Moorebank Precinct East - Stage 1 Project

Review of Operational Sleep Disturbance Impacts

(SSD 14-6766)

SIMTA SYDNEY INTERMODAL TERMINAL ALLIANCE

March 2018

ACOUSTICS AND AIR

MPE STAGE 1

REVIEW OF OPERATIONAL SLEEP DISTURBANCE IMPACTS

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GLOSSARY OF ACOUSTIC TERMS

Most environments are affected by environmental noise which continuously varies, largely as a result of road traffic. To describe the overall noise environment, a number of noise descriptors have been developed and these involve statistical and other analysis of the varying noise over sampling periods, typically taken as 15 minutes. These descriptors, which are demonstrated in the graph below, are here defined.

Maximum Noise Level (L_{Amax}) – The maximum noise level over a sample period is the maximum level, measured on fast response, during the sample period.

L_{A1} – The L_{A1} level is the noise level which is exceeded for 1% of the sample period. During the sample period, the noise level is below the L_{A1} level for 99% of the time.

L_{A10} – The L_{A10} level is the noise level which is exceeded for 10% of the sample period. During the sample period, the noise level is below the L_{A10} level for 90% of the time. The L_{A10} is a common noise descriptor for environmental noise and road traffic noise.

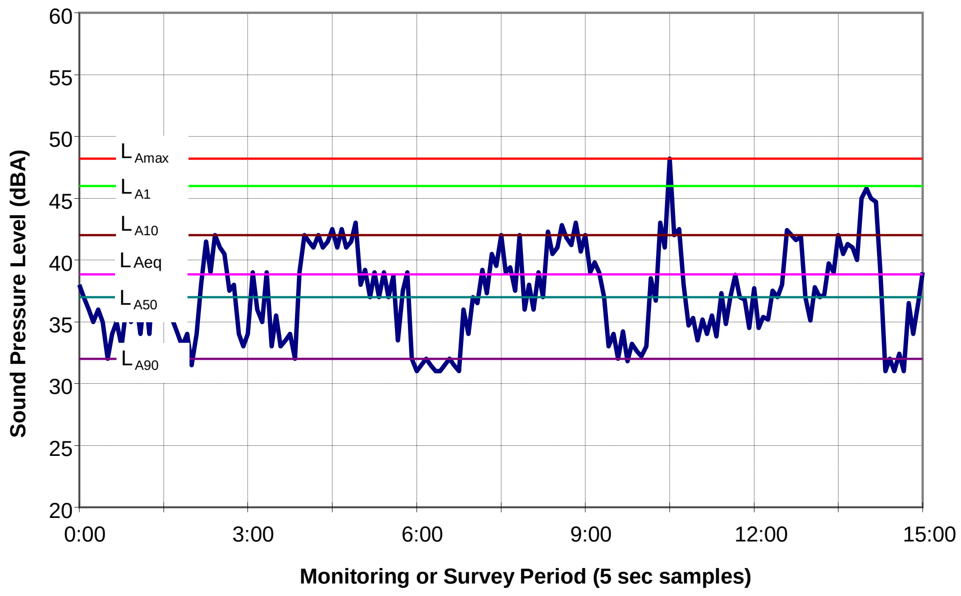
L_{A90} – The L_{A90} level is the noise level which is exceeded for 90% of the sample period. During the sample period, the noise level is below the L_{A90} level for 10% of the time. This measure is commonly referred to as the background noise level.

L_{Aeq} – The equivalent continuous sound level (L_{Aeq}) is the energy average of the varying noise over the sample period and is equivalent to the level of a constant noise which contains the same energy as the varying noise environment. This measure is also a common measure of environmental noise and road traffic noise.

ABL – The Assessment Background Level is the single figure background level representing each assessment period (daytime, evening and night time) for each day. It is determined by calculating the 10th percentile (lowest 10th percent) background level (L_{A90}) for each period.

RBL – The Rating Background Level for each period is the median value of the ABL values for the period over all of the days measured. There is therefore an RBL value for each period – daytime, evening and night time.

Typical Graph of Sound Pressure Level vs Time



1 INTRODUCTION

1.1 Background

The Sydney Intermodal Terminal Alliance (SIMTA) received approval for the construction and operation of Stage 1 (the Project) of the Moorebank Precinct East (MPE) Project, comprising an Intermodal (IMT) Facility including a rail link and Import Export (IMEX No.1) Terminal on 12 December 2016 (SSD 6766).

The Moorebank Precinct East (MPE) Project involves the development of an intermodal facility including warehouse and distribution facilities, freight village (ancillary site and operational services), stormwater, landscaping, servicing and associated works on the eastern side of Moorebank Avenue, Moorebank. It is to be developed in three key stages:

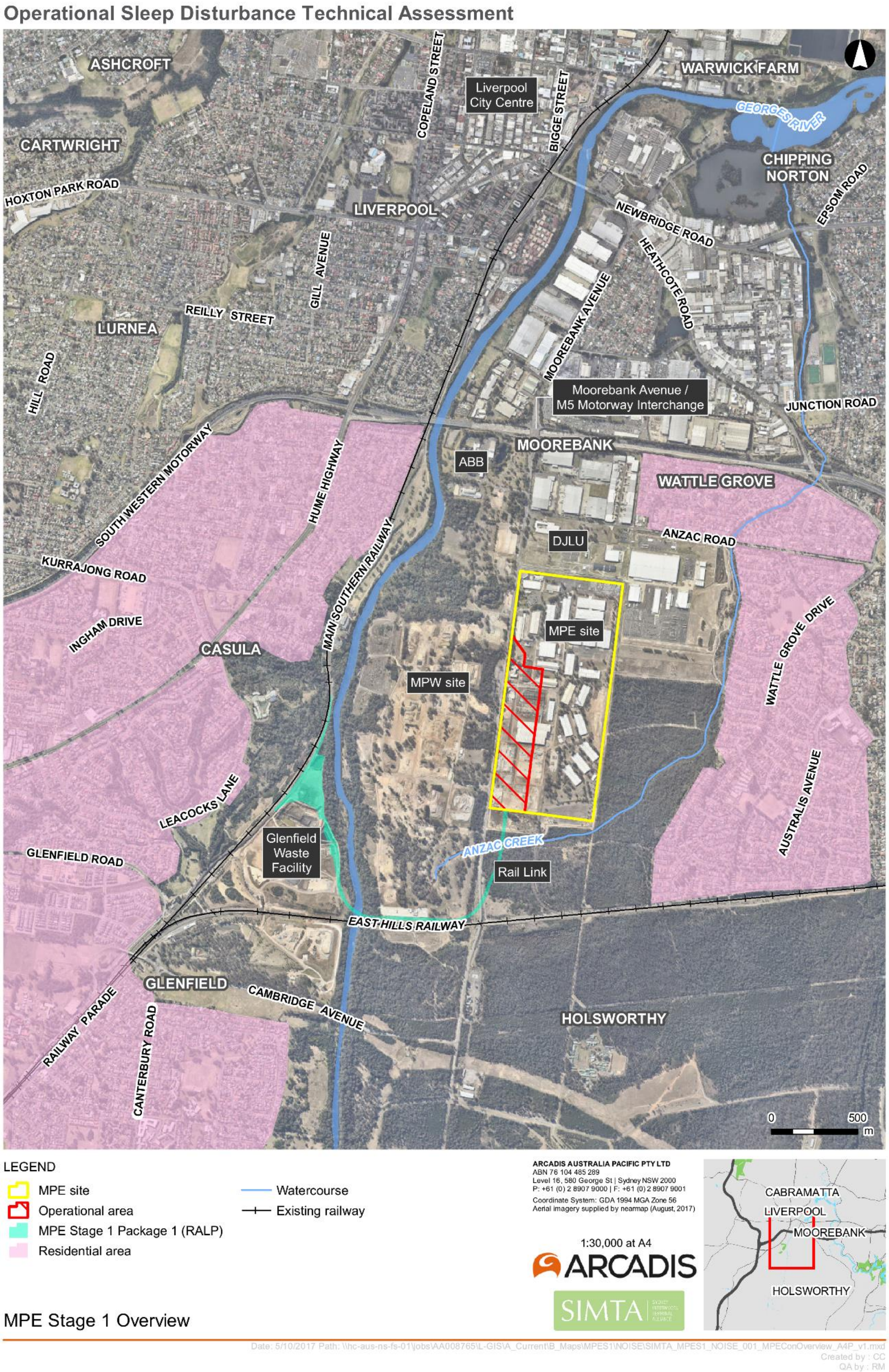
- Stage 1 – Construction of the IMEX No.1 facility and rail link
- Stage 2 – Construction of warehouse and distribution facilities
- Stage 3 – Extension of the IMEX No.1 and completion of warehouse and distribution facilities.

The Rail Link includes a connection to the IMEX No.1 facility, and traverses across Moorebank Avenue, Anzac Creek, Georges River and Glenfield Waste Services (GWS) prior to connecting to the Southern Sydney Freight Line (SSFL). The constructed IMEX No.1 Facility includes the following key components:

- Truck processing, holding and loading areas – entrance and exit from Moorebank Avenue
- Rail loading and container storage areas – installation of four rail sidings with adjacent container storage area serviced by manual handling equipment initially and overhead gantry cranes progressively
- Administration facility and associated car parking – light vehicle access from Moorebank Avenue.

Below outlines the MPE Stage 1 operational area (IMEX No.1), and MPE site boundary in relation to the local area.

Figure 1-1 Site Location



1.2 Purpose

The purpose of this technical report is to provide an updated assessment of sleep disturbance impacts based on the final Approved for Construction (AFC) design of the IMEX No.1 terminal, as part of the MPE Stage 1 Project (SSD 14-6766) to satisfy the MPE Stage 1 Development Consent (SSD 14-6766) *Condition E25: Review of Operational Sleep Disturbance Impacts.* Table 1-1 below details the requirements of Condition E25 and where this has been addressed within this review.

Table 1-1 Condition of Approval E25

Requirements of Condition E25	Where Addressed in this Report
The Applicant shall prepare a review of sleep disturbance impacts based on detailed design, including:	
a) An assessment of how often noise events occur, the time of day they occur and whether there are any times of day when there is a clear change in the noise environment;	Section 5
b) Confirm the operational sleep disturbance predictions identified in the documents listed under Condition A1; and,	Section 3.3 & Section 5.1.2
c) Consider appropriate noise mitigation measures where required.	Section 5.1.3
The report shall be prepared in consultation with the EPA and be submitted to the satisfaction of the Secretary within 6 months of the commencement of construction, unless otherwise agreed by the Secretary	Section 1.2

It is noted that the documents listed under condition A1 are as follows:

a. State Significant Development Application SSD 6766;

b. SIMTA Intermodal Terminal Facility – Stage 1 – Environmental Impact Statement (Hyder Consulting Pty Ltd, May 2014);

c. SIMTA Intermodal Terminal Facility – Stage 1 – Response to Submissions (Hyder Consulting Pty Ltd, September 2015); and

d. The conditions of this consent.

The approval for the MPE Stage 1 Project has been appealed to in the NSW Land and Environment Court (LEC). As part of these proceedings, the following documents, which have been developed wholly or in-part by the expert witness (acoustics) acting for Qube, Renzo Tonin, have been reviewed, and the results of which incorporated into this Sleep Disturbance Review (SDR):

- *Qube ats RAID – Expert Report of Dr Renzo Tonin*, dated 5 October 2017 (the Tonin Expert Report); and,
- *Qube ats RAID – Joint Expert Report of Mr Matthew Harrison, Dr Renzo Tonin and Mr Dave Anderson*, dated 19 October 2016 (the Joint Expert Report).

