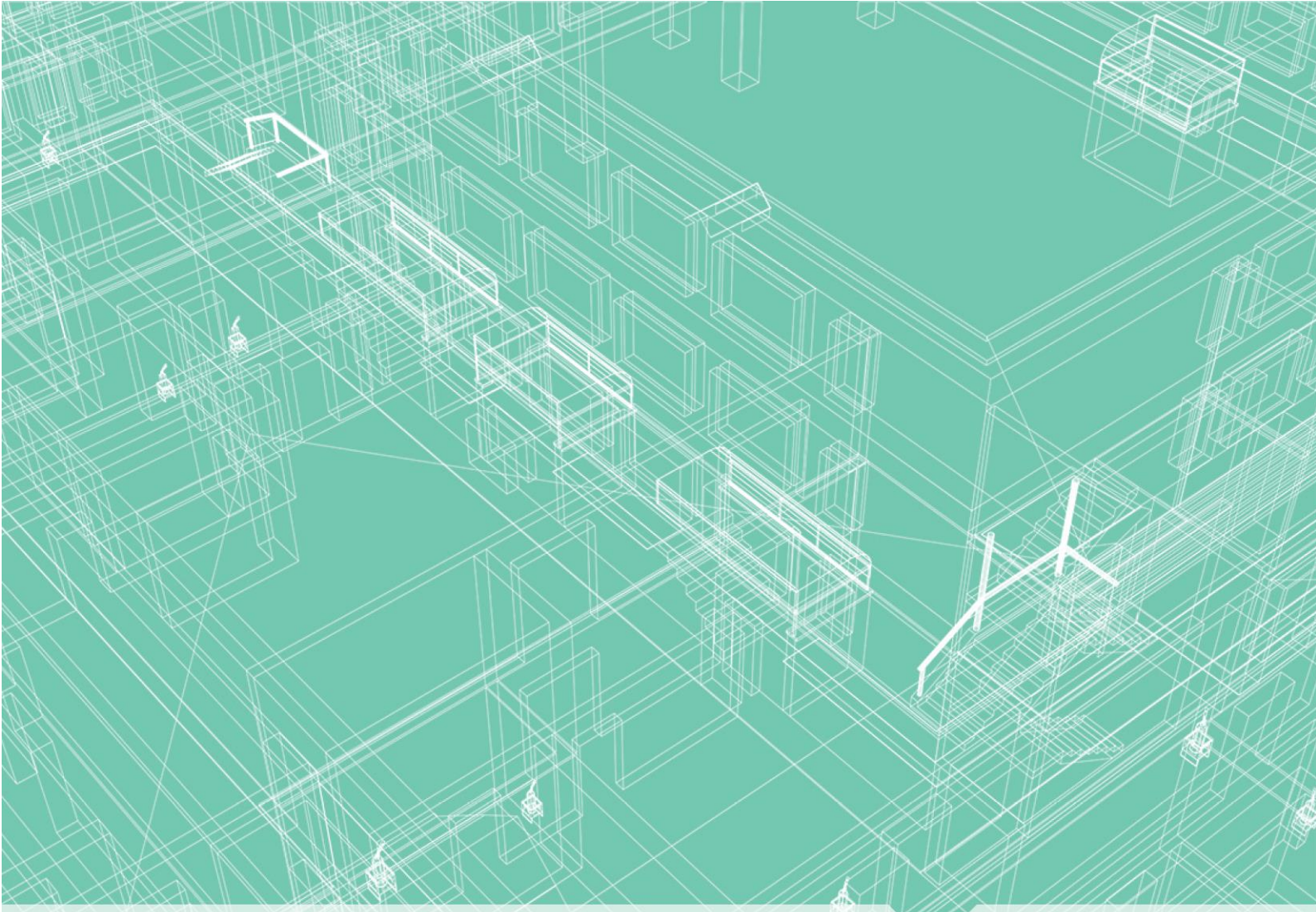

NOISE & VIBRATION IMPACT ASSESSMENT FOR SSDA (SSD-10383)

WESTMEAD CATHOLIC COMMUNITY EDUCATION CAMPUS

(STAGE 1)

JHA

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CONTENTS

1 INTRODUCTION

1.1 OVERVIEW

This acoustic report has been prepared by JHA Consulting Engineers on behalf of the Catholic Education Diocese of Parramatta (CEDP) (the Applicant).

This accompanies the State Significant Development Application (SSD 10383) for the proposed Westmead Catholic Community Education Campus (the Proposal) located on the intersection of Darcy Road with Mons Road.

Westmead Catholic Community Education Campus seeks consent for a new Primary school with capacity for approximately 1,680 students, new Parish church, Early Learning Centre, and landscaping.

This report shall be read in conjunction with the Architectural design drawings and other consultant design reports submitted as part of the application.

The objectives of this acoustic assessment are:

- Identify noise sensitive receivers that will potentially be affected by the operation and construction of the proposed development.
- Carry out noise surveys to determine existing ambient and background noise levels on site.
- Establish appropriate noise criteria in accordance with the relevant standards, guidelines and legislation for the following noise emissions:
  - Mechanical plant from the development to the surrounding receivers.
  - Public address and school bell systems.
  - Activities and events within the Parish Church.
  - Noise from Outdoor spaces located within the Primary School.
  - Early Learning Centre.
  - Traffic Noise Generated.
- Establish noise and vibration criteria for construction work in accordance with the standards and guidelines.
- Determine whether the relevant criteria can be achieved based on the proposed operations and construction methods. Where applicable, provide recommendations for any necessary acoustic control measures that will need to be incorporated into the development or use in order to ensure with the assessment criteria.
- Provide recommendations for Construction Noise and Vibration Planning.

The following documentation has been used for the preparation of this report:

- Architectural drawings of the proposed development.
- Noise data collected on site through the use of noise loggers and a hand held spectrum analyser.
- Traffic Report Prepared by The Transport Planning Partnership
- SEARS request provided.

This document and related work has been prepared following JHA Consulting Engineers Quality and Environmental Management Systems, which are based on AS/NZS ISO 9001 and ISO 14001.

1.2 RESPONSE TO SEARS

The acoustic report is required by the Secretary's Environmental Assessment Requirements (SEARs) for SSD 10383. This table identifies the relevant SEARs requirement/s and corresponding reference/s within this report.

SEARs Item	*Report Reference*
5. Environmental Amenity *• Detail amenity impacts including solar access, acoustic impacts, visual privacy, view loss, overshadowing and wind impacts. A high level of environmental amenity for any surrounding residential land uses must be demonstrated.*	Section 5
12. Noise and Vibration *• Identify and provide a quantitative assessment of the main noise and vibration generating sources during demolition, site preparation, bulk excavation, construction. Outline measures to minimise and mitigate the potential noise impacts on surrounding occupiers of land.*	Section 6
• Identify and assess operational noise, including consideration of any public-address system, school bell, mechanical services (e.g. air conditioning plant), use of any school hall for concerts etc. (both during and outside school hours) and any out of hours community use of school facilities, and outline measures to minimise and mitigate the potential noise impacts on surrounding occupiers of land.	Section 5
Relevant Policies and Guidelines: • *NSW EPA Noise Policy for Industry (2017)* • *Interim Construction Noise Guideline (DECC)* • *Assessing Vibration: A Technical Guideline 2006* • *Development Near Rail Corridors and Busy Roads – Interim Guideline (Department of Planning 2008)* • *Australian Standard 2363:1999 'Acoustics – Measurement of noise from helicopter operations'.*	Section 4

Table 1: SEARs and Relevant References.

2 DESCRIPTION OF THE PROPOSAL

Westmead is a suburb of Sydney in the local government area of Cumberland, being approximately 26km West of Sydney CBD. The Westmead Catholic Community Education Campus (WCC) site is located on Darcy Road at the intersection of Mons Road, in Westmead.

The existing site is surrounded by public and private health infrastructure (specifically Westmead Public and Private Hospitals), NSW Health Staff Housing, Western Sydney University Westmead Campus and residential receivers. The surrounding land uses are as follows:

- *North*: Immediately north of the site is currently Occupied by Medical Uses. It is identified as part of the Westmead Hospital Complex.
- *East*: Land to the east is currently occupied by Educational and Hospital uses. It is identified as the Westmead Campus of Western Sydney University, and the Greater Westmead Hospital Complex.
- *South*: Land to the south is currently occupied by residential receivers. It is identified as part of the greater Westmead residential area. The boundary between this residential area and the site is the T1 Western Railway Line.
- *West*: Land to the west of the site is currently identified as residential receivers. This land is part of the Monaco Estate and NSW Health Staff Housing for the nearby Westmead Hospital Complex.

Figure 1 highlights the location of the WCC Stage 1 site (red shadow), Residential Receivers (blue shadow), Educational Receivers (yellow shadow), Hospital (Medical) Receivers (green shadow) and the greater WCC site (orange line).

Figure 1: Westmead Catholic Community Education Campus Stage 1 location (red shadow) with the extent of the site outlined in orange.

The WCC Stage 1 is proposed to accommodate approximately 1680 students in a new primary school. The proposed development will include:

- New 5 level educational building with outdoor rooftop space for Kindergarten to Year 6 students
- New Parish Church.
- Catholic Early Learning Centre (CELC) / administrating building fit out of existing facility.
- New Landscaping areas.

Figure 2 shows the proposed development layout within its boundary as shown in the architectural drawings.

