicle negotiates a tight curve

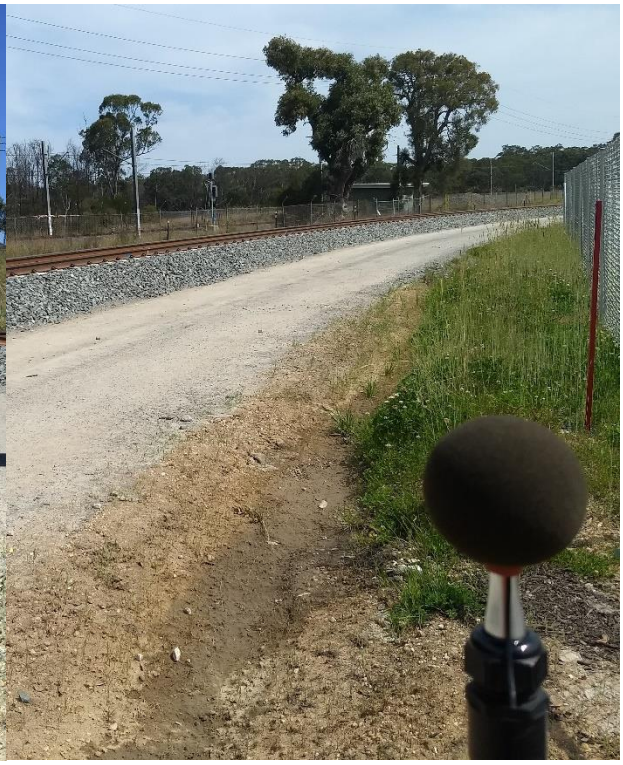
APPENDIX B Noise monitoring locations

B.1 Curve 1

B.2 Curve 2

B.3 Curve 3

B.4 Curve 4



B.5 Curve 5

B.6 Curve 6

N
Logger

RAIL
CROSS
WAY
2 TRACKS
STOP
LOOK
FOR
TRAINS
AUTHORISED
VEHICLES
ONLY

APPENDIX C Detailed passby and noise event results

ID	Location	Passby	Direction	Distance to track centre (m)	Comment	Start Date and Time	Temperature (°C)	Relative humidity (%)	Rain (mm)	Wind (km/h)	Duration (secs)	Measured noise level dB(A)			Noise level at 15m dB(A)			1/3 octave centre-band frequency Leq measured noise level (dB)																												
												LAeq	LAE	LAFmax	LAeq	LAE	LAFmax	6.3 Hz	8 Hz	10 Hz	12.5 Hz	16 Hz	20 Hz	25 Hz	31.5 Hz	40 Hz	50 Hz	63 Hz	80 Hz	100 Hz	125 Hz	160 Hz	200 Hz	250 Hz	315 Hz	400 Hz	500 Hz	630 Hz	800 Hz	1 kHz	1.25 kHz	1.6 kHz	2 kHz	2.5 kHz	3.15 kHz	4 kHz	5 kHz	6.3 kHz	8 kHz	10 k Hz	12.5 kHz	1.6 kHz	20 kHz
C1P801	Curve 1	P801	IN	8.2		15/10/16 36:35	25	42	0	24.1	01:19	88.1	107.2	106.8	87.3	106.3	105.1	73.9	72.7	71.4	69.7	71.3	72.6	71.7	74.7	73.6	75.8	75.6	76.3	78.9	74.5	68.8	68.3	67.7	72	73.2	74.9	68.8	66	63.7	66.8	68.9	71.4	76.8	80.5	83.8	70.7	69.8	72.6	76.1	72.7	65.7	61.5
C2P801	Curve 2	P801	IN	6.3		15/10/16 37:22	25	42	0	24.1	01:31	82.5	102.1	100.2	81.7	101.3	98.6	69.8	68.5	68.5	66.4	69.6	68.4	69.6	72.1	74.7	74.9	73.4	76.6	77.8	73	66.8	69.4	64.5	67.3	66.8	67.8	67.5	67.3	72.3	73.4	66.8	67	64.9	69.6	70.8	67.9	64.1	60.8	52.8
C3P801	Curve 3	P801	IN	7.4		15/10/16 37:51	25	42	0	24.1	02:14	88.1	109.4	109.8	86.8	108.1	107.2	61.1	60.6	59.7	59.6	62.1	64.4	67.5	67	69.2	67.7	68.6	71.4	74.1	71.9	64.8	67.1	66	68.5	69.3	67.8	65.9	67.1	62	67.1	72.2	74.4	81.4	83.2	72.7	73.1	72.3	75.5	72.7	71.7	62.6	56.7
C4P801	Curve 4	P801	IN	24.1		15/10/16 40:24	25	42	0	24.1	02:49	86.9	108.6	98.1	85.3	107.6	96.2	75.4	75.6	73	71.5	67.2	66	65.7	66.8	65.3	66.4	69.6	68.7	69.8	66.5	65.6	66.2	65.5	71.4	70.3	72.7	68.8	67.5	66.5	72	75	75.9	75.9	73.3	75.5	74.1	71.2	65.3	55.2
C5P801	Curve 5	P801	IN	3.3		15/10/16 42:07	25	42	0	24.1	02:00	90.3	111.1	108.6	85.5	106.3	99.0	64.7	64.5	62.1	61.9	64.6	71	67.9	67.6	70.6	69.9	72.4	73.9	72.1	70.3	69.3	69.6	74.1	72.6	67.2	69.2	68.3	70.1	71.8	73.9	79	80	79	84.2	82	77.2	76.2	74.9	72.8	67.9	59
C1P802	Curve 1	P802	OUT	8.2		16/10/16 08:32	16.2	97	0	24.1	01:11	80.4	98.9	100.3	79.5	98.6	98.6	54.8	52	51.8	61.2	60.3	64.3	60.8	62.4	62.7	71.7	72.1	70.8	73.2	70.2	68.4	69.3	68.8	73.1	73.8	75.6	73.1	65.8	64.2	66.5	68.1	68.3	66.7	72.4	62.7	63.5	63.8	59.9	59	54.7	53.2	47.9
C2P802	Curve 2	P802	OUT	3.1		16/10/16 08:42	16.2	97	0	5.4	01:17	74.9	93.8	88.8	69.8	88.7	83.8	78.6	76.5	51.4	55.4	58.6	56.2	60.5	59.9	63.3	66.7	72.8	77.1	70.4	70.2	65.8	63.5	68.7	70.5	72.9	69.6	68	67.6	63.8	62.6	64.7	63.6	61.8	59.6	58.4	53.9	46.5	42.9	40.8	38.6	35.2	31.9
C3P802	Curve 3	P802	OUT	12.6	Power fail																																											
C4P802	Curve 4	P802	OUT	8		16/10/16 08:53	16.2	97	0	5.4	02:07	76.5	97.6	93	75.5	96.6	89.1	51.9	50.2	49	57.3	54.8	60.8	59.7	61.9	64.1	68.7	73.3	67.3	68.7	68	67.3	68.5	70.6	74.8	73.5	71.4	67.7	65.2	64.7	65.7	63.7	61.9	59.1	58.8	59.3	56.2	46.6	49.2	48.4	49	48.8	41.4
C5P802	Curve 5	P802	OUT	3.3		16/10/16 04:45	16.2	97	0	5.4	02:11	79.9	101	96.3	75.1	96.2	86.7	60.2	57.2	55.9	61	57.2	63.1	59.2	62.2	65.5	73.4	74.6	71.3	73.8	73.1	71.9	74	74.9	77.6	76.8	77.4	72.1	68	66.3	66.6	64.2	64	60.7	60.2	58.9	54.2	53.8	49.8	54.1	51	43.1	39
C6P802	Curve 6	P802	OUT	2.5		15/10/16 22:22	13.9	91	0	5.4	01:12	82.5	101.1	98.5	81.6	100.2	96.8	61.3	66.7	66.8	70.7	73.9	74.3	76.3	70.2	72.1	72.7	71.3	74.8	73.6	70.1	64.1	62.8	64.2	65.9	66.6	67.8	64.7	63.5	60.8	63.7	67.6	70.8	72.1	73.5	74.3	74.2	73.4	72.1	70.9	64.4
C7P802	Curve 7	P802	IN	8.3		15/10/16 22:02	13.9	91	0	5.4	01:24	83.7	103	98.3	82.3	102.2	96.7	66.3	65.3	68.3	67.4	74.2	74.9	75.8	76.2	72.9	72.6	73.6	72.4	75	71.5	59.8	62.6	69.2	67.8	67.4	65.6	65.7	63.7	64.5	64.9	67.8	71.5	71.1	72.8	73.5	73.5	74.5	75.4	75.9	75.9	75.3	65.9
C8P802	Curve 8	P802	IN	7.4	Power fail																																										
C9P802	Curve 9	P802	IN	3		25/10/02 24:14	13.9	91	0	5.4	01:46	89.2	109.5	105.6	88.2	108.5	103.7	66.2	68.4	65.9	67.5	66.8	67.4	69.2	70.6	70.8	71.2	68.9	63.2	64.6	65.2	66.8	67.4	66.1	64.2	67	66.4	69.8	68.9	76.3	75	79.1	79.4	77.6	85	75.1	78.3	70.3	67.9	57.2
C10P802	Curve 10	P802	OUT	8.2		25/10/02 25:20	13.9	91	0	5.4	04:17	88.7	112.8	110.3	83.9	108.0	100.7	65.6	67.3	70.2	68.1	68.5	69.6	67.3	69.2	65.9	68.6	72.3	71.7	72.4	65.9	62.8	66.6	69	69.3	69.6	67.1	65.8	66.2	68.5	72.6	82.4	77.4	81.7	72.4	70.4	65.2	59
C1P804	Curve 1	P804	OUT	8.2		25/10/08 58:12	28	30	0	11.2	01:45	69	89.2	82.7	68.1	88.3	81.0	58.5	58.8	62.3	64.9	65.7	76.9	70	68.3	68.9	72.2	72	72.1	70.5	66.4	59	57.3	59.3	62.6	57.7	54	51.5	51.8	52.3	51.5	51.7	53.8	52.5	51.9	50.2	53.6	49.2	47.3	51.7	70.8	63.5	56.8
C2P804	Curve 2	P804	OUT	3.1		25/10/09 00:40	28	30	0	11.2	02:33	77.1	98.9	96.4	72.0	93.8	86.2	47.8	52.9	55.2	54.8	59	59.4	64	63.8	63.5	67.3	69.5	73.1	69.5	64.8	64	69	67.9	68.9	71.3	67.2	65.1	65	63.5	66.3	67.2	63.7	62.3	61.2	60.8	59.9	57	55	49.4	42
C3P804	Curve 3	P804	OUT	12.6	Power fail																																										
C4P804	Curve 4	P804	OUT	8		25/10/08 55:53	28	30	0	11.2	02:07	84	105	102.9	83.0	104.0	101.0	50.4	50.3	52.7	55.4	56.1	60.4	64.6	64.5	65.4	71	77.9	69.4	69.9	67.9	67.9	69.2	71.1	73.9	73	70.9	67.3	66.9	65.8	69	79.7	72.8	70.2	70	70.1	70	68.7	68.1	66.7	63.2	57.7	44.3
C5P804	Curve 5	P804	OUT	3.3		25/10/08 58:18	28	30	0	11.2	01:42	91	111.1	111.2	86.2	106.3	101.6	62.3	60.4	60.3	57.8	58.2	59.7	63.8	62.6	64.4	72.8	71.7	73.8	74.8	72.5	71.9	73.9	73.6	75.7	78.3	77.5	71.4	71.2	69.5	72.3	74	77.1	78.4	80.2	85.8	82.1	76.5	75.1	78.9	74.4	69	58.8
C6P804	Curve 6	P804	OUT	2.5		25/10/08 51:52	33	14	0	16.6	01:17	78.8	97.7	94.3	77.9	96.8	92.6	77.2	75.8	74.4	74.4	72.9	72.4	74.3	69.9	70.1	71.7	71.5	73.9	77	72.5	64.7	63.3	63.6	64.4	66.7	64.7	63.9	62.5	64.1	66.1	67.3	68.6	69.8	70.1	69.1	70	69.6	67.5	63.8	61.7
C7P804	Curve 7	P804	IN	8.3		25/10/08 53:08	33	14	0	16.6	01:36	83.3	103.1	98.6	82.5	102.3	97.0	75.8	76.3	74.9	74.4	73.6	72.6	73.6	70.3	70	70.4	70.6	68.7	73.3	69.6	64	68.6	67.5	64.9	66.7	65	64	62.9	63	66.1	67.6	71.2	71.4	70.5	76.5	77	69.3	68.9	72.1	66.9	62.2	53
C8P804	Curve 8	P804	IN	7.4		25/10/08 55:36	33	14	0	16.6	02:46	83.5	105.8	101.8	82.2	104.1	99.3	75.4	73.7	71.8	70.7	70.7	70.7	67.7	66.4	69.6	66.3	71.3	74.6	70.4	65.1	57.5	56	65.9	71.4	69.5	65.3	64.7	63.7	68.3	71.3	72.7	72.8	72.5	73.7	71.4	77.5	70.3	68.3	65.7	63.9	59
C9P804	Curve 9	P804	IN	3		25/10/08 53:36	33	14	0	16.6	02:46	83.5	103.7	99.5	78.5	103.7	97.6	61.5	61	58.9	58.6	60.8	60.1	62.4	62	62.9	63.8	67.2	70.6	67.8	70	63.2	65.6	66.3	67.3	67.7	66.4	64.5	63.3	61.3	66.3	67	69.4	68.6	66.7	66.8	70.1	69.1	70	69.6	67.5	63.8	61
C10P804	Curve 10	P804	IN	3.3		25/10/08 58:30	33	14	0	16.6	05:10	84.7	109.6	106.6	79.9	104.8	97.0	67.3	70.3	68.2	68.1	66.8	68.2	73.2	68.2	66.9	71	68.5	72.5	74.5	74.8	64.9	66.4	67.2	69.6	69.4	69.7	66.2	66.1	67.2	66.3	70.3	75.8	76.3	75.8	73.5	75.6	71.9	69.8	67.1	64.6	59.6	50.9
C1P805	Curve 1	P805	OUT	8.2		25/10/08 52:46	25.7	37	0	9.4	02:24	74.9	96.4	90.7	74.0	95.5	89.0	54.8	51.8	56.5	60.6	58.3	61.7	61.9	64.9	61.6	69.1	76.3	70.1	71.6	67.1	66.1	64.8	67.5	69.6	68.4	68.5	67	61.7	61.8	65	61	62.2	59.3	61.5	60.3	61.7	60.2	59.1	58.6	57.8	52.4	54.9
C2P805	Curve 2	P805	OUT	3.1		25/10/17 58:28	25.7	37	0	9.4	04:37	72	96.5	88.6	66.9	91.4	78.4	52	49.6	51.3	58.3	54.5	61.5	61.3	64.5	60.5	66.8	74	68.4	69.4	67.3	64.5	63.3	66.4	68.6	68.4	63.7	63.2	64.1	61.5	58.5	58.6	56.2	54.7	51.2	48.4	45.2	42.5	40.4	36.2	30.8
C3P805	Curve 3	P805	OUT	12.6		25/10/17 53:41	25.7	37	0	9.4	04:29	78.9	103.2	99.5	78.9	100.4	101.5	49	49.4	52.2	52.6	53.9	53.3	58.7	60.3	59.5	67.8	64.7	67.7	70.8	72	63.3	67	68.3	68.5	69.2	67.8	65.7	62.4	61.7	64.1	68.8	69.1	67.9	68.1	67.6	67.4	67.6	65.3	63.7	60	56	48.4
C4P805	Curve 4	P805	OUT	8		25/10/17 56:02	25.7	37	0	9.4	03:55	76.2	99.9	94.2	71.4	95.1	84.6	54.4	54.2	56.2	62.8	59	61.3	61.4	64.8	64.7	71.2	73.5	74.2	70	67.8	69.7	69.5	73	72.1	72.6	69.6	65.5	64.5	65.4	63	61.5	58	56.4	53.1	50.3	47.7	48	45.8	42.7	38.4	33.3
C5P805	Curve 5	P805	OUT	3.3		25/10/17 49:40	25.7	37	0	9.4	04:37	77.5	101.9	97.9	77.5	101.4	97.0	80.1	78.8	77.4	75.4	74.2	72.9	71.6	68	67.8	70.7	73.1	74.6	74.2	71.7	68.1	66.2	66.2	66.8	69.8	70.3	68.8	68.2	68.1	69.1	69.8	70.5	68.8	68.7	70.1	72.2	70.8	69.4	67.5	61.2	53.9
C6P805	Curve 6	P805	IN	8.3		25/10/17 52:56	27.5	16	0	27.7	01:48	84.6	103.5	98.8	82.2	102.1	97.0	80.1	78.8	77.4	75.4	74.2	72.9	72.1	68.9	68.7	71.2	73.1	74.6	74.2	71.7	68.1	66.2	66.2	66.8	69.8	70.3	68.8	68.2	68.1	69.1	69.8	70.5	68.8	68.7	70.1	72.2	70.8	69.4	67.5	61.2	53.9
C7P805	Curve 7	P805	IN	7.4		25/10/17 55:25	27.5	16	0	27.7	01:46	83.2	103.5	98.8	82.2	102.1	97.0	80.1	78.8	77.4	75.4	74.2	72.9	72.1	68.9	68.7	71.2	73.1	74.6	74.2	71.7	68.1	66.2	66.2	66.8	69.8	70.3	68.8	68.2	68.1	69.1	69.8	70.5	68.8	68.7	70.1	72.2	70.8	69.4	67.5	61.2	53.9
C8P805	Curve 8	P805	IN	3		25/10/17 52:50	27.5	16	0	27.7	01:26	75.2	94.6	91.5	70.4	89.8	81.9	74.4	73.3	71.6	70.4	69.7	69.8	69.5	70.4	68.2	70.4	71	74.4	75.7	73.3	68.7	67.4	65.7	66.6	68.2	67.6	64.5	63.4	63.3	63.3	61.4	63.6	64.1	60.8	59.4	60	61	63	62.6	59.1	56.7	45.4
C9P805	Curve 9	P805	IN	2.5		25/10/17 58:36	27.5	16	0	27.7	01:48	84.6	102.9	99.5	83.3	101.6	96.9	68	78.4	77.7	73.5	72.9	72.7	72.1	68.8	68.7	71.2	73.1	73.5	74.1	73.6	68.7	67.6	66.2	66.8	69.8	70.3	68.8	68.2	68.1	69.1	69.8	70.5	68.8	68.7	70.1	72.2	70.8	69.4	67.5	61.2	53.9
C10P805	Curve 10	P805	IN	3.3		25/10/17 55:44	27.5	16	0	27.7	01:46	83.2	103.5	98.8	82.2	102.1	97.0	80.1	78.8	77.4	75.4	74.2	72.9	72.1	68.9	68.7	71.2	73.1	74.6	74.2	71.7	68.1	66.2	66.2	66.8	69.8	70.3	68.8	68.2	68.1	69.1	69.8	70.5	68.8	68.7	70.1	72.2	70.8	69.4	67.5	61.2	53.9
C1P806	Curve 1	P806	OUT	8.2		26/10/20 17:40	20.2	22	0	18.4	03:25	78.3	101.4	96	79.3	102.4	98.0	62.1	60.7	60.4	62.3	63.7	64.1	66.6	64.9	65	68.2	68.2	65.1	66.9	66.1	69.1	64.8	63.8	66.4	68.6	70.3	69.3	68.1	65.6	63.4	65.6	62.4	59	65.3	63.7	60	56	48.4
C2P806	Curve 2	P806	OUT	3.1		26/10/20 18:38	20.2	22	0	18.4	02:32	72.2	94	88.6	67.1	88.9	78.4	58.1	54.4	54.4	63.8	59.9	61.7	64.4	62.9	62.9	69.4	74.8	72.3	68.2	67.2	64	65.1	66.4	69.6	66.3	65.2	63.2	60.4	63.5	64.2	64.4	58.4	54.4	59.3	58.3	42.6	40.3	39.7	37.2	31.2
C3P806	Curve 3	P806	OUT	12.6		26/10/20 17:40	20.2	22	0	18.4	03:25	78.3	101.4	96	79.3	102.4	98.0	62.1	60.7	60.4	62.3	63.7	64.1	66.6	64.9	65	68.2	68.2	65.1	66.9	66.1	69.1	64.8	63.8	66.4	68.6	70.3	69.3	68.1	65.6	63.4	65.6	62.4	59	65.3	63.7	60	56	48.4
C4P806	Curve 4	P806	OUT	8		26/10/20 15:10	20.2	22	0	18.4	02:56	76.7	99.2	94.2	75.7	98.2	92.3	68.9	68.2	68.2	68.6	64.9	65	64.2	64.5	65.9	68.2	76.2	67.5	70.9	65.9	67.8	69	71.6	73.5	70.8	68	68.4	63.9	62.8	65.8	63.1	65.6	62.4	59	65.3	63.7	60.6	62.8	59.2	54.7	53.8	45.9	32.4
C5P806	Curve 5	P806	OUT	3.3		26/10/20 13:46	20.2	22	0	18.4	02:32	74.4	97.3	91.8	69.6	92.2	83.8	60.8	58.5	58.7	63.2	63.3	60.9	66.2	66.7	62.4	70.2	71.1	70.2	68.7	67.3	65.2	66.4	68.2	68.3	71.5	69.6	67.2	65.2	61.4	66.2	59.4	63.1	64.3	57.8	51.9	51.8	56.2	54.2	44.6	39.7	37.2	31.2
C6P806	Curve 6	P806	IN	8.2		27/10/03 20:00	12.2	41	0	0.4	03:45	82.9	106.4	105.2	82.0	105.5	103.5	50.8	50.2	53.8	58.7	61.4	61.4	70.5	62.9	63.3	66.2	66.3	70.5	71.7	66.4	58.5	59.5	61.1	63.2	64.1	60.7	63	59.4	63.5	70.1	69.5	69.4	71	70.6	79.3	69.4	68.3	73	65.5	61.8	55.3
C7P806	Curve 7	P806	IN	7.4		27/10/03 21:58	12.2	41	0	0.4	03:45	82.9	106.4	105.2	82.0	105.5	103.5	50.8	50.2	53.8	58.7	61.4	61.4	70.5	62.9	63.3	66.2	66.3	70.5	71.7	66.4	58.5	59.5	61.1	63.2	64.1	60.7	63	59.4	63.5	70.1	69.5	69.4	71	70.6	79.3	69.4	68.3	73	65.5	61.8	55.3
C8P806	Curve 8	P806	IN	3		27/10/03 22:51	12.2	41	0	0.4	03:45	82.9	105.4	105.1	81.9	104.8	98.5	59.2	59.2	59	64	66	64.9	67.6	65.5	66.2	68.8	68.7	71.8	68.2	65.4	65.1	68.7	72.2	74.5	72.1	68.8

| ID | Location | Passby | Direction | Distance to track centre (m) | Comment | Start Date and Time | Temperature (°C) | Relative humidity (%) | Rain (mm) | Wind (km/h) | Duration (m:s) | Measured noise level dB(A) | | | Noise level at 15m dB(A) | | | 1/3 octave centre-band frequency LZeq measured noise level (dB) | | |