As required by Condition E25, the SDR has been prepare in consultation with the EPA. The EPA has reviewed the previous version of this report (Version E, dated December 2017). In their letter dated 19 January 2018, included in Appendix A of this report, the EPA advises that, in their view, the SDR satisfactorily addresses the requirements of Condition E25.

The SDR is required to be submitted for approval by the Secretary within six months of the commencement of construction which commenced on 23 June 2017. The time for submission of this report has been extended to 23 March 2018 by agreement with the Secretary, as contemplated by Condition E25.

In respect of the requirement "a" in Table 1-1 it should be noted that, in accordance with the EPA sleep disturbance policy, a detailed assessment of this kind is only warranted when the predicted noise levels exceed the established sleep disturbance screening levels. Under the proposal herein, and with the adoption of the Container Noise Barrier Management Plan recommended in the Joint Expert Report, there are predicted to be no exceedances of the screening levels. Notwithstanding, the data in this assessment is provided for informative purposes only.

1.3 Structure

The structure of this report is as follows:

- **Section 1 – Introduction:** provides an introduction to the MPE Stage 1 Project and the purpose of this report;
- **Section 2 – Project Description:** provides an overview of the Project;
- **Section 3 – Background:** identifies sensitive receivers and relevant noise goals, and summarises the results of previous sleep disturbance impact assessments;
- **Section 4 – Methodology:** describes the assessment approach;
- **Section 5 – Results and Discussion:** presents the results of the modelling and provides an assessment of the results against nominated criteria and a comparison to the results reported in the EIS and RtS; and,
- **Section 6** – **Conclusion and Recommendations**: summarises the outcomes of the assessment and provides recommendations based on the results.

2 PROJECT DESCRIPTION

2.1 Site context

The MPE site comprises approximately 67 hectares (ha) of land, located mostly within Lot 1 in Deposited Plan (DP) 1048263 and Lot 2 in DP 1197707. The MPE site is located approximately 27 kilometres (km) south-west of the Sydney Central Business District (CBD) and approximately 26 km west of Port Botany. It is approximately 2.5 km south of the Liverpool City Centre, 800 metres (m) south of the Moorebank Avenue/M5 Motorway Interchange and one kilometre to the east of the SSFL. Land surrounding the MPE site comprises:

- The MPW site, formerly the School of Military Engineering (SME), on the western side of Moorebank Avenue directly adjacent to the MPE site (subject to the MPW Concept Approval);
- The Holsworthy Military Reserve, to the south of the MPE site on the southern side of the East Hills Rail Corridor, which is owned and operated by Sydney Trains;
- Residual Commonwealth Land (known as the Boot Land), to the east of the MPE site between the site boundary and the Wattle Grove residential area;
- The Defence Joint Logistics Unit (DJLU), immediately to the north of the MPE site.

Several residential suburbs are located in proximity to the MPE site (refer to Figure 1-1), including:

- Wattle Grove, located approximately 770 m to the east of the MPE site;
- Wattle Grove North, located approximately 1,050 m to the north of the MPE site;
- Casula, located approximately 960 m to the west of the MPE site; and,
- Glenfield, located approximately 1,700 m to the south west of the MPE site.

While the Department of Defence has vacated the MPE site, the following infrastructure and site features are still present:

- Several existing buildings previously utilised by the Department of Defence, comprising a mixture of warehouses, offices and administrative facilities;
- An internal road network and areas of large hardstand, typically comprising asphalt and concrete;
- A relatively flat topography with a ridge which runs along the central portion of the MPE site, parallel to Moorebank Avenue. This ridge results in surface water drainage flowing in either an easterly direction towards Anzac Creek or a westerly direction to the Georges River;
- Planted vegetation along site boundaries, walkways, internal roads and areas of open space; and
- A primary access point, about one kilometre south of the intersection of Moorebank Avenue and Anzac Road and a number of additional general access points along Moorebank Avenue.

All existing vegetation and buildings within the Stage 1 construction footprint will be cleared and demolished to facilitate construction of the IMEX No.1.

The layout of the IMEX No.1 generally comprises operational areas, an administration area, rail sidings, utilities and drainage infrastructure, landscaping and signage. The operational areas of the IMEX No.1 consist of the primary and secondary container loading / unloading areas and container storage areas, and the truck holding area. Within these areas containers would be stacked up to five high.

3 BACKGROUND

3.1 Sensitive Receivers

A number of residential noise catchment areas (NCA) have been identified in proximity to the Project. Table 3-1 presents the sensitive receivers identified in this assessment, and their proximity to the Project.

Table 3-1 Sensitive Receivers

Receiver ID	Description	Distance (m)
NCA1	Wattle Grove	770
NCA2	Wattle Grove North	1,050
NCA3	Casula	960
NCA4	Glenfield	1,700

The locations of the identified sensitive receivers are shown in Figure 3-1.

3.2 Sleep Disturbance Screening Levels

Screening levels for maximum operational noise levels during the night time period (10.00pm – 7.00am) were established in accordance with the *Noise Guide for Local Government* (NGLG) and the INP Application Notes (www.epa.nsw.gov.au/noise/applicnotesindustnoise.htm) and are set at 15 dBA above the night time rating background noise level (RBL).

The night time RBL in each receiver catchment were established as part of the Noise and Vibration Impact Assessment (NVIA) prepared for the Concept Plan Approval for the MPE Project, and adopted in the NVIA for the MPE Stage 1 Project.

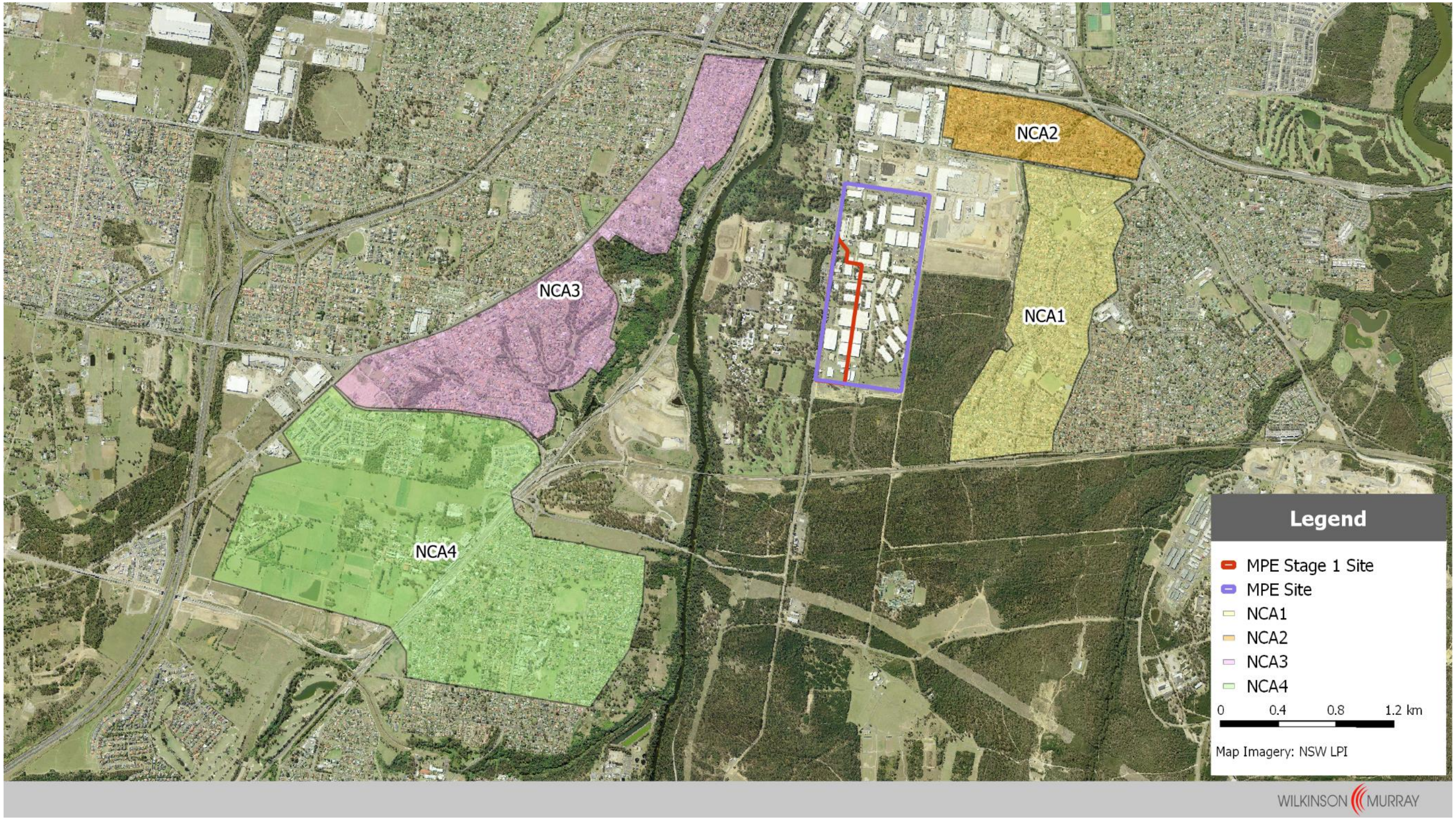
The approval for the MPE Stage 1 Project has been appealed to in the NSW Land and Environment Court (LEC). As part of these proceedings, the expert witness (acoustics) acting for Qube, Renzo Tonin, has argued that the time night RBL in Casula and Wattle Grove be adjusted downwards, based on recent background noise monitoring data.

Table 3-2 presents the night time RBL and sleep disturbance screening levels for each receiver catchment, as established in the NVIA for the MPE Concept Plan and subsequently adopted in the NVIA for the MPE Stage 1 Project, and those values recommended by Renzo Tonin.

Table 3-2 Sleep Disturbance Screening Levels

Receiver ID	Night Time RBL (dBA)		Sleep Disturbance Screening Level (dBA – $L_{A,1min}$ / L_{Amax})	
	MPE Concept Plan and Stage 1 NVIA	Recommended by Renzo Tonin	MPE Concept Plan and Stage 1 NVIA	Recommended by Renzo Tonin
NCA1	37	37	52	52
NCA2	36	36	51	51
NCA3	34	32	49	47
NCA4	37	35	52	50

Figure 3-1 Sensitive Receivers



3.3 Previous Assessments of Sleep Disturbance Impacts

The Noise and Vibration Impact Assessment (NVIA) prepared for the MPE Stage 1 EIS identified "banging" noises associated with "dropping" containers as being the most likely source of maximum noise levels. The L_{Amax} sound power level (SWL) of container drops was assumed to be up to 118 dBA.

The predicted operational L_{Amax} noise levels presented in the NVIA for the MPE Stage 1 EIS are shown in Table 3-3.

Table 3-3 Predicted L_{Amax} Noise Levels – MPE Stage 1 EIS

Receiver ID	Predicted Level due to Transient Events (dBA – L_{Amax})	Sleep Disturbance Screening Level (dBA – L_{Amax})	Complies?
NCA1	48	52	Yes
NCA2	38	51	Yes
NCA3	48	49	Yes
NCA4	41	52	Yes

Review of Table 3-3 shows that the predicted L_{Amax} levels in all residential receiver catchments are less than the established sleep disturbance screening levels, and therefore; no further assessment of sleep disturbance was conducted in the EIS.