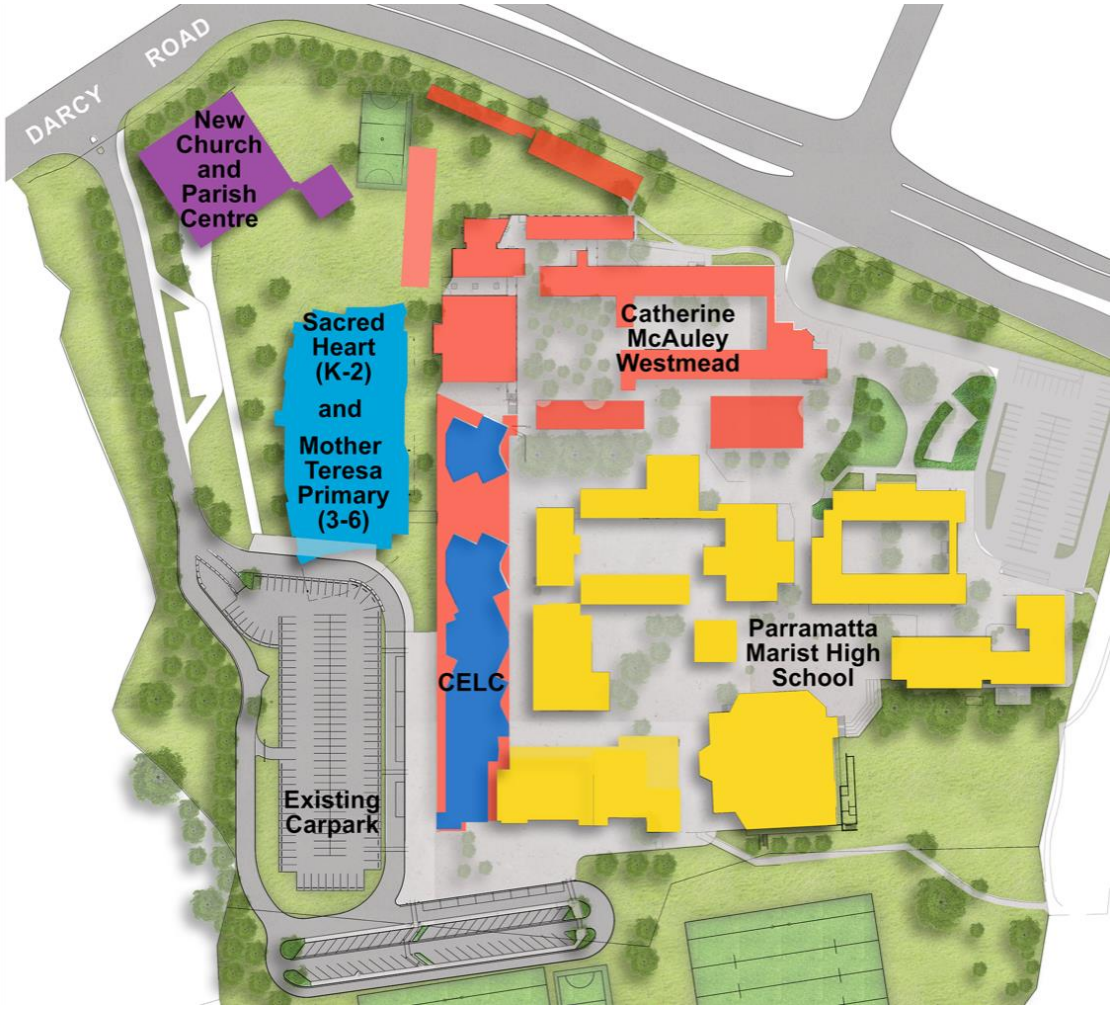


Figure 2: Site layout of the proposed development.

At this stage, it is understood that WCC will operate within typical school hours. The following operating hours have been used for the noise assessment purposes:

- School hours: 6am to 6pm.
- Out of hours: 6am to 6pm
- CELC: 6am to 6pm
- Parish Church Operating Hours
  - Mon-Fri: 8-10am
  - Sat: 8-10am, 4:30-7pm
  - Sun: 7am-12pm

3 SITE MEASUREMENTS

3.1 GENERAL

Attended and unattended noise surveys were conducted at the locations shown in Figure 3 in order to establish the ambient and background noise levels of the site and surrounds. The location L1 was found to be representative of the nearest most affected residential receivers to the West. Measurements were conducted at L2 to establish traffic noise levels impacting the site. It shall be noted that during the second week of noise monitoring, the existing on-site school facilities were in operation.

Noise surveys have been carried out in accordance with the method described in the AS/NZS 1055:2018 *'Acoustics – Description and measurement of environmental noise'.*

Figure 3: Noise surveys location, Stage 1 (Red Shading) and boundary of the WCC site

3.2 SHORT-TERM NOISE MONITORING

Short-term noise monitoring was carried out to obtain representative octave band noise levels of the site and noise levels from the site.

On Thursday 23rd January 2020, a short-term noise measurement was carried out during the day-time period. Short-term noise measurement was carried out with a Rion NL-52EX hand-held Sound Level Meter (SLM) (Serial Number 1054192). The calibration of the SLM was checked before and after each use with a Larson Davis Cal 200 Class 1 Calibrator (Serial Number 15054) and no deviations were recorded.

The SLM microphone was mounted 1.5 metres above the ground and a windshield was used to protect the microphone. Measurement was undertaken in the free-field – i.e. more than 3.5 metres away from any

building façade or vertical reflective surface. Weather conditions were calm and dry during the attended noise monitoring.

From observations during the site visit, it is noted that at location 2, the ambient and background noise levels are dominated by surrounding traffic noise. A summary of the results of the short-term noise monitoring are shown in Table 2.

Location	*Date and Time*	*Parameter*	*Sound Pressure Level, dB re 20µPa*								
			Overall dB(A)	*Octave Band Centre Frequency, Hz*							
				63	*125*	*250*	*500*	*1k*	*2k*	*4k*	*8k*
M1	23/01/2020 10.45 – 11.00	$L_{90,15min}$	**51**	60	59	54	50	49	47	40	33
		$L_{eq,15min}$	**52**	61	61	55	52	50	47	42	36
		$L_{10,15min}$	**56**	65	65	59	57	53	51	46	41
M2	05/02/2020 14.45 – 15:00	$L_{90,15min}$	**55**	62	55	51	52	51	48	42	34
		$L_{eq,15min}$	**63**	70	62	58	60	59	56	51	45
		$L_{10,15min}$	**67**	72	65	61	63	63	60	54	48

Table 2: Results of the short-term noise monitoring.

3.3 LONG-TERM NOISE MONITORING

Long-term noise monitoring was carried out from Thursday 23rd January to Tuesday 3rd February 2020 with two Rion NL-52 noise loggers (Serial Numbers 553892 and 175549). The noise loggers recorded L_{A1}, L_{A10}, L_{Aeq} and L_{A90} noise parameters at 15-minute intervals during the measurement period. The calibration of the noise loggers were checked before and after use and no deviations were recorded.

The locations were secure and considered to be representative of the typical ambient and background noise levels. The microphone was mounted 1.5 meters above the ground and windshields were used to protect the microphone.

The detailed results of the long-term noise monitoring are presented graphically in Appendix A. Weather conditions were monitored for the duration of the noise survey and were typically calm and dry with some rain and wind events having been noted to occur during the measurement period. As stated in the NSW NPI, any data likely to be affected by rain, wind or other extraneous noise has been excluded from the calculations (shadowed in the Appendix A graphs).

Background noise levels (L_{A90}) are shown in Table 3, together with the ambient noise levels (L_{Aeq}) measured for each period.

Location	*L_{A90} Background Noise Levels, dB(A)*			*L_{Aeq} Ambient Noise Levels, dB(A)*		
	Day 7am-6pm	*Evening 6pm-10pm*	*Night 10pm-7am*	*Day 7am-6pm*	*Evening 6pm-10pm*	*Night 10pm-7am*
L1	48	44	40	61	56	47
L2	50	50	44	63	63	57

Table 3: Results of the long-term noise monitoring.

4 RELEVANT NOISE STANDARDS AND GUIDELINES

4.1 STANDARDS AND GUIDELINES

The following standards and guidelines are considered relevant to the project and have been referenced in developing the project noise level criteria.

- Noise Emissions
  - Environmental Planning and Assessment (EP&A) Act 1979.
  - Protection of the Environmental Operations (POEO) Act 1997.
  - NSW Environment Protection Authority (EPA) Noise Guide for Local Government (NGLG) 2013.
  - Parramatta Council Legislation.
  - NSW Environment Protection Authority (EPA) Noise Policy for Industry (NPI) 2017.
  - Association of Australasian Acoustical Consultants (AAAC) '*Guideline for Child Care Centre Acoustic Assessment*' 2010.
- Transport Noise
  - NSW Department of Planning (DoP) 'Development Near Rail Corridors or Busy Roads – Interim Guideline' 2008.
  - NSW RNP (Road Noise Policy) 2011.
  - Australian Standard 2363:1999 '*Acoustics – Measurement of Noise from Helicopter Operations.'*
- Construction Noise and Vibration
  - NSW DECCW Interim Construction Noise Guideline (ICNG) 2009.
  - NSW DECC Assessing Vibration: A Technical Guideline 2006.
  - NSW Road Maritime Service (RMS) Construction Noise and Vibration Guideline 2016.
  - Australian Standard AS 2436:2010 '*Acoustics – Guide to Noise Control on Construction, Maintenance & Demolition Sites*'.

4.2 REGULATORY FRAMEWORK

The Environmental Planning and Assessment Act 1979 (EP&A Act) provides the regulatory framework for the protection of the environment in NSW. The EP&A Act is relevantly about planning matters and ensuring that "environmental impact" associated with the proposed development is properly considered and reasonable before granting development consent to develop.

The assessment of "environmental impact" relies upon the identification of acceptable noise criteria which may be defined in a Development Control Plan, or derived from principles using guidelines like NSW EPA Noise Policy for Industry (NPI 2017) or Noise Guide for Local Government (NGLG 2013).

The Protection of the Environment Operations (POEO) Act 1997 has the objective of protecting, restoring and enhancing the quality of NSW environment. Abatement of noise pollution is underpinned by the definition of "offensive noise" as follows:

"...

(a) that, by reason of its level, nature, character or quality, or the time at which it is made, or any other circumstances:

(i) is harmful to (or is likely to be harmful to) a person who is outside the premises from which it is emitted, or

(ii) interferes unreasonably with (or is likely to interfere unreasonably with) the comfort or repose of a person who is outside the premises from which it is emitted, or

(b) that is of a level, nature, character or quality prescribed by the regulations or that is made at a time, or in other circumstances, prescribed by the regulations.

..."

NGLG 2013 provides a checklist to determine an "offensive noise".

4.3 NSW NOISE GUIDE FOR LOCAL GOVERNMENT

NGLG 2013 is a guideline that is at aimed at councils and planners to provide guidance in the management of local noise problems and in the interpretation of existing policy and legislation.

Table 1.3 of NGLG 2013 contains the management for common neighbourhood noise issues and describes Council as the Appropriate Regulatory Authority (ARA) for private educational facilities. The offensive noise test aids in making a systematic judgment about the offensive nature of noise emissions. The NGLG 2013 offensive noise test considers that noise may be offensive in three ways, according to:

- Audibility.
- Duration.
- Inherently offensive characteristics.

4.4 PARRAMATTA COUNCIL LEGISLATION

Relevant Planning Documents of Parramatta Council Legislation have been reviewed for any noise requirement or criteria.

4.4.1 PARRAMATTA COUNCIL LOCAL ENVIRONMENTAL PLAN

The Parramatta Council Local Environmental Plan (P-LEP 2011) is the environmental planning instrument that applies to the site. The Westmead Catholic Community Education Campus site is zoned as Local Centre (SP2) and the surrounding is zoned as Health Services Facility (SP2), High Density Residential (R4), and Mixed Use (B4). Figure 4 shows the land zoning as per information extracted from P-LEP 2011 map 6250_COM_LZN_004_010_20170505.