ID	Location	Passby	Event	Direction	Distance to track centre (m)	Comment	Start Date and Time	Duration (m:s)	Measured noise level dB(A)			Noise level at 15m dB(A)			LAFmax 1.2 m from rear rail	1/3 octave centre-band frequency LZeq measured noise level (dB)																						Dominant A-weighted freq (Hz)
									LAeq	LAE	LAFmax	LAeq	LAE	LAFmax		6.3 Hz	8 Hz	10 Hz	12.5 Hz	16 Hz	20 Hz	25 Hz	31.5 Hz	40 Hz	50 Hz	63 Hz	80 Hz	100 Hz	125 Hz	160 Hz	200 Hz	250 Hz	315 Hz	400 Hz	500 Hz	630 Hz	800 Hz	1 kHz	1.25 kHz	1.6 kHz	2 kHz	2.5 kHz	3.15 kHz	4 kHz	5 kHz	6.3 kHz	8 kHz	10 k Hz	12.5 kHz	1.6 kHz	20 kHz	
C2PB01EV01	Curve 1	PB01	Event 01	IN	8.2	squeal	15/10/16 16:36:38	00:08	108	107	106.8	97.1	106.1	105.1	130.5	78.5	69.8	75.1	72.4	69.4	70.2	69.3	78.1	69.5	72.8	75.8	79.5	73.5	71.5	75.2	75.1	79.7	79.9	83.1	76.8	74.8	71.1	74.3	79.1	86.1	90.8	93.3	80.4	75.2	82.5	86.1	82.5	68.7	4000
C2PB01EV02	Curve 2	PB01	Event 01	IN	8.3	flanging	15/10/16 16:37:29	00:08	92.7	101.8	100.2	91.9	101.0	98.6	114.0	70	68.9	65.4	64	63.7	68.1	70.6	70.8	70.3	75.7	75.1	75.2	76.5	81.4	75.1	75.2	79.2	81.2	81.1	83.8	83.1	77.9	76.8	73.9	77.1	76.5	77.4	77.3	77.5	87.8	83.9	77.2	77.2	75.1	79.9	70.8	62.9	4000
C2PB01EV03	Curve 2	PB01	Event 02	IN	8.3	flanging	15/10/16 16:38:10	00:05	73.6	81	79	72.8	80.2	76.4	91.9	64.7	64.5	62	65.3	67.6	68.1	72.1	74.6	74.2	80	79.2	83.2	79.3	73.9	69	64.5	67.7	69.1	69.5	65.7	62.7	59.7	60.7	60.2	59.1	62.2	60.6	58.8	57	59.4	53.8	53.6	53.4	54.9	48.2	44.4	400
C2PB01EV04	Curve 2	PB01	Event 03	IN	8.3	braking	15/10/16 16:38:46	00:04	72	78.1	77.1	72.2	77.5	75.5	90.9	62.4	59.4	61.3	66.2	68.2	66.5	67.5	73.4	76.2	72.9	72.6	76.2	80.5	76.6	62.4	61.8	66	59.3	55.8	54.7	57.3	57.2	58.4	54	49.7	45.9	39.6	33.5	25.1	100
C2PB01EV01	Curve 3	PB01	Event 01	IN	7.4	flanging	15/10/16 16:38:03	00:15	97.4	109.2	109.8	96.1	107.9	107.2	122.6	61	60.9	62.1	59.2	65.7	64.2	72.9	64.4	67.9	70.1	70.7	76	75.3	71.5	69.1	74.4	73.5	75.7	76.2	76.2	73.7	76.3	69.4	75.4	81.3	83.6	90.8	92.6	81.6	81.8	81.5	84.8	82	80.5	70.4	65.6	3150
C2PB01EV02	Curve 3	PB01	Event 02	IN	7.4	flanging	15/10/16 16:38:25	00:18	75.3	87.8	80.8	74.0	86.5	78.2	93.6	62.7	62.2	61.4	60.8	62.6	65.2	69.6	69.7	70.9	67.4	68.8	70.5	73.2	72.8	66.7	62.7	63.2	67.2	70.5	65.9	63.1	58.5	58.6	60.7	59.8	64.4	62.4	62	60.5	62.6	62.4	65.3	66.4	68.3	60.5	50.7	400
C2PB01EV03	Curve 3	PB01	Event 03	IN	7.4	squeal	15/10/16 16:38:57	00:02	74.3	77.3	76.8	73.0	75.8	74.2	89.6	56.8	56.7	57.9	60.1	66.5	70.4	63.3	64.9	68.5	64.2	64.8	66.6	68.8	70.8	62.7	69.1	62.2	58.5	62	58.4	60.6	54.7	56.2	58.7	60.8	62.4	61.8	60.8	61.1	69.9	58.6	57.7	61.9	52.4	56.8	42.4	5000
C2PB01EV04	Curve 3	PB01	Event 04	IN	7.4	braking	15/10/16 16:38:55	00:06	73.9	81.4	77	72.6	80.1	74.4	89.8	57.6	56.6	57.6	54	58.8	62.9	61.5	64.7	67.2	66.6	67.4	82.9	79.7	62.9	65	63.6	65.9	62.2	61.1	61.2	58.5	59.7	61	62.6	62.6	61	61.7	62.1	59.5	57.4	54.4	51.8	45.9	36	100
C2PB01EV05	Curve 3	PB01	Event 05	IN	7.4	flanging	15/10/16 16:39:07	00:16	75.3	87.4	84.2	74.0	86.1	81.6	97.0	57.7	57.5	57.8	57.1	58.9	61.8	65.8	69.4	71.2	68	70	71.7	72.5	68.4	61.6	62.2	59.1	59.2	61.8	58.7	55.2	55.1	56.8	59.2	57.4	65.8	62.7	64.9	65.5	69.5	61.5	60.1	61	60.9	53.7	45.3	5000
C2PB01EV06	Curve 3	PB01	Event 06	IN	7.4	flanging	15/10/16 16:39:27	00:06	78.9	85.4	83	76.5	72	67.7	75.3	68.4	64.9	58.8	56.7	56.6	60.6	62.1	61.9	65.2	70.2	65.2	66.4	68.8	69	72.2	68.4	65	61.7	59.9	59.4	54.8	55.2	53.6	59.6	58	53.6	53.2	53	50.7	46.6	52.1	46.7	39.4	1250
C2PB01EV07	Curve 3	PB01	Event 07	IN	7.4	flanging	15/10/16 16:39:41	00:12	79.5	90.2	85.8	78.2	88.9	83.2	98.6	65.3	63	62.2	60.4	58.8	62.5	60.6	63.8	68.2	64.3	63.6	68.2	70.1	66.5	61.4	58.5	60.2	61	64.5	60.4	57.2	56.2	57.5	61.2	62	66	67.4	66.1	72.1	67.3	67.4	68.7	59.5	52.2	5000
C2PB01EV01	Curve 4	PB01	Event 01	IN	8.2	squeal and flanging	15/10/16 16:40:25	00:18	92.3	105.1	98.1	91.3	104.1	96.2	111.6	78.2	75.5	73.6	72.2	70.4	69.5	69.2	69.3	67.8	72.7	75.6	72.7	76.1	71.5	73	73.6	73.6	80.3	78.9	79.9	75.8	76.4	74.1	79	82	83.1	81.1	80.7	83.3	80.8	79.8	79.4	79.4	74.3	69.7	60.6	2000
C2PB01EV02	Curve 4	PB01	Event 02	IN	8.3	flanging	15/10/16 16:41:54	00:08	91.2	104.9	97.3	89.5	103.1	95.2	110.6	75.5	73.6	72.3	72.4	68.1	67.8	67.7	69.2	67.2	67.7	67.7	72.3	72.7	70.4	68.8	65	65.8	64.3	67	68.7	71.7	69.8	62.2	62.3	64.3	67.4	80.6	73.1	84.6	77.7	79.8	76.2	81	77.8	77.2	70.8	58.8	3150
C2PB01EV03	Curve 4	PB01	Event 03	IN	8	flanging	15/10/16 16:42:36	00:09	97	86.1	96.6	97	86.1	95.5	110.5	71.5	71.3	70.1	66.7	66.6	66.2	66.7	66.6	64.4	64.1	64.5	66	67.6	64.3	60.2	58.1	59.6	63.8	63.9	63.3	58.9	60.4	64.3	67.4	64.6	75	72	80.1	76.8	79.7	75	78.3	79.2	71.9	63.2	56.9	3150
C2PB01EV01	Curve 4	PB01	Event 01	IN	8	flanging	15/10/16 16:41:18	00:08	88.4	97.5	95	87.4	96.5	93.1	108.5	68.7	66.8	61.9	61.9	61.9	62.5	63.6	66.6	64.2	63.2	65.7	68.4	66.2	65.3	61.3	58.3	58.6	61	67.6	74.2	60.6	62.9	67.7	69.9	66.3	80.9	72.6	82	77.4	79.7	75.5	75.8	74.2	71.7	63.6	57.3	3150
C2PB01EV02	Curve 4	PB01	Event 02	IN	8	flanging	15/10/16 16:41:36	00:20	78.7	92.7	88.2	78.3	91.7	86.3	101.7	68.7	66.5	64.3	59.8	58.6	62.8	65.6	67.4	64.4	63.6	66.4	68.1	69.8	65.7	67.5	65.6	64	59.4	59.2	61.2	66.1	69.8	55.7	56.2	58.4	62.7	59	62.2	66	61.9	58.2	49	2000
C2PB01EV03	Curve 4	PB01	Event 03	IN	8	flanging	15/10/16 16:42:46	00:02	77.5	80.2	80.2	76.2	79.2	78.3	93	69.4	64.1	59.6	67.6	64.4	59.2	59.7	64.9	64.3	59.4	60.9	62.2	68.9	56.9	55.4	52.6	51.1	52.9	56	56.8	49.6	51.7	53.2	62	57.8	71.2	62.9	71.5	62.8	65.1	62.1	64.1	59.8	56.2	47.5	3150
C2PB01EV01	Curve 5	PB01	Event 01	IN	3.3	squeal	15/10/16 16:42:08	00:10	100	110	108.6	95.2	105.2	99.0	114.4	55.2	54	60.7	57.2	60.5	62.9	80.1	66	68.7	73.7	71.4	74.2	76.1	77.5	78.5	77.7	77.6	84.4	81.5	86.1	78.3	77.7	78.7	79.9	84.3	87.5	90.1	88.1	94.6	91.5	86.4	85.1	83.7	81.5	77.3	68.2	4000
C2PB01EV02	Curve 5	PB01	Event 02	IN	3.3	squeal	15/10/16 16:42:36	00:05	78.9	85.8	85.3	74.1	83.2	75.7	91.1	63.5	62.9	62.6	65	62.2	67.4	70.8	66.8	65.6	67.2	69.1	71.1	72.7	70.5	66.2	65.2	64.4	64.7	68.2	71.5	64	62	61.5	63.6	60.5	75.1	63.3	63.8	66.2	61	59.2	60.4	60.7	57.2	50.5	42.2	2000
C2PB01EV03	Curve 5	PB01	Event 03	IN	3.3	squeal	15/10/16 16:43:00	00:04	78.9	84.9	86.2	74.1	80.1	76.6	92.0	61.5	60.2	61.3	62.1	63.7	65.6	68.6	68.2	66	66	67.7	67.9	67	66.3	63	63.4	62.7	67.2	71.2	62.4	61.5	66.8	77.2	58.7	60.7	58.8	55.3	51.2	48.3	42.1	37.1	32.3	28.8	26.3	20.9	1250
C2PB01EV01	Curve 6	PB01	Event 01	IN	3.3	flanging	15/10/16 16:42:42	00:07	86.9	95.4	94.2	82.1	90.6	84.6	100.0	61.9	60.7	62.4	63.2	63.1	67.4	66.9	66.4	67.8	67.1	66.2	69	72.9	71.6	66.1	67.7	67.8	64.6	68.4	72.9	66.2	66.2	67.5	66.8	64.7	75.8	69.2	76.1	81.2	79.8	75.2	68.8	78.1	70.2	69.7	57.5	4000
C2PB01EV02	Curve 6	PB01	Event 02	IN	3.3	flanging	15/10/16 16:43:08	00:11	88.8	98.7	94.8	83.5	93.8	85.3	100.7	69.9	69.3	68.8	65	62.7	66.2	68.8	69.1	71	75.3	75.5	79.4	79.5	76.3	72.1	70.9	71.5	68.6	68.2	70.3	69.7	68.2	68.6	73.3	80.7	77.4	82	74.5	74	77.1	73.8	67.1	60.4	5000
C2PB01EV03	Curve 6	PB01	Event 03	IN	3.3	flanging	15/10/16 16:43:20	00:13	88.5	99.7	97.6	83.7	94.9	88.0	103.4	66.3	66.2	64.4	61.9	60.8	66.1	67	69.5	68.5	68.6	67.7	69.6	71.9	71	66.1	63.7	62.8	63.7	67.8	72.6	65.6	66.1	69.3	68.1	67	80.8	73.9	79.3	77.6	82.1	75.3	78.2	72.7	75.5	61.1	58.9	5000
C2PB01EV04	Curve 6	PB01	Event 04	IN	3.3	flanging	15/10/16 16:43:39	00:02	82.8	85.8	89.9	78.0	81.0	80.3	95.7	62.4	60	65.1	65.4	65.6	68.3	69.8	72.5	67.6	69.4	66.3	69.6	70.6	68.5	64.8	64.9	65.5	64.3	67.8	73.8	66.6	65.2	71.6	65.8	63.3	75.2	69	77.1	68	70.3	64.1	69.4	64.8	66.3	58.9	51.4	3150
C2PB01EV05	Curve 6	PB01	Event 05	IN	3.3	flanging	15/10/16 16:43:45	00:04	99	96	95.7	85.2	91.2	86.1	101.5	68.5	67.8	67.2	62.5	64.3	63.6	63.2	67.8	65.7	68.6	63.4	67.2	70.5	66.1	62.7	62.1	63.3	63.8	68.3	74	65.5	67.3	71.4	73.9	70.4	83.7	77.8	77.4	78.7	75.5	83.5	80.7	73.2	73.2	66.5	58.6	2000
C2PB01EV06	Curve 6	PB01	Event 06	IN	3.3	flanging	15/10/16 16:43:50	00:05	80.1	87.1	86.7	75.3	82.3	77.1	92.5	67.3	69.4	69.7	65.9	67.1	62.1	62.2	64.1	68.7	67.1	66.6	63.7	68.7	70.3	69.4	64.5	62.2	62.1	61.3	66.2	69	62.7	62.1	63.9	65	63.4	72	68.3	71	66.2	69.3	64.4	70.8	66.1	63.1	59.7	48.4	2000
C2PB02EV01	Curve 1	PB02	Event 01	OUT	8.2	flanging	16/10/16 08:09:39	00:02	77.6	79.9	79.6	76.7	79.0	77.1	92.5	67.3	69.4	66.9	63.1	62.2	64.1	68.7	67.1	66.6	63.7	68.7	70.3	69.4	64.5	62.2	62.1	61.3	66.2	69	62.7	62.1	63.9	65	63.4	72	68.3	71	66.2	69.3	64.4	70.8	66.1	63.1	59.7	48.4	2000
C2PB02EV02	Curve 1	PB02	Event 02	OUT	8.2	flanging	16/10/16 08:09:41	00:03	94.1	94.9	100.3	93.2	94.0	98.6	114.0	86.9	87.6	84.9	84.9	81.7	82.1	84.9	84.2	82.1	83	82.7	85.2	87.5	84.2	82.1	82.2	82.1	84.2	87.5	84.2	82.1	84.7	88.7	84.2	84.7	88.7	84.2	82.1	82.2	84.7	88.7	82.5	80.3	83.8	88.6	3150
C2PB02EV03	Curve 1	PB02	Event 03	OUT	8.2	flanging	16/10/16 08:09:42	00:01	89.8	90.6	91.1	88.9	89.7	89.4	104.8	85.8	86.4	82.8	85.1	83.8	83.9	82	84.7	81.1	82.8	78.1	82.1	82.8	78.1	78.2	80.1	78.8	78.9	84.8	84.2	85.6	81.4	77	78.4	75.1	79.3	71.7	70.4	75.9	71.3	73.2	67.3	65.9	59.9	500
C2PB02EV04	Curve 1	PB02	Event 04	OUT	8.2	squeal	16/10/16 08:10:03	00:01	73.8	74.1	76.9	72.7	73.2	75.2	90.6	45.8	49.3	51.2	53.4	63	64.8	58.2	56.5	63.2	71.1	70	70.6	67	63.7	60.6	61.2	62.2	64.1	63.1	57.2	54.3	52.3	57.7	57.8	60.2	58.3	70.6	54.6	53.4	49	43.9	39.1	34.4	26.9	20.5	3150
C2PB02EV05	Curve 1	PB02	Event 05	OUT	8.2	braking	16/10/16 08:10:32	00:06	75.7	83.5	80.7	74.8	82.6	79.0	94.4	57.1	54.2	56	60.9	59.9	63.3	60.5	59.3	62.7	75.1	73	71.1	74.2	72.1	65.5	64.6	63.8	65.8	66.4	65.4	63.3	59.5	63.3	60.1	61.4	71.9	60.5	60.4	66	56.9	53.7	49.7	45.2	40.5	34.8	27.1	2000
C2PB02EV01	Curve 2	PB02	Event 01	OUT	8.1	squeal	16/10/16 08:08:58	00:02	71.4	74.9	73.8	66.3	69.8	63.4	78.5	54.3	55.9	57.6	56.5	55.3	60.8	59.1	61.9	65.7	71.6	67.3	67.9	67.9	66.3	61.9	63.6	62.5	61.8	61.3	59.3	55.7	56.7	59.8	59.4	59.9	57.1	56.5	58.2	55.2	39.7	33.2	28.6	20.6	16.3	2500
C2PB02EV01	Curve 4	PB02	Event 01	OUT	8	squeal	16/10/16 08:10:58	00:09	75.1	84.6	79.3	74.1	83.1	77.4	92.8	47.7	46.4	46.4	56.2	55.1	56.8	56.5	55.7	59.5	59.2	61.3	65.7	60.3	59.2	55.2	52.5	52.2	52.8	51.3	50.9	52.4	56.4	53.9	58.5	70.9	60.5	58.5	55	64	65.4	51.8	58.5	57.1	59.4	60.5	51.9	1600
C2PB02EV02	Curve 4	PB02	Event 02	OUT	8.2	flanging	16/10/16 08:09:24	00:02	77.9	81.1	83.4	74.8	77.9	82.4	92.7	68.1	65.3	67.6	70.3	66.6	69.1	69.1	69.5	72.4	77.9	75.1	73.8	75.1	73.1	72.1	69.7	70.8	69.6	65.7	64	66.6	63.9	68.9	57.5	60.5	60.6	57.5	58.1	47.1	4000
C2PB02EV01	Curve 4	PB02	Event 01	OUT	8	flanging	16/10/16 08:08:16	00:03	78.7	83	82.5	73.9	78.2	72.9	88.3	54.4	49.9	49.2	52	51.3	57	56.3	59.7	59.6	66.2	68.8	63.9	68.5	64.8	63.5	64.1	70.5	69.3	64.6	66.2	69	62.7	62.1	63.9	65	63.4	72	68.3	71	66.2	69.3	64.4	70.8	66.1	63.1	59.7	48.4	2000
C2PB02EV02	Curve 5	PB02	Event 02	OUT	8.3	flanging	16/10/16 08:08:19	00:02	78.9	81.7	86	74.1	76.9	76.4	91.8	52	46.1	50.7	53.3	52.6	53.9	59.2	55.3	58.3	61	64.2	66.7	62.9	65.6	63.8	62.1	66.8	82.1	73.8	66.9	80	65	70.6	63.1	61.2	65.6	59.4	57.6	53.7	51.3	49.9	48.8	45.4	46.2	40.5	33.6	500
C2PB02EV01	Curve 6	PB02	Event 01	OUT	8.2	flanging	16/10/16 08:08:35	00:02	79.5	85.1	90.1	78.3	84.3	85.5	103.9	67.5	71.4	70.5	70.3	69.2	74.2	72.4	72.1	75	78.7	77.1	74.1	67.5	75.8	76.2	82.6	82.2	90.5	77.8	79.5	79	75.2	73.5	70.3	69	63.1	3150
C2PB02EV03	Curve 1	PB02	Event 03	OUT	8.2	flanging	16/10/16 08:08:42	00:01	89.8	90.6	91.1	88.9	89.7	89.4	104.8	85.8	86.4	82.8	85.1	83.8	83.9	82	84.7	81.1	82.8	78.1	82.1	82.8	78.1	78.2	80.1	78.8	78.9	84.8	84.2	85.6	81.4	77	78.4	75.1	79.3	71.7	70.4	75.9	71.3	73.2	67.3	65.9	59.9	500
C2PB02EV04	Curve 2	PB02	Event 04	OUT	8.2	squeal	16/10/16 08:10:03	00:01	73.8	74.1	76.9	72.7	73.2	75.2	90.6	45.8	49.3	51.2	53.4	63	64.8	58.2	56.5	63.2	71.1	70	70.6	67	63.7	60.6	61.2	62.2	64.1	63.1	57.2	54.3	52.3	57.7	57.8	60.2	58.3	70.6	54.6	53.4	49	43.9	39.1	34.4	26.9	20.5	3150
C2PB02EV05	Curve 2	PB02	Event 05	OUT	8.2	braking	16/10/16 08:10:32	00:06	75.7	83.5	80.7	74.8	82.6	79.0	94.4	57.1	54.2	56	60.9	59.9	63.3	60.5	59.3	62.7	75.1	73	71.1	74.2	72.1	65.5	64.6	63.8	65.8	66.4	65.4	63.3	59.5	63.3	60.1	61.4	71.9	60.5	60.4	66	56.9	53.7	49.7	45.2	40.5	34.8	27.1	2000
C2PB02EV01	Curve 3	PB02	Event 01	OUT	8.2	squeal	16/10/16 08:08:58	00:02	71.4	74.9	73.8	66.3	69.8	63.4	78.5	54.3	55.9	57.6	56.5	55.3	60.8	59.1	61.9	65.7	71.6	67.3	67.9	67.9	66.3	61.9	63.6	62.5	61.8	61.3	59.3	55.7	56.7	59.8	59.4	59.9	57.1	56.5	58.2	55.2	39.7	33.2	28.6	20.6	16.3	2500
C2PB02EV01	Curve 4	PB02	Event 01	OUT	8	squeal	16/10/16 08:10:58	00:09	75.1	84.6	79.3	74.1	83.1	77.4	92.8	47.7	46.4	46.4	56.2	55.1	56.8	56.5	55.7	59.5	59.2	61.3	65.7	60.3	59.2	55.2	52.5	52.2	52.8	51.3	50.9	52.4	56.4	53.9	58.5	70.9	60.5	58.5	55	64	65.4	51.8	58.5	57.1	59.4	60.5	51.9	1600
C2PB02EV02	Curve 4	PB02	Event 02	OUT	8	flanging	16/10/16 08:10:24	00:02	77.9	81.1	83.4	74.8	77.9	82.4	92.7	68.1	65.3	67.6	70.3	66.6	69.1	69.1	69.5	72.4	77.9	75.1	73.8	75.1	73.1	72.1	69.7	70.8	69.6	65.7	64	66.6	63.9	68.9	57.5	60.5	60.6	57.5	58.1	47.1	4000
C2PB02EV03	Curve 5	PB02	Event 03	OUT	8.3	flanging	16/10/16 08:10:16	00:03	78.7	83	82.5	73.9	78.2	72.9	88.3	54.4	49.9	49.2	52	51.3	57	56.3	59.7	59.6	66.2	68.8	63.9	68.5	64.8	63.5	64.1	70.5	69.3	64.6	66.2	69	62.7	62.1	63.9	65	63.4	72	68.3	71	66.2	69.3	64.4	70.8	66.1	63.1	59.7	48.4	2000
C2PB02EV04	Curve 5	PB02	Event 04	OUT	8.3	flanging	16/10/16 08:10:19	00:02	82.8	85.8	89.9	78.0	81.0	80.3	95.7	62.4	60	65.1	65.4	65.6	68.3	69.8	72.5	67.6	69.4	66.3	69.6	70.6	68.5	64.8	64.9	65.5	64.3	67.8	73.8	66.6	65.2	71.6	65.8	63.3	75.2	69	77.1	68	70.3	64.1	69.4	64.8	66.3	58.9	51.4	3150
C2PB02EV05	Curve 5	PB02	Event 05	OUT	8.3	flanging	16/10/16 08:10:43	00:04	99	96	95.7	85.2	91.2	86.1	101.5	68.5	67.8	67.2	62.5	64.3	63.6	63.2	67.8	65.7	68.6	63.4	67.2	70.5	66.1	62.7	62.1	63.3	63.8	68.3	74	65.5	67.3	71.4	73.9	70.4	83.7	77.8	77.4	78.7	75.5	83.5	80.7	73.2	73.2	66.5	58.6	2000
C2PB02EV06	Curve 5	PB02	Event 06	OUT	8.3	flanging	16/10/16 08:10:50	00:05	80.1	87.1	86.7	75.3	82.3	77.1	92.5	67.3	69.4	69.7	65.9	67.1	62.1	62.2	64.1	68.7	67.1	66.6	63.7	68.7	70.3	69.4	64.5	62.2	62.1	61.3	66.2	69	62.7	62.1	63.9	65	63.4	72	68.3	71	66.2	69.3	64.4	70.8	66.1	63.1	59.7	48.4	2000
C2PB03EV01	Curve 1	PB03	Event 01	IN	8	flanging	15/10/16 08:09:39	00:02	77.6	79.9	79.6	76.7	79.0	77.1	92.5	67.3	69.4	66.9	63.1	62.2	64.1	68.7	67.1	66.6	63.7	68.7	70.3	69.4	64.5	62.2	62.1	61.3	66.2	69	62.7	62.1	63.9	65	63.4	72	68.3	71	66.2	69.3	64.4	70.8	66.1	63.1	59.7	48.4	2000
C2PB03EV02	Curve 1	PB03	Event 02	IN	8	flanging	15/10/16 08:09:41	00:03	94.1	94.9	100.3	93.2	94.0	98.6	114.0	86.9	87.6	84.9	84.9	81.7	82.1	84.9	84.2	82.1	83	82.7	85.2	87.5	84.2	82.1	82.2	82.1	84.2	87.5	84.2	82.1	84.7	88.7	84.2	84.7	88.7	84.2	82.1	82.2	84.7	88.7	82.5	80.3	83.8	88.6	3150
C2PB03EV03	Curve 1	PB03	Event 03