However, the predicted L_{Amax} noise levels presented in the EIS NVIA were incorrectly transposed from the noise model. The predicted operational L_{Amax} noise levels from the MPE Stage 1 noise model have since been correctly transposed, for both calm and adverse meteorological conditions, and are shown in Table 3-4, along the with sleep disturbance screening levels adopted in the MPE Stage 1 NVIA and those recommended by Renzo Tonin.

Table 3-4 Predicted L_{Amax} Noise Levels – MPE Stage 1 EIS, Corrected

Receiver ID	Predicted L_{Amax} Noise Level (dBA)		Sleep Disturbance Screening Level (dBA)		Complies?
	Calm[1]	Adverse[2]	MPE Concept Plan and Stage 1 NVIA	Recommended by Renzo Tonin	
NCA1	40	44	52	52	Yes
NCA2	24	28	51	51	Yes
NCA3	36	41	49	47	Yes
NCA4	29	34	52	50	Yes

1. CONCAWE Category 4.
2. CONCAWE Category 6.

Table 3-4 shows that the correctly transposed L_{Amax} predictions for the Project, in all receiver catchments, comply with the sleep disturbance screening levels established in the MPE Stage 1 NVIA and those recommended by Renzo Tonin, and are significantly lower than those presented in the MPE Stage 1 NVIA.

4 METHODOLOGY

4.1 Noise Predictions from LEC Proceedings

As noted in Section 3.2, the approval for the MPE Stage 1 Project has been appealed to in the LEC. As part of these proceedings, a *Joint Expert Report* has been prepared by Mr Matthew Harrison, Dr Renzo Tonin and Mr Dave Anderson (the Joint Expert Report).

The Joint Expert Report presents predicted L_{Amax} noise levels at sensitive receivers based on revised L_{Amax} sound power levels for transient events, agreed to by the relevant expert witnesses. Additionally, these predicted levels are presented for a range of transient noise events and, in the case of containers being staked on top of each other, occurring at various heights above ground.

In the Joint Expert Report, the relevant experts agree that a 4.5 metre high and 400 metre long noise barrier is required along the western boundary of the site, commencing from the administration building and running southwards. Renzo Tonin has noted that a number of large existing and proposed off-site structures, which are not accounted for in the modelling, will provide shielding in the future and has suggested that a more reasonable approach would be to prepare a Container Noise Barrier Management Plan (CNBMP) so as to achieve an equivalent level of noise reduction.

The noise predictions presented in the Joint Expert Report, and reproduced herein, include the recommended barrier along the western site boundary.

4.2 Consideration of Detailed Design

The operational layout of the Project, following detailed design, has been compared to the proposed layout presented in the EIS to identify any changes that may affect the operational sleep disturbance impacts associated with the Project. Since container handling is considered the primary source of L_{Amax} noise levels from the IMEX No.1, the review focused on identifying any changes to the location(s) of container handling and any changes to structures that might provide significant shielding of noise between the IMEX No.1 and sensitive receivers.

A review of the Approved for Construction (AFC) design of the IMEX No.1 indicates that the rail siding has moved approximately 4 m to the west, compared to the IMEX No.1 layout presented in the EIS. Considering that the nearest residential receivers are more than 700 m away from the site, this change would have a negligible effect on L_{Amax} noise levels.

4.3 Distribution of L_{Amax} Noise Levels

Operational L_{Amax} noise levels associated with the Project have been predicted using fixed values to represent the typical L_{Amax} sound power level of various maximum noise level events. However, the L_{Amax} sound power associated with these events would, in practice, vary significantly and would depend on a range of factors, including but not limited to:

- The level of care and/or skill of the machine operators;
- The condition of the container and the trailer/wagon;
- Whether the container is full or empty; and,
- The surface onto which the container is placed.

Data from attended noise measurements conducted by Wilkinson Murray at an operational intermodal facility in NSW has been used to understand the both the distribution in L_{Amax} noise levels associated with container handling activities, and how often these L_{Amax} noise levels occur.

4.4 Existing L_{Amax} Noise Environment at Most Sensitive Receivers

The potential for maximum noise events associated with an industrial development to cause sleep disturbance impacts depends not only on the absolute L_{Amax} noise levels at receivers due to the new activity, but also how these noise events compare to the existing maximum noise level environment. Accordingly, it can be useful to compare the magnitude and frequency of occurrence of maximum noise events associated with a development with those of the existing ambient noise environment.

Unattended noise logger data, recorded at 100 ms intervals, has been analysed to describe the existing maximum noise level environment at sensitive residential receivers in NCA1 and NCA3. Residential receivers in NCA1 (Wattle Grove) and NCA3 (Casula) are considered the most sensitive receiver locations for sleep disturbance impacts from the Project. This is supported by the predicted L_{Amax} noise levels presented in Table 3-4.

5 RESULTS & DISCUSSION

The following section presents the agreed L_{Amax} sound power levels and noise modelling results presented in the Joint Expert Report; a consideration of the potential distribution of L_{Amax} noise levels during the operation of the Project; and investigation of the existing ambient L_{Amax} noise levels in the two most potentially affected receiver catchments; and, a comparison of the predicted operational L_{Amax} noise levels from the Project with the existing ambient L_{Amax} noise levels the most potentially affected receivers.

5.1 Joint Report Noise Levels

5.1.1 Agreed L_{Amax} Sound Power Levels

The L_{Amax} sound power levels (SWL) and modelled source heights for the most significant transient noise events associated with the operation of the Project, as presented to the Court in the Joint Expert Report are presented in Table 5-1.

Table 5-1 L_{Amax} Sound Power Levels and Source Heights

Source	Height (m)	L_{Amax} SWL (dBA)
Container drop on wagon	2.8	125
Container drop on hardstand	1.5	125
	4.5	125
	7.5	125
Truck pneumatic brake	1.0	122

5.1.2 Predicted L_{Amax} Noise Levels

The predicted L_{Amax} noise levels at the most potentially affected residences in each catchment, as presented to the Court in the Joint Expert Report, for calm and adverse meteorological conditions are presented in Table 5-2 and Table 5-3, respectively.

Table 5-2 Predicted L_{Amax} Receiver Noise Levels – Calm Meteorology

Receiver	Source/Activity					Sleep Disturbance Screening Level	Complies?
	Pneumatic Brake	Drop on Wagons	Hardstand Drop 1.5 m	Hardstand Drop 4.5 m	Hardstand Drop 7.5 m		
NCA1	36	48	44	48	49	52	Yes
NCA2	<20	32	31	33	34	51	Yes
NCA3	32	43	42	43	45	47	Yes
NCA4	25	36	36	37	37	50	Yes

Table 5-3 Predicted L_{Amax} Receiver Noise Levels – Adverse Meteorology

Receiver	Source/Activity					Sleep Disturbance Screening Level	Complies?
	Pneumatic Brake	Drop on Wagons	Hardstand Drop 1.5 m	Hardstand Drop 4.5 m	Hardstand Drop 7.5 m		
NCA1	40	51	48	52	52	52	Yes
NCA2	23	36	35	37	38	51	Yes
NCA3	37	47	47	47	**49**	47	**No**
NCA4	30	41	41	42	42	50	Yes

The results in Table 5-2 indicate that L_{Amax} noise levels are predicted to comply at all residential receivers under calm meteorology. Under adverse meteorology, Table 5-3 shows that the predicted L_{Amax} noise levels at the most potentially affected receivers in NCA1, NCA2 and NCA4 are predicted to comply with the sleep disturbance screening levels, but are predicted to exceed the sleep disturbance screening level at the most potentially affected receiver in NCA3 by 2 dB.

5.1.3 Mitigation of L_{Amax} Noise Levels

The predicted exceedance of the sleep disturbance screening level in NCA3 is based on modelling the source at a height of 7.5 meters, which represents stacking a container "three high".

As noted in the Joint Expert Report, a number of large structures proposed to be established on the wider MPE Site, and on other sites to the north and west of the Project will provide significant acoustic shielding in the future. In the meantime, it is proposed that a Container Noise Barrier Management Plan (CNBMP) is developed so that container stacks are used to provide shielding, and to manage container handling activities with a view to lowering L_{Amax} noise levels at sensitive residential receivers associated with these activities.

The Joint Expert Report recommends that stacking containers during the night time should be considered in detail in the CNBMP. Specifically, the Joint Expert Report recommends that, during the night time, containers should not be stacked more than "two high". This recommendation is not suggesting a height limit on the container stacks. Rather, the recommendation is that, during the night time, a container may be stacked onto a single container, but not onto a stack of two or more containers. Such an approach would avoid the activity identified in Table 5-3 as having the potential to cause an exceedance of the sleep disturbance screening level at sensitive receivers.

The efficacy of the CNBMP should be confirmed, and the need for any additional mitigation or management identified, via compliance monitoring.

5.2 Distribution of Maximum Noise Levels

Wilkinson Murray has previously conducted a number of attended measurements at an operational intermodal facility during the unloading of trains by manual handling equipment including container forklifts and reach stackers.

The measurement results indicate that the L_{Amax} SWL of container handling, at that facility, typically ranges from 111 dBA to 123 dBA, with the majority of events having an L_{Amax} SWL of

118 dBA or less. It is noted that the highest observed L_{Amax} SWL is within the range, however not quite as high, as the highest L_{Amax} SWL in the Joint Expert Report. With consideration of the measurements conducted by Wilkinson Murray, and the Joint Expert Report, the likely range of L_{Amax} SWL associated with container handling is assumed to be 111 – 125 dBA.

It was observed that three reach stackers were typically used to unload each train. The measurement results show that three reach stackers typically produce 6 – 10 maximum noise events in a 15-minute period. It was noted during the monitoring that it typically takes approximately 2 hours to unload a train. Therefore, it is anticipated that approximately 48 – 80 maximum noise events would be generated for each train that is unloaded.

As presented in the EIS, approximately two trains per night would be unloaded within the IMEX No.1 terminal, resulting in approximately 100 – 160 maximum noise events. Up to six reach stackers would operate within the Project site, and it is anticipated that, typically, three reach stackers would operate on the eastern side of the rail siding and three on the western side. During typical night time operations of the IMEX No.1 it is considered most likely that only one train would be unloaded at a time, resulting in up to 80 maximum noise events in a 2-hour period, with two such 2-hour periods occurring per night. It is also foreseeable that the unloading of one train could begin prior to the completion of unloading the previous train. In this case, maximum noise events would be expected to be generated at a rate of approximately 12 – 20 events per 15-minute period.

As described above, the greatest occurrence of maximum noise events is anticipated to occur during the unloading of trains. Therefore, a noticeable change in the L_{Amax} noise environment at sensitive receiver may occur shortly following the arrival of a train. However, since the movement of trains would not typically follow a regular "timetable" these changes in L_{Amax} noise levels would not be associated with a particular time of the day but, rather, the activity of a train arriving at the site.

The predicted L_{Amax} noise levels at sensitive receivers presented in Table 5-2 and Table 5-3 are based upon fixed L_{Amax} SWLs of 122 dBA and 125 dBA for pneumatic brakes and container drops, respectively. Therefore, based on the measured range of the L_{Amax} SWL from container drops of 111 – 125 dBA, Table 5-4 presents the likely range of L_{Amax} noise levels at receivers, during both calm and adverse meteorological conditions, during the operation of the IMEX No.1, as per the AFC design.