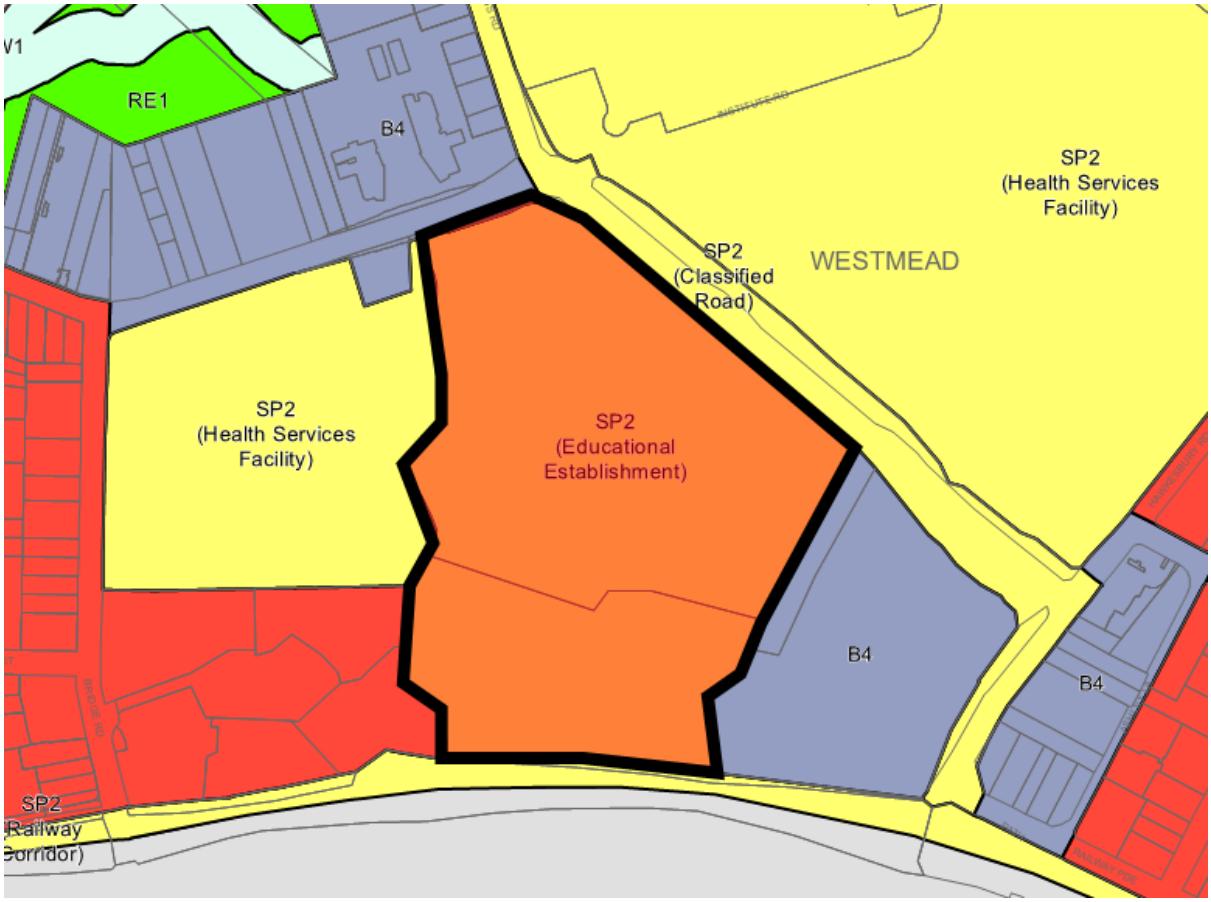


Figure 4: Land Zoning of the site (Orange Shading) and surroundings.

4.4.2 PARRAMATTA COUNCIL DEVELOPMENT CONTROL PLAN

The Parramatta DCP has been reviewed to determine any relevant noise information that applies to the development. The following information has been found in Section 5 which applies to Child Care Centres.

"...

Appendix A10. Acoustic Privacy – Child Care Centres

Noise Criteria:

Intrusiveness

- *A source noise (sound pressure) level of 75 dB(A) at 1 metre, positioned a minimum of 1 metre, above the ground, must be adopted for noise from children's activities (internal and external).*
- *L_{Aeq} 15 minute from the child centre must not exceed the pre-existing background L_{A90} noise levels plus 5 dB(A), at 1 metre from the façade of sensitive receivers.*

Applicable to:

- *Noise emissions from activities at the child care centre (including noise from external and internal play/teaching/sleeping areas, car parking and fixed plant).*

Notes:

- *Applies at all sensitive receptors with a potential to be affected by noise emissions from all activities at the child care centre.*

Noise Criteria

External Noise – Playgrounds and Activity Areas

- *$L_{Aeq\ 1\ Hour}$ 55 dB(A)*

Applicable to:

- *All external areas at the Centre that are utilised by children or babies for external recreation and learning activities.*

Notes:

- *Existing ambient noise levels at the site must not result in internal noise levels in excess of the criterion.*

..."

Further to the above, the following information has been found in Section 5.3.3.3 which applies to Places of Public Worship and Educational Establishments

"...

5.3.3.3 Acoustic Privacy

Objective

O.1 To minimize noise levels from places of public worship and educational establishments that may impact upon neighbouring or nearby properties.

Design Principles

P.1 The design of the proposed place of public worship or educational establishment should minimise the projection of noise from the various activities anticipated to occur within the site. Adjoining and nearby residents should not be exposed to unreasonable levels of noise arising from the proposed use.

P.2 A noise impact assessment statement, prepared by a suitably qualified acoustic engineer, is to be submitted with all applications for development within residential zones or which adjoin residential zones. This should describe hours of operation and predicted noise levels for regular lunch and tea breaks and for special events such as festivals and religious celebrations. Where possible, reference should be made to similar operating uses whether or not within the Parramatta Local Government Area.

..."

4.5 NOISE EMISSIONS AND INTRUSIVE NOISE

4.5.1 NSW EPA NOISE POLICY FOR INDUSTRY

The NSW EPA Noise Policy for Industry 2017 assesses noise from industrial noise sources - scheduled under the POEO. Mechanical noise from the development shall be addressed following the recommendations in the NSW NPI.

The assessment is carried out based on the existing ambient and background noise levels addressing the following:

- Intrusiveness Criteria, to control intrusive noise into nearby sensitive receivers.
- Amenity Criteria, to maintain the noise level amenity for particular land uses.

These criteria are established for each assessment period (day, evening and night) and the more stringent of the two criteria sets the Project Noise Trigger Level (PNTL).

4.5.2 INTRUSIVENESS CRITERIA

The NSW NPI defines the intrusiveness criteria as follows:

"The intrusiveness of an industrial noise source may generally be considered acceptable if the level of noise from the source (represented by the L_{Aeq} descriptor), measured over a 15 minute period, and does not exceed the background noise level by more than 5 dB when beyond a minimum threshold."

Based on the intrusiveness criteria definition and the estimated background noise levels on site, Table 4 shows the intrusiveness criteria for the noise sensitive receivers.

Indicative Noise Amenity Area	*Period*	*Rating Background Level $L_{A90,period}$ dB(A)*	*Intrusiveness Criterion dB(A)*
Residential (R4)	Day	48	53
	Evening	44	49
	Night	40	45

Table 4: Determination of the intrusiveness criterion.

4.5.3 AMENITY CRITERIA

The NSW NPI states the following to define the amenity criteria:

"To limit continuing increases in noise levels from application of the intrusiveness level alone, the ambient noise level within an area from all industrial noise sources combined should remain below the recommended amenity noise levels specified in Table 2.2 where feasible and reasonable. The recommended amenity noise levels will protect against noise impacts such as speech interference, community annoyance and some sleep disturbance."

Based on the amenity criteria definition and the land zoning, Table 5 shows the amenity criteria for the noise sensitive receivers.

Indicative Noise Amenity Area	*Period*	*Amenity Noise Level $L_{Aeq,period}$ dB(A)*	*Adjusted Amenity Criterion dB(A)*
Residential (R4)	Day	60	58 $L_{Aeq,15min}$ (60-5+3)
	Evening	50	48 $L_{Aeq,15min}$ (50-5+3)
	Night	45	43 $L_{Aeq,15min}$ (45-5+3)
Hospital	Nosiest 1 hour	50	50
Educational	(Internal)	35	33 $L_{Aeq,15min}$ (35-5+3)

Table 5: Determination of amenity criterion.

4.5.4 PROJECT NOISE TRIGGER LEVELS

Table 6 shows the PNTL for the noise sensitive receivers.

Indicative Noise Amenity Area	*Period*	*Intrusiveness Criterion dB(A)*	*Amenity Criterion, dB(A)*
Residential (R4)	Day	53	58
	Evening	49	48
	Night	45	43
Hospital		--	50
Educational	When In Use	--	33

Table 6: PNTL for noise sensitive receivers.

4.5.5 AAAC GUIDELINE FOR OUTDOOR PLAYGROUNDS

There are no prescribed regulations or legislation that apply to noise from outdoor playgrounds. Therefore, there is no prescribed noise criteria that can be used. Furthermore, we understand that common approach of "offensive noise" criteria is not appropriate for a planning situation such as this proposal.

Our noise assessment approach is based on:

- NSW tribunal decisions when assessing noise from the use of child care centres.
- 'Guideline for Childcare Centre Acoustic Assessment' prepared by the Association of Australasian Acoustical Consultants (AAAC).

The AAAC guideline is addressed for assessment of childcare centres and its noise level criterion for outdoor spaces have been considered as adequate by NSW tribunal decisions. As children do not play outdoors continuously for long periods of time, and as the duration of time for children playing outside is reduced, the overall noise annoyance reduces. Therefore, it is reasonable to allow a higher level of noise impact for a shorter duration.

Whilst the AAAC guideline does not apply for schools, there are similarities in noise emissions from uses of outdoor playground areas for schools and child care centres. Therefore, we recommend that the following noise criteria shall be applied to noise impacts arising from the school's outdoor playgrounds.

Table 7 shows the noise level criteria proposed by the AAAC guideline for assessing noise from outdoor spaces. These are the noise levels at which it is considered that complaints are unlikely.

Use of outdoor area	*Noise Level Criteria*	*Criteria*
Up to 2 hours (total) per day	$L_{Aeq,15min}$ noise level from outdoor area not to exceed the existing background noise level ($L_{A90,15min}$) plus 10 dB $L_{Aeq,15min} < L_{A90,15min} + 10$ dB(A)	$L_{Aeq,15min} \leq 58$ dB(A)
More than 2 hours (total) per day	$L_{Aeq,15min}$ noise level from outdoor area not to exceed the existing background noise level ($L_{A90,15min}$) plus 5 dB $L_{Aeq,15min} < L_{A90,15min} + 5$ dB(A)	$L_{Aeq,15min} \leq 53$ dB(A)

Table 7: Noise level criteria for the playground areas as per AAAC guideline.

4.5.6 SUMMARY OF OPERATIONAL NOISE LEVEL CRITERIA

Based on the criteria from the relevant noise standards and guidelines detailed above. Table 8 summarizes the noise level criteria. For noise assessment purposes, the corresponding criteria based on background noise level measured, the lowest value has been used.