ID	Location	Passby	Event	Direction	Distance to track centre (m)	Comment	Start Date and Time	Duration (m:s)	Measured noise level dB(A)			Noise level at 15m dB(A)			LAFmax 1.2 m from rear rail	1/3 octave centre-band frequency LZeq measured noise level (dB)																										Dominant A-weighted freq (Hz)
									LAeq	LAE	LAFmax	LAeq	LAE	LAFmax		6.3 Hz	8 Hz	10 Hz	12.5 Hz	16 Hz	20 Hz	25 Hz	31.5 Hz	40 Hz	50 Hz	63 Hz	80 Hz	100 Hz	125 Hz	160 Hz	200 Hz	250 Hz	315 Hz	400 Hz	500 Hz	630 Hz	800 Hz	1 kHz	1.25 kHz	1.6 kHz	2 kHz	2.5 kHz	3.15 kHz	4 kHz	5 kHz	6.3 kHz	8 kHz	10 k Hz	12.5 kHz	1.6 kHz	20 kHz	
C1PB19EV01	Curve 1	PB19	Event 01	OUT	8.2	flanging	09/12/05:20:24	00:08	96.5	105.9	102.8	95.6	104.6	102.1	116.5	45.2	48.6	57.2	66.4	67.2	75.3	73.2	74.9	72.5	78.1	77.8	87.1	87.3	74.5	79.5	78.4	78	80.6	85.2	85.5	78.3	78	79.9	84.3	84.8	83.8	83.8	81.5	77.5	69.2	4000
C1PB19EV02	Curve 1	PB19	Event 02	OUT	8.2	squeal	09/12/05:21:25	00:02	90.1	94	97.3	89.2	93.1	95.6	111.0	61.1	68.4	64.6	73	75.8	71	75.4	78.1	72.5	70.1	65.9	66.9	65.1	62.5	62.8	65.1	64.1	65.7	67.4	66.3	63.5	65.9	67	73.5	75.7	82.2	75.1	84.9	73.5	75.4	71.1	67.6	59	2000
C1PB19EV03	Curve 1	PB19	Event 03	OUT	8.2	squeal	09/12/05:21:24	00:04	88.6	94.4	97.3	87.7	93.5	95.6	111.0	60.5	68.8	64.9	72.3	76.8	73.4	75	77.5	71.6	69.6	65.4	66.9	65	61.9	62.5	64.4	63.7	65.1	66.5	66.1	61.6	59.6	62.3	64.7	66.3	72.5	83.2	68.2	74.7	80.4	73.5	83.2	72.2	74	69.6	65.9	57.4	2000
C1PB19EV04	Curve 1	PB19	Event 04	OUT	8	squeal	09/12/05:09:41	00:02	90.1	92.8	105.9	98.4	91.8	102.2	96.5	111.9	42.5	59.5	56.4	61.1	73.5	67.7	72.1	75.2	77.3	88.9	90.1	78.7	75.1	79	81.1	83.3	84.3	84.5	81.8	79.4	79.1	77.7	79	82.6	82.5	81.6	81.9	81.1	78.4	77.9	77.4	73.3	67.6	59.5	2000
C1PB19EV05	Curve 1	PB19	Event 05	OUT	8	squeal	09/12/05:11:41	00:08	90.6	99.6	97.8	89.6	98.6	95.9	111.3	54.8	57.4	64.7	64.1	70.2	66.9	67.7	69.3	68.4	68.5	66.7	65.4	63.1	63.7	62.1	69.5	71.1	67.8	69.2	70.5	63.6	64	64.9	66.4	65.5	66.3	68.5	70.9	83.9	71.2	82.5	69.7	71.9	72.5	61.5	55.7	2000
C1PB19EV06	Curve 1	PB19	Event 06	OUT	8	squeal	09/12/05:09:19	00:08	89.8	96.8	98.2	85.0	92.0	88.6	104.0	63.2	69.7	72.6	69.9	72.4	70	68.9	71.4	65.6	66.1	62.7	62.4	60.8	61.4	60.5	61.9	66.2	62.5	59.4	58.7	57.7	57	56.7	55.6	54.7	54.7	54.2	58.5	47.8	44.4	57	37.3	36.2	31.7	36.3	33.6	3150
C1PB20EV01	Curve 1	PB20	Event 01	IN	7.4	squeal	09/12/11:39:16	00:03	103.3	108.1	110	102.0	106.8	107.4	122.8	48.4	49.6	58.9	65.5	63.5	67.9	68.7	71.6	71.8	81.2	92.8	83.6	78.5	74.9	75.2	76.5	77.1	81.9	83.7	80.3	79.7	85.7	77.6	81.5	85.8	98.2	99.4	87.8	82.8	88.2	84.5	85.4	86.6	73.6	67.4	3150
C1PB20EV02	Curve 3	PB20	Event 02	IN	7.4	squeal	09/12/11:39:52	00:03	93.6	98.4	97.4	92.3	97.1	94.8	110.2	58.4	66	75.6	74.2	78.3	73.5	74.1	74.4	70.1	72.4	65.2	64.4	62.2	62.4	60.1	63.3	64.9	65	68.4	69.8	62.5	62.9	67.8	68.5	68.5	73.7	71.8	89.7	72	72.2	89.7	72.6	75.9	78.1	71	62.2	3150
C1PB20EV03	Curve 3	PB20	Event 03	IN	7.4	squeal	09/12/11:40:13	00:04	89.7	96	95.9	88.4	94.7	93.3	108.7	63	69	78.5	77.5	71.3	78.1	76	77.9	73.8	72.3	63.5	62.7	62.8	61.5	61	65	69.1	72.9	68.5	66.9	58.5	57.2	55.6	55	57.3	58.3	61.4	51.7	62.9	46.1	45.6	41	36.3	32	23.4	17	2000
C1PB20EV04	Curve 3	PB20	Event 04	IN	7.4	squeal	09/12/11:40:28	00:03	89.4	93.7	95.8	88.1	92.4	93.2	108.6	64.4	66.5	67.5	64.9	64.5	59.7	63.4	63.4	60	70.8	59.8	59.1	58	56.6	56.1	58.7	63.7	62.3	62.7	57.3	52.4	52.6	51.5	51.3	54	58.1	56.1	47.8	55	41.5	40.8	35	32.8	25.6	20.2	15.5	2000
C1PB20EV01	Curve 4	PB20	Event 01	IN	8	squeal	09/12/11:42:58	00:07	81.8	90.2	90.9	80.8	89.2	89.0	104.4	59.8	57.7	66.2	69.3	69.9	67.9	71.5	69.1	65.9	66.8	69.4	60.9	60.3	59.4	57.7	62.8	62.7	63.2	62.8	62.5	54.3	54.9	58.3	61.1	57.7	79.8	60.3	66	63.8	61.5	66.7	61.5	58.6	58.1	51.3	42.5	2000
C1PB20EV02	Curve 4	PB20	Event 02	IN	8	squeal	09/12/11:43:13	00:05	91	105	103.8	90.0	104.0	101.9	117.3	59.8	62.1	70.5	67.9	71.4	67.1	67.6	67.8	67.5	63.5	66.3	58.2	58.2	56.8	57	56	66.6	68.9	65	66.7	68.9	59.2	55.3	54.7	55	54.1	89.7	61.3	53.1	61.8	52.6	49.4	48	46.5	44.2	45.1	38.5	2000
C1PB20EV01	Curve 5	PB20	Event 01	IN	3.3	flanging	09/12/11:43:14	00:08	93.5	102.5	98.8	88.7	97.7	89.2	104.6	51.3	50.9	54.9	66.7	65.9	69.7	67.9	72	71.8	82.5	92.3	82	82.6	78.2	81	79.4	80.4	84.6	83.9	84.8	81.1	79.8	78.9	83	83.9	82.2	82.7	82	80.8	78.9	78.1	78.3	75.9	69.3	62.3	2000
C1PB20EV02	Curve 5	PB20	Event 02	IN	3.3	squeal	09/12/11:44:14	00:06	83.1	90.9	90.2	79.3	86.1	80.6	96.0	67.3	71.1	77.4	76.7	75.8	76.7	76.8	76.6	76	72	67.4	65.6	65.7	64.7	62.2	60.8	62.8	60.8	60.9	63.6	59.1	57.7	57.7	56.2	54.5	55	53.9	57.9	82	43.6	39.1	47.6	31.3	29.7	21.2	17.7	4000
C1PB20EV03	Curve 5	PB20	Event 03	IN	3.3	squeal	09/12/11:44:29	00:04	82.7	88.7	90.2	77.9	83.9	80.6	96.0	62.7	66.7	71.9	71.5	70.7	70.3	70.6	71.1	69.1	67.8	66.8	64	63.7	61.8	58.8	57.4	58.7	56	58.1	61.6	55.4	54.7	53.4	53	53.1	81.5	54.6	47.7	54	42.3	38.9	33.9	29.2	24.8	19.6	17.2	2000
C1PB20EV04	Curve 5	PB20	Event 04	IN	3.3	squeal	09/12/11:45:20	00:04	80	88	88	77.2	83.2	78.4	93.8	48.7	53.1	56.7	59.2	59.9	58.3	58.6	59.7	59.2	62.3	60.7	61.6	61.9	62.3	59.8	59.7	64.1	59.2	60.6	62.8	56.8	56.9	57.1	56.7	56.4	80.4	57	58.7	62	54.6	62.7	57	54.6	53.3	47.4	36.9	2000
C1PB20EV05	Curve 5	PB20	Event 05	IN	3.3	squeal	09/12/11:45:39	00:04	88	94	97.3	83.2	89.2	87.7	103.1	57	51.7	54.3	57.6	58.8	56.5	57.4	59.1	59.6	61.5	60.1	62.3	65.5	67.5	58.7	60.6	63.1	58.4	58.3	60.2	55.5	53.8	53	51.7	51.5	83.6	83.6	47.4	48.5	47.5	36	31.9	28.8	26.1	21.4	17.5	2500
C1PE21EV01	Curve 3	PB21	Event 01	OUT	7.4	flanging	09/12/12:12:25	00:04	94.8	101	98.4	93.5	99.7	95.8	111.2	43.5	52.4	58	65.9	68.1	66.5	72.1	77	75.3	84.8	93.7	83.8	82.9	78.8	79.8	81.7	83.4	85.4	85.6	83.9	82.7	78.8	78.4	81.6	84	85.5	83.9	84.4	82.9	82.8	81.4	80.9	81.2	78.6	72.5	67.5	2000
C1PE21EV01	Curve 4	PB21	Event 01	IN	8	flanging	09/12/12:00:14	00:05	93.8	100.8	97.8	92.8	99.8	95.9	111.1	67.6	64.5	61.6	62.9	63.3	63.5	67	67.8	70.1	78.1	78	80.8	83.7	82.6	79.9	79	77.7	77	80.2	81.8	83.5	82.3	81.8	82.5	85.2	83.2	80.7	82.4	80.5	71.8	66.1	5000
C1PE21EV01	Curve 5	PB21	Event 01	IN	3.3	flanging	09/12/11:59:09	00:03	96.9	101.3	100.8	92.1	96.5	91.2	106.6	67.6	63.5	61.5	61.8	66.2	57.6	58.7	65.9	69.4	76.3	74.5	79.6	79	75.2	73.6	79.4	76.5	82.1	83.1	84.1	78.2	81.4	78.3	77.4	83.4	85	84.6	85.6	88.4	91.3	82.7	80.5	81.8	79.2	74.3	67	5000
C1PE22EV01	Curve 2	PB22	Event 01	IN	8.3	flanging	09/12/12:12:09	00:05	98	105.4	104.5	97.2	104.6	102.9	118.3	52.9	59.3	58	67	64.8	64.7	70.5	74.6	75.2	83.2	90.7	84.1	84	80.4	83.6	85.3	86.3	91.6	90.5	88.9	88.3	84.8	82.2	83.1	82.6	84.5	84.4	84.2	84.4	82.4	83	80.8	83.3	79.2	73.8	66.9	5000
C1PE22EV01	Curve 4	PB22	Event 01	IN	8	flanging	09/12/12:11:58	00:03	92.3	97.4	95.7	91.3	96.4	93.8	109.2	45.9	47.3	48.1	66.6	68.8	66.9	70	73.9	76.2	87.9	98.9	80.2	79.5	79.5	80.6	80.9	83.8	86	84.3	81.3	79.6	77.7	77	80.1	80.4	82.3	80.8	82.8	80.8	80.6	79.6	80.1	78.2	80.6	77.2	70.4	64.7	2000
C1PE23EV01	Curve 1	PB23	Event 01	OUT	8.2	flanging	09/12/10:49:55	00:04	96.1	102	101	95.2	101.1	99.3	114.7	42.1	48.2	55	67.3	69.5	64.8	69.4	72.9	70.9	83.4	94.8	83.2	81.5	77.3	78.6	78.5	80.8	84.4	84.1	84.5	81	77.2	75.7	78.7	81.8	81.4	82.5	85.3	89.2	87.8	84.8	84.5	85	81.5	77.3	70.1	4000
C1PE23EV02	Curve 1	PB23	Event 02	OUT	8.2	squeal	09/12/10:50:11	00:01	87.4	85.1	90.3	86.5	84.2	88.6	104.0	48.2	43.4	65.7	62	55	54.3	48.3	54.7	59.3	60.7	64.5	76.1	62.1	60.5	62.2	63.2	63.3	63.3	58.6	55.8	55.5	57.9	62.8	85.9	72.1	58.9	60.6	52.7	49.8	44.1	41.2	36.2	28	21.9	2000
C1PE23EV03	Curve 1	PB23	Event 03	OUT	8.2	flanging	09/12/10:50:16	00:02	85.4	88.7	93.5	84.5	87.8	91.8	107.2	51.4	42.9	64.8	70.3	59.5	58.1	57.8	56.2	59.8	66.2	69.5	68.3	69.2	64.2	65.6	66.6	66.6	66.9	68.3	70	63	61.2	62.4	65.9	65.2	75.1	65.4	61.5	69.6	77.7	72	67.3	71.3	69.5	62.8	55	3150
C1PE23EV04	Curve 1	PB23	Event 04	OUT	8.2	squeal	09/12/10:50:28	00:01	88.9	86.7	92	88.0	85.8	90.3	105.7	50.9	50	59	63	57.6	56.1	55	53.5	56.5	60.7	62	62.2	61.6	61.1	62.6	64.1	64.6	64.2	64.5	67.1	60.8	59.2	61.6	59.5	62	63.6	60.4	65.1	87.7	54.8	50.8	58.8	44.9	42	33.7	26.3	4000
C1PE23EV05	Curve 1	PB23	Event 05	OUT	8.2	squeal	09/12/10:50:31	00:01	91.6	88.6	95.2	90.7	87.7	93.5	108.9	48.3	47.7	56.2	63.2	56	51.4	57	50.9	58.6	58.4	60.6	64	61.6	59.1	60.3	64.2	68.2	63.9	62.6	65.5	60	57.9	57.2	60.1	64	91	60.7	58.8	63	54.4	54.5	49.7	44.5	39.4	32.7	25.2	2000
C1PE21EV02	Curve 2	PB21	Event 01	IN	3.1	squeal	09/12/10:49:41	00:06	90.7	98.5	102.5	85.6	93.4	92.3	107.7	45.4	51.2	55.1	59	61.9	56.5	63	63.4	67.8	69.2	69.3	66.4	64.3	64.9	66.2	70	73.1	72.8	73.9	77.4	77.7	69.3	65.3	67.8	67.7	68.9	69.1	62.5	60.7	55.7	52.1	46.4	41.5	36.6	29.3	20.7	5000
C1PE23EV02	Curve 2	PB23	Event 02	IN	3.1	squeal	09/12/10:50:14	00:07	87.2	95.6	96.9	82.1	90.5	86.7	102.1	68.1	65.5	62.6	58.7	59.8	59.5	60.2	57.5	59	62.3	62.3	62.1	61.2	62.4	66.7	68.7	79.3	73.9	70.5	76.8	79.3	75.2	78.7	84	68.2	73.3	68.5	65.8	61.2	58.6	53.7	49.2	43.8	38.2	30.1	23.3	1250
C1PE23EV01	Curve 3	PB23	Event 01	OUT	12.6	squeal	09/12/10:42:17	00:08	74.7	83.7	82.3	75.7	84.7	84.3	99.7	48.4	52.5	52.4	52.1	52.5	48.8	59.6	52.1	53.7	65.9	58.4	63.5	58.7	57.7	55.3	55.6	59	61.2	58.6	57.6	52.6	49	47.7	48.3	49.4	73.2	50.5	47.4	48	41	36.8	31.8	34.3	30.8	18.7	14.7	2000
C1PE23EV02	Curve 4	PB23	Event 02	IN	12.6	braking	09/12/10:42:50	00:07	68.5	76.9	73.4	69.5	77.9	75.4	90.8	43.6	44.3	45.6	46.2	46.6	46.1	52.7	46.6	49	64.4	53.6	57.8	52.1	52.3	53.4	54.8	57.6	58.3	52.6	52.9	53.5	52.2	53.4	54.4	57.6	58.3	58.3	62.8	55.8	55.2	47.6	42	36.9	27	5000
C1PE23EV01	Curve 4	PB23	Event 01	OUT	8	squeal	09/12/10:39:43	00:09	88.8	98.4	97.9	87.8	97.4	96.0	111.4	67.3	65.4	62.7	57	55.7	54.4	57.5	57.3	59	60.8	60.5	63.2	56.9	58.3	58.1	70.4	70.3	66.1	66.2	70.4	57.3	58.9	55.4	55.5	53.9	87.5	63.4	51.7	61.4	50.2	48.2	46	46.1	47.5	39	29.9	2000
C1PE23EV02	Curve 4	PB23	Event 02	IN	8	squeal	09/12/10:40:25	00:08	88.3	97.4	96.4	87.3	96.4	95.0	110.4	57.5	54.2	51.3	52.3	52.4	50.4	49.9	49.9	52.2	52.4	56.4	53.7	53.8	54.4	53.6	57.8	60.2	53.5	53.8	54.4	53.1	53.5	53.2	87.1	53.2	49.7	53.1	54.9	43.3	49.1	37.7	34.9	30.7	23.5	17.6	2000
C1PE23EV03	Curve 4	PB23	Event 03	OUT	8	squeal	09/12/10:41:00	00:06	81.5	89.3	89.5	80.5	88.3	87.6	103.0	55.4	54.2	53.7	50.7	50.4	49.1	51.4	52.9	54.8	54	57.6	55.8	54.4	54.8	54.7	56.4	71.3	69	65.6	71	61.5	61.2	58	57.8	56.2	79.8	57.8	51.4	52.2	44.7	41.7	37.2	35	30.4	22	16.6	2000
C1PE23EV01	Curve 5	PB23	Event 01	OUT	3.3	flanging	09/12/10:37:49	00:02	87.5	91.3	92.1	82.7	86.5	82.5	97.9	47.5	53	57	60.2	72.2	67.2	80.5	70.8	71.3	82.3	77.5	80.7	78.5	78.5	77.4	76.5	76.3	79	77.6	79.1	74.3	70.2	69.7	67.6	67.6	80.8	69.3	63.4	63.2	63.1	58.5	61.3	62.8	59.9	55.3	46.8	2500
C1PE23EV04	Curve 5	PB23	Event 04	OUT	3.3	squeal	09/12/10:38:32	00:04	94.5	99.4	99.3	89.5	94.4	93.3	109.0	54.4	55.6	58.2	63.3	64.9	62.4	63.3	64.2	63.1	68.8	67.9	69.4	67.2	67.7	65.5	64.4	73.9	71.7	65.5	64.4	73.9	61.2	62.4	59.4	58.6	58.3	86.8	68.5	51.5	58.5	45.9	44	42.1	35.3	30.9	20.9	17.4	2000
C1PE23EV03	Curve 5	PB23	Event 03	OUT	3.3	squeal	09/12/10:20:46	00:04	93.5	99.4	99.6	88.7	94.6	90.0	105.4	52.8	54.7	53.9	52.8	53.7	54.6	54.4	56	59.6	62.4	73.6	64.8	61.5	62.1	62.7	67.4	72	66.8	64.3	73.7	61.7	62.5	59.9	57.9	57.9	57.4	66.2	92.2	75.7	78.7	63.8	50.4	44.9	39.1	30.4	26.3	3150
C1PE24EV01	Curve 1	PB24	Event 01	IN	8.2	flanging	09/12/12:06:47	00:04	100.5	108	106.2	99.6	105.1	104.5	119.9	57.9	53.5	56.4	60	64.1	61	78.3	69.8	67.2	88.5	80.9	78.8	78.8	71.7	69.5	71.2	71.5	77.2	76.1	78.1	75.2	77.3	73.7	91.7	92.2	82.8	91.7	92.9	85.4	84.8	90.9	83.1	84.5	83.4	76.3	73	3150
C1PE24EV02	Curve 1	PB24	Event 02	IN	8.2	flanging	09/12/12:07:55	00:04	97.3	103.1	100.8	96.0	102.5	98.6	113.5	55.2	60.9	60.5	62	66.6	64.8	77.1	69.4	67.5	78.5	73.6	76.2	76.2	71.6	73.9	73.9	79.6	77.9	76.3	77.2	76.9	74.1	79	82.3	83.2	83.3	85.5	86.9	89.4	90.5	88.8	84.8	89.5	76.5	68.8	6300
C1PE24EV01	Curve 2	PB24	Event 01	IN	7.4	flanging	09/12/12:08:02	00:04	88.5	94.7	95.3	87.2	93.4	92.7	108.1	62	70.5	69.2	74.2	75	74.3	74.8	72.7	68.3	66.8	66.2	67.5	65.8	64	62.7	68.5	72.7	70.6	71.9	76.2	69.4	68.2	67.8	71.3	68.6	79.2	70.2	72.8	72.8	74.1	85.1	81.3	72.4	73.5	68.7	62.4	6300
C1PE24EV02	Curve 2	PB24	Event 02	IN	7.4	flanging	09/12/12:08:11	00:02	90.5	93.9	96.3	89.2	92.6	94.9	109.4	66.9	67.7	69.3	71	75	71.9	74	72.2	72.4	73.2	70.6	69.8	68	64.9	64.2	69.1	70.4	68.9	71	71.2	69.2	67.7	66.5	71.1	68.5	86.7	72.6	76	75.6	78.8	80.4	75	81.8	66.6	62.4	2000
C1PE24EV01	Curve 4	PB24	Event 01	IN	8	flanging	09/12/12:08:16	00:03	90	94.6	95.6	88.7	93.3	93.0	108.4	65.7	71.2	72.5	82.3	75.3	74.4	74.7	79.3	76.3	72.2	74.7	69.7	70.1	70.8	71	73.9	71.8	74.7	82.5	80	71.1	73.9	71.8	74.7	82.5	80	79.7	79.4	77.2	76	75.4	69	59.9	3150
C1PE24EV01	Curve 4	PB24	Event 01	IN	8	flanging	09/12/12:09:07	00:09	99.2	108.7	107	98.2	107.7	105.1	120.5	56.8	55.9	56.4	71.4	69.8	64	77.2	68.4	68.2	77.4	75.2	75.1	74.1	71.3	71.9	73.7	76.6	78.1	79.7	79.3	75.1	85.7	83.1	84.2	92.4	88.9	91.9	89.3	83.9	86.1	79.9	80.4	77	70.6	62.4	2000
C1PE24EV02	Curve 4	PB24	Event 02	IN	8	squeal	09/12/12:09:30	00:08	94.9	102.6	102.4	93.9	101.6	100.5	115.9	67.4	65.6	63.2	67.4	63.6	61.1	67.4	63.6	66	59.4	62.8	60.5	63.9	63.8	61.3	70.5	72.7	67.5	65.1	64.3	72.6	63.8	62.6	63.1	62.4	76.9	77.3	71.8	74.6	76.9	77.3	71.8	66.6	55.9	2000
C1PE24EV04	Curve 4	PB24	Event 04	IN	8	squeal	09/12/12:10:51	00:04	93.8	99.8	100.3	92.8	98.8	98.4	113.6	60.5	60	63	65.6	61.1	59.2	59.7	60.9	60.5	65.9	63.5	59.7	57.2	58.3	58.7	65.5	75.1	64.7	66.8	74.5	59.9	60.7	58.8	60.9	58.4	61.2	56.9	72.4	92.7	76.7	79.7	58.3	51.5	54.4	57.7	50.1	2000
C1PE24EV05	Curve 4	PB24	Event 05	IN	8	squeal	09/12/12:10:20	00:03	96.3	101.8	102.4	91.5	96.8	92.8	108.2	61.4	67.4	71.4	58.2	64.3	65.3	64.5	68.1	63.1	67.7	70.8	66.4	70.5	67.7	66.7	63.7	63.5	64.2	66.1	66	63.6	63.9	63.9	62.8	61.9	63.1	95.8	61.1	60.5	67.5	49.2	45.5	33.7	5000
C1PE25EV01	Curve 1	PB25	Event 01	OUT	8.2	flanging	09/12/12:04:23	00:07	88.9	98.9	98.9	87.9	98.1	96.2	114.3	53.6	55.1	57.2	65.1	75	68.8	74.6	73.3	72.4	73.2	76.2	77.3	78.4	80.4	86.6	88.9	78.2	80.8	84.2	84.1	81.3	80.3	85.4	86.3	88.9	94.1	88.6	86.3	78.5	77.6	75.8	78.8	80.4	75	81.6	62.2	3150
C1PE25EV02	Curve 1	PB25	Event 02	OUT	12.6	squeal	09/12/12:04:23	00:06	89.6	92.1	97.2	90.6	93.1	99.2	114.6	56.5	64.6	72.9	75.3	78.6	80.1	77.7	75.2	68.8	64.7	63.1	61.9	60.9	59	56	61.2	65.8	61.3	60.2	63.5	62.1	62	56.1	57.7	59.6	88.2	66.2	58.5	60.2	53.7	50.3	45.7	46.5	40.5	30.1	20.3	2000
C1PE25EV01	Curve 4	PB25	Event 01	OUT	8	squeal	09/12/12:04:21	00:05	88.5	95.3	94.5	87.5	94.3	92.6	108.0	51.9	60.8	68.2	66.9	74	69.7	69.3	72	68.8	64.3	63.8	63.9	64.5	59	59.6	70.2	70.5	67.2	71.2	69.5	62.7	61.8	59.4	59	56.7	58.8	56.1	66.5	87.3	48.7	45	55.5	36	36.6	30.3	18	4000