Table 5-4 Predicted Range of L_{Amax} Noise Levels

Receiver ID	Predicted L_{Amax} Noise Level (dBA)				Sleep Disturbance Screening Level (dBA)	Complies?
	Calm[1]		Adverse[2]			
	Min	Max	Min	Max		
NCA1	35	49	38	52	52	Yes
NCA2	20	34	24	38	51	Yes
NCA3	31	45	35	**49**	47	**No**
NCA4	23	37	28	42	50	Yes

1. CONCAWE Category 4.
2. CONCAWE Category 6.

The results in Table 5-4 indicate that L_{Amax} noise levels at sensitive receivers, associated with the operation of the Project, would vary considerably depending upon the activities conducted on the site, and the prevailing meteorology.

5.3 Existing Ambient L_{Amax} Noise Levels

Data from unattended noise monitoring conducted by Wilkinson Murray at 26 Woodlake Court, Wattle Grove (L16) and 17 Buckland Road, Casula (L17) have been used to provide an indication of the existing maximum noise levels in NCA1 and NCA3, respectively. The noise monitoring locations are shown on Figure 5-1, and are labelled L16 and L17 consistent with the Tonin Expert Report from the LEC proceedings. The noise monitoring was conducted between 18 and 25 July 2017 at L16 and between 20 July and 2 August at L17.

At monitoring location L16, the existing ambient L_{Amax} noise events were dominated by birds, whereas train movements on the Main Southern Line and Southern Sydney Freight Line dominated the ambient L_{Amax} noise levels at monitoring location L17.

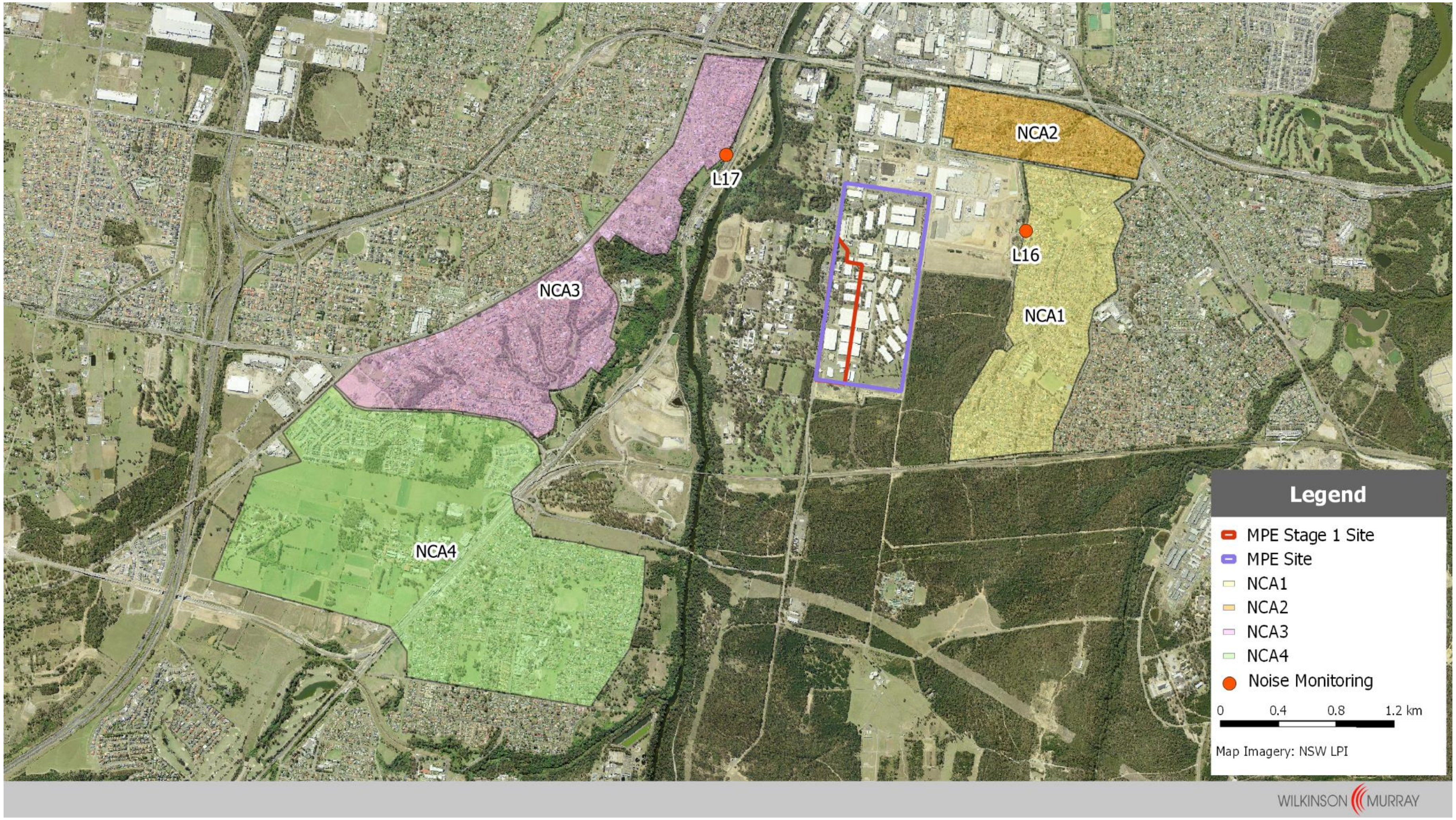
The monitoring data was analysed to understand the range of existing L_{Amax} noise levels in the respective noise catchments. All noise events with an L_{Amax} noise level of 55 dBA or more where identified during the night time period (10:00pm – 7:00am). The period between 6:00am and 7:00am was often omitted from the analysis as the morning "bird song" produced far too many L_{Amax} noise events to sensibly analyse. The identified L_{Amax} noise events from all night time periods were collated into 5 dBA "bins" and the average number of events per night in each bin are presented in Table 5-5.

It should be noted that, in reality, the number of maximum noise events in NCA1 and NCA3 may be lower than that presented in Table 5-5. Although there is no formal definition of what constitutes a maximum noise event, it is reasonable to assume that maximum noise level events should only be counted where the L_{Amax} noise level exceeds the background noise level by more than 15 dBA. There would be some periods of time in both NCA1 and NCA3 where the background noise levels exceed 40 dBA, and some maximum noise events, particularly in the 55-60 dBA range, should not be counted.

Table 5-5 Existing L_{Amax} Noise Levels

L_{Amax} noise Level (dBA)	Average No. of Events Per Night	
	L16 (NCA1 – Wattle Grove)	L17 (NCA3 – Casula)
55-60	53	62
60-65	11	61
65-70	2	23
70-75	0	9
75-80	0	7
80-85	0	2
85-90	0	0

Figure 5-1 Unattended Noise Monitoring Locations



5.4 L_{Amax} Noise Levels from the Project versus Ambient Noise Levels

The range of predicted L_{Amax} noise levels at the most affected residential receivers in NCA1 and NCA3, compared to the existing noise levels during a typical night, are shown graphically in Figure 5-2 and Figure 5-3, respectively.

In Figure 5-2 and Figure 5-3, the existing ambient noise levels were established using the L_{Aeq} noise level, measured at 1 second intervals. The $L_{Aeq, 1sec}$ noise descriptor provides an approximation of the overall ambient sound pressure level versus time.

The plots also show that ambient noise levels are typically lowest between approximately midnight and 4:00am, after which time there is a noticeable increase in ambient noise levels. The increase in ambient noise levels from 4:00am is typically associated with increased human and wildlife activity.

As discussed in Section 5.3, maximum noise level events should only be counted where the L_{Amax} noise level exceeds the background noise level by more than 15 dBA. Therefore, the number of maximum noise level events would reduce after 4:00am due to the increase in the background noise level.

Plots in Appendix B show the existing ambient L_{Amax} noise levels, in one minute intervals, during the night time for both monitoring locations.

Figure 5-2 Predicted Operational L_{Amax} Noise Levels Vs Ambient Noise Levels – NCA1 (24 July 2017)

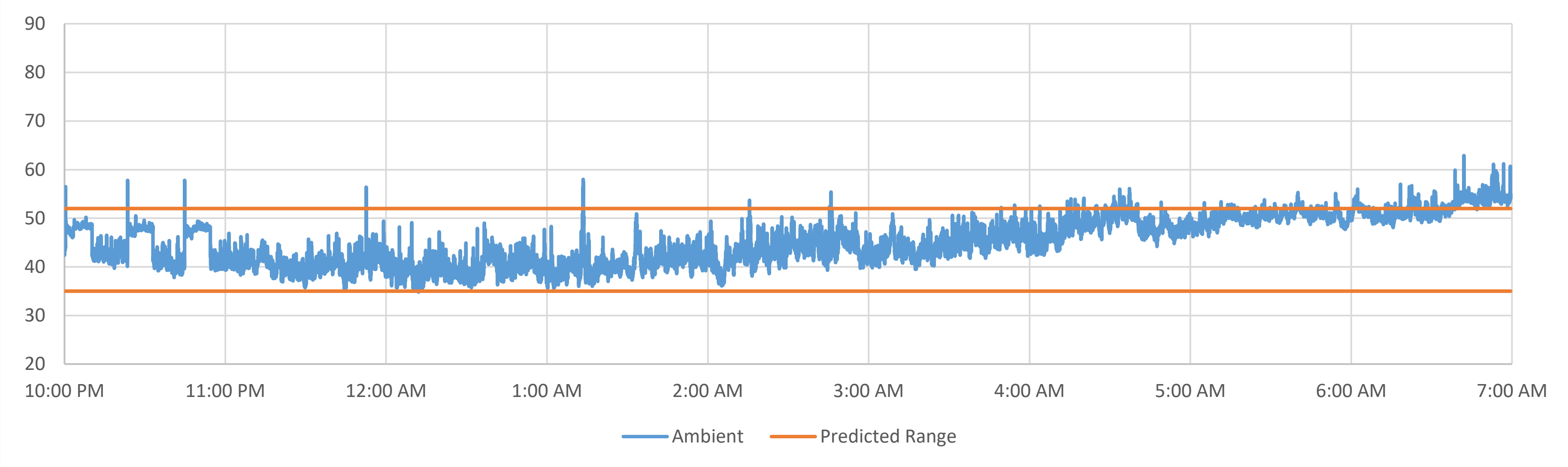
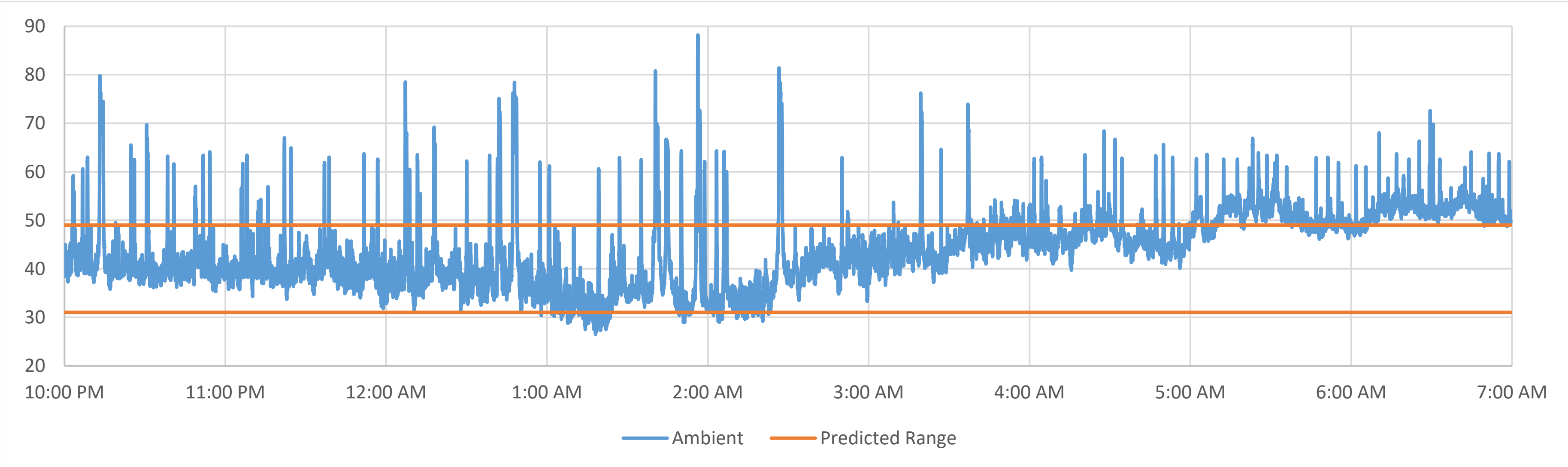