Noise Emission	*Standard / Guideline*	*Time Period*	*Noise Level Criteria dB(A)*
External Mechanical Plant	NSW EPA NPI	Day Time (7am – 6pm)	53 $L_{Aeq,15min}$
		Evening Time (6pm – 10pm)	48 $L_{Aeq,15min}$
		Night Time (10pm - 7am)	43 $L_{Aeq,15min}$
Parish Church	NSW EPA NPI	Day Time	$L_{Aeq,15min} \leq L_{A90,15min} + 5$ dB(A)
		Night Time	$L_{Aeq,15min} \leq L_{A90,15min} + 5$ dB(A)
Outdoor Playgrounds	AAAC Guideline	Up to 2 hours	$L_{Aeq,15min} \leq L_{A90,15min} + 10$ dB(A) = 58 dB
		More than 2 hours	$L_{Aeq,15min} \leq L_{A90,15min} + 5$ dB(A) = 53 dB
Child Care Centre	Parramatta DCP/AAAC Guideline	When in Use	$L_{Aeq,15min} \leq L_{A90,15min} + 5$ dB(A) = 53 dB

Table 8: Summary of the noise level criteria at the nearest noise sensitive receivers.

4.6 TRANSPORT NOISE

4.6.1 DEVELOPMENT NEAR RAIL CORRIDORS OR BUSY ROADS – INTERIM GUIDELINE

The guideline details the application of clauses 85, 86, 87, 102 and 103 of the Infrastructure State Environmental Planning Policy (SEPP) which is required to be used when a development is adjacent to a rail corridor, a freeway, a toll-way, a transit-way or a road with an annual average daily traffic volume (AADT) of more than 40,000 vehicles. It is noted that while there is a rail corridor directly south of the proposed site, it is at a distance (approx. 150m) at which a detailed acoustic assessment is not required. Nevertheless, Darcy road has an AADT greater than 40,000. Therefore, this guideline does apply to the proposal and assessments for road noise shall be carried out.

4.6.1.1 Rail Noise

Rail noise assessments are based on the requirement of NSW Department of Planning (DoP) '*Development Near Rail Corridors and Busy Roads – Interim Guideline'*. Railway noise has been considered for the proposed development. An extract of Acoustic Assessment Zones shown below in Figure 5.

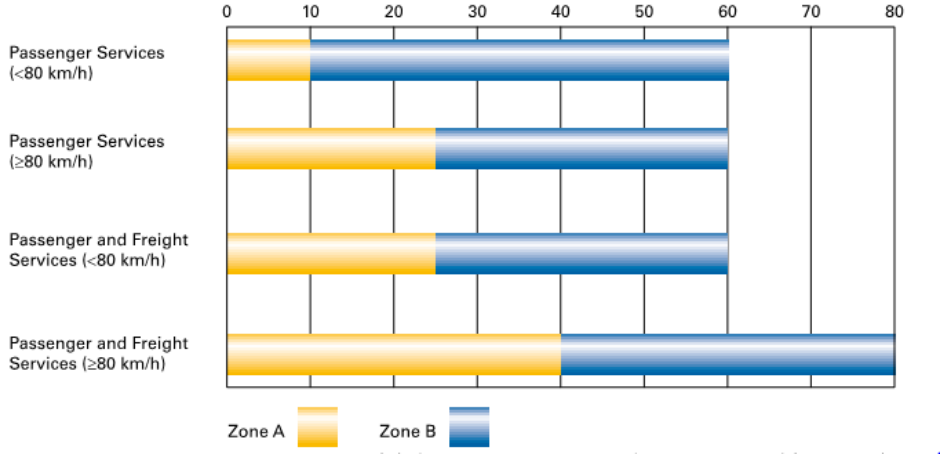


Figure 5: Acoustic Assessment Zones based on distance (m) of noise sensitive development from rail corridor.

As the development is located more than 100 metres from the rail corridor, a detailed acoustic assessment is not required for rail noise.

4.6.1.2 Rail Vibration

Similarly to Section 4.6.1.1, rail vibration has been considered as per the assessment zones shown in Figure 6.

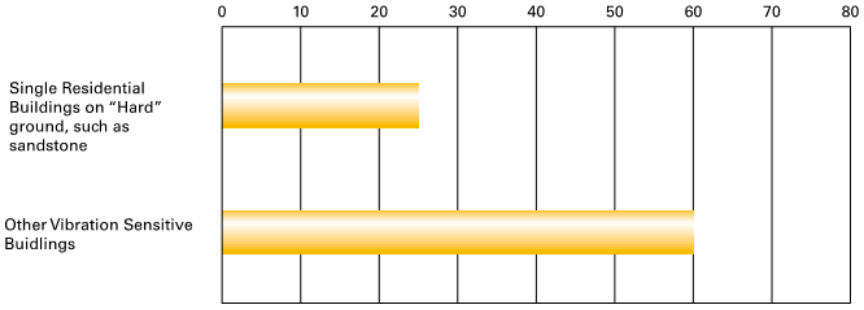


Figure 6: Vibration Assessment Zones based on distance (m) of vibration sensitive development from rail corridor

As the development is located more than 100 metres from the rail corridor, a detailed acoustic assessment is not required for rail vibration.

4.6.1.3 Road Noise

The NSW Department of Planning (DoP) *'Development Near Rail Corridors or Busy Roads – Interim Guideline'* details the application of clauses 102 and 103 of the Infrastructure State Environmental Planning Policy (SEPP) which is required to be used when a residential development is adjacent to a freeway, a toll-way, a transit-way or a road with an annual average daily traffic volume (AADT) of more than 40,000 vehicles.

Darcy Road carries an AADT greater than 40,000 vehicles as per NSW RMS information available. Therefore, there are requirements to assess and include mitigation against road traffic noise for the proposed development and noise mitigation measures are advisable.

The internal noise level criteria as per SEPP's Clause 103 requirements are summarised below in Table 9.

Type of Receiver	*Noise Assessment Criteria dB(A)*
Educational Institutions including Child Care Centres	40
Places of Worship	40

Table 9: Internal Design Noise Level Criteria due to traffic noise.

4.6.2 NSW ROAD NOISE POLICY

The NSW Road Noise Policy (RNP) establishes criteria for traffic noise from:

- Existing roads,
- New road projects,
- Road development projects,
- New traffic generated by developments.

For existing residences and other sensitive land uses affected by additional traffic on existing roads generated by land use developments, any increase in the total traffic noise level should be limited up to 2.0dB above the existing noise levels. An increase of up to 2.0dB represents a minor impact that is considered barely perceptible to the average person.

4.6.3 HELICOPTER NOISE IMPACTS

There is no specific criteria applying to the movements of emergency helicopters from the adjacent Westmead hospital.

However, a detailed assessment is recommended to be conducted considering the emergency helicopter noise impacts from the Westmead Hospital. The assessment should consider the frequency of movements, and provide recommendations in order to achieve a suitable level of amenity in accordance with relevant standards and guidelines.

4.7 CONSTRUCTION NOISE AND VIBRATION

4.7.1 NOISE CRITERIA

The ICNG suggest construction noise management levels that may minimise the likelihood of annoyance being caused to noise sensitive residential receivers depending on the duration of works. The management levels for long-term duration works are as follows:

- Within recommended standard hours.

  The Management Level ($L_{Aeq,15min}$) measured at the most exposed boundary of any affected residential receiver when the construction site is in operation must not exceed the background noise level (RBL) by more than 10 dB(A). This noise level represents the point above which there may be some community reaction to noise.

  However, in the case of a highly noise affected area, the Management Level ($L_{Aeq,15min}$) at the most exposed boundary of any affected residential receiver when the construction site is in operation should not exceed 75 dB(A). This level represents the point above which there may be strong community reaction to noise.

- Outside recommended standard hours.

  The Management Level ($L_{Aeq,15min}$) measured at the most exposed boundary of any affected residential receiver when the construction site is in operation must not exceed the background noise level (RBL) by more than 5 dB(A). It is noted that a strong justification is required for works outside the recommended standard hours.

ICNG suggests construction noise management levels for other sensitive land uses surrounding construction sites. Table 10 below summarises the airborne construction noise criteria for most affected noise sensitive receivers surrounding the development site.

Sensitive Receiver		*Airborne Construction Noise Criteria, L_{Aeq} dB(A)*	
		Within Standard Hours	*Outside Standard Hours*
Residential	Noise affected / External	RBL + 10	RBL + 5
	Highly noise affected / External	75	N/A
Educational	Internal	-	-
Hospital Wards & Operating Theatres	Internal	45	45

Table 10: ICNG construction airborne noise criteria for sensitive receivers surrounding the site.

The ICNG recommends internal ground-borne noise maximum levels at residences affected by nearby construction activities. Ground-borne noise is noise generated by vibration transmitted through the ground into a structure and can be more noticeable than airborne noise for some sensitive receivers. The ground-borne noise levels presented below from the ICNG are for residential receivers during evening and night-time periods only, as the objective is to protect the amenity and sleep of people when they are at home.

- Evening: $L_{Aeq,15min}$ 40 dB(A) - internal
- Night: $L_{Aeq,15min}$ 35 dB(A) - internal

The internal noise levels are assessed at the centre of the most affected habitable room.

4.7.2 VIBRATION CRITERIA

4.7.2.1 Human Comfort

The Department of Environment and Climate Change (DECC) developed the document '*Assessing Vibration: A Technical Guideline*' in February 2006 to assist in preventing people from exposure to excessive vibration

levels within buildings. It is based on the guidelines contained in BS 6472.1:2008 '*Guide to evaluation of human exposure to vibration in buildings – Vibration sources other than blasting*'.

The guideline does not address vibration induced damage to structures or structure-borne noise effects. Vibration and its associated effects are usually classified as continuous (with magnitudes varying or remaining constant with time), impulsive (such as shocks) or intermittent (with the magnitude of each event being either constant or varying with time). Vibration criteria for continuous and impulsive vibration are presented in Table 11 below, in terms of vibration velocity levels.

Place	*Time*	*r.m.s. velocity, mm/s [dB ref 10^{-6}mm/s]*			
		Continuous Vibration		*Impulsive Vibration*	
		Preferred	*Maximum*	*Preferred*	*Maximum*
Residences	Day-time	0.20 [106 dB]	0.40 [112 dB]	6.00 [136 dB]	12.00 [142 dB]
	Night-time	0.14 [103 dB]	0.28 [109 dB]	2.00 [126 dB]	4.00 [132 dB]
Offices, schools, educational and worship	When in use	0.40 [112 dB]	0.80 [118 dB]	13.00 [142 dB]	26.00 [148 dB]
Critical Areas (Hospital Wards & Operating Theatres)	Day Or Night-Time	0.10 [100 dB]	0.20 [106 dB]	0.10 [100 dB]	0.20 [106 dB]

Table 11: Continuous and impulsive vibration criteria applicable to the site

When assessing intermittent vibration comprising a number of events, the Vibration Dose Value (VDV) it is recommended to be used. Table 12 shows the acceptable VDV values for intermittent vibration.