B.15 Operational Road Traffic Noise Assessment - June 2021

Renzo Tonin Report TL116-05F14 Moorebank IMT Road Traffic (r1)

RENZO TONIN & ASSOCIATES
inspired to achieve

Acoustics
Vibration
Structural Dynamics

MOOREBANK LOGISTIC PARK - PRECINCT EAST

Operational Road Traffic Noise Assessment - June 2021

18 June 2021

Qube Property Management Services Pty Ltd c/- Tactical Group

TL116-05F14 Moorebank IMT Road Traffic (r1)

35 1982-2017 ACOUSTIC ENGINEERING EXCELLENCE

Sydney Melbourne Brisbane Gold Coast Kuwait Singapore
Renzo Tonin & Associates ABN 29 117 462 861
Level 1/418A Elizabeth St SURRY HILLS NSW 2010 | PO Box 877 STRAWBERRY HILLS NSW 2012
P (02) 8218 0500 F (02) 8218 0501 sydney@renzotonin.com.au www.renzotonin.com.au

aaac Association of Australian Acoustical Consultants

Document details

Detail	Reference
Doc reference:	TL116-05F14 Moorebank IMT Road Traffic (r1)
Prepared for:	Qube Property Management Services Pty Ltd c/- Tactical Group
Address:	Level 15, 124 Walker Street North Sydney NSW 2060
Attention:	Fei Chen

Document control

Date	Revision history	Non-issued revision	Issued revision	Prepared	Instructed	Reviewed / Authorised
17.06.2021	First Issue	0	1	C. Weber		M. Chung

Important Disclaimers:

The work presented in this document was carried out in accordance with the Renzo Tonin & Associates Quality Assurance System, which is based on Australian/New Zealand Standard AS/NZS ISO 9001.

This document is issued subject to review and authorisation by the suitably qualified and experienced person named in the last column above. If no name appears, this document shall be considered as preliminary or draft only and no reliance shall be placed upon it other than for information to be verified later.

This document is prepared for the particular requirements of our Client referred to above in the 'Document details' which are based on a specific brief with limitations as agreed to with the Client. It is not intended for and should not be relied upon by a third party and no responsibility is undertaken to any third party without prior consent provided by Renzo Tonin & Associates. The information herein should not be reproduced, presented or reviewed except in full. Prior to passing on to a third party, the Client is to fully inform the third party of the specific brief and limitations associated with the commission.

In preparing this report, we have relied upon, and presumed accurate, any information (or confirmation of the absence thereof) provided by the Client and/or from other sources. Except as otherwise stated in the report, we have not attempted to verify the accuracy or completeness of any such information. If the information is subsequently determined to be false, inaccurate or incomplete then it is possible that our observations and conclusions as expressed in this report may change.

We have derived data in this report from information sourced from the Client (if any) and/or available in the public domain at the time or times outlined in this report. The passage of time, manifestation of latent conditions or impacts of future events may require further examination and re-evaluation of the data, findings, observations and conclusions expressed in this report.

We have prepared this report in accordance with the usual care and thoroughness of the consulting profession, for the sole purpose described above and by reference to applicable standards, guidelines, procedures and practices at the date of issue of this report. For the reasons outlined above, however, no other warranty or guarantee, whether expressed or implied, is made as to the data, observations and findings expressed in this report, to the extent permitted by law.

The information contained herein is for the purpose of acoustics only. No claims are made and no liability is accepted in respect of design and construction issues falling outside of the specialist field of acoustics engineering including and not limited to structural integrity, fire rating, architectural buildability and fit-for-purpose, waterproofing and the like. Supplementary professional advice should be sought in respect of these issues.

External cladding disclaimer: No claims are made and no liability is accepted in respect of any external wall and/or roof systems (eg facade / cladding materials, insulation etc) that are: (a) not compliant with or do not conform to any relevant non-acoustic legislation, regulation, standard, instructions or Building Codes; or (b) installed, applied, specified or utilised in such a manner that is not compliant with or does not conform to any relevant non-acoustic legislation, regulation, standard, instructions or Building Codes.

Contents

1 Introduction 4
1.1 Project overview 4
1.2 Scope of assessment 6
2 Compliance Matrix 7
3 Summary of noise objectives 8
3.1 Applicable operation noise criteria 8
3.2 Summary of EIS noise assessment 9
4 Validation of road traffic noise model 11
5 MPE road traffic noise predictions 13
6 Attended noise measurements 15
7 Conclusion 16
APPENDIX A Description of technical terms 17
APPENDIX B Unattended noise monitoring results 18

List of tables

Table 1 Compliance matrix 7
Table 2 Road Traffic Noise Assessment Criteria for Residential Land Uses 8
Table 3 Road traffic volumes and mix (from EIS) 9
Table 4 Summary of road traffic volumes (28 May to 10 June 2021) – Moorebank Avenue north of M5 interchange 11
Table 5 Summary of road traffic noise model validation – 62 Moorebank Avenue 12
Table 6 Origin destination road traffic volumes and mix 13
Table 7 Predicted MPE road traffic noise levels at representative residential receivers 14

List of figures

Figure 1 MPE Precinct, major roads and nearest sensitive receivers 5

1 Introduction

1.1 Project overview

The Sydney Intermodal Terminal Alliance (SIMTA) received approval for the construction and operation of Stages 1 and 2 of the Moorebank Precinct East (MPE) Project (SSD 6766 and SSD 7628, respectively), which together comprise the two stages of development under the MPE Concept Approval (MP10_0193).

This assessment has been conducted to assess the operational road traffic noise levels associated with MPE at the point in time when the site is 50% occupied.

Operational noise levels of road traffic on the public roads in proximity to the site are compared with the criteria and noise goals established in the NSW Road Noise Policy (RNP, EPA 2011). These are consistent with the road traffic noise goals established in the EIS.

This report addresses the following Approval Conditions. Additional details are provided in the compliance matrix (Table 1):

- SSD 6766

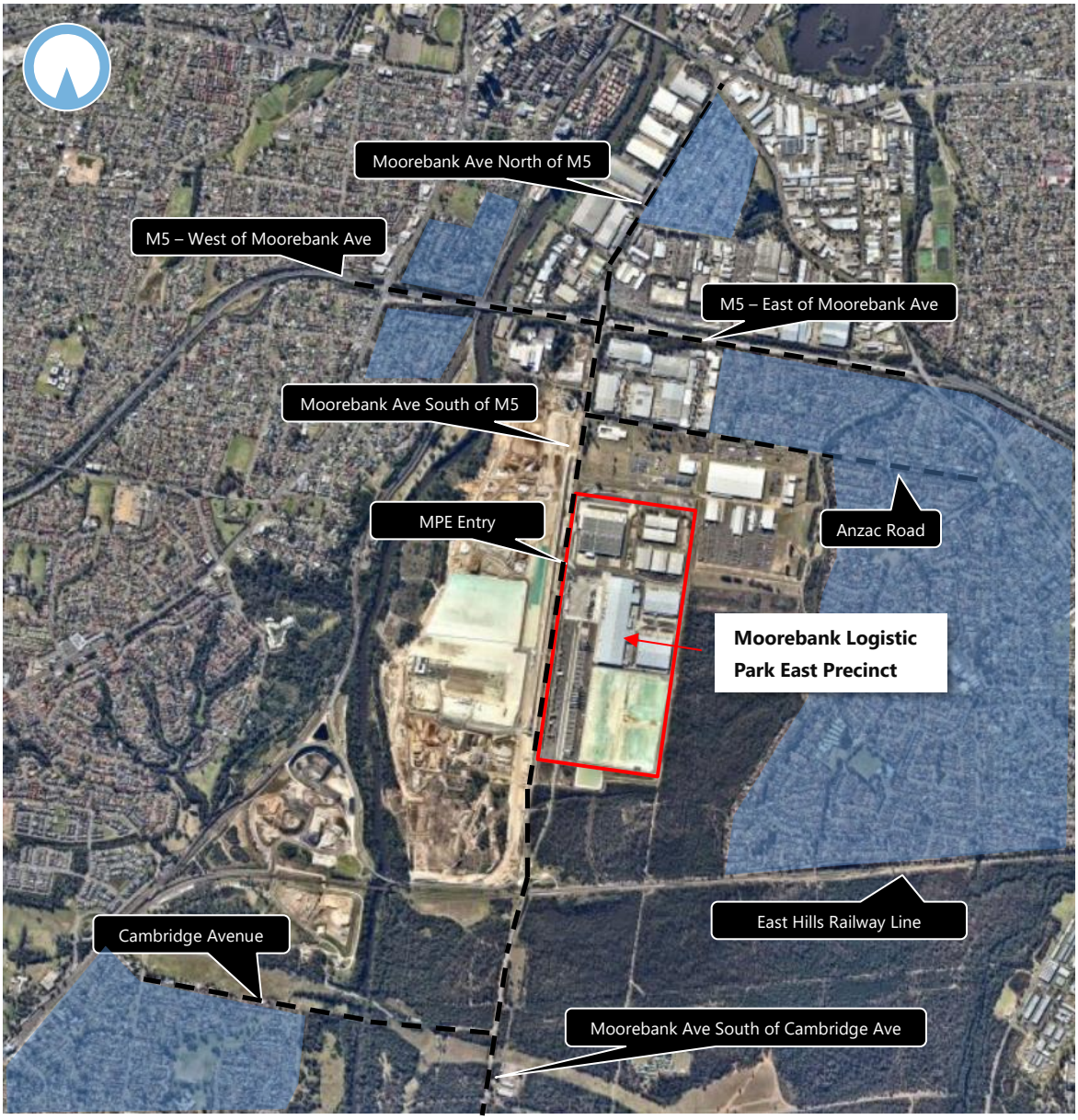
  "*Condition G15 – A review of the operational noise levels in terms of criteria and noise goals established in the NSW Road Noise Policy (EPA, 2011). Identification of additional feasible and reasonable measures that would be implemented with the objective of meeting the criteria outlined in the NSW Road Noise Policy (EPA, 2011).*"

- SSD 7628

  "*Condition B86 – A validation by predictive modelling of the operational noise levels in terms of criteria and noise goals established in the NSW RNP (EPA, 2011). Any required recalibrations of the noise model taking into consideration factors such as actual traffic numbers and heavy vehicle proportions. Operational noise monitoring is required to assess compliance with the noise criteria at a point in time when the site is 50% occupied.*"

The location of Moorebank Precinct East (MPE) in relation to the nearest representative receivers and public roads is illustrated in Figure 1.

Figure 1 MPE Precinct, major roads and nearest sensitive receivers



Note: Blue shading represents residential land use areas adjacent to public roads in proximity to MPE.

1.2 Scope of assessment

Renzo Tonin & Associates (NSW) Pty Ltd has been engaged by Tactical to assess the potential noise impact associated with project-related road traffic travelling to and from MPE, in accordance with the approval conditions. This assessment includes attended noise measurements on Moorebank Avenue (north and south of the M5 Motorway), unattended noise monitoring at a representative residential receiver location on Moorebank Avenue (north of the M5 Motorway) and a review of traffic counting results.

The purpose of the assessment is to determine if the project-related road traffic noise for traffic travelling to and from MPE is within the RNP noise criteria.

A description of technical terms used within this report is provided in Appendix A.

2 Compliance Matrix

Table 1 provides a summary of the Approval Conditions which relate to operational road traffic noise on public roads.