Figure 5-3 Predicted Operational L_{Amax} Noise Levels Vs Ambient Noise Levels – NCA3 (24 July 2017)



6 CONCLUSION

This technical report has been prepared to provide an updated assessment of sleep disturbance impacts based on the final Approved for Construction (AFC) design of the IMEX No.1 terminal, as part of the MPE Stage 1 Project (SSD 14-6766) to satisfy the MPE Stage 1 Development Consent (SSD 14-6766) *Condition E25: Review of Operational Sleep Disturbance Impacts.*

The AFC design of the IMEX No.1 terminal has been reviewed, and compared to the design presented in the EIS. Changes to the design of the IMEX No.1 terminal between the EIS and RTS design levels are considered to be minor and would have a negligible effect on L_{Amax} noise levels at sensitive receivers.

Further, the Joint Expert Report as presented to the LEC, has also been reviewed and considered within this report. As part of these proceedings, the expert witness (acoustics) acting for Qube, Renzo Tonin, has argued that the time night RBL in Casula and Wattle Grove be adjusted downwards, based on recent background noise monitoring data. Revised sleep disturbance screening levels have been established based on the recommended night time RBL in each receiver catchment.

L_{Amax} sound power levels for transient events, agreed to by the relevant expert witnesses, and revised L_{Amax} predictions presented in the Joint Expert Report have been adopted in this assessment to represent the highest expected L_{Amax} noise levels at the most affected residential receivers due to the operation of the Project.

The predicted L_{Amax} noise levels comply with the sleep disturbance screening levels at all residential receivers under calm meteorology. Under adverse meteorology, the predicted L_{Amax} noise levels at the most potentially affected receivers in NCA1, NCA2 and NCA4 are predicted to comply with the sleep disturbance screening levels, but are predicted to exceed the sleep disturbance screening level at the most potentially affected receiver in NCA3 by 2 dB.

In order to mitigate L_{Amax} noise levels at sensitive receivers, the Joint Expert Report proposes that a Container Noise Barrier Management Plan (CNBMP) is developed so that container stacks are used to provide shielding, and also to manage container handling activities with a view to managing L_{Amax} noise levels at sensitive residential receivers. The efficacy of the CNBMP would be confirmed, and the need for corrective actions identified, via compliance monitoring.

Data from noise measurements conducted by Wilkinson Murray at an operational intermodal facility has been used to identify the range of likely L_{Amax} noise levels at receivers due to the operation of the IMEX No.1 terminal.

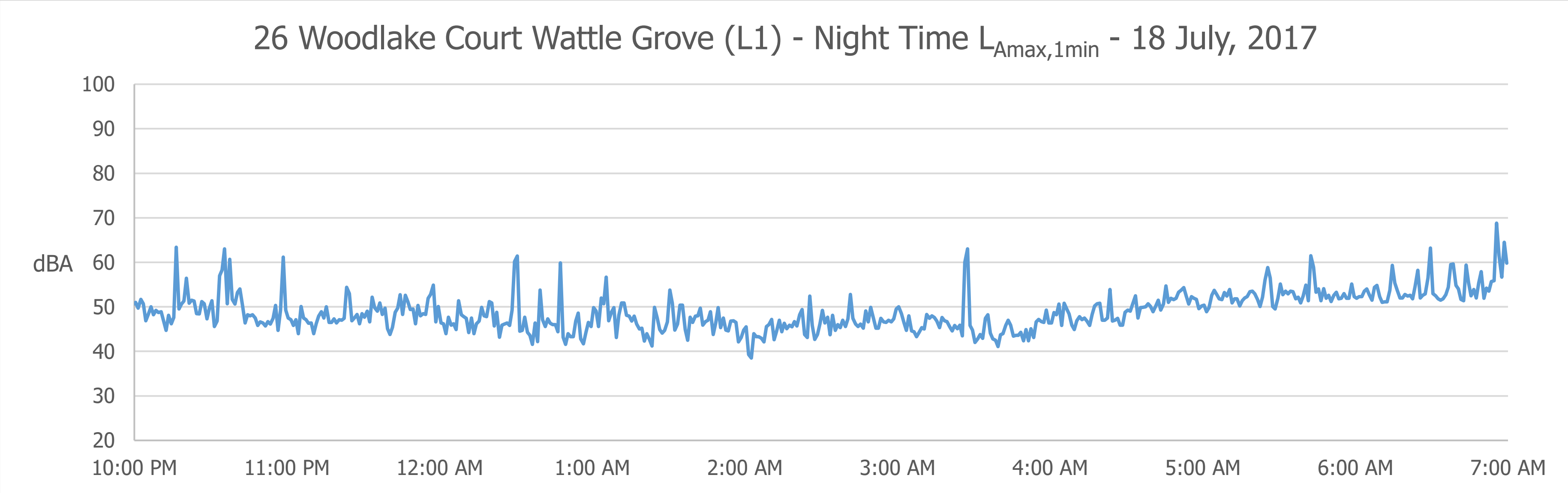
The existing ambient maximum noise level environment in the most sensitive receiver catchments, Wattle Grove and Casula, have been understood by analysing 100 ms data from unattended noise monitoring recently conducted by Wilkinson Murray.