Place	*Time*	*Vibration Dose Values, $m/s^{1.75}$*	
		Preferred	*Maximum*
Residences	Day-time	0.20	0.40
	Night-time	0.13	0.26
Offices, schools, educational and worship	When in use	0.40	0.80
Critical Areas (Hospital Wards & Operating Theatres)	Day Or Night-Time	0.10	0.20

Table 12: Intermittent vibration criteria applicable to the site.

4.7.2.2 Structural Building Damage

Ground vibration from construction activities can damage surrounding buildings or structures. For occupied buildings, the vibration criteria given in previous section for Human Comfort shall generally form the limiting vibration criteria for the Project.

For unoccupied buildings, or during periods where the buildings are unoccupied, the vibration criteria for building damage suggested by German Standard DIN 4150.3:1993 '*Structural Vibration – Effects of Vibration on Structures*' and British Standard BS 7385.2:1993 '*Evaluation and Measurement for Vibration in Buildings*' are to be adopted. Guideline values from DIN 4150.3:1993 and BS 7385.2:1993 are presented in Table 13 and Table 14 respectively.

Structural type	*r.m.s. velocity, mm/s*			
	Foundation			*Plane of floor uppermost full storey*
	Less than 10Hz	*10 to 50Hz*	*50 to 100Hz*	*Frequency mixture*
Dwellings or similar	5	5 to 15	15 to 20	15
Particularly sensitive	3	3 to 8	8 to 10	8

Table 13: DIN 4150.3:1993 Guideline values of vibration velocity for evaluating the effects of short-term vibration.

Structural type	*Peak particle velocity, mm/s*	
	4 to 15Hz	*15Hz and above*
Unreinforced or light framed structures *Residential or light commercial type buildings*	15mm/s @ 4Hz increasing to 20mm/s @ 15Hz	20mm/s @ 15Hz increasing to 50mm/s @ 40Hz and above

Table 14: BS 7385.2:1993 Guideline values of vibration velocity for evaluating cosmetic damage.

5 OPERATIONAL NOISE EMISSIONS ASSESSMENT

Noise break-out from the proposed development has the potential to impact on existing noise sensitive receivers. For the purpose of this noise impact assessment, the noise sources are assumed as follows:

- Noise emissions from mechanical plant.
- Noise emissions from School Bells & Public Address system.
- Noise emissions from the proposed Parish Church.
- Noise emissions from outdoor spaces.
- Noise Emissions from Early Learning Centre.
- Traffic Generation Noise

Each of these noise sources has been considered in the noise impact assessment. The noise impact assessments have also considered the following:

- Noise levels have been considered as continuous over assessment time period to provide the worst-case scenario.
- Distance attenuation, building reflections and directivity.
- Lowest background levels measured.

5.1 EXTERNAL MECHANICAL PLANT

Noise from proposed development mechanical plant rooms should be controlled to ensure external noise emissions are not intrusive and do not impact on the amenity of the noise sensitive receivers.

At this stage, mechanical plant selections have not been made; therefore, it is not possible to undertake a detailed assessment of the mechanical plant noise emissions.

Noise controls will need to be incorporated with the design of the mechanical plant rooms to ensure that the cumulative noise levels from plant to the nearest noise sensitive receivers meets the NSW NPI noise level criteria – refer to Table 8.

Usual design noise controls that may need to be implemented will typically include, but are not limited to:

- Strategic location and selection of mechanical plant to ensure the cumulative noise levels at the receiver boundaries is met.
- Selection of appropriate quiet plant.
- Acoustic noise control measures to be put in place to minimise noise impacts such as:
  - In-duct attenuation
  - Noise enclosures as required
  - Sound absorptive panels
  - Acoustic louvres as required
  - Noise barriers as required

Acoustic assessment of all mechanical plant shall continue during the detailed design phase of the project in order to confirm any noise control measures to achieve the relevant noise criteria at the nearest noise sensitive receivers.

5.2 PUBLIC ADDRESS AND SCHOOL BELL SYSTEMS

Noise from proposed development public address and school bell systems should be controlled to ensure external noise emissions are not intrusive and do not impact on the amenity of noise sensitive receivers.

At this stage, public address and school bell systems selections have been not made; therefore, it is not possible to undertake a detailed assessment of the public address and school bell noise emissions.

The EPA notes numerous reports of community concern arising from inadequate design and installation as well as inappropriate use of school public address and bell systems. EPA considers that appropriate design, installation and use of those systems can both:

- Meet the proponent's objectives of proper administration of the school and ensuring safety of students, staff and visitors, and
- Avoid interfering unreasonably with the comfort and repose of occupants of nearby residences.

The Public Address and School Bell Systems shall be designed, installed and operated such that the systems does not interfere unreasonably with the comfort and repose of occupants of nearby residences. It is anticipated that the noise impact to the nearest sensitive receivers will be negligible if following measures are implemented:

- Low-powered horn-type speakers shall be located and orientated to provide a good coverage of the school areas whilst being directly away from residences and near sensitive receivers. System coverage shall be reviewed during the detailed design phase.
- Speakers shall be mounted with a downward angle and as close to the floor as possible.
- The noise level of the systems shall be adjusted on site so they will be clearly audible on the school site without being excessive. The systems shall initially be set sot that the noise at nearby residences and sensitive receivers do not exceed noise level criteria.
- Once the appropriate noise level has been determined on site, the systems shall be limited to these noise levels so that staff cannot increase the noise levels.
- The systems shall be set so that it only occurs on school days.

5.3 NEW PARISH CHURCH

The New Parish Church is anticipated to host events that include amplified music. The expected noise impacts from the chapel hall have been assessed at the nearest sensitive receivers, using the methodology and assumptions given below.

The noise assessment was made considering the proposed layout as shown on the architectural drawings. The following assumptions have been made for the assessment:

- Events occurring during evening time hours.
- Doors and windows shut during noise generating events
- Typical sound power levels for concerts and events

The noise levels inside the Parish, and form the basis of the expected worst-case noise emission from the proposed use, is expected to be up to 100 dB(A).

The façade, other external building elements and any ventilation openings of the Parish Church will need to be considered throughout the detailed design stage in order to meet the noise level criteria in the nearest commercial and residential receivers. The predicted noise levels of the Parish Church are shown below in Table 15.

Calculation	*Nearest Hospital Receiver*	*Nearest Residential Receiver*
Reverberant Internal Noise Level $L_{Aeq,15min}$ at 1m	97	97
Increase in Reverberant field, dB	+3	+3
Distance attenuation, dB	-35 (60m)	-36 (65m)
Sound Reduction of Façade	-35	-35
Predicted Noise Level at Nearest Receiver, $L_{Aeq,15min}$	30	29
Noise Level Criteria (evening) / Complies?	50 / Yes	48 / Yes

Table 15: Predicted noise levels from Chapel Hall to Nearest Receivers

5.4 K-6 BUILDING OUTDOOR SPACES

The K-6 building is a 5-storey education block with an outdoor rooftop space. Each level has an outdoor space that have the potential to impact on the nearest residential sensitive receivers to the West. The use of the outdoor spaces will occur during school hours. Therefore, the noise assessment considers the worst-case scenario as the day-time period. The following assessment has considered the following parameters:

- Sound power level of 73 dB (A) per child.
- Assumed all children are distributed on or near Western external areas
- Assumed 1 in 2 children speaking at any one time.
- Outdoor spaces spread across 5 levels.

Predicted noise levels at the nearest noise residential receiver associated with the outdoor spaces use are shown in the following table for the worst-case scenarios.

Calculation	*Noise Level dB(A)*
Noise levels from 840 Children	94
Distance attenuation (80m), dB	-38
Resulting level at residential receiver	56
Noise Level Criterion day-time (less than 2 hours) / Complies?	58 / Yes

Table 16: Noise assessment at nearest residential receiver from the outdoor spaces.

For the worst-case scenario, the predicted noise level from the use of the outdoor spaces at the nearest noise sensitive receiver meets the noise level criteria.

5.5 ROOF TOP SPORTS ACTIVITIES

The rooftop sports area of the K-6 building has the potential to impact on the nearest residential sensitive receivers to the West. The use of the rooftop sports area will occur during school hours and out of hours by the community. Therefore, the noise assessment considers the worst-case scenario as evening-time period.

Predicted noise levels at the nearest noise residential receiver associated with the rooftop sports grounds use are shown in the following table for the worst-case scenarios.

Calculation	*Noise Level dB(A)*
$L_{Aeq,15min}$ sports game at 1m in free-field	76
Distance (80 m) attenuation, dB	-38
Resulting level at residential receiver	38
Noise Level Criterion Evening-time / Complies?	58 / Yes

Table 17: Noise assessment at nearest residential receiver from the rooftop court.

For the worst-case scenario, the predicted $L_{Aeq,15min}$ noise level from the use of the rooftop sports area at the nearest noise sensitive receiver meets the noise level criteria.

5.6 EARLY LEARNING CENTRE

Noise emissions from the CELC has the potential to impact on the nearest noise sensitive receivers. The key noise source will be children playing in the outdoor area and the indoor play areas. The CELC centre is proposed to operate from 6:00am to 6:00pm.

5.6.1 EARLY LEARNING CENTRE OUTDOOR PLAY AREA NOISE EMISSIONS

The external play area noise impact assessment has considered the following:

- Noise emissions to equal a sound pressure level of 75 dB (A) at 1 metre as required by Parramatta DCP.
- Worst case scenario assumes 100 children are using the Early Learning Centre.
- Criteria is established to be Background $L_{A90,\ 15min}$+ 5 dB(A) as per Parramatta DCP.
- Background noise levels at the nearest noise sensitive receiver have been used to provide worst-case scenario.

The nearest residential receiver to be considered is approximately at 100 metres. Predicted noise levels at the nearest noise residential receiver associated with the outdoor playground are shown in the following table.

Calculation	*Outdoor Playground, dB(A)*
$L_{Aeq,15min}$ of Early Learning Centre at 1m	95
Distance (100 m) attenuation, dB	-40
Resulting level at residential receiver	55
Noise Level Criterion Day-time (more than 2 hours) / Complies?	58 / Yes

Table 18: Noise assessment at nearest noise sensitive receiver from the outdoor playground.

Based on the noise assessment, outdoor playground shall be restricted to the day-time period (7am to 6pm). For the day-time period scenario, the predicted $L_{Aeq,15min}$ noise level from the use of the outdoor playground area is expected to meet the night-time criteria.

5.6.2 EARLY LEARNING CENTRE INDOOR NOISE EMISSIONS

Use of indoor play areas shall not exceed noise level criteria at the nearest noise sensitive receiver. Predicted noise levels with Western open and closed windows are shown in Table 19.