Table 1 Compliance matrix

Condition ID	Condition	Comments on compliance	Reference for further information
SSD 6766			
G15	Within 12 months of the commencement of operation of the project, or as otherwise agreed by the Secretary, the Applicant shall undertake operational noise monitoring to compare actual noise performance of the project against noise performance predicted in the review of noise mitigation measures predicted in documents specified under condition A1 of this approval, and prepare an Operational Noise Report to document this monitoring. The Report shall include, but not necessarily be limited to:	This report includes operational road traffic noise modelling and prediction results. These are compared with the levels presented in the EIS and the criteria in the Planning Approval conditions.	n/a
G15 a)	noise monitoring to assess compliance with the operational noise levels predicted in documents specified under condition A1 of this approval;	Noise monitoring results are presented in Sections 4 and 6.	Sections 4 and 6
G15 b)	a review of the operational noise levels in terms of criteria and noise goals established in the NSW Road Noise Policy (EPA, 2011);	The applicable noise criteria are presented in Section 3.	Section 3.
G15 f)	any required recalibrations of the noise model taking into consideration factors such as actual traffic numbers and proportions;	All noise monitoring undertaken to date has complied with the operational noise limits. On this basis, recalibration of the noise models has not been required.	n/a
B86	Within 12 months of occupation of the first warehouse, 50% occupation of the site and 100% occupation of the site, or as otherwise agreed by the Secretary, the Applicant must undertake operational noise monitoring to compare actual noise performance of the project against predicted noise performance, and prepare an Operational Noise Report to document this monitoring. The Report must include, but not necessarily be limited to:	This report has been prepared at 50% site occupancy stage. Noise monitoring results are presented in Sections 4 and 6.	Sections 4 and 6
B86 b)	a validation by predictive modelling of the operational noise levels in terms of criteria and noise goals established in the NSW RNP (EPA, 2011);	A validation of the noise prediction model is provided in Section 4.	Section 4
B86 g)	any required recalibrations of the noise model taking into consideration factors such as actual traffic numbers and heavy vehicle proportions; and	All noise monitoring undertaken to date has complied with the operational noise limits. On this basis, recalibration of the noise models has not been required.	Sections 4, 5, 6 and 7

3 Summary of noise objectives

3.1 Applicable operation noise criteria

Noise impact from the potential increase in traffic on the roads surrounding the development is assessed against the NSW 'Road Noise Policy' (RNP). The RNP sets out noise criteria to be applied to particular types of road and land uses. These noise criteria are to be applied when assessing noise impact and determining mitigation measures for sensitive receivers that are potentially affected by road traffic noise associated with the subject development, with the aim of preserving the amenity appropriate to the land use.

The assessment considers the use of different types of vehicles entering and exiting the subject site through Moorebank Avenue and potential impacts upon nearby residences, in accordance with the relevant noise criteria. Vehicles associated with the subject site will travel along the following roads on the surrounding road network, consistent with the EIS. All roads are classified as motorways, arterial roads or sub-arterial roads, with the potential noise increase being assessed over the 15-hour day (7am to 10pm) and 9-hour night (10pm to 7am) periods, accordingly.

- Moorebank Avenue, north of the M5 Motorway
- Moorebank Avenue, south of the M5 Motorway (between M5 and MPE)
- Cambridge Avenue
- Moorebank Avenue, south of Cambridge Avenue
- Anzac Road
- M5 Motorway, east of Moorebank Avenue
- M5 Motorway, west of Moorebank Avenue

These roads are identified in Figure 1.

The RNP is used to assess the potential traffic noise impact from additional traffic generated by developments. The RNP provides criteria for residential type receivers impacted by the additional traffic generated by the project. All roads around the development are categorised as motorways, arterial roads or sub-arterial roads[1] and the appropriate assessment criteria are presented in Table 2.

Table 2 Road Traffic Noise Assessment Criteria for Residential Land Uses

Road category	Type of development	Assessment criteria, dB(A)	
		Day (7am - 10pm)	Night (10pm - 7am)
Freeway/ arterial/ sub-arterial roads	Existing residences affected by additional traffic on existing freeways/ arterial/ sub-arterial roads generated by land use developments	$L_{Aeq,\ (15\ hour)}$ 60 (external)	$L_{Aeq,\ (9\ hour)}$ 55 (external)

[1] Page 10 RNP, a "collector road" is classified in the same category as a sub-arterial road

Furthermore, the RNP states the following regarding increase in traffic noise on surrounding roads due to the subject development:

> *"For existing residences and other noise sensitive land uses affected by additional traffic on existing roads generated by land use development, any increase in the total traffic noise level should be limited to 2dB above that of the corresponding 'no build option'."*

3.2 Summary of EIS noise assessment

Consistent with the operational noise criteria summarised in Section 3.1, the EIS noise and vibration assessment[2] identified that *"any increase in road traffic noise levels, at residential receivers, due to the SIMTA proposal should not exceed 2 dBA"*.

Assessment of the increase in road traffic noise levels along the M5 Motorway and Moorebank Avenue were calculated, using the Calculation of Road Traffic Noise (CoRTN) algorithm, and the following assumptions:

- Road traffic volume and mix
- Vehicle speeds (posted) of 100 km/h on the M5 Motorway and 60 km/h on Moorebank Avenue
- Typical receiver setback of 50 m along the M5 Motorway and 20 m along Moorebank Avenue.

Table 3 Road traffic volumes and mix (from EIS)

Location	Time	Current (no Development)		Current (with Development)	
		Volume	Mix	Volume	Mix
M5 Motorway East of Moorebank Avenue	Day (7.00am to 10.00pm)	91,500	10%	92,400	10%
	Night (10.00pm to 7.00am)	17,900	11%	18,200	10%
M5 Motorway West of Moorebank Avenue	Day (7.00am to 10.00pm)	107,200	10%	110,300	12%
	Night (10.00pm to 7.00am)	21,100	11%	21,700	12%
Moorebank Avenue North of M5 Motorway	Day (7.00am to 10.00pm)	26,700	10%	27,800	12%
	Night (10.00pm to 7.00am)	6,250	10%	6,410	10%
Moorebank Avenue South of M5 Motorway	Day (7.00am to 10.00pm)	14,400	6%	19,300	16%
	Night (10.00pm to 7.00am)	3,000	4%	4,100	10%

The study concluded that the project-related increase in road traffic noise levels along the M5 Motorway and along Moorebank Avenue, north of the M5 interchange are less than 2 dB(A) and therefore, comply with the relevant RNP criteria.

[2] Wilkinson Murray Report 12186-C – Sydney Intermodal Terminal Alliance Noise Assessment – Concept Plan, Section 6.3 Road Traffic Noise Assessment

In the area along Moorebank Avenue, south of the M5 interchange, road traffic noise levels were predicted to increase by approximately 3 dB(A). However, since there are no residential receivers in this area, no noise impact was expected.

4 Validation of road traffic noise model

Approval Condition B86 of SSD 7628 requires a validation of the operational road traffic prediction model. This has been performed in the current study via concurrent road traffic noise monitoring and road traffic counting at a representative residential receiver on Moorebank Avenue, north of the M5 interchange. The noise monitoring and road traffic counting were performed over a 14-day period between Thursday 27 May and Friday 11 June 2021.

An unattended noise logger was set up at a free-field location in the front yard of 62 Moorebank Avenue, 7.5 m from the edge of the nearside southbound lane. Moorebank Avenue comprises two southbound and two northbound lanes at this location.

The unattended noise monitoring was performed with a Type 1 sound level meter. A Type 1 microphone calibrator was utilised before and after the measurements to verify that the pre- and post-calibration levels were within 0.5 dB of the reference value. The noise measurements were performed in accordance with the requirements of the RNP.

Daily plots of the measured road traffic noise levels are provided in Appendix B. The noise logging results were processed to determine the $L_{Aeq(15hour)}$ daytime and $L_{Aeq(9hour)}$ night-time noise levels at the measurement position, averaged over the two-week survey period. Extraneous noise events during rain periods were excluded from the summary results. The noise monitoring results were also reviewed to identify 15-minute periods that contained siren noise from emergency services. These periods were also excluded from the summary results.

Road traffic counting was performed by Matrix Traffic and Transport Data at a position between Church Road and King Lane, along Moorebank Avenue. The traffic survey included full classification of heavy and light vehicles in both directions, summarised on an hourly basis over the 14-day survey period. The average vehicle speeds in each hour were also recorded.

A summary of the average road traffic volumes, speeds and percentage heavy vehicles is provided in Table 4.

Table 4 Summary of road traffic volumes (28 May to 10 June 2021) – Moorebank Avenue north of M5 interchange

Location	Daytime period (7am to 10pm)			Night-time period (10pm to 7am)		
	Northbound	Southbound	Total	Northbound	Southbound	Total
Number of vehicles per day	13,006	9,033	**22,039**	2,952	1,659	**4,612**
Percentage heavy vehicles	14%	16%	**14%**	16%	12%	**15%**
Average speed	59 km/h (daytime)			63 km/h (night-time)		

The average road traffic volumes, heavy vehicle mix and speeds were utilised in a CoRTN model to predict the daytime and night-time noise levels at the unattended noise logger position.

A comparison of the predicted and measured noise levels at the noise monitoring position is provided in Table 5.

Table 5 Summary of road traffic noise model validation – 62 Moorebank Avenue

Period	Measured $L_{Aeq(period)}$ noise level, dB(A)	Predicted $L_{Aeq(period)}$ noise level, dB(A)	Noise Level Difference, Predicted minus Measured, dB(A)
7.00am to 10.00pm daytime	71.3	71.6	0.3
10.00pm to 7.00am night-time	68.0	67.3	-0.7

The results in the above table identify that the difference between the measured noise levels and predicted noise levels at the noise monitoring location are within an acceptable tolerance of ± 1.0 dB(A).

This indicates that the CoRTN noise model is acceptable for predicting the overall noise levels and project-related noise increase at other representative locations near MPE.

5 MPE road traffic noise predictions

A Biannual Trip Origin and Destination Report (BTODR)[3] was prepared by Ason Group for MPE, in accordance with the requirements of Approval Condition B28 of SSD 7628.

The report provides a summary of origin destination (OD) road traffic survey results to understand the distribution of MPE traffic on the surrounding road network. The measurement data is applicable for the reporting period between 1 November 2020 and 30 April 2021.

A summary of the average day / night traffic volumes (weekdays), derived from the BTODR data is provided in Table 6.

Table 6 Origin destination road traffic volumes and mix

Location	Time	Current (excluding MPE)		Current (including MPE)	
		Volume	Mix	Volume	Mix
M5 Motorway On/Off ramps to East[1]	Day (7.00am to 10.00pm)	15,237	9%	15,543	9%
	Night (10.00pm to 7.00am)	2,510	7%	2,551	7%
M5 Motorway On/Off ramps to West[1]	Day (7.00am to 10.00pm)	34,933	10%	35,378	10%
	Night (10.00pm to 7.00am)	5,240	9%	5,331	9%
Moorebank Avenue North of M5 Motorway	Day (7.00am to 10.00pm)	33,196	10%	33,405	10%
	Night (10.00pm to 7.00am)	5,074	9%	5,113	9%
Moorebank Avenue South of M5 Motorway	Day (7.00am to 10.00pm)	33,786	8%	34,827	9%
	Night (10.00pm to 7.00am)	5,193	6%	5,376	6%
Anzac Road	Day (7.00am to 10.00pm)	16,595	6%	16,684	6%
	Night (10.00pm to 7.00am)	1,983	5%	1,987	5%
Cambridge Avenue	Day (7.00am to 10.00pm)	22,661	6%	22,722	6%
	Night (10.00pm to 7.00am)	3,978	4%	3,983	4%
Moorebank Avenue South of Cambridge Avenue	Day (7.00am to 10.00pm)	1,976	4%	1,976	4%
	Night (10.00pm to 7.00am)	290	2%	290	2%

1. The BTODR did not include road traffic volumes for the M5 Motorway. For noise modelling purposes, road traffic volumes without MPE are based on the volumes in Table 3. The road traffic volumes with MPE are based on the including and excluding MPE traffic volumes in this table.

Based on the above traffic volumes with and without the MPE traffic, calculations of road traffic noise using CoRTN have been performed at representative residential receivers along each section of road. The results are provided in Table 7.

[3] Ason Group, Biannual Trip Origin Destination Report - November 2020 - April 2021- Report P1065r03v1

Table 7 Predicted MPE road traffic noise levels at representative residential receivers

Location	Time	Typical setback distance to residential receivers, m	Predicted $L_{Aeq(period)}$ noise level, dB(A)[1]		Predicted noise increase from MPE
			Without MPE	With MPE	
M5 Motorway East of Moorebank Ave	Day (7.00am to 10.00pm)	25	64.5	64.5	0.0
	Night (10.00pm to 7.00am)	25	59.8	59.8	0.0
M5 Motorway On/Off ramps to West	Day (7.00am to 10.00pm)	25	65.2	65.2	0.0
	Night (10.00pm to 7.00am)	25	60.5	60.5	0.0
Moorebank Avenue North of M5 Motorway	Day (7.00am to 10.00pm)	10	71.7	71.8	0.1
	Night (10.00pm to 7.00am)	10	65.9	66.0	0.1
Moorebank Avenue South of M5 Motorway	Day (7.00am to 10.00pm)	n/a	No nearby residential receivers		0.3
	Night (10.00pm to 7.00am)	n/a	No nearby residential receivers		0.2
Anzac Road	Day (7.00am to 10.00pm)	6	71.9	71.9	0.0
	Night (10.00pm to 7.00am)	6	64.5	64.5	0.0
Cambridge Avenue	Day (7.00am to 10.00pm)	145	55.3	55.4	0.1
	Night (10.00pm to 7.00am)	145	49.7	49.7	0.0
Moorebank Avenue South of Cambridge Avenue	Day (7.00am to 10.00pm)	n/a	No nearby residential receivers		0.0
	Night (10.00pm to 7.00am)	n/a	No nearby residential receivers		0.0

Note: Overall noise levels are shown to 1 decimal place for the purpose of indicating the change in noise levels from MPE traffic. The accuracy of the overall noise level predictions is approximately ± 1 dB(A).

The results in the above table identify that the project-related increase in road traffic noise levels from MPE is 0.1 dB(A) or less at the nearest residential receivers.

The highest predicted increase of 0.3 dB(A) occurs in the area between the MPE site entry and the M5 interchange. It is noted that there are no residential receivers in this area.

6 Attended noise measurements

Attended noise measurements were performed at two locations on 27 May 2021 for the purpose of quantifying the noise levels of heavy vehicles entering / exiting MPE. The measurements were performed between 8:30 am and 10:30 am at the following locations.

- Near the MPE entry / exit on Moorebank Avenue (south of the M5 interchange) – opposite Target Warehouse
- Moorebank Avenue (north of the M5 interchange) – near King Lane

At each location, continuous noise measurements of road traffic noise were made. Video cameras were set up to provide a visual record of road traffic movements. These were time-synchronised with the noise recordings. The video recordings were reviewed to positively identify MPE heavy vehicles that entered / exited MPE and also passed by the Moorebank Avenue residential area, north of the M5 interchange.

The noise measurement results were post-processed to determine the noise contribution of MPE heavy vehicles in relation to non-MPE road traffic noise.

During the two-hour noise survey, 48 heavy vehicles were observed to enter / exit the MPE facility. Nine (9) MPE heavy vehicles were observed to pass the Moorebank Avenue residential area, north of the M5 interchange. The noise levels of these passbys were analysed and compared with the prevailing road traffic noise levels during the two-hour survey period and the noise increase from MPE heavy vehicles was determined to be 0.1 dB(A).

The measured traffic noise level increase of 0.1 dB(A) from MPE trucks in the residential area adjacent to Moorebank Avenue, north of the M5 interchange is consistent with the calculated 0.1 dB(A) increase presented in Table 7 and less than the 2 dB(A) allowance stipulated in Section 3.1.

7 Conclusion

The assessment presented in this report has been conducted to address the requirements of Approval Condition B86 of SSD 7628 and Approval Condition G15 of SSD 6766, and assesses the operational road traffic noise levels associated with MPE at the point in time when the subject site is 50% occupied.

This report presents the results of road traffic noise measurements and calculations at representative residential receiver locations along public roads in proximity to MPE. The measured and calculated increase in project-related road traffic noise have been compared with the 2 dB(A) allowance, derived from the NSW RNP.

Approval Condition B86 of SSD 7628 requires a validation of the operational road traffic prediction model. This has been performed in this current study via concurrent road traffic noise monitoring and road traffic counting at a representative residential receiver on Moorebank Avenue, north of the M5 interchange. The difference between the measured and predicted noise levels was less than the acceptable tolerance of ± 1.0 dB(A).

This validated noise model was subsequently utilised in conjunction with the Biannual Trip Origin and Destination Report, to understand the distribution of MPE traffic on the surrounding road network, and to predict the project-related increase in road traffic noise levels.

The project-related increase in road traffic noise levels from MPE was calculated to be 0.1 dB(A) or less at the nearest residential receivers. The highest calculated increase of 0.3 dB(A) occurs in the area between the MPE site entry and M5 interchange where there are no residential receivers in this area.

Attended noise measurements were performed in conjunction with visual observations of trucks entering / exiting MPE to directly measure the noise increase of MPE trucks over a two-hour period in the residential area on Moorebank Avenue, north of the M5 interchange. The measured noise level increase from MPE trucks was 0.1 dB(A), consistent with the noise model calculations.

It is concluded that the project-related increase in road traffic noise levels related to MPE is less than the 2 dB(A) allowance in the NSW RNP. Therefore, no re-calibration of the road traffic noise model and/or consideration of additional mitigation measures are required at this stage.

APPENDIX A Description of technical terms

The following is a brief description of the technical terms used to describe noise to assist in understanding the technical issues presented.

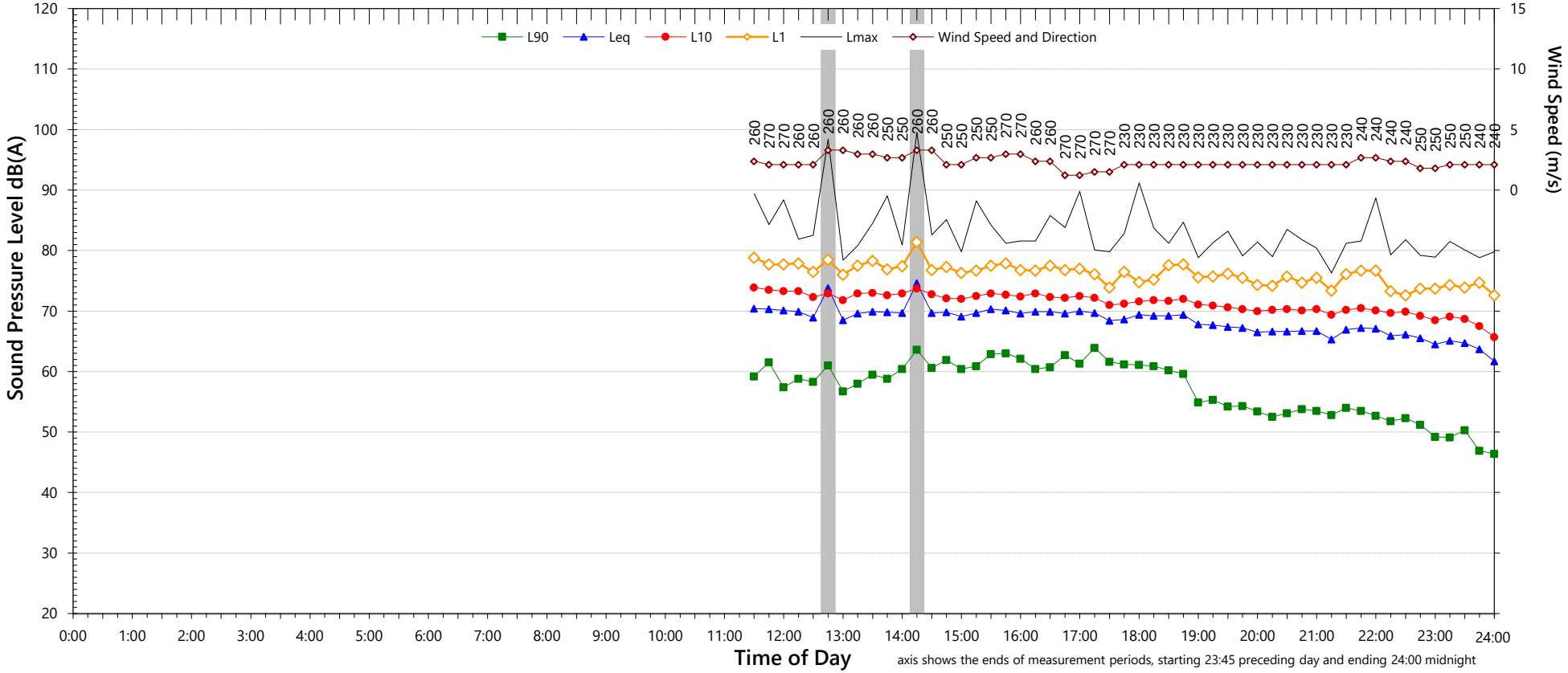
Adverse weather	Weather effects that enhance noise (that is, wind and temperature inversions) that occur at a site for a significant period of time (that is, wind occurring more than 30% of the time in any assessment period in any season and/or temperature inversions occurring more than 30% of the nights in winter).
Ambient noise	The all-encompassing noise associated within a given environment at a given time, usually composed of sound from all sources near and far.
Assessment period	The period in a day over which assessments are made.
Assessment point	A point at which noise measurements are taken or estimated. A point at which noise measurements are taken or estimated.
Background noise	Background noise is the term used to describe the underlying level of noise present in the ambient noise, measured in the absence of the noise under investigation, when extraneous noise is removed. It is described as the average of the minimum noise levels measured on a sound level meter and is measured statistically as the A-weighted noise level exceeded for ninety percent of a sample period. This is represented as the L90 noise level (see below).
Decibel [dB]	The units that sound is measured in. The following are examples of the decibel readings of every day sounds: 0dB The faintest sound we can hear 30dB A quiet library or in a quiet location in the country 45dB Typical office space. Ambience in the city at night 60dB CBD mall at lunch time 70dB The sound of a car passing on the street 80dB Loud music played at home 90dB The sound of a truck passing on the street 100dB The sound of a rock band 115dB Limit of sound permitted in industry 120dB Deafening
dB(A)	A-weighted decibels. The A- weighting noise filter simulates the response of the human ear at relatively low levels, where the ear is not as effective in hearing low frequency sounds as it is in 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.
dB(C)	C-weighted decibels. The C-weighting noise filter simulates the response of the human ear at relatively high levels, where the human ear is nearly equally effective at hearing from mid-low frequency (63Hz) to mid-high frequency (4kHz), but is less effective outside these frequencies.
Frequency	Frequency is synonymous to pitch. 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.
Impulsive noise	Having a high peak of short duration or a sequence of such peaks. A sequence of impulses in rapid succession is termed repetitive impulsive noise.
Intermittent noise	The level suddenly drops to that of the background noise several times during the period of observation. The time during which the noise remains at levels different from that of the ambient is one second or more.
LMax	The maximum sound pressure level measured over a given period.
LMin	The minimum sound pressure level measured over a given period.