APPENDIX A

EPA REVIEW LETTER

APPENDIX B

NIGHT TIME AMBIENT L_{AMAX} NOISE LEVELS


26 Woodlake Court Wattle Grove (L1) - Night Time $L_{Amax,1min}$ - 18 July, 2017
dBA
100
90
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10:00 PM
11:00 PM
12:00 AM
1:00 AM
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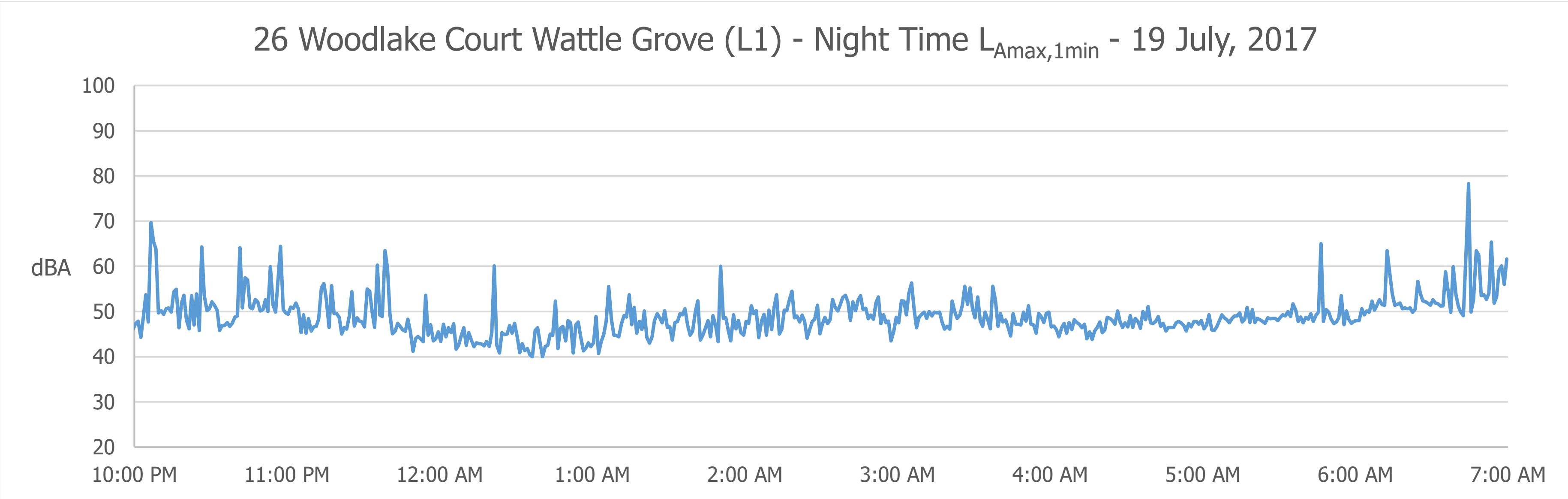
3:00 AM
4:00 AM
5:00 AM
6:00 AM
7:00 AM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dBA
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10:00 PM
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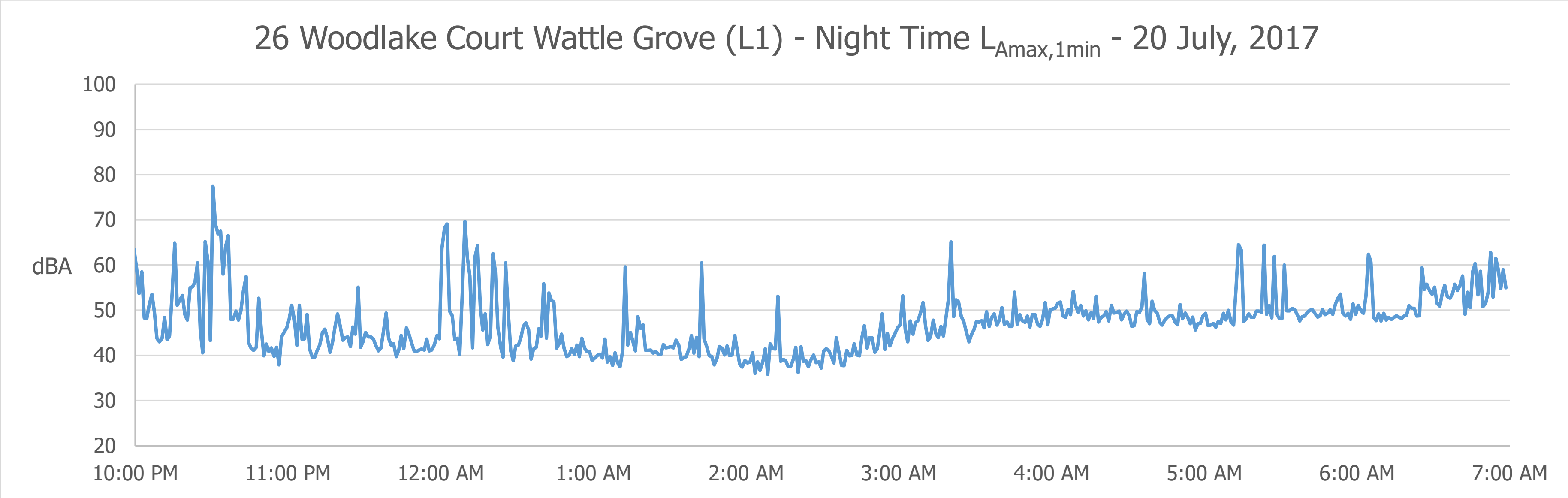
26 Woodlake Court Wattle Grove (L1) - Night Time LAmax,1min - 20 July, 2017
dBA
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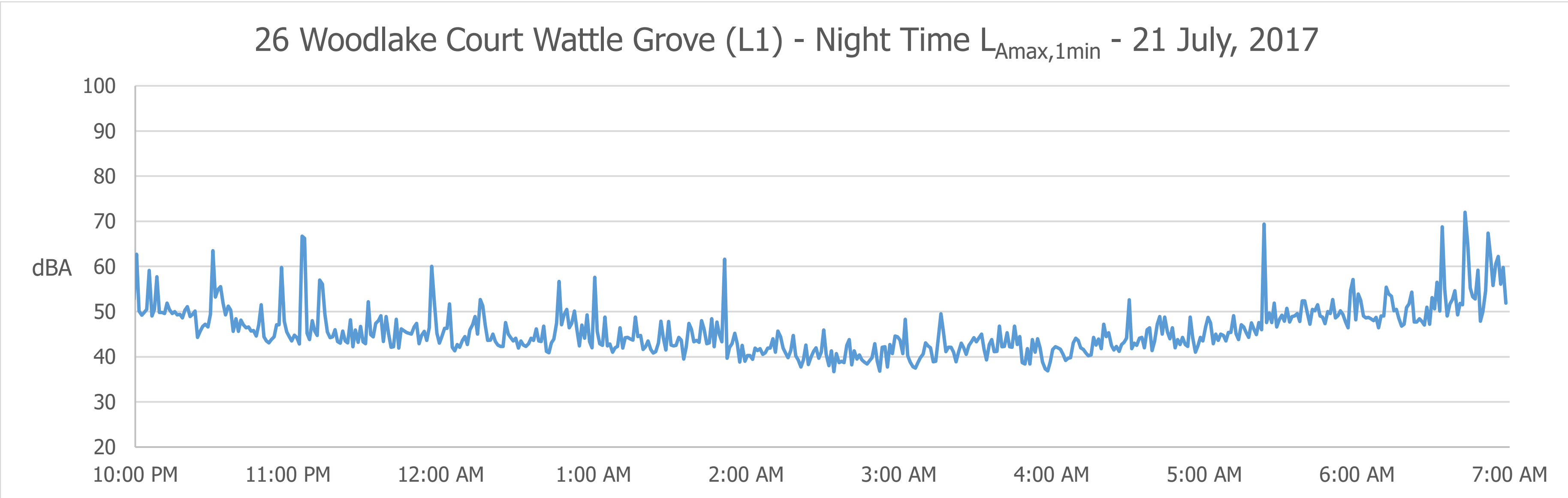
26 Woodlake Court Wattle Grove (L1) - Night Time LAmax,1min - 21 July, 2017
dBA
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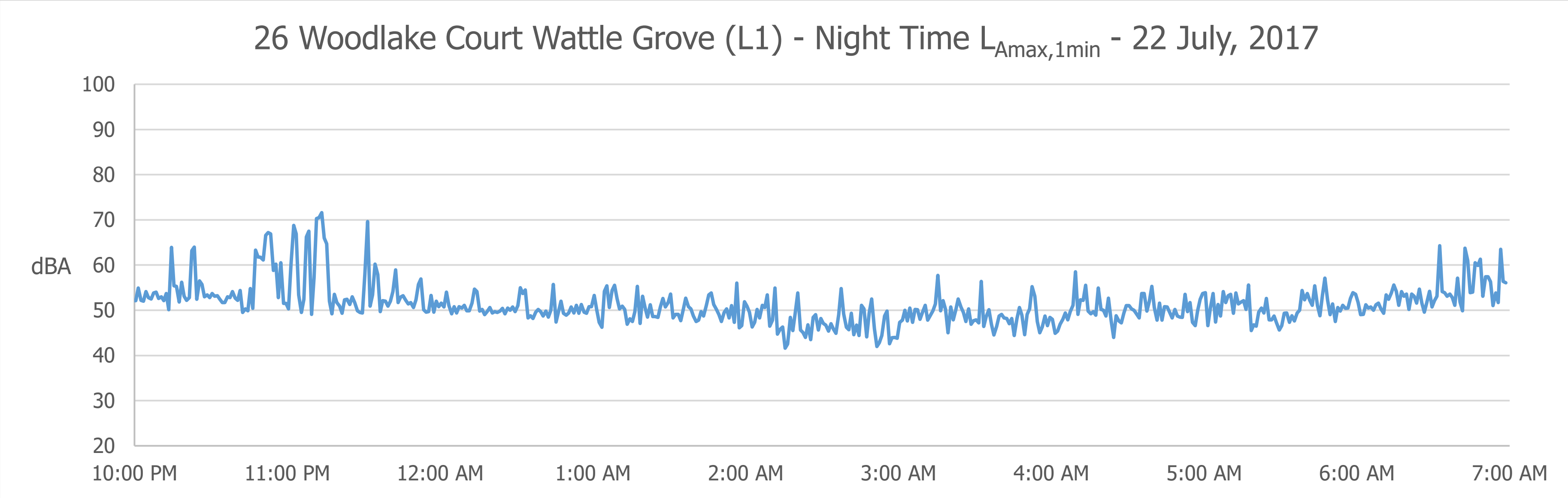