Calculation	*Indoor Areas, dB(A)*	
	Open Windows	*Closed Windows*
$L_{Aeq,15min}$ of Early Learning Centre at 1m	95	95
Increase in reverberant field, dB	3	3
Distance (100 m) attenuation, dB	-40	-40
Reduction from windows, dB	-10[1]	-27[2]
Resulting level at residential receiver	50	33
Noise Level Criterion Day-time / Complies?	53 / Yes	53 / Yes

Table 19: Noise assessment at nearest noise sensitive receiver to the south-west – children aged 3 to 6 years.

Based on the noise assessment, open windows shall be restricted to the day-time period (7am to 6pm). For the open windows day-time period scenario, the predicted $L_{Aeq,15min}$ noise level from the use of the indoor playground areas at the nearest residential receiver are expected to meet the required criteria.

5.7 OFFENSIVE NOISE

Based on the noise emissions assessments presented in the sections above, following comments regarding "offensive noise" shall be considered:

- The operational key noise sources from the proposed school will be mechanical plant, public address and school bell system, out-of-school-hours events at the Chapel, rooftop basketball court, outdoor playgrounds and the early learning centre.
- Mechanical plant will be selected and noise control measures implemented to ensure that the noise levels at the nearest noise sensitive receiver do not exceed the NSW NPI noise criteria established in Section 4.5.1.
- Recommendations for the implementation and use of the public address and school bell systems has been provided in Section 5.2 in order to meet the noise level criteria at the nearest noise sensitive receivers.
- Noise from out-of-school-hours events held within the Chapel will meet the noise level criteria at the nearest noise sensitive receivers assuming that building envelope construction designed achieves the sound insulation rating provided in Section 5.3 and provided that doors remain closed during use.

[1] Open Window Scenario assumes 10dB reduction through a window open to 5% of the floor area.

[2] Closed windows assumes the minimum sound reduction achieved through a glazed façade. *(Will Reword).

- Noise associated with the rooftop sports court, outdoor spaces within the K-6 building and outdoor CELC are anticipated to meet the noise level criteria.
- By controlling noise emissions (associated with the operation of the proposed development) in accordance with the relevant criteria, amenity of noise sensitive receivers will be maintained and noise emissions should not be intrusive, therefore it is not expected that people and noise sensitive receivers will be adversely affected by the development.

Based on the comments above, the development is able to satisfy the requirements of the POEO for "offensive noise" provided the relevant criteria outlined in Section 4.5 are achieved.

5.8 TRAFFIC GENERATION NOISE

A traffic generation noise assessment has been undertaken in order to determine the potential noise impact of traffic generated by the proposed development.

Based on the traffic report prepared by TTPP planning consultants, the additional traffic from the School for the year 2023 as well as the expected traffic volumes on streets surrounding the proposed school are presented below in Table 20.

Road / Street	*Peak Hour Vehicle Trips*			
	Existing Traffic 2020		*Predicted Traffic 2023*	
	am	*pm*	*am*	*pm*
Darcy Road	4337	6555	4583 (+246)	6801 (+246)

Table 20: Current and predicted noise on Darcy Road plus development.

5.8.1 NOISE ASSESSMENT

As noted in Section 4.6.1.3, when considering land use development and the impact on sensitive land uses, the NSW RNP states that an increase up to 2.0dB in relation to existing noise levels is anticipated to be insignificant. Considering the predicted traffic volumes as shown above, the increase in traffic noise is summarised below in Table 21.

Road / Street	*Peak Hour Traffic Volume*		*Increase in Traffic Noise (dB(A))*	*Complies?*
	2020	*2023*		
Darcy Road (am)	4337	4583 (+246)	0.2 dB	Yes
Darcy Road (pm)	6555	6801 (+246)	0.1 dB	Yes

Table 21: Predicted traffic noise levels increase for the roads around the site (2020 – 2023).

Based on the assessment shown above, traffic generated as a result of the proposed school development is not expected to have an adverse noise impact on the surrounding roads.

5.9 EXTERNAL NOISE INGRESS

5.9.1 PARISH CHURCH

Noise levels from the road were predicted in accordance with the Calculation of Road Traffic Noise (CoRTN) methodology. This method is recognized by regulatory authorities around Australia and is endorsed by the NSW OEH for use in projects of this scale.

The Northern facades of the Parish Church overlook Darcy Road which is a source of continuous traffic noise with and AADT of over 40000. Our assessment has been based on the following:

- Detailed noise survey as shown in Section 3.
- The Parish Church is located approximately 5 metres above the road level.
- The Parish Church is located 15 metres from the edge of the road.
- Internal Church Areas based on Architectural Drawings provided by Alleanza Architecture.
- Solid sections of the façade with a sound reduction index of R_w 50.
- No specific meteorological characteristics such as dominant wind direction and speed of temperature.

Based on the analysis, recommended glazing systems and their corresponding sound insulation performances are presented below in Table 22.

Location	*Weighted Sound Reduction Index (R_w)*	*Fixed Single Glazing System*	*Fixed Double Glazing System*
All glazing areas	35	10.38mm laminated	6mm / 12mm air gap / 10mm

Table 22: Recommended Glazing for New Parish Church

6 CONSTRUCTION NOISE AND VIBRATION PLANNING

Currently the project is at an early design stage and a detailed construction program is not yet full defined. This section of the Construction Noise and Vibration Planning provides general recommendations only and provides applicable criteria together with best noise and vibration control practices to be observed during the construction of the proposed development.

This preliminary advice in relation to construction noise and vibration management shall form the basis for the Contractor's Construction Noise and Vibration Management Plan.

Any noise from demolition and construction activities to be carried out on site must not result in *'offensive noise'* to any noise sensitive receiver. To this end, the Contractor employed to undertake the demolition and/or construction works is responsible for ensuring that any site noise and, in particular, any complaints shall be monitored, investigated, managed and controlled.

6.1 RELEVANT STANDARDS FOR CONSTRUCTION NOISE AND VIBRATION CRITERIA

Section 4.6.3 of this report contains the relevant legislation, codes and standards plus construction noise and vibration criteria for this project.

6.2 WORKING HOURS

The following construction hours are proposed as follows:

- Monday to Friday: 7am to 6pm.
- Saturday: 8am to 1pm.
- Sundays and Public Holidays: No excavation or construction works

6.3 PRELIMINARY CONSTRUCTION NOISE ASSESSMENT

A preliminary construction noise assessment has been carried out based on typical plant and machinery expected throughout the construction stages. The preliminary noise assessment has been considered at the nearest existing residential receivers.

These levels are based on the database published by the UK Department for Environmental, Food and Rural Affairs (DEFRA) & Australian Standard AS2436:2010 *'Guide to Noise Control on Construction, Maintenance & Demolition Sites'* for a 15-minute period.

The expected construction noise sources and the predicted noise levels at the nearest residential receiver are shown below in Table 23.

Item	*Typical Power Noise Level L_{A10} (dB ref 10pW)*	*Typical Noise Level $L_{A10,15m}$ at 7m (dB ref 20µPa)*	*Predicted Noise Level $L_{Aeq,15m}$ at nearest residential receiver*
Angle grinders	104	76	61-55
Truck	108	80	65-59
Circular saw	115	87	72-66
Piling rig	120	92	77-71
10-40tn Excavator	117	89	74-68
Truck	114	86	71-65
40-50tn Mobile crane	111	83	68-62
Concrete pump	114	86	71-65
Concrete truck	110	82	67-61
Drill	94	66	51-45

Table 23: Anticipated airborne noise levels for equipment / plant used during construction works.

Based on the results of the preliminary assessment as shown above, the noise associated with the normal construction works is expected to exceed the noise limits for standard hours & out-of-hours works in accordance with the ICNG Guideline. This assessment is based on typical noise levels associated with construction sites and machinery. At such time that a detailed construction plan is provided, a more detailed assessment will be carried out.

6.4 CONTROL ELEMENTS

In order to meet the noise and vibration requirements of the site, the Contractor will be required to engage a qualified acoustic consultant to assist in the compilation of a Construction Noise and Vibration Management Plan, and undertake noise and vibration monitoring for the duration of the project.

6.4.1 GENERAL CONTROL ELEMENTS

As a general rule, minimising noise and vibration should be applied as universal work practice at any time of day, but especially for any construction works to be undertaken at critical times outside normal daytime/weekday periods. Therefore, it is recommended that noisy construction works will not be undertaken between 6am and 7am in order to minimise any sleep disturbance to the nearest residential receivers.

It is noted that the reduction of noise and vibration at the source and the control of the transmission path between the construction site and the receiver(s) are the preferred options for noise minimisation. Providing treatments at the affected receivers should only be considered as a last resort. Construction noise and vibration shall be managed by implementing the strategies listed below:

- *Plant and equipment*. In terms of both cost and results, controlling noise and vibration at the sources is one of the most effective methods of minimising the impacts from any work site activities. Work practices that will reduce noise and vibration at the source include:
  - Employing quieter techniques for all high noise activities such as rock breaking, concrete sawing, and using power and pneumatic tools.

  - Use quieter plant and equipment based on the optimal power and size to most efficiently perform the required tasks.
  - Selecting plant and equipment with low vibration generation characteristics.
  - Operate plant in a quietest and most effective manner.
  - Where appropriate, limit the operating noise of equipment.
  - Regularly inspecting and maintain plant and equipment to minimise noise and vibration level increases, to ensure that all noise and vibration reduction devices are operating effectively.
- *On site noise management.* Practices that will reduce noise from the site include:
  - Maximising the distance between noise activities and noise sensitive receivers. Strategically locate equipment and plant.
  - Undertaking noisy fabrication work off-site where possible.
  - Avoid the use of reversing beeping alarms or provide for alternative systems, such as broadband reversing alarms, particularly during night or out-of-hours works.
  - Maintaining any pre-existing barriers or walls on a demolition or excavation site as long as possible to provide optimum sound propagation control.
  - Constructing barriers that are part of the project design early in the project to afford mitigation against site noise.
  - Using temporary site building and material stockpiles as noise barriers. These can often be created using site earthworks and may be included as a part of final landscape design.
  - Installing purpose built noise barriers, acoustic sheds and enclosures.
- *Work scheduling.* Scheduling work during periods when people are least affected is an important way of reducing adverse impacts. The following scheduling aspects may reduce impacts:
  - Provide respite periods, including restricting very noisy activities to daytime, restricting the number of nights that after-hours work is conducted near residences, or by determining any specific requirements, particularly those needed for noise sensitive receivers.
  - Scheduling activities to minimise impacts by undertaking all possible work during hours that will least adversely affect sensitive receivers and by avoiding conflicts with other scheduled events.
  - Scheduling work to coincide with non-sensitive periods.
  - Scheduling noisy activities to coincide with high levels of neighbourhood noise so that noise from the activities is partially masked and not as intrusive.
  - Planning deliveries and access to the site to occur quietly and efficiently and organising parking only within designated areas located away from sensitive receivers.
  - Optimising the number of deliveries to the site by amalgamating loads where possible and scheduling arrivals within designated hours.
  - Designating, designing and maintaining access routes to the site to minimise impacts.
  - Including contract conditions that include penalties for non-compliance with reasonable instructions by the principal to minimise noise or arrange suitable scheduling.
- *Consultation, notification and complaints handling.*
  - Provide information to neighbours before and during construction.
  - Maintain good communication between the community and Project staff.
  - Have a documented complaints process and keep register of any complaints.
  - Give complaints a fair hearing and provide for a quick response.
  - Implement all feasible and reasonable measures to address the source of complaint. Implementation of all reasonable and feasible mitigation measures for all works will ensure that

any adverse noise impacts to surrounding receivers are minimised when noise goals cannot be met due to safety or space constraints.