APPENDIX B Unattended noise monitoring results

Unattended Noise Monitoring Results

62 Moorebank Avenue - Front Yard

Thursday, 27 May 2021



NSW Noise Policy for Industry (Free Field)			
Descriptor	Day[2]	Evening[3]	Night[4 5]
L_{A90} ABL	-	53	45
L_{Aeq}	-	67	66

Night Time Maximum Noise Levels			(see note 7)
L_{AFMax} (Range)	79	to	93
L_{AFMax} - L_{Aeq} (Range)	15	to	23

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	Day	Night[5]
	7am-10pm	10pm-7am
$L_{Aeq\ 15\ hr}$ and $L_{Aeq\ 9\ hr}$	-	-
$L_{Aeq\ 1hr}$ upper 10 percentile	-	-
$L_{Aeq\ 1hr}$ lower 10 percentile	-	-

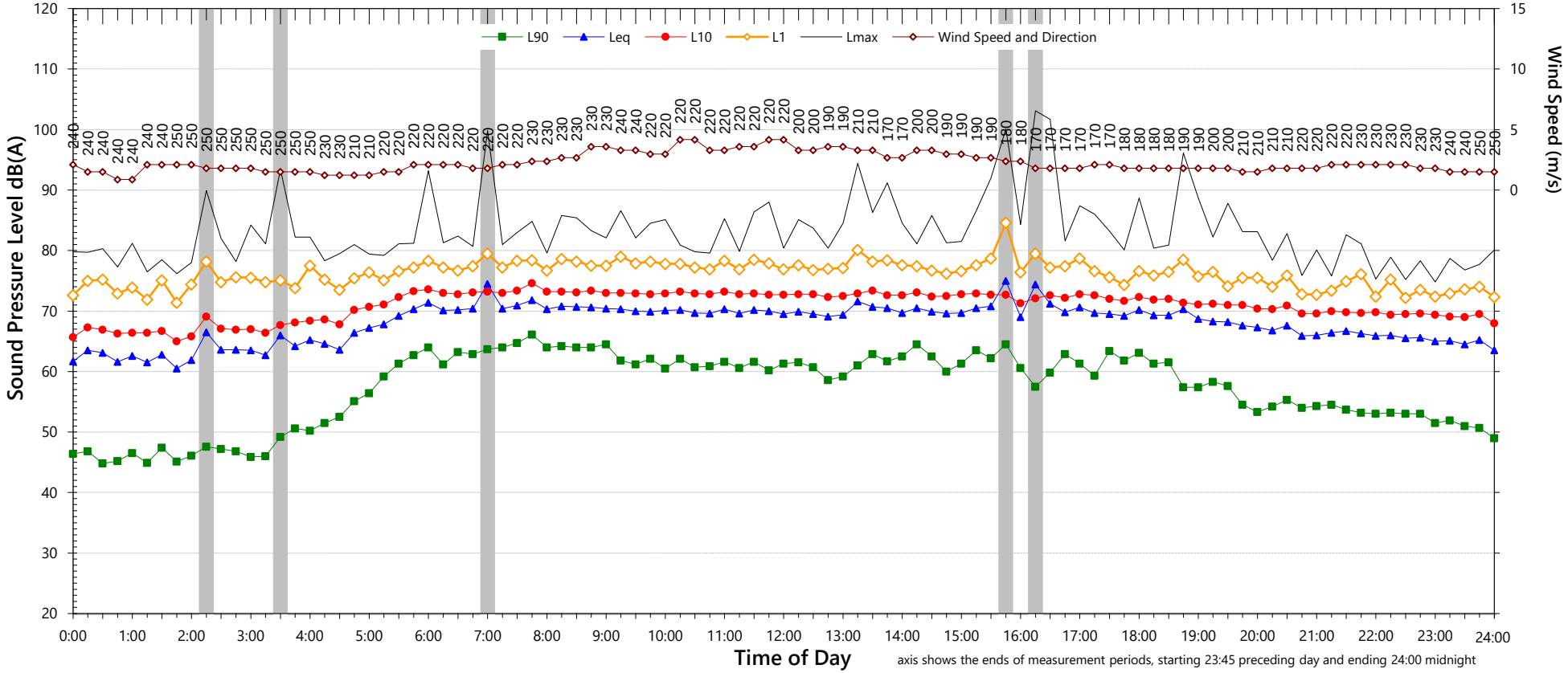
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am till 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. 1-hour values for L_{AFMax} are shown only where L_{AFMax} >65dB(A) and where L_{AFMax}- L_{Aeq} ≥15dB(A)

Unattended Noise Monitoring Results

62 Moorebank Avenue - Front Yard

Friday, 28 May 2021



NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{A90} ABL	60	53	45
L_{Aeq}	70	68	64

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{Aeq\ 15\ hr}$ and $L_{Aeq\ 9\ hr}$	72	67
$L_{Aeq\ 1hr}$ upper 10 percentile	73	68
$L_{Aeq\ 1hr}$ lower 10 percentile	70	64

Night Time Maximum Noise Levels			(see note 7)
L_{AFMax} (Range)	80	to	86
L_{AFMax} - L_{Aeq} (Range)	15	to	23

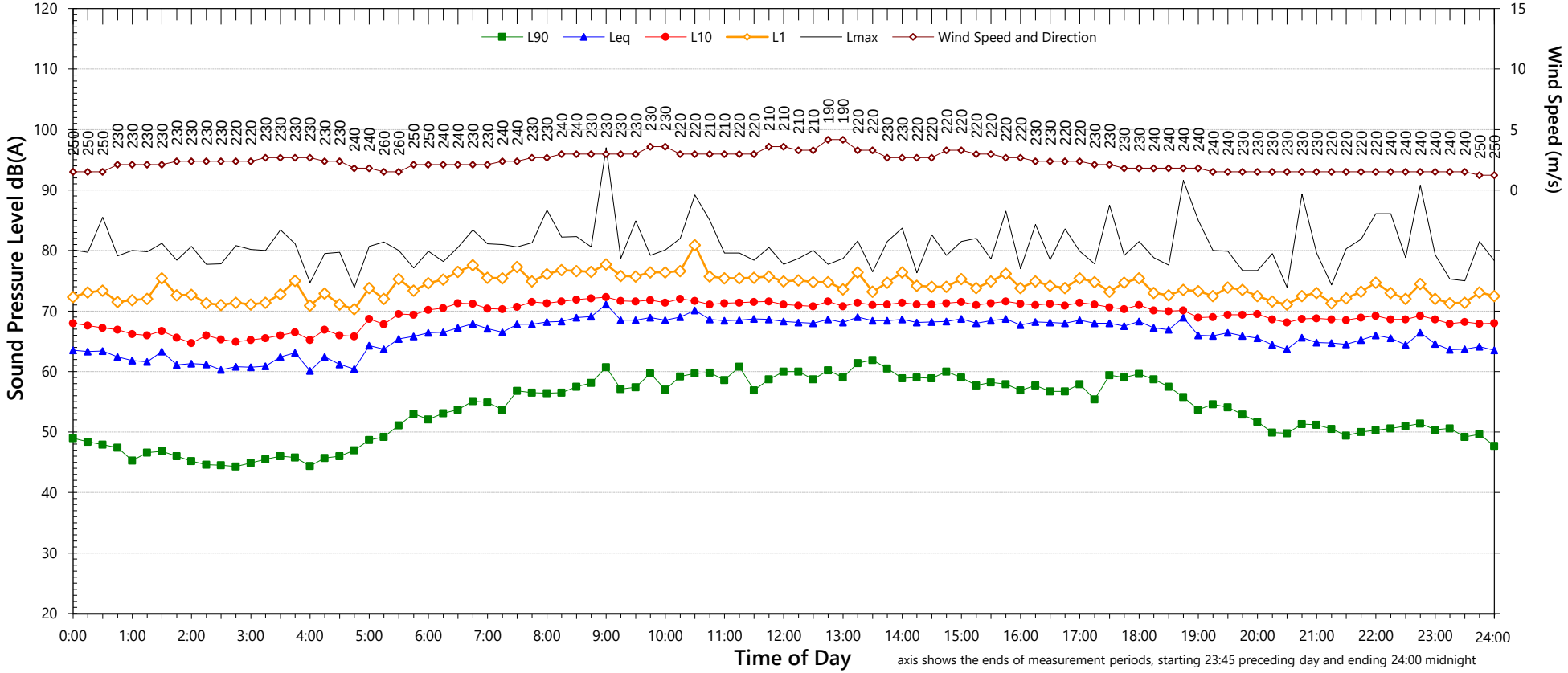
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am till 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. 1-hour values for L_{AFMax} are shown only where L_{AFMax} >65dB(A) and where L_{AFMax}- L_{Aeq} ≥15dB(A)

Unattended Noise Monitoring Results

62 Moorebank Avenue - Front Yard

Saturday, 29 May 2021



NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{A90} ABL	57	50	43
L_{Aeq}	68	66	63

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{Aeq\ 15\ hr}$ and $L_{Aeq\ 9\ hr}$	70	65
$L_{Aeq\ 1hr}$ upper 10 percentile	71	67
$L_{Aeq\ 1hr}$ lower 10 percentile	68	62

Night Time Maximum Noise Levels			(see note 7)
L_{AFMax} (Range)	78	to	91
L_{AFMax} - L_{Aeq} (Range)	16	to	26

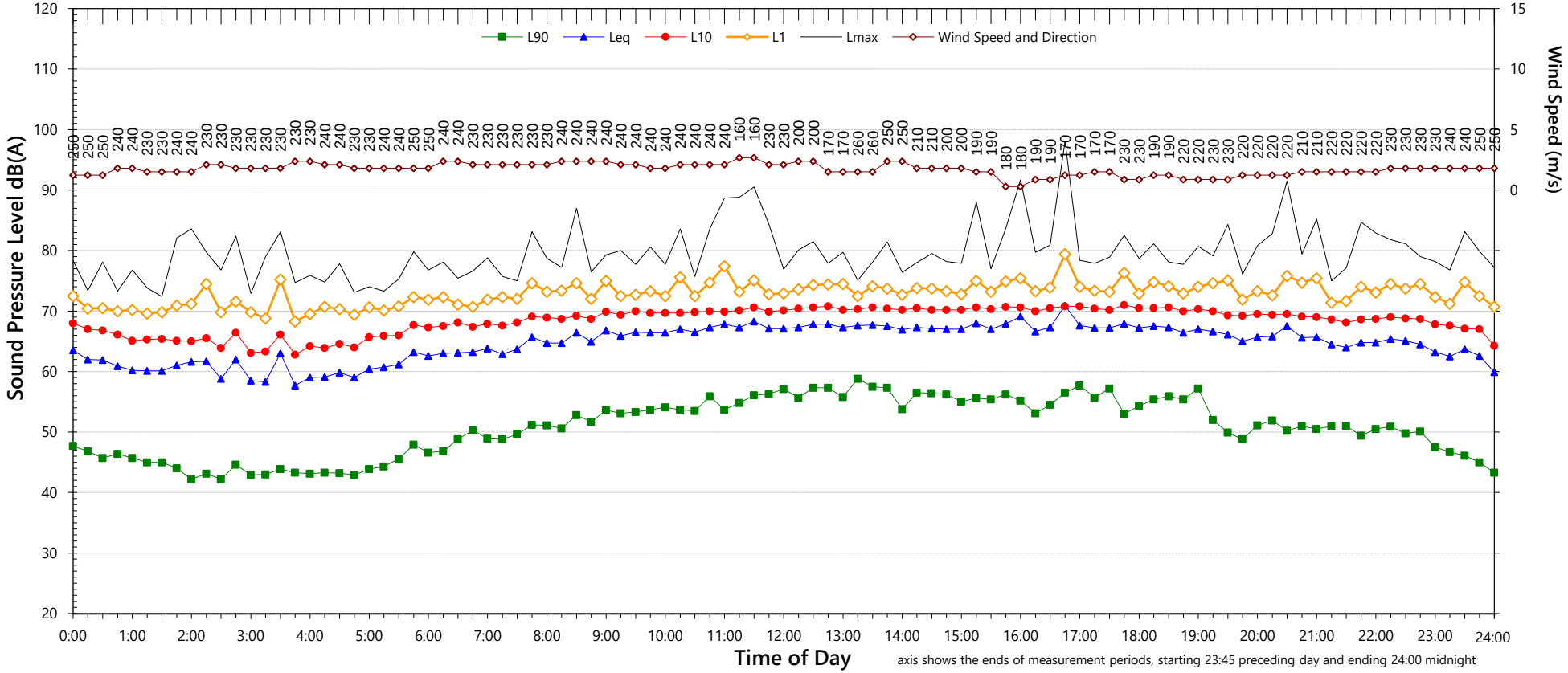
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am till 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. 1-hour values for L_{AFMax} are shown only where L_{AFMax} >65dB(A) and where L_{AFMax}- L_{Aeq} ≥15dB(A)

Unattended Noise Monitoring Results

62 Moorebank Avenue - Front Yard

Sunday, 30 May 2021



NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{A90} ABL	53	50	40
L_{Aeq}	67	66	65

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{Aeq\ 15\ hr}$ and $L_{Aeq\ 9\ hr}$	69	68
$L_{Aeq\ 1hr}$ upper 10 percentile	70	72
$L_{Aeq\ 1hr}$ lower 10 percentile	68	63

Night Time Maximum Noise Levels			(see note 7)
L_{AFMax} (Range)	81	to	88
L_{AFMax} - L_{Aeq} (Range)	17	to	23

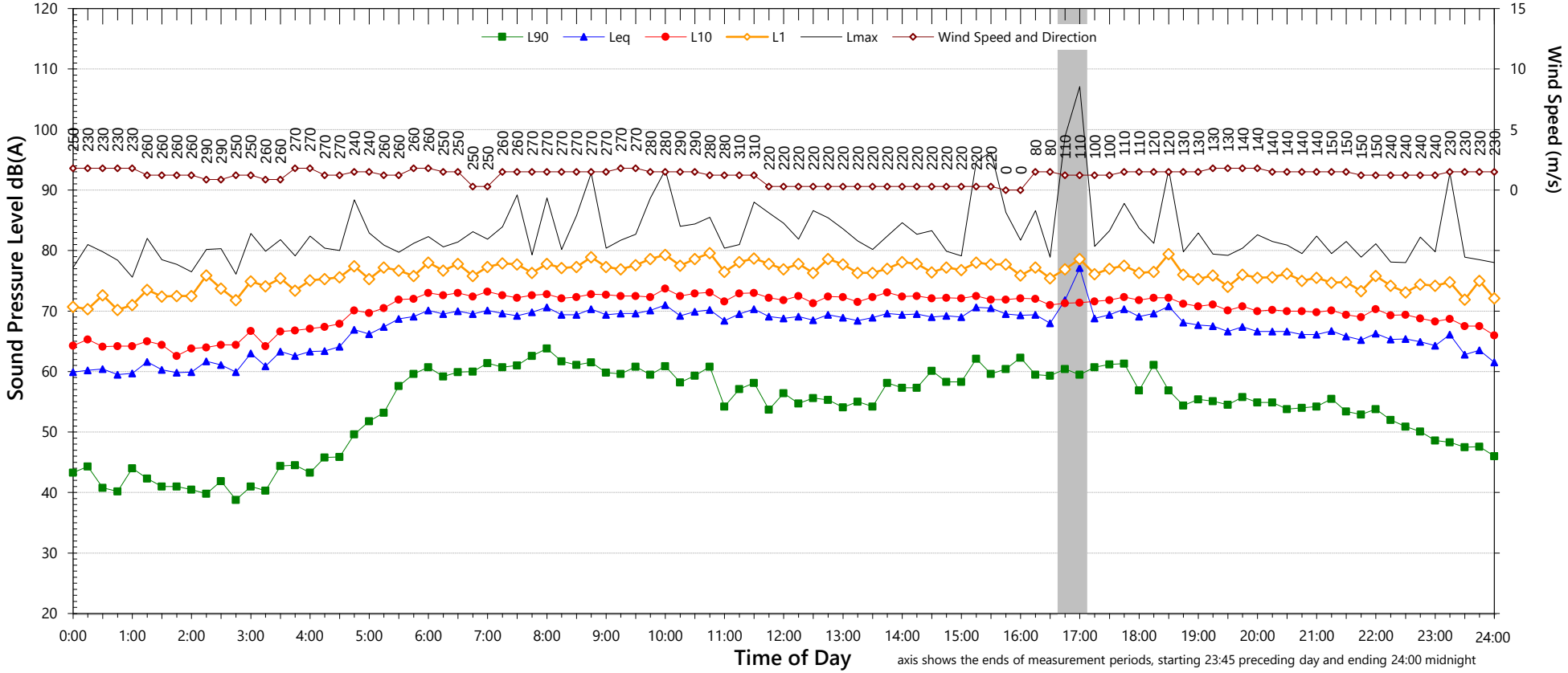
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am till 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. 1-hour values for L_{AFMax} are shown only where L_{AFMax} >65dB(A) and where L_{AFMax}- L_{Aeq} ≥15dB(A)

Unattended Noise Monitoring Results

62 Moorebank Avenue - Front Yard

Monday, 31 May 2021



NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{A90} ABL	55	54	41
L_{Aeq}	70	67	66

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{Aeq\ 15\ hr}$ and $L_{Aeq\ 9\ hr}$	72	69
$L_{Aeq\ 1hr}$ upper 10 percentile	72	72
$L_{Aeq\ 1hr}$ lower 10 percentile	69	64

Night Time Maximum Noise Levels			(see note 7)
L_{AFMax} (Range)	81	to	93
L_{AFMax} - L_{Aeq} (Range)	17	to	29

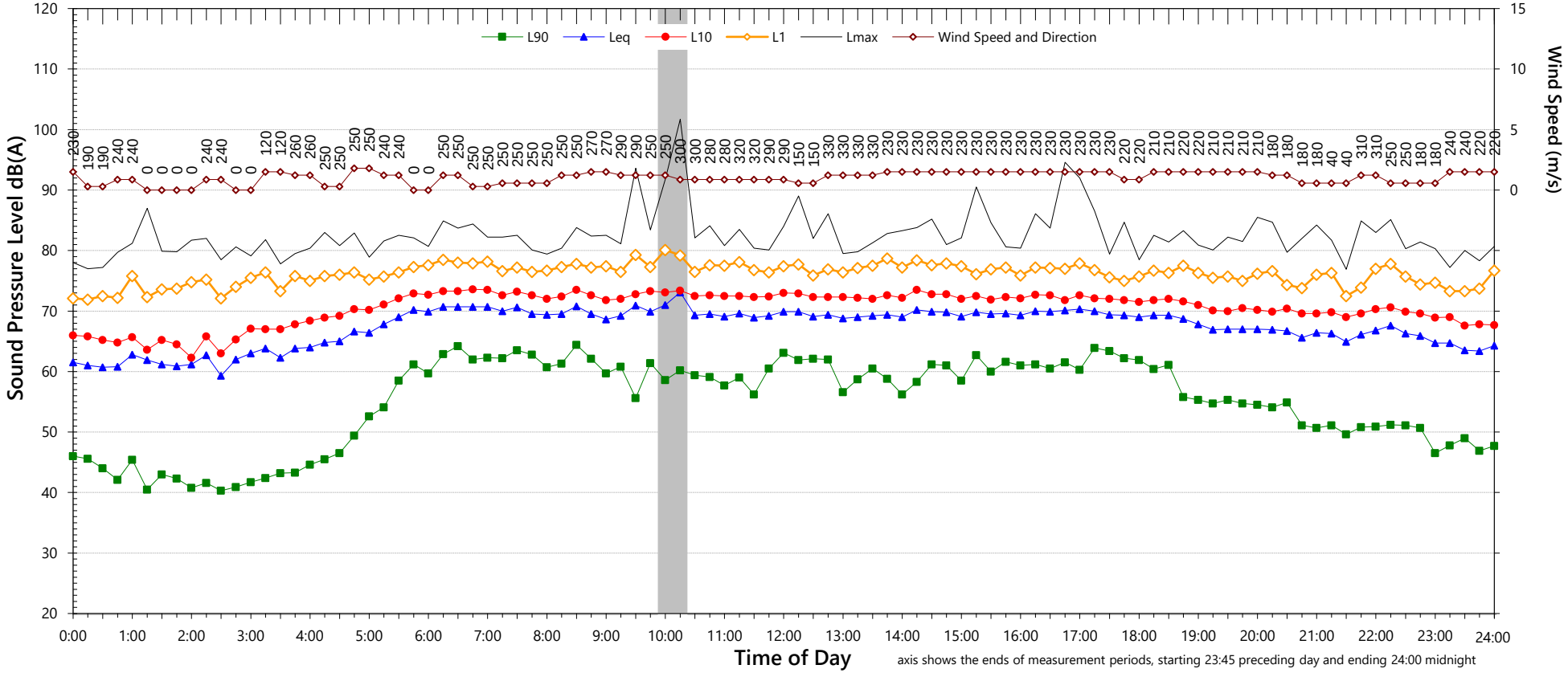
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am till 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. 1-hour values for L_{AFMax} are shown only where L_{AFMax} >65dB(A) and where L_{AFMax}- L_{Aeq} ≥15dB(A)