26 Woodlake Court Wattle Grove (L1) - Night Time LAmax,1min - 22 July, 2017
dBA
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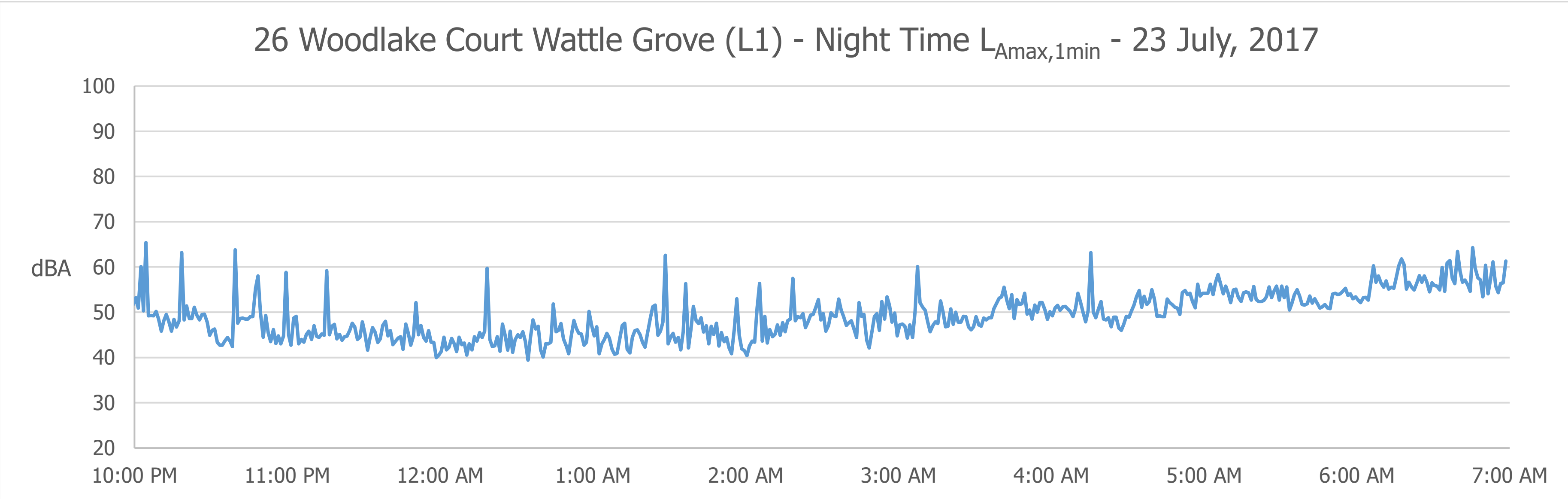
26 Woodlake Court Wattle Grove (L1) - Night Time LAmax,1min - 23 July, 2017
dBA
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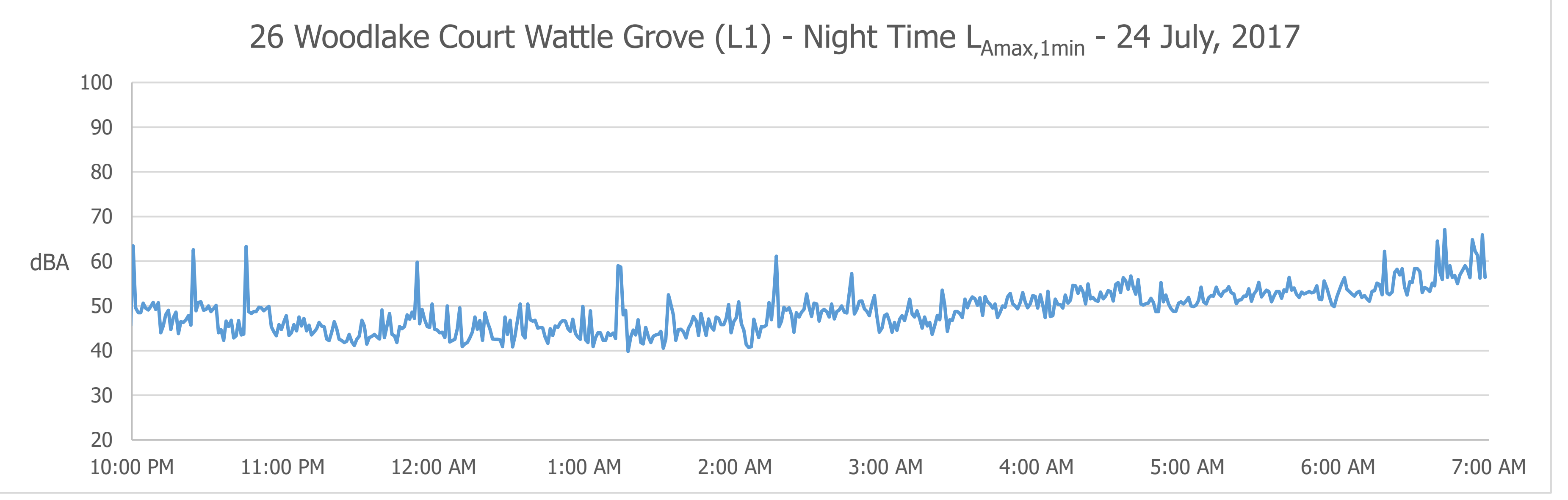
26 Woodlake Court Wattle Grove (L1) - Night Time L Amax,1min - 24 July, 2017
dBA
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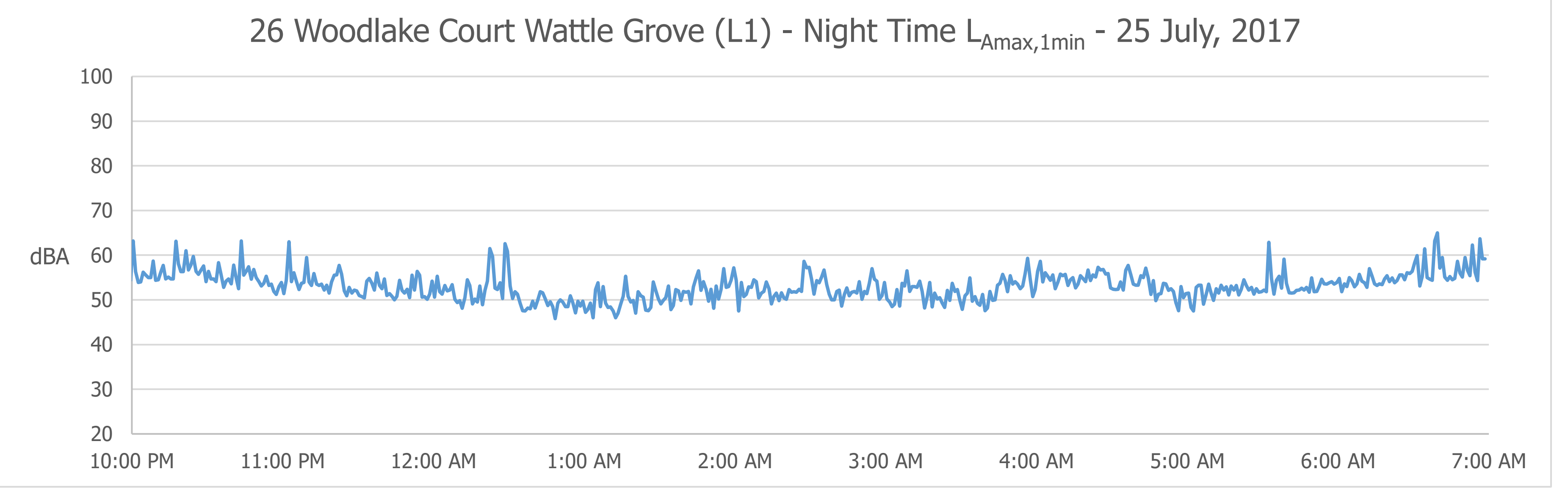
26 Woodlake Court Wattle Grove (L1) - Night Time L Amax,1min - 25 July, 2017
dBA
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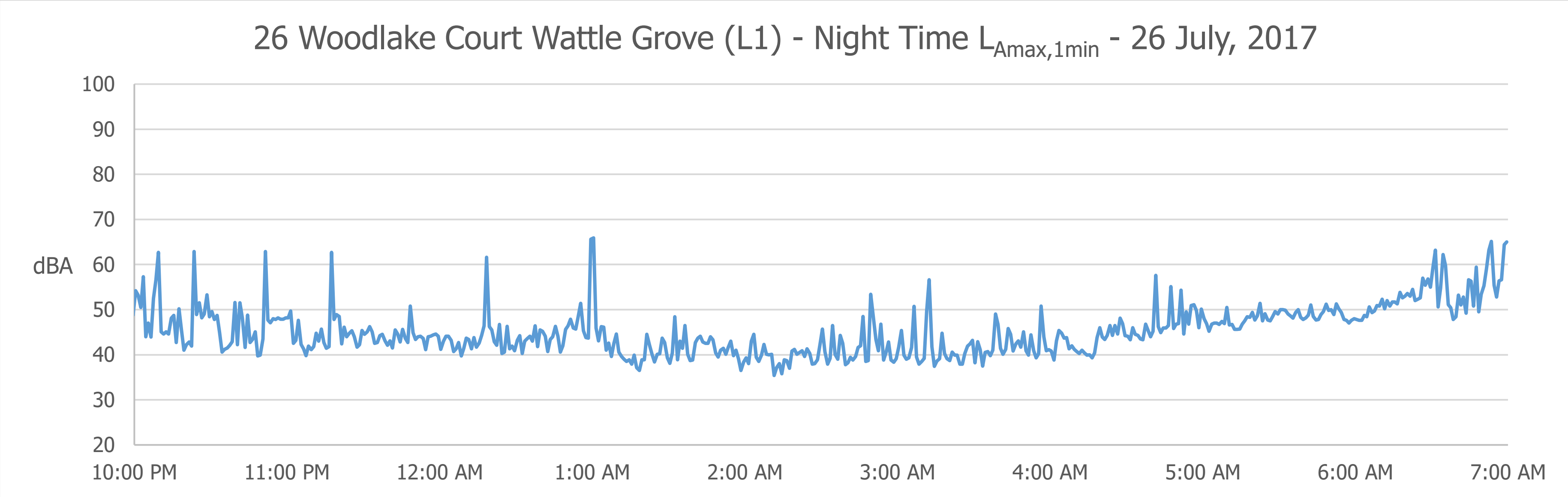
26 Woodlake Court Wattle Grove (L1) - Night Time LAmax,1min - 26 July, 2017
dBA
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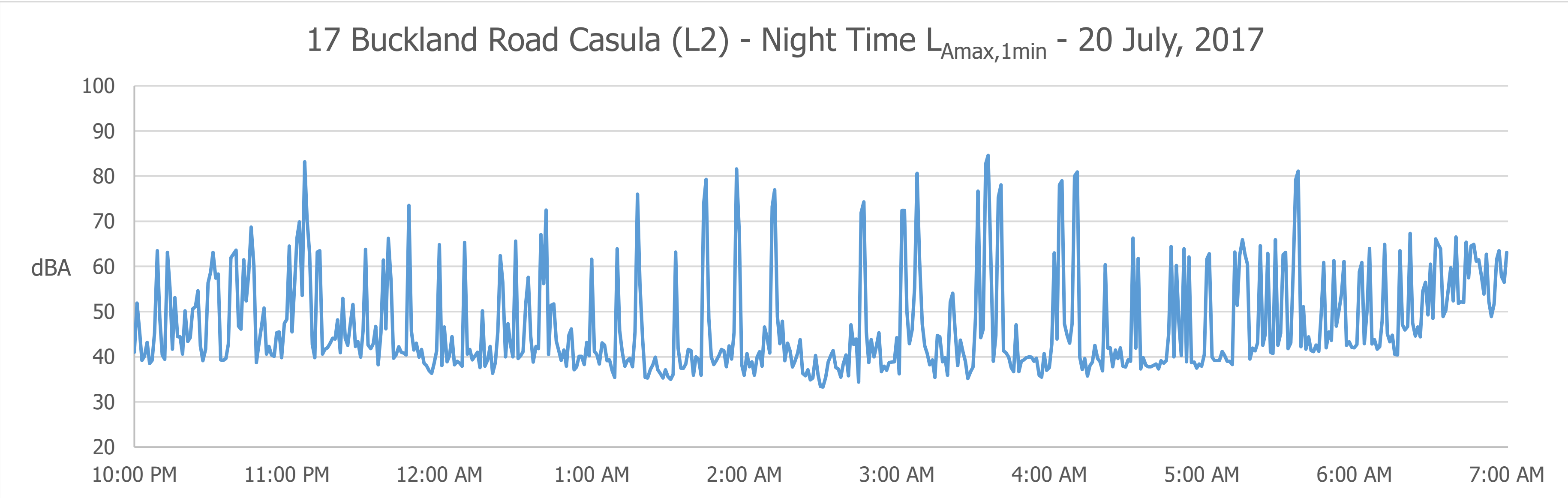
17 Buckland Road Casula (L2) - Night Time LAmax,1min - 20 July, 2017
dBA
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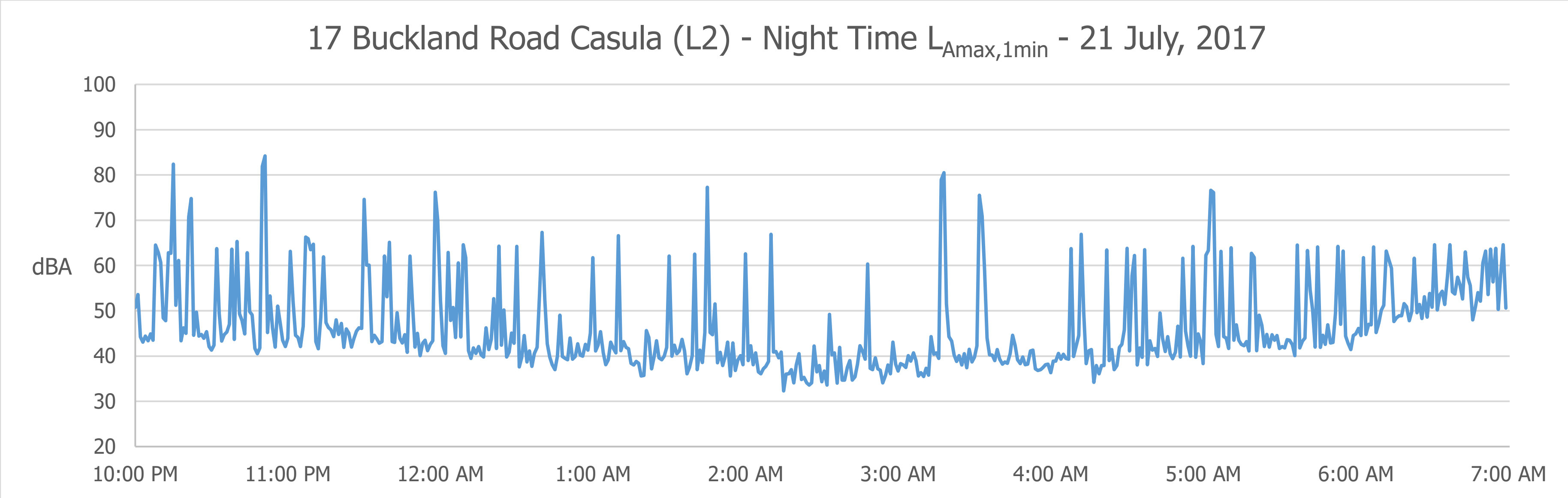