6.4.2 ADDITIONAL NOISE AND VIBRATION CONTROL MEASURES

If, during construction, an item of equipment exceeds ether the noise criteria at any location or the equipment noise level limits, the following noise control measures, together with construction best practices, shall be considered to minimise the noise impacts on the neighbourhood.

- Schedule noisy activities to occur outside of the most sensitive times of the day for each nominated receiver.
- Consider implementing equipment-specific screening or other noise control measures recommended in Appendix C of AS 2436:2010.
- Limit the number of trucks on site at the commencement of site activities to the minimum required by the loading facilities on site.
- When loading trucks, adopt best practice noise management strategies to avoid materials being dropped from height into dump trucks.
- Avoid unnecessary idling of trucks and equipment.
- Ensure that any miscellaneous equipment (extraction fans, hand tools, etc) not specifically identified in this plan incorporates silencing/shielding equipment as required to meet the noise criteria.

Implementation of all reasonable and feasible mitigation measures for all internal and underground works will ensure that any adverse noise impacts to surrounding residential, commercial and recreational receivers are minimised when noise goals cannot be met due to safety or space constraints.

The NSW RMS '*Construction Noise and Vibration Guideline*' provides safe working distances for vibration intensive plant and are quoted for both 'cosmetic' damage (in accordance with BS 7385.2:1993) and human comfort (in accordance with DECC's '*Assessing Vibration: A Technical Guideline*'). The recommended safe working distances for typical construction plant are provided in Table 24.

Plant Item	*Description*	*Cosmetic Damage*	*Human Response*
Small Hydraulic Hammer	5-12 tonne	2m	7m
Medium Hydraulic Hammer	12-18 tonne	7m	23m
Large Hydraulic Hammer	18-34 tonne	22m	73m
Vibratory Pile Driver	Sheet piles	2-20m	20m
Pile Boring	<800mm	2m	N/A
Jackhammer	Hand held	1m	Avoid Contact with Structure

Table 24: Recommended minimum working distances for vibration intensive plant from sensitive receivers.

If Contractor has concerns for the disruptions at nearest sensitive receivers due to vibration intensive plant use, it is recommended that prior to the commencement of the works, to undertake a preliminary vibration survey on each key vibration generating activity / equipment.

The preliminary vibration survey and assessment will determine whether the vibration levels might exceed the relevant criteria then vibration mitigation and management measures will need to be put in place to ensure vibration impacts are minimized as far as practicable.

7 CONCLUSION

A noise and vibration impact assessment has been carried out for Stage 1 of Westmead Catholic Community Education Campus at Westmead. This report forms part of the documentation package submitted to the Department of Planning as part of the State Significant Development Application.

This report establishes relevant noise level criteria, details the acoustic assessment and provides comments and recommendations for the proposed development.

Ambient and background noise surveys have been undertaken at the existing site to establish the appropriate noise criteria in accordance with the relevant guidelines.

The noise assessment has adopted methodology from relevant guidelines, standards and legislation to assess noise impact. The noise impacts have been predicted at the nearest noise sensitive receiver boundaries.

At this stage, mechanical plant selections have not been made. Therefore, recommendations have been provided to minimise the impact of external noise emissions associated with the mechanical plant of the proposed development to the nearest sensitive receivers.

At this stage, public address and school bell systems have not been selected. Therefore, recommendations have been provided to minimise the impact of external noise emissions associated with the public address and school bell systems of the proposed development to the nearest sensitive receivers.

The use of the chapel during out-of-hours is expected to meet the noise criteria during the evening time at the nearest noise sensitive receivers.

The expected noise impact from the use of the outdoor spaces & rooftop playgrounds are expected to meet the established noise level criteria at the nearest residential receiver. However, it is not to be used during the night-time period.

The CELC outdoor playground area noise impact has been assessed and is expected to be compliant with noise requirements.

An assessment of traffic generation noise has been carried out. Based on the assessment, additional traffic movements will not result in any noticeable change in traffic noise levels and is expected to meet the NSW Road Noise Policy recommendations.

A preliminary construction noise assessment has been carried out. Based on the results of the preliminary assessment as shown above, the noise associated with the normal construction works is expected to exceed the noise limits for standard hours & out-of-hours works in accordance with the ICNG Guideline.

Based on the information presented in this report, relevant objectives will be satisfied and therefore approval is recommended to be granted.

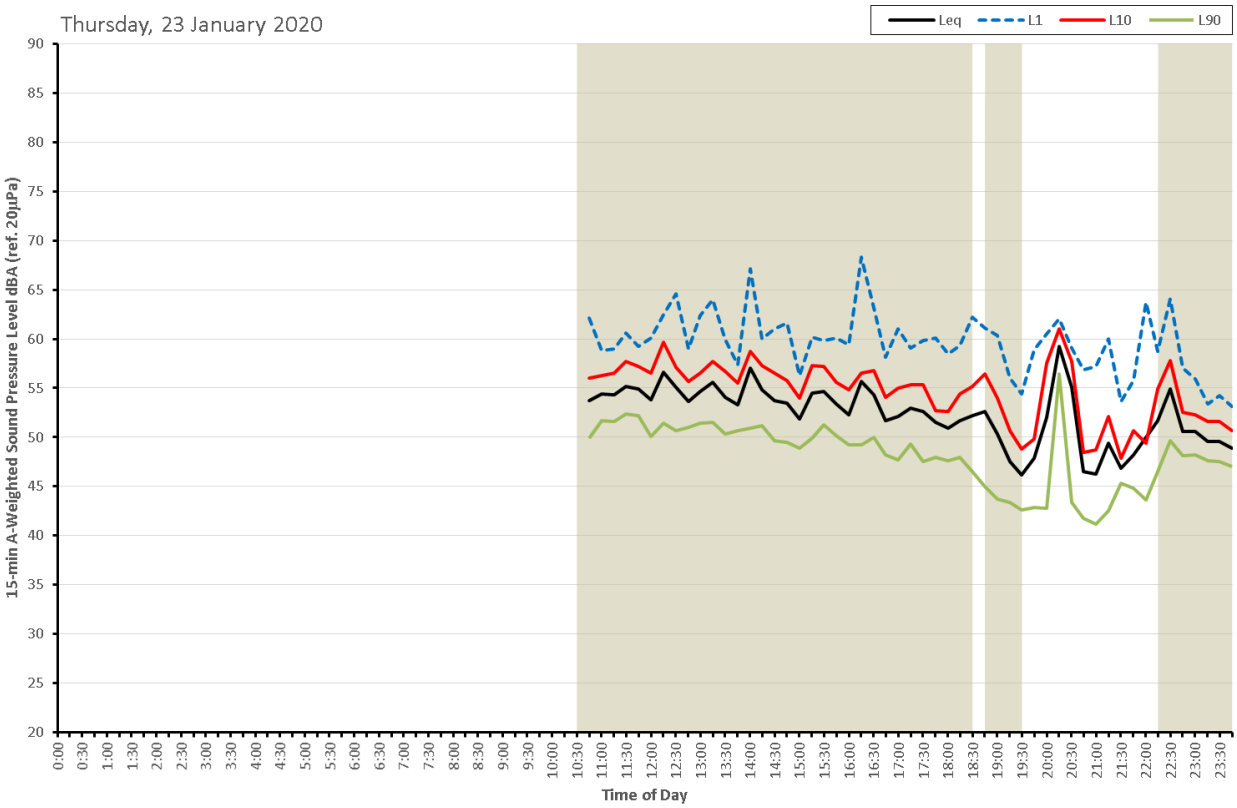
APPENDIX A: LONG-TERM NOISE MONITORING RESULTS

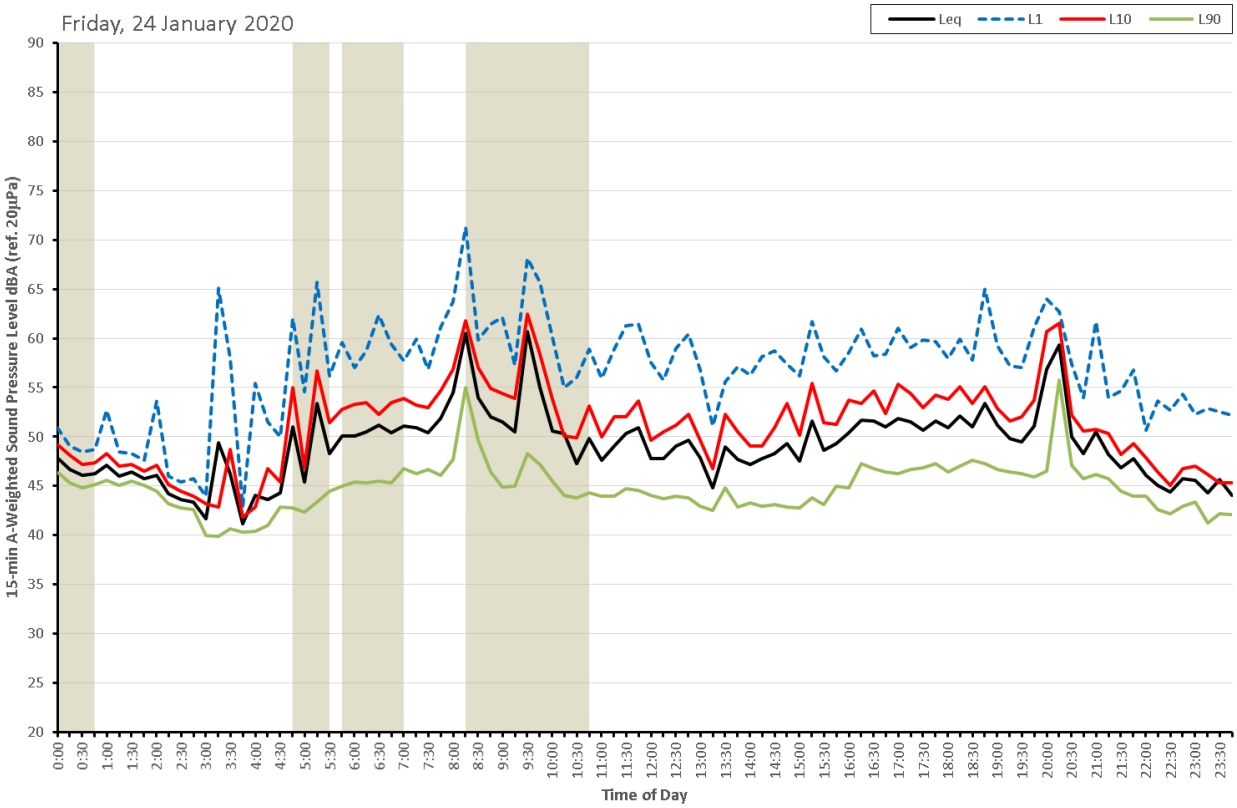
L_{A1} – The L_{A1} level is the noise level which is exceeded for 1% of the sample period. During the sample period, the noise level is below the L_{A1} level for 99% of the time.