Unattended Noise Monitoring Results

62 Moorebank Avenue - Front Yard

Tuesday, 1 June 2021



NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{A90} ABL	58	51	41
L_{Aeq}	70	67	66

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{Aeq\ 15\ hr}$ and $L_{Aeq\ 9\ hr}$	72	69
$L_{Aeq\ 1hr}$ upper 10 percentile	72	72
$L_{Aeq\ 1hr}$ lower 10 percentile	69	64

Night Time Maximum Noise Levels			(see note 7)
L_{AFMax} (Range)	81	to	88
L_{AFMax} - L_{Aeq} (Range)	17	to	22

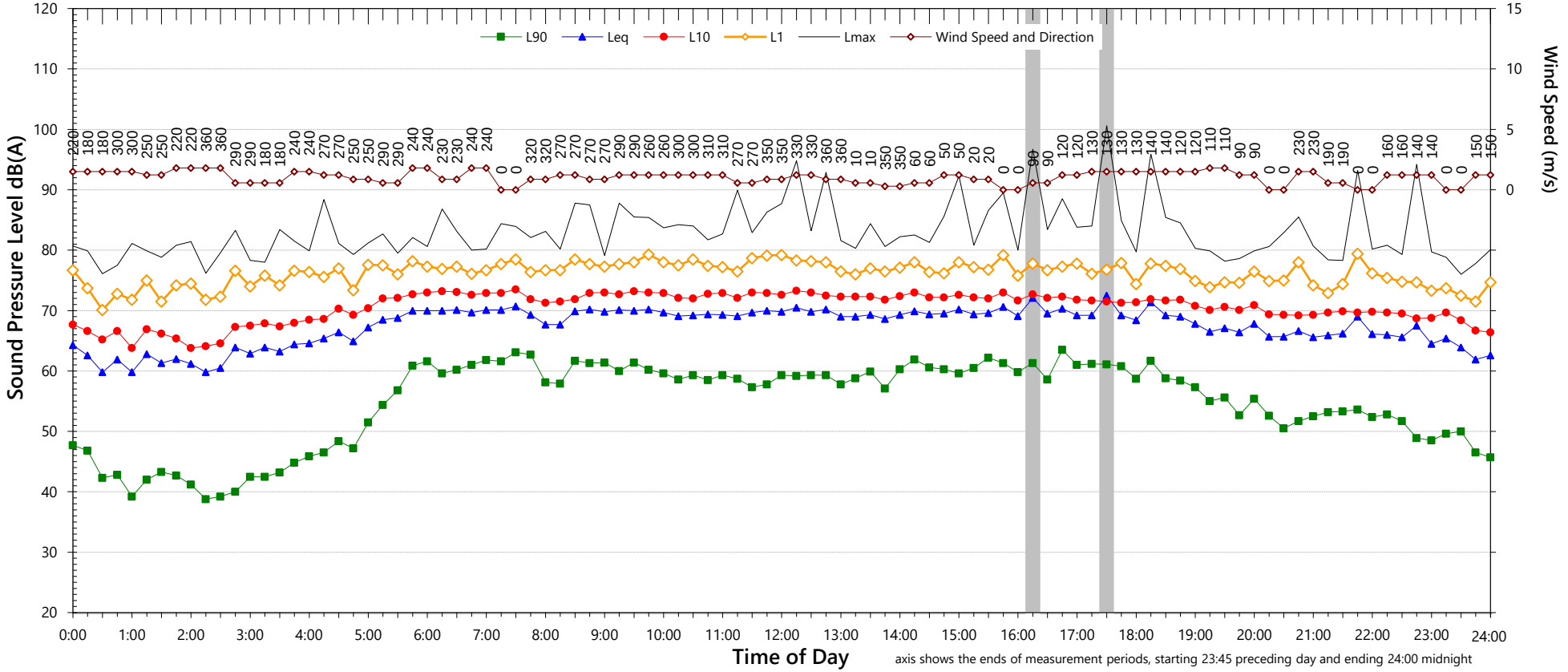
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am till 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. 1-hour values for L_{AFMax} are shown only where L_{AFMax} >65dB(A) and where L_{AFMax}- L_{Aeq} ≥15dB(A)

Unattended Noise Monitoring Results

62 Moorebank Avenue - Front Yard

Wednesday, 2 June 2021



NSW Noise Policy for Industry (Free Field)			
Descriptor	Day[2]	Evening[3]	Night[4 5]
L_{A90} ABL	58	52	43
L_{Aeq}	70	68	66

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	Day	Night[5]
	7am-10pm	10pm-7am
$L_{Aeq\ 15\ hr}$ and $L_{Aeq\ 9\ hr}$	72	68
$L_{Aeq\ 1hr}$ upper 10 percentile	72	72
$L_{Aeq\ 1hr}$ lower 10 percentile	69	64

Night Time Maximum Noise Levels			(see note 7)
L_{AFMax} (Range)	80	to	94
L_{AFMax} - L_{Aeq} (Range)	16	to	28

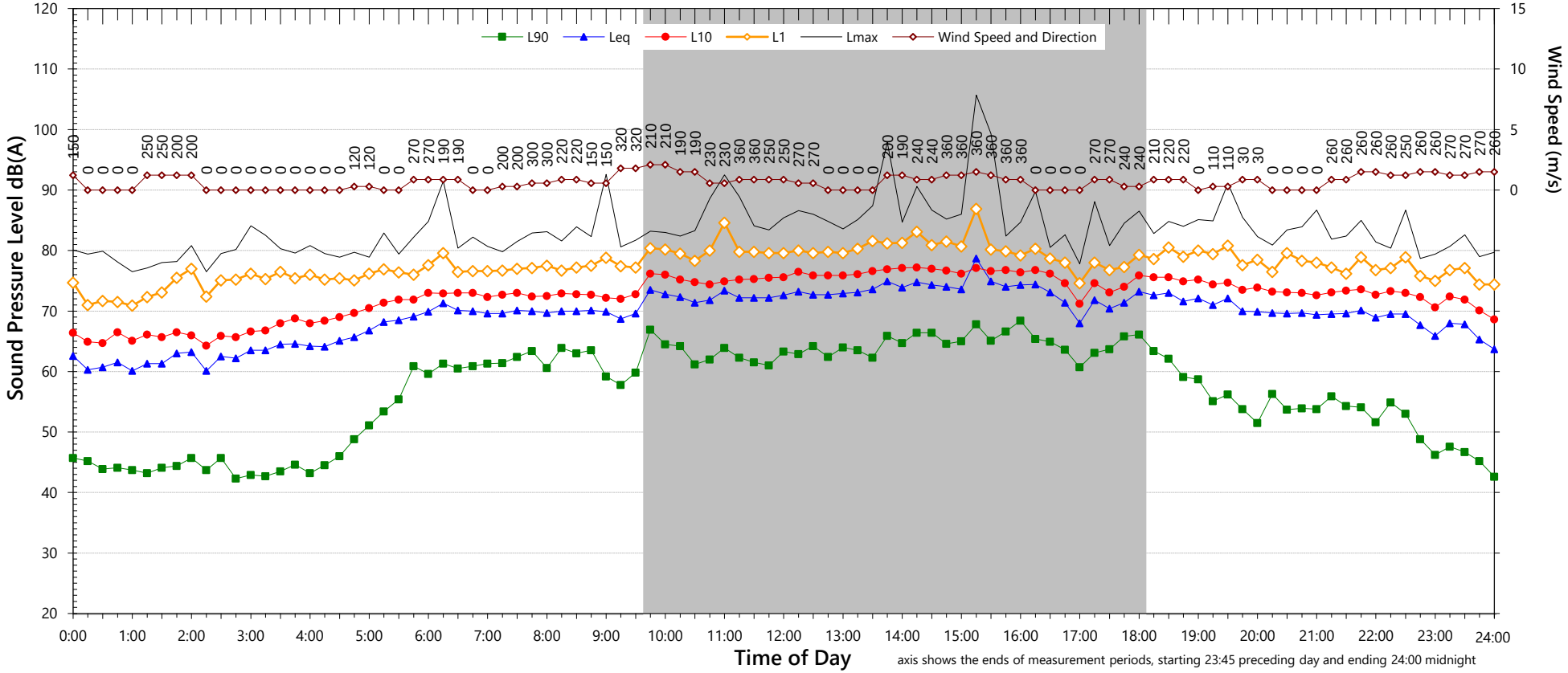
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am till 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. 1-hour values for L_{AFMax} are shown only where L_{AFMax} >65dB(A) and where L_{AFMax}- L_{Aeq} ≥15dB(A)

Unattended Noise Monitoring Results

62 Moorebank Avenue - Front Yard

Thursday, 3 June 2021



NSW Noise Policy for Industry (Free Field)			
Descriptor	Day[2]	Evening[3]	Night[4 5]
L_{A90} ABL	-	53	44
L_{Aeq}	-	71	69

Night Time Maximum Noise Levels			(see note 7)
L_{AFMax} (Range)	81	to	91
L_{AFMax} - L_{Aeq} (Range)	16	to	23

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	Day	Night[5]
	7am-10pm	10pm-7am
$L_{Aeq\ 15\ hr}$ and $L_{Aeq\ 9\ hr}$	73	71
$L_{Aeq\ 1hr}$ upper 10 percentile	74	75
$L_{Aeq\ 1hr}$ lower 10 percentile	72	67

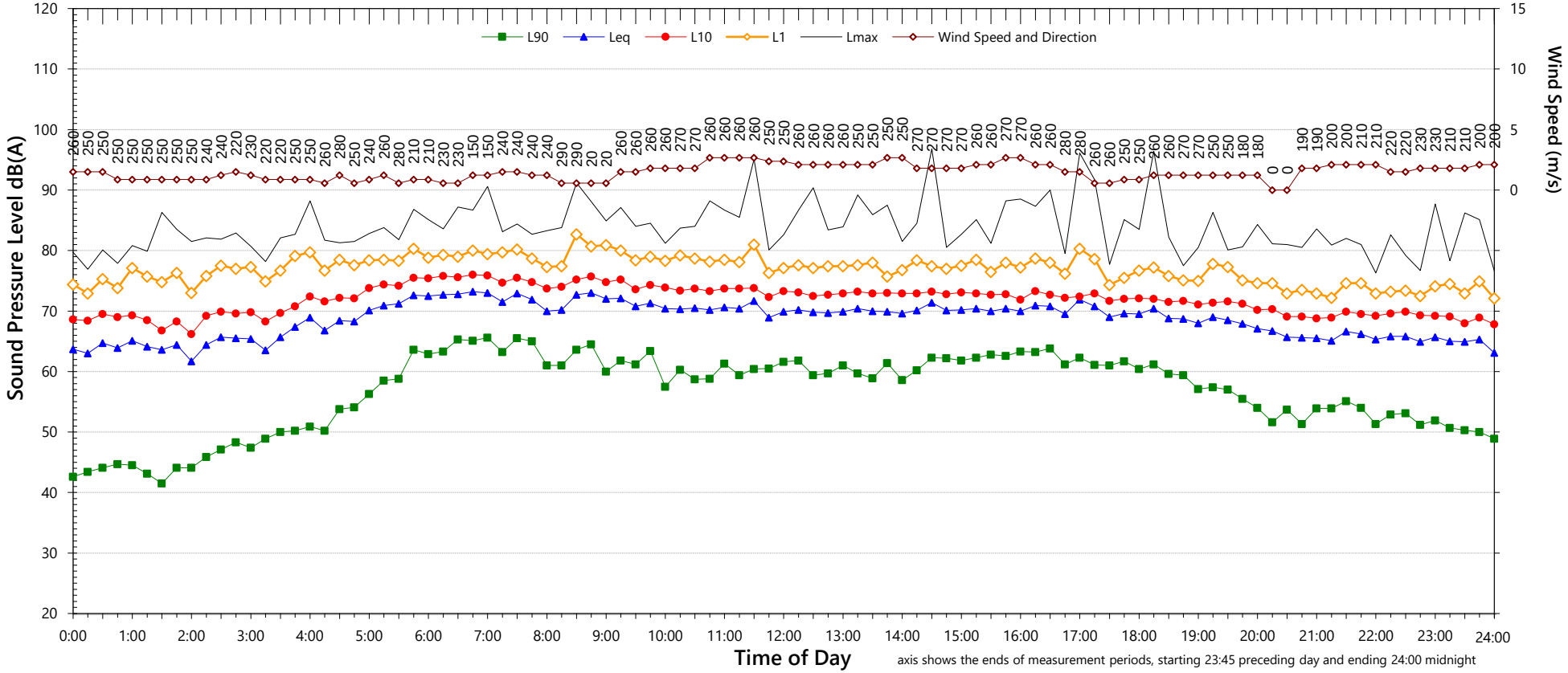
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am till 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. 1-hour values for L_{AFMax} are shown only where L_{AFMax} >65dB(A) and where L_{AFMax}- L_{Aeq} ≥15dB(A)

Unattended Noise Monitoring Results

62 Moorebank Avenue - Front Yard

Friday, 4 June 2021



NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{A90} ABL	59	51	46
L_{Aeq}	71	67	64

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{Aeq\ 15\ hr}$ and $L_{Aeq\ 9\ hr}$	73	67
$L_{Aeq\ 1hr}$ upper 10 percentile	74	68
$L_{Aeq\ 1hr}$ lower 10 percentile	69	64

Night Time Maximum Noise Levels			(see note 7)
L_{AFMax} (Range)	78	to	93
L_{AFMax} - L_{Aeq} (Range)	15	to	30

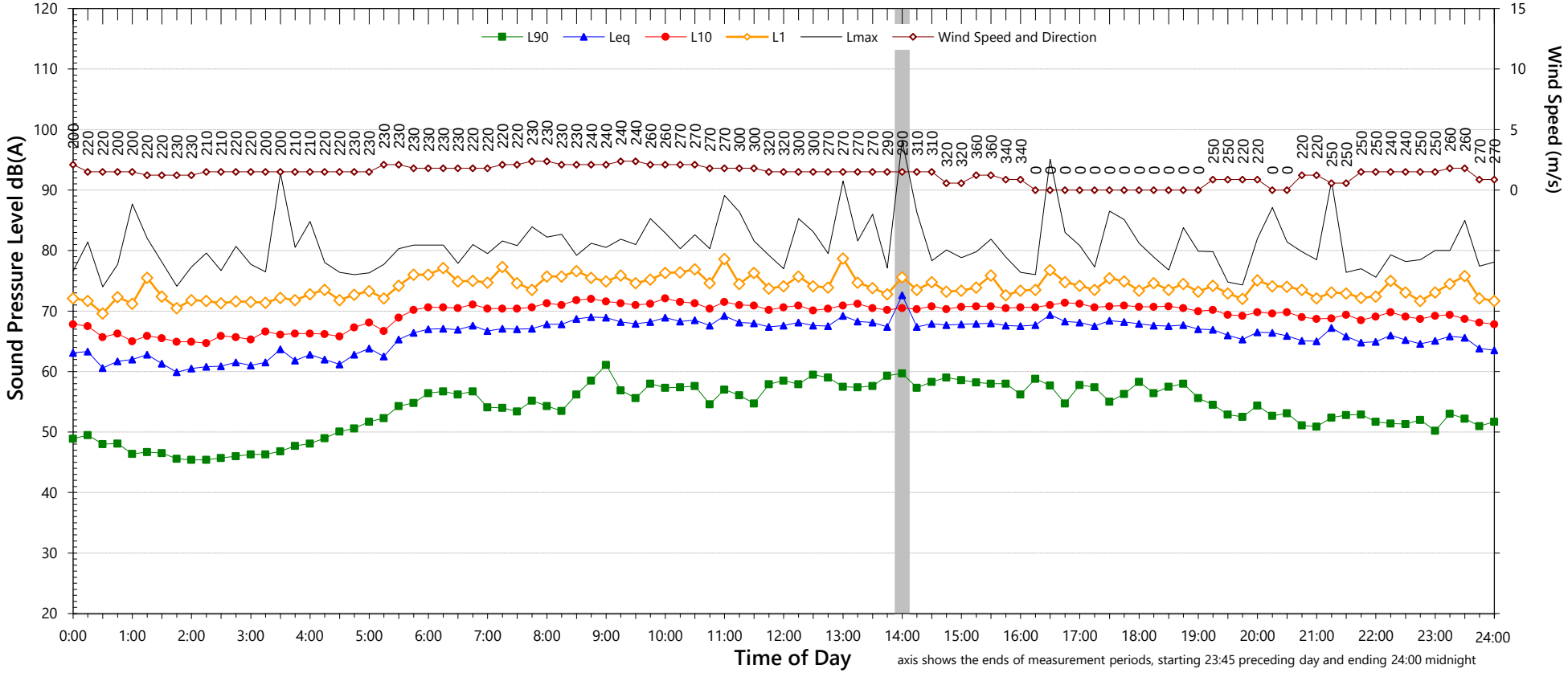
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am till 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. 1-hour values for L_{AFMax} are shown only where L_{AFMax} >65dB(A) and where L_{AFMax}- L_{Aeq} ≥15dB(A)

Unattended Noise Monitoring Results

62 Moorebank Avenue - Front Yard

Saturday, 5 June 2021



NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{A90} ABL	55	51	44
L_{Aeq}	68	66	63

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{Aeq\ 15\ hr}$ and $L_{Aeq\ 9\ hr}$	70	65
$L_{Aeq\ 1hr}$ upper 10 percentile	71	67
$L_{Aeq\ 1hr}$ lower 10 percentile	68	62

Night Time Maximum Noise Levels			(see note 7)
L_{AFMax} (Range)	78	to	90
L_{AFMax} - L_{Aeq} (Range)	15	to	29

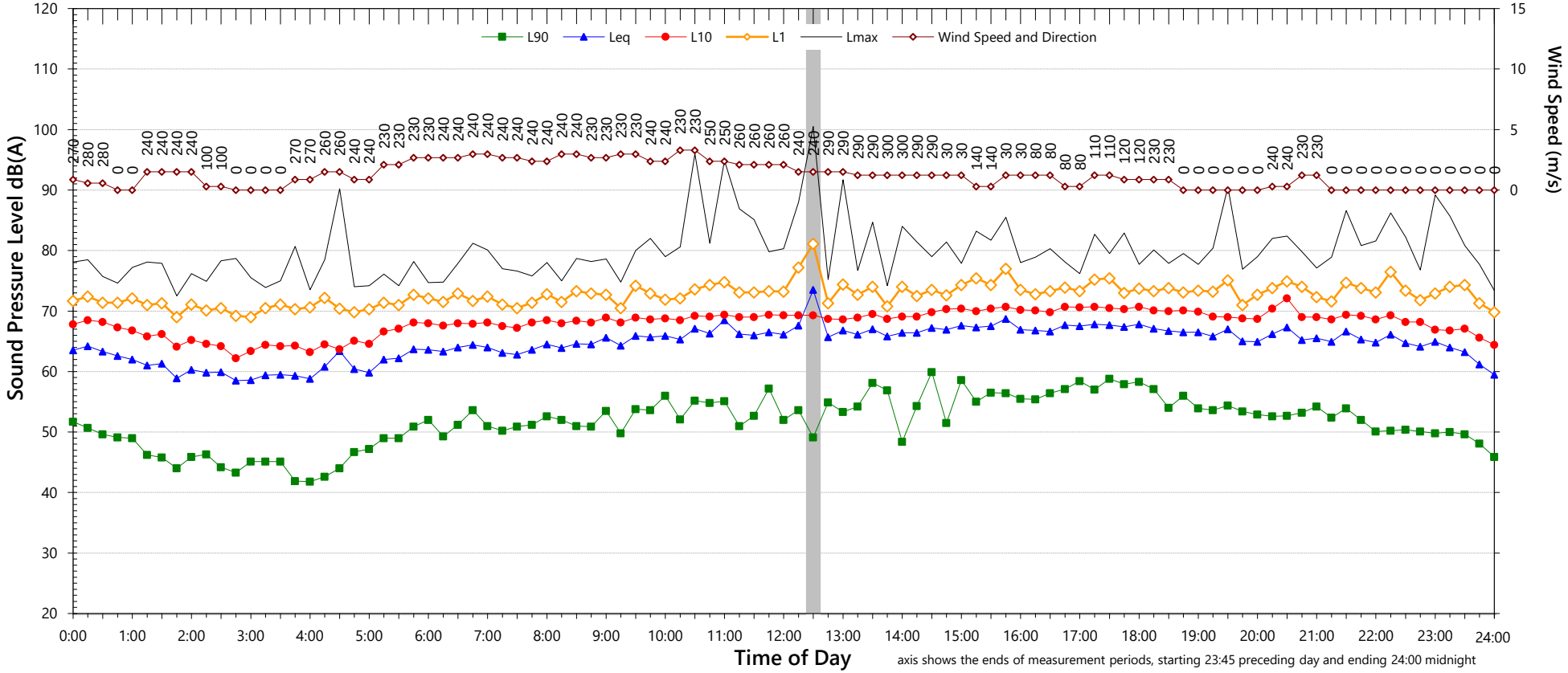
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am till 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. 1-hour values for L_{AFMax} are shown only where L_{AFMax} >65dB(A) and where L_{AFMax}- L_{Aeq} ≥15dB(A)

Unattended Noise Monitoring Results

62 Moorebank Avenue - Front Yard

Sunday, 6 June 2021



NSW Noise Policy for Industry (Free Field)			
Descriptor	Day[2]	Evening[3]	Night[4 5]
L_{A90} ABL	51	52	44
L_{Aeq}	67	66	65

Night Time Maximum Noise Levels			(see note 7)
L_{AFMax} (Range)	79	to	91
L_{AFMax} - L_{Aeq} (Range)	18	to	24