17 Buckland Road Casula (L2) - Night Time $L_{Amax,1min}$ - 21 July, 2017
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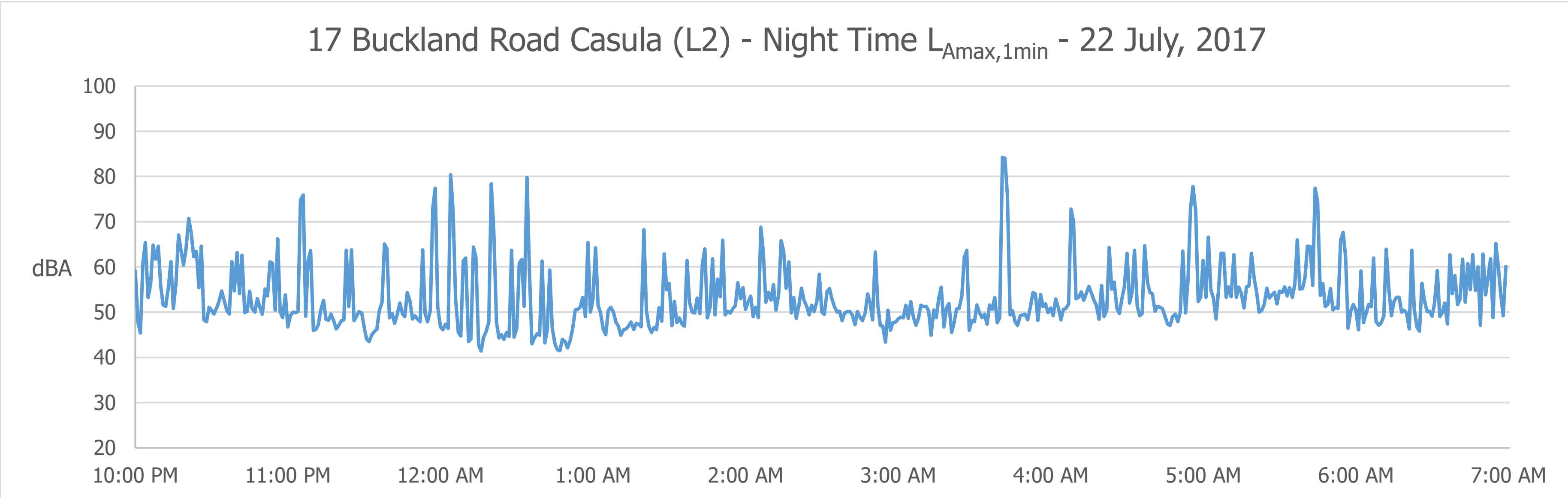
17 Buckland Road Casula (L2) - Night Time $L_{Amax,1min}$ - 22 July, 2017
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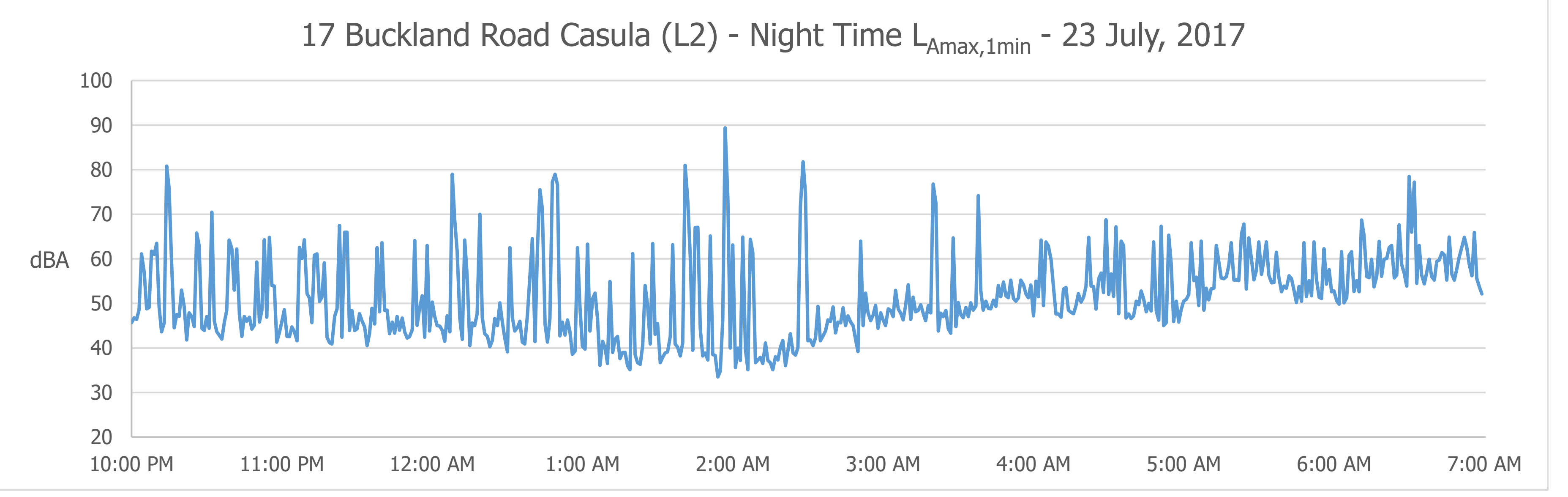
17 Buckland Road Casula (L2) - Night Time LAmax,1min - 23 July, 2017
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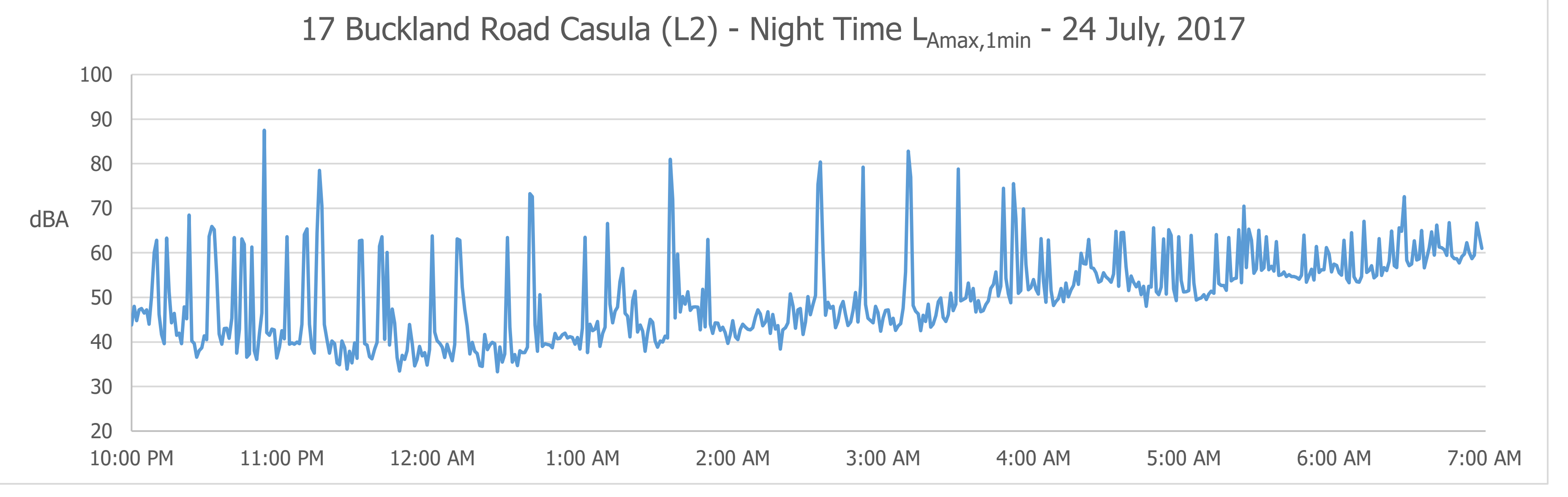
17 Buckland Road Casula (L2) - Night Time LAmax,1min - 24 July, 2017
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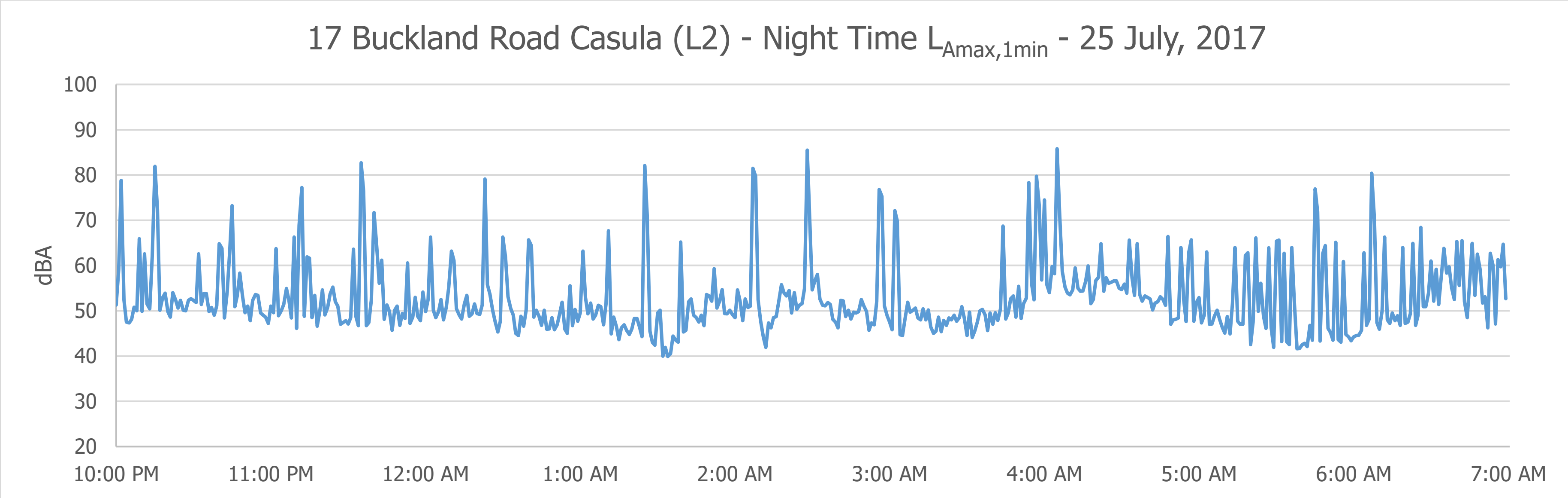
17 Buckland Road Casula (L2) - Night Time LAmax,1min - 25 July, 2017
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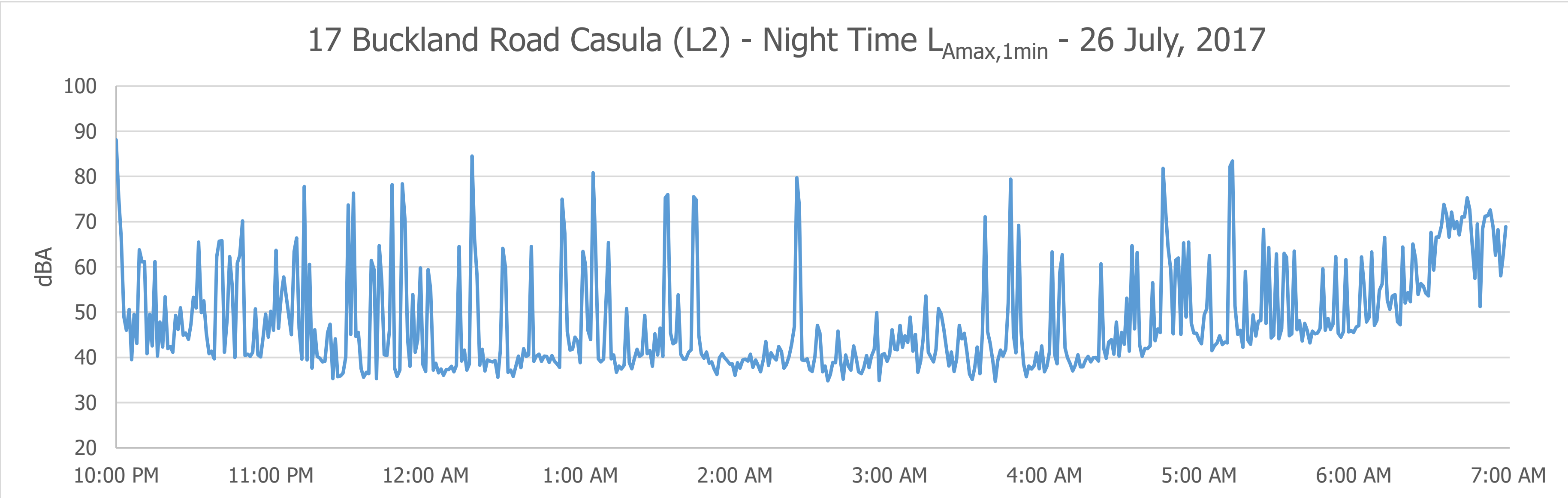
17 Buckland Road Casula (L2) - Night Time LAmax,1min - 26 July, 2017
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