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	Day	Night[5]
	7am-10pm	10pm-7am
$L_{Aeq\ 15\ hr}$ and $L_{Aeq\ 9\ hr}$	69	68
$L_{Aeq\ 1hr}$ upper 10 percentile	70	71
$L_{Aeq\ 1hr}$ lower 10 percentile	68	64

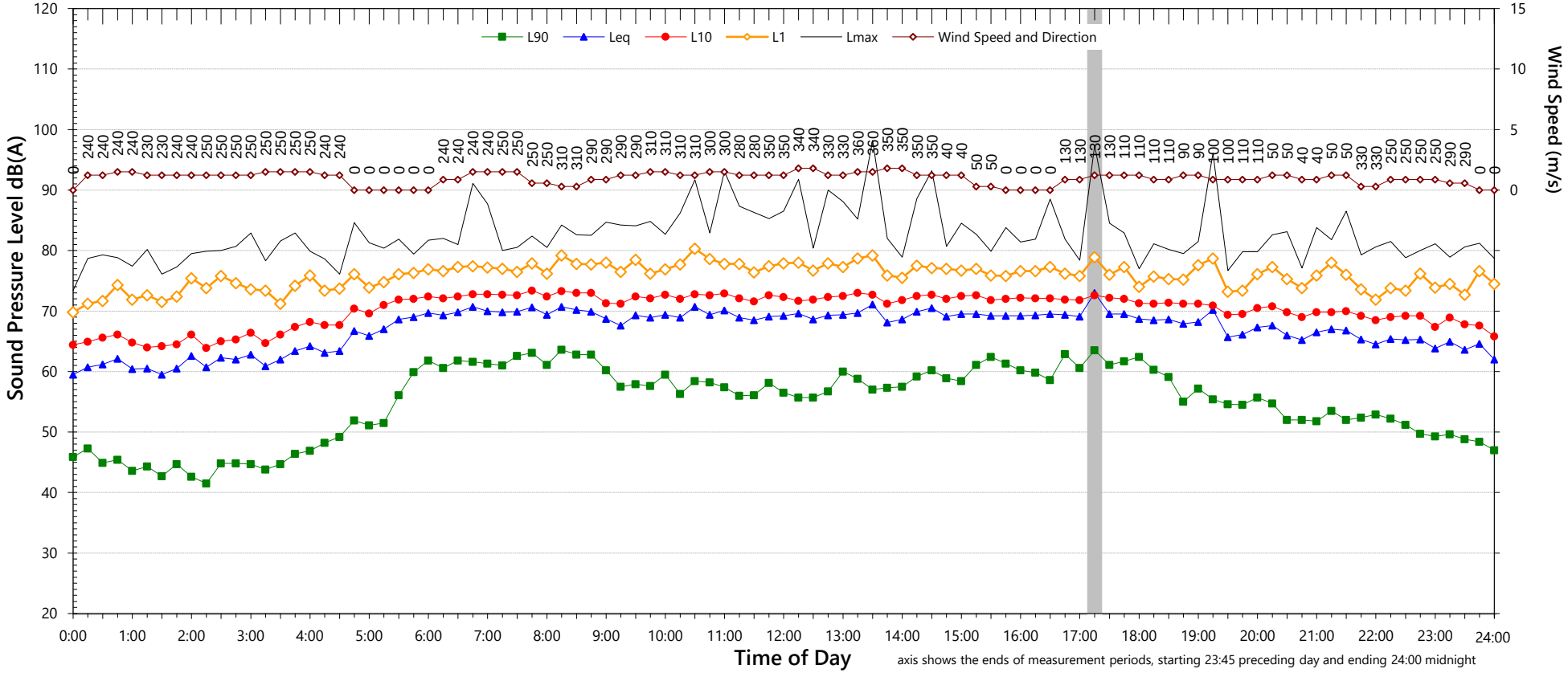
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am till 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. 1-hour values for L_{AFMax} are shown only where L_{AFMax} >65dB(A) and where L_{AFMax}- L_{Aeq} ≥15dB(A)

Unattended Noise Monitoring Results

62 Moorebank Avenue - Front Yard

Monday, 7 June 2021



NSW Noise Policy for Industry (Free Field)			
Descriptor	Day[2]	Evening[3]	Night[4 5]
L_{A90} ABL	56	52	47
L_{Aeq}	69	67	66

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	Day	Night[5]
	7am-10pm	10pm-7am
$L_{Aeq\ 15\ hr}$ and $L_{Aeq\ 9\ hr}$	71	68
$L_{Aeq\ 1hr}$ upper 10 percentile	72	72
$L_{Aeq\ 1hr}$ lower 10 percentile	69	64

Night Time Maximum Noise Levels			(see note 7)
L_{AFMax} (Range)	79	to	90
L_{AFMax} - L_{Aeq} (Range)	17	to	20

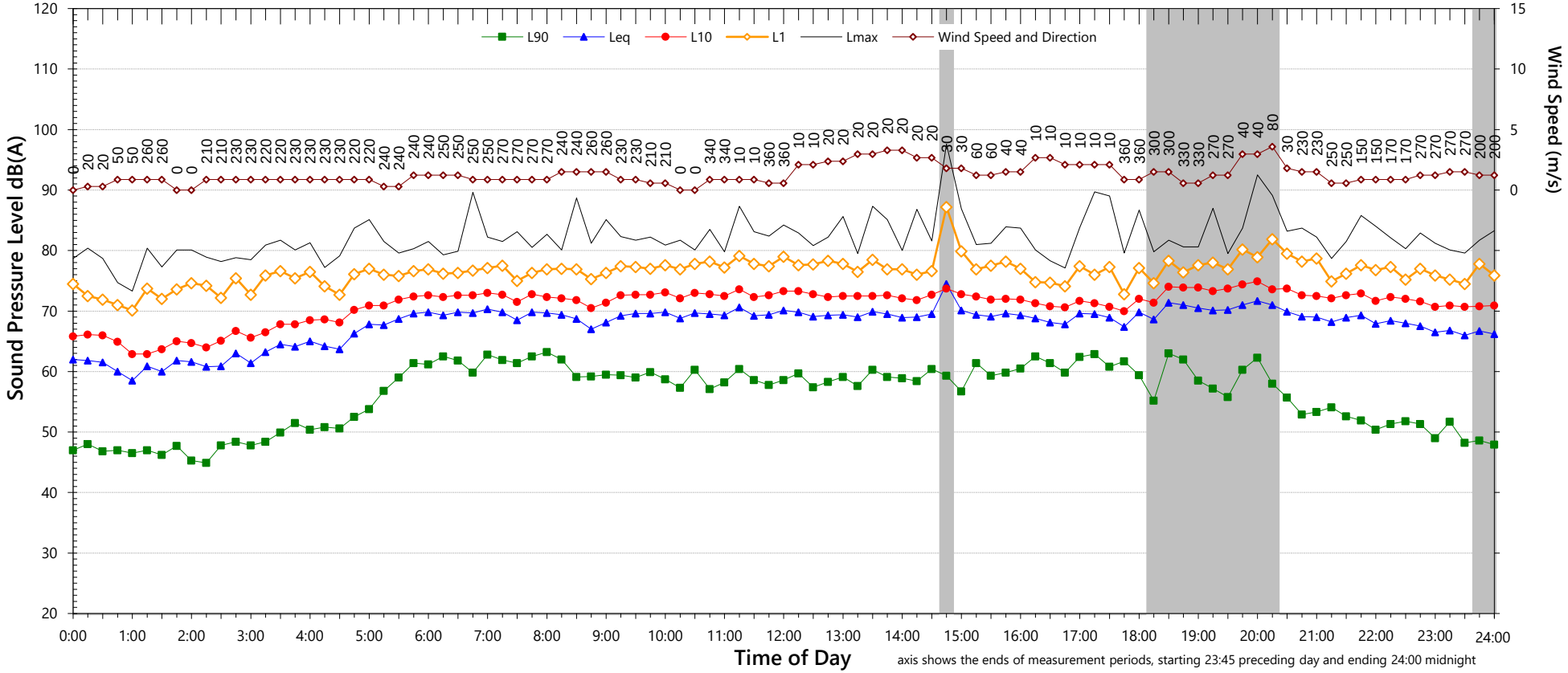
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am till 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. 1-hour values for L_{AFMax} are shown only where L_{AFMax} >65dB(A) and where L_{AFMax}- L_{Aeq} ≥15dB(A)

Unattended Noise Monitoring Results

62 Moorebank Avenue - Front Yard

Tuesday, 8 June 2021



NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{A90} ABL	58	-	41
L_{Aeq}	69	-	69

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{Aeq\ 15\ hr}$ and $L_{Aeq\ 9\ hr}$	72	71
$L_{Aeq\ 1hr}$ upper 10 percentile	72	74
$L_{Aeq\ 1hr}$ lower 10 percentile	71	67

Night Time Maximum Noise Levels			(see note 7)
L_{AFMax} (Range)	81	to	94
L_{AFMax} - L_{Aeq} (Range)	15	to	28

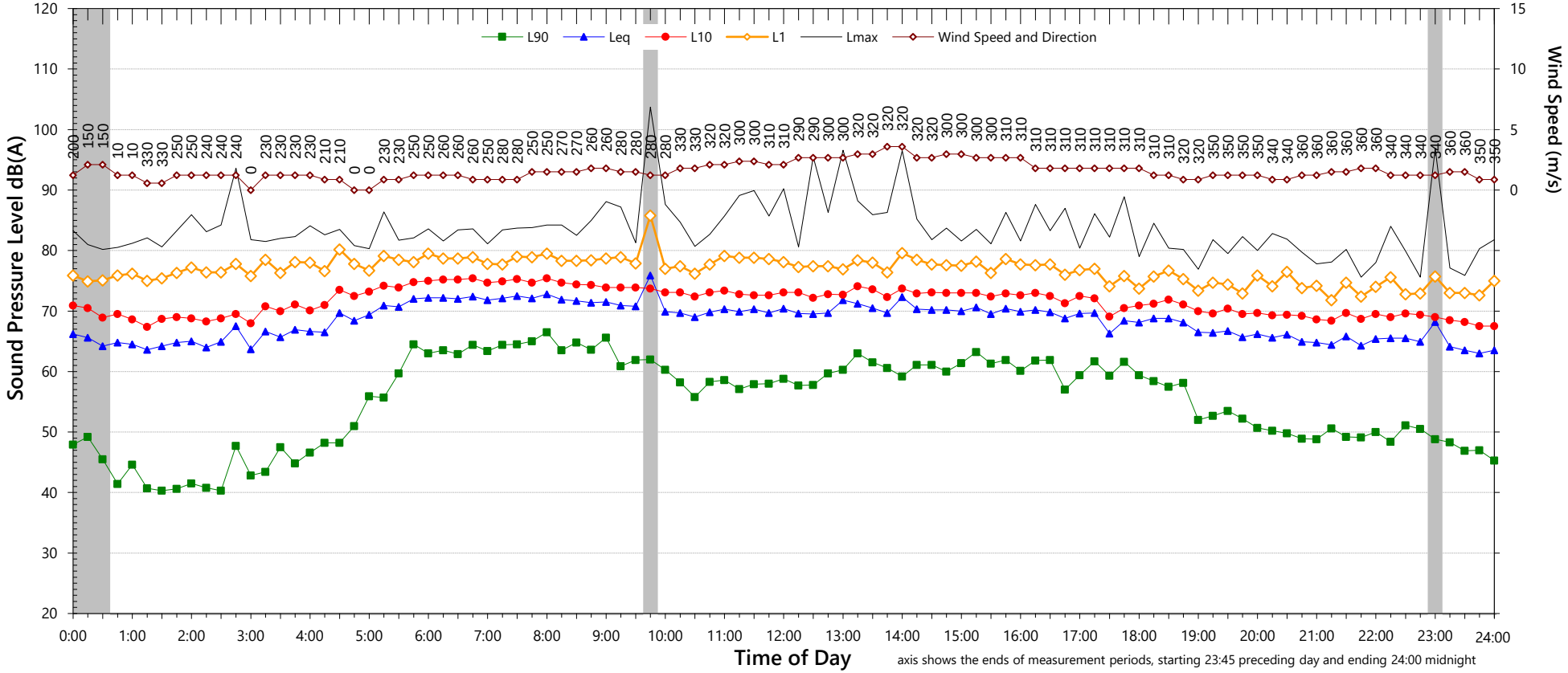
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am till 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. 1-hour values for L_{AFMax} are shown only where L_{AFMax} >65dB(A) and where L_{AFMax}- L_{Aeq} ≥15dB(A)

Unattended Noise Monitoring Results

62 Moorebank Avenue - Front Yard

Wednesday, 9 June 2021



NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{A90} ABL	58	49	42
L_{Aeq}	70	66	66

Night Time Maximum Noise Levels			(see note 7)
L_{AFMax} (Range)	80	to	92
L_{AFMax} - L_{Aeq} (Range)	17	to	23

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{Aeq\ 15\ hr}$ and $L_{Aeq\ 9\ hr}$	72	68
$L_{Aeq\ 1hr}$ upper 10 percentile	74	72
$L_{Aeq\ 1hr}$ lower 10 percentile	68	64

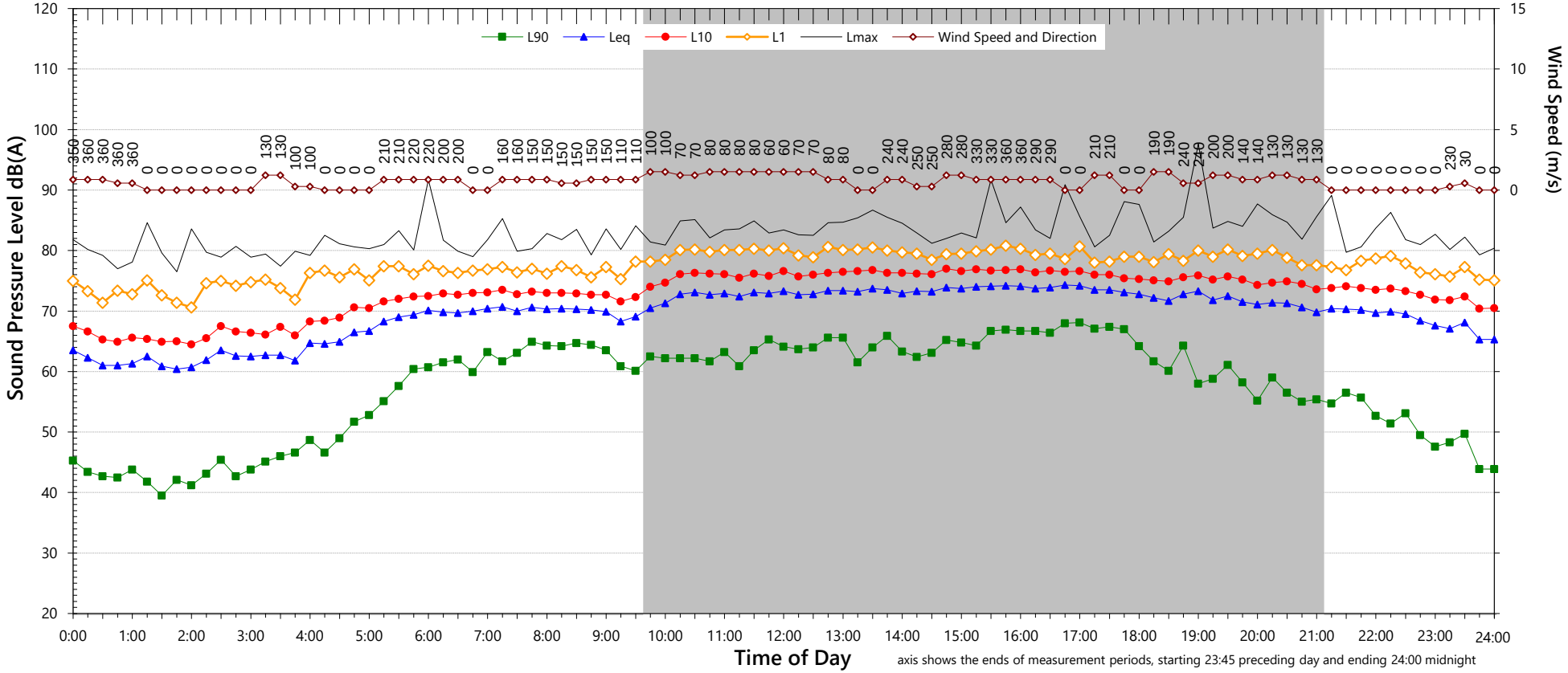
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am till 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. 1-hour values for L_{AFMax} are shown only where L_{AFMax} >65dB(A) and where L_{AFMax}- L_{Aeq} ≥15dB(A)

Unattended Noise Monitoring Results

62 Moorebank Avenue - Front Yard

Thursday, 10 June 2021



NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{A90} ABL	-	-	42
L_{Aeq}	-	-	69

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{Aeq\ 15\ hr}$ and $L_{Aeq\ 9\ hr}$	73	71
$L_{Aeq\ 1hr}$ upper 10 percentile	73	74
$L_{Aeq\ 1hr}$ lower 10 percentile	72	67

Night Time Maximum Noise Levels			(see note 7)
L_{AFMax} (Range)	82	to	97
L_{AFMax} - L_{Aeq} (Range)	16	to	28

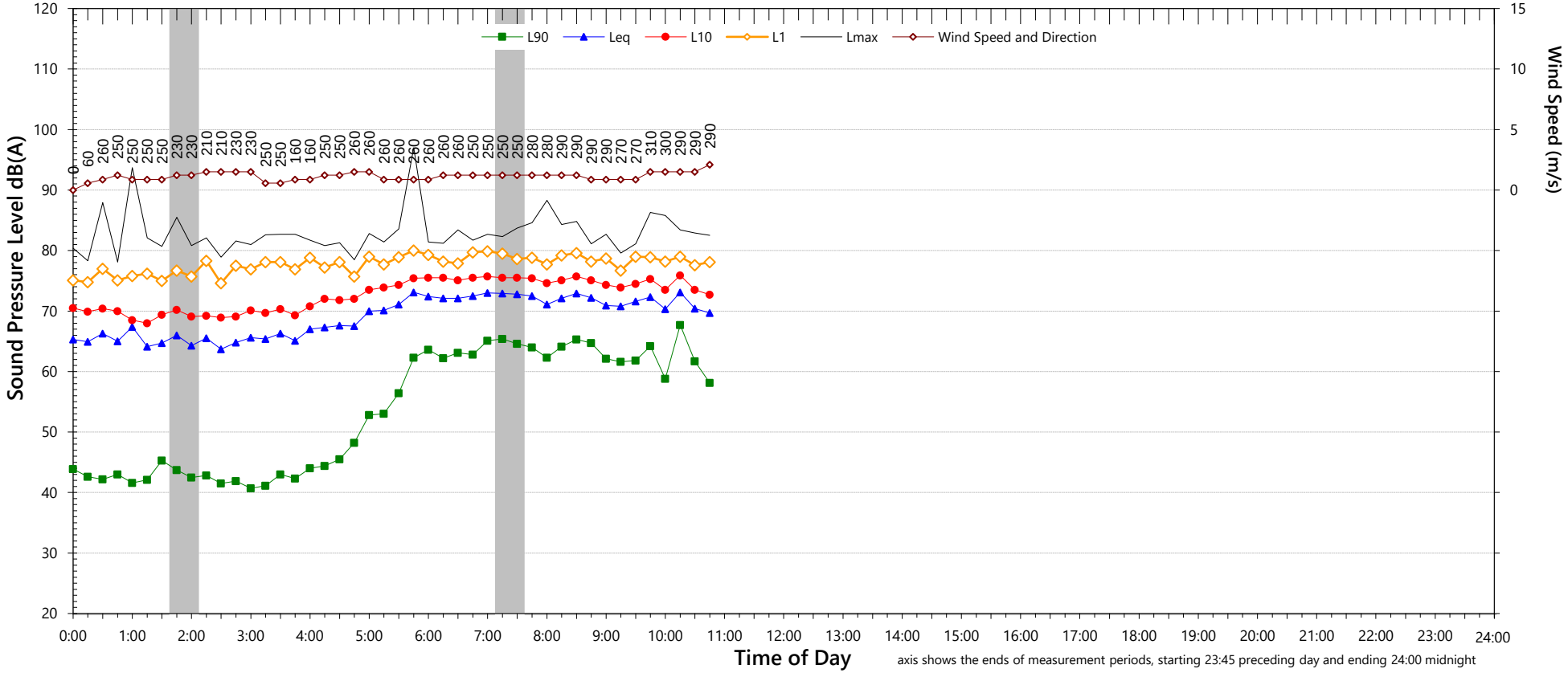
Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am till 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. 1-hour values for L_{AFMax} are shown only where L_{AFMax} >65dB(A) and where L_{AFMax}- L_{Aeq} ≥15dB(A)

Unattended Noise Monitoring Results

62 Moorebank Avenue - Front Yard

Friday, 11 June 2021



NSW Noise Policy for Industry (Free Field)			
Descriptor	**Day[2]**	**Evening[3]**	**Night[4 5]**
L_{A90} ABL	-	-	-
L_{Aeq}	-	-	-

Night Time Maximum Noise Levels			(see note 7)
L_{AFMax} (Range)	-	to	-
L_{AFMax} - L_{Aeq} (Range)	-	to	-

NSW Road Noise Policy (1m from facade)		(see note 6)
Descriptor	**Day**	**Night[5]**
	7am-10pm	**10pm-7am**
$L_{Aeq\ 15\ hr}$ and $L_{Aeq\ 9\ hr}$	-	-
$L_{Aeq\ 1hr}$ upper 10 percentile	-	-
$L_{Aeq\ 1hr}$ lower 10 percentile	-	-

Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am till 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. 1-hour values for L_{AFMax} are shown only where L_{AFMax} >65dB(A) and where L_{AFMax}- L_{Aeq} ≥15dB(A)