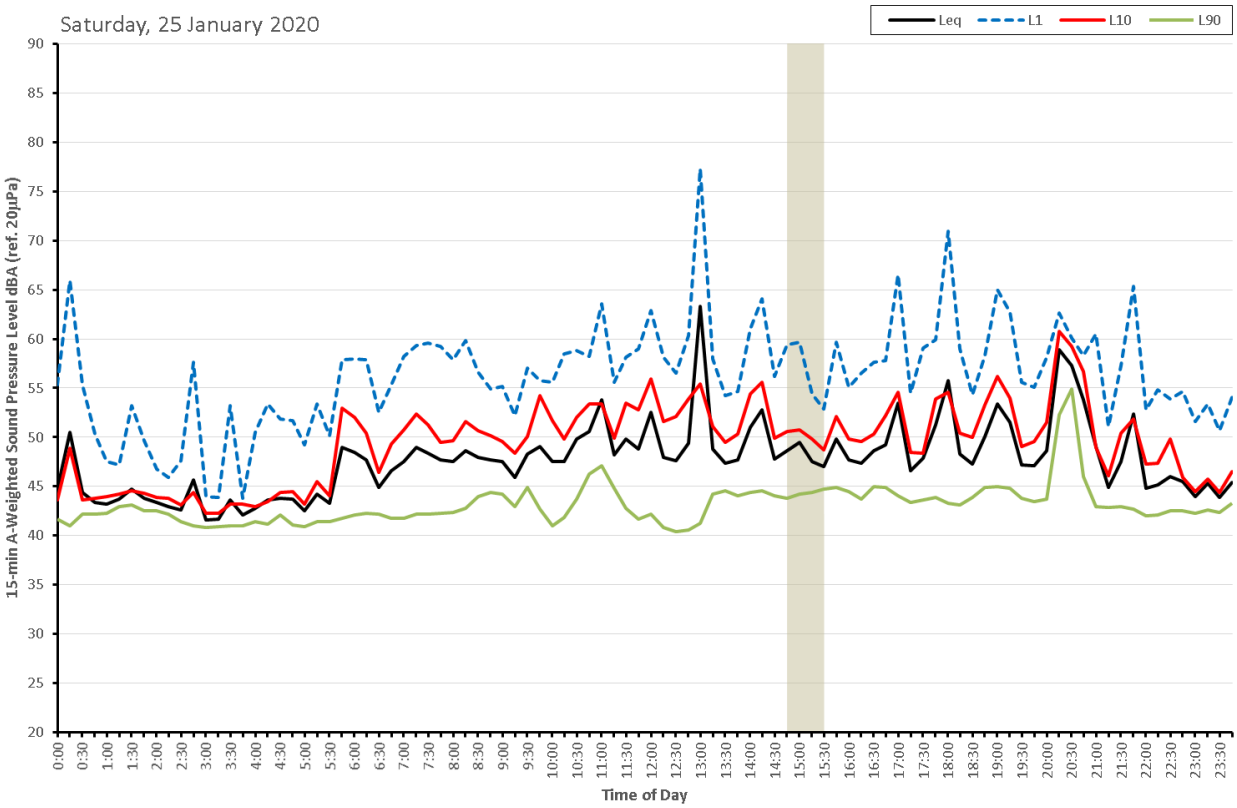
L_{A10} – The L_{A10} level is the noise level which is exceeded for 10% of the sample period. During the sample period, the noise level is below the L_{A10} level for 90% of the time. The L_{A10} is a common noise descriptor for environmental noise and road traffic noise.

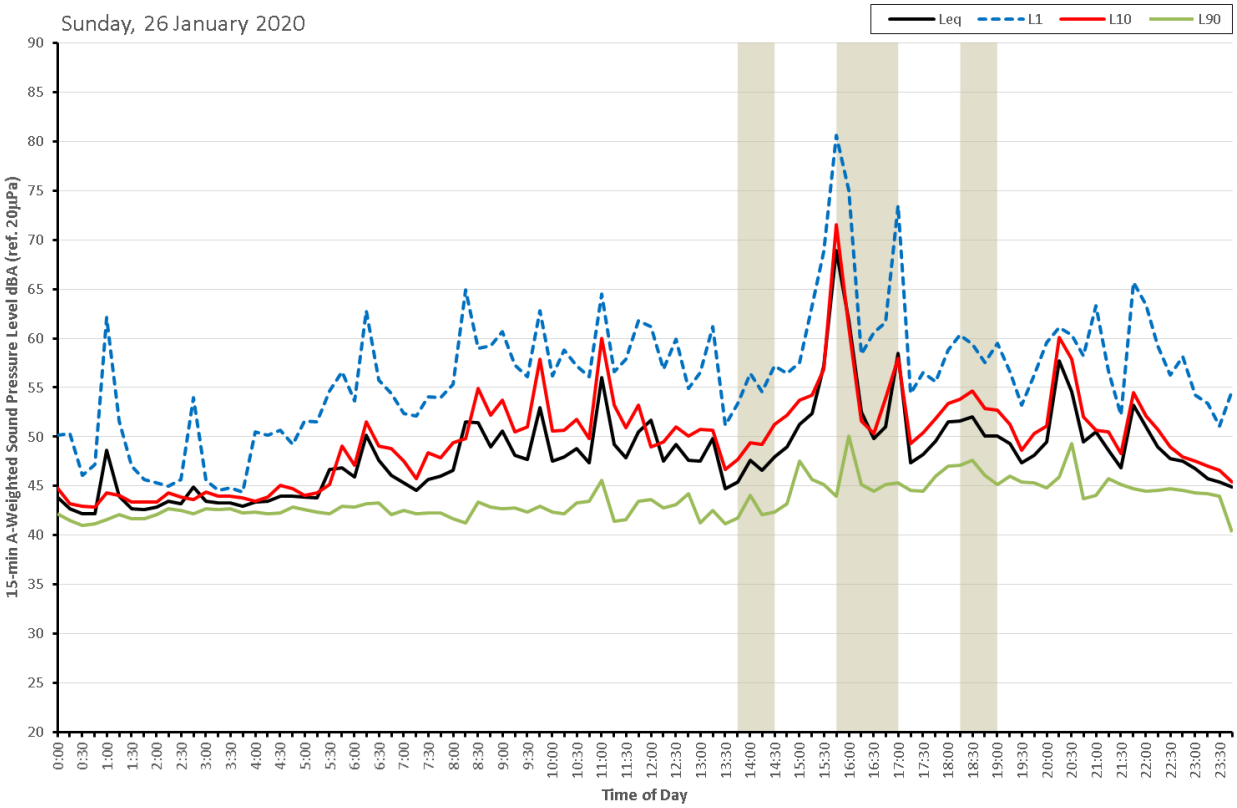
L_{A90} – The L_{A90} level is the noise level which is exceeded for 90% of the sample period. During the sample period, the noise level is below the L_{A90} level for 10% of the time. This measure is commonly referred to as the background noise level.

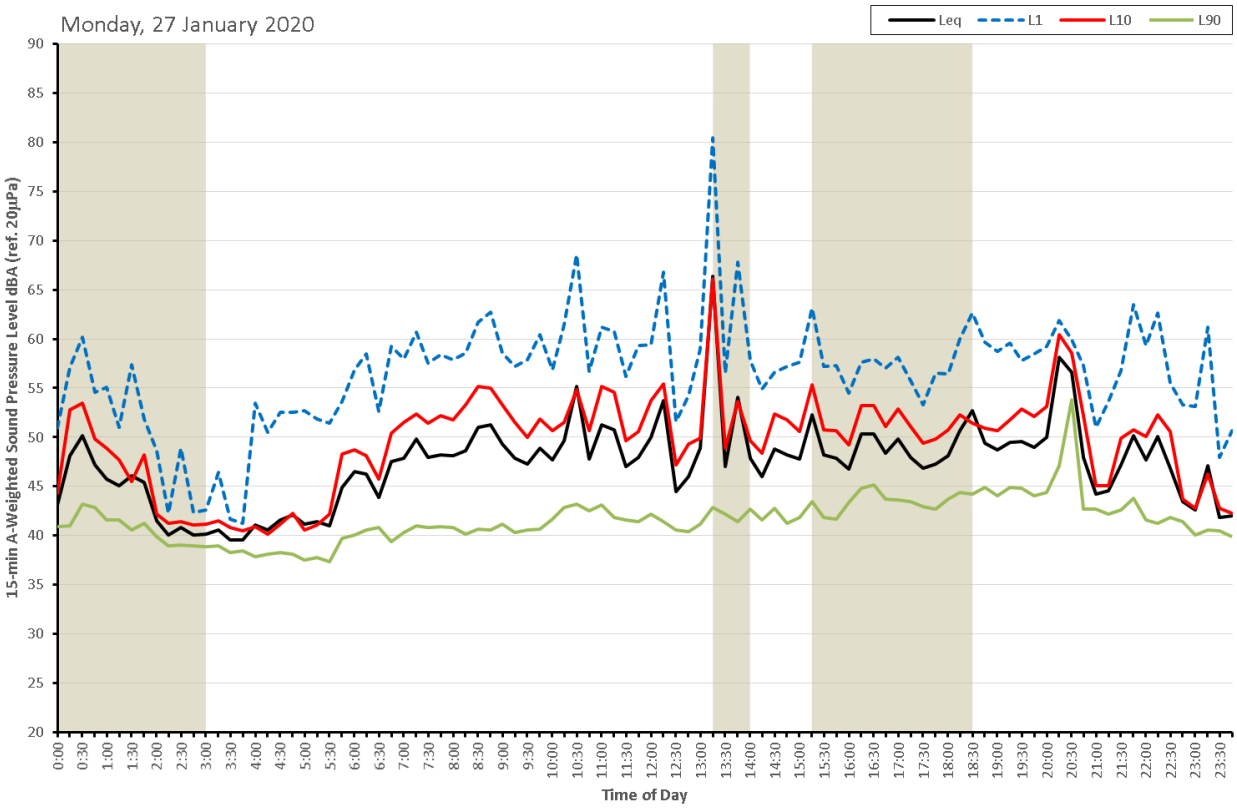
L_{Aeq} – The equivalent continuous sound level (L_{Aeq}) is the energy average of the varying noise over the sample period and is equivalent to the level of a constant noise which contains the same energy as the varying noise environment. This measure is also a common measure of environmental noise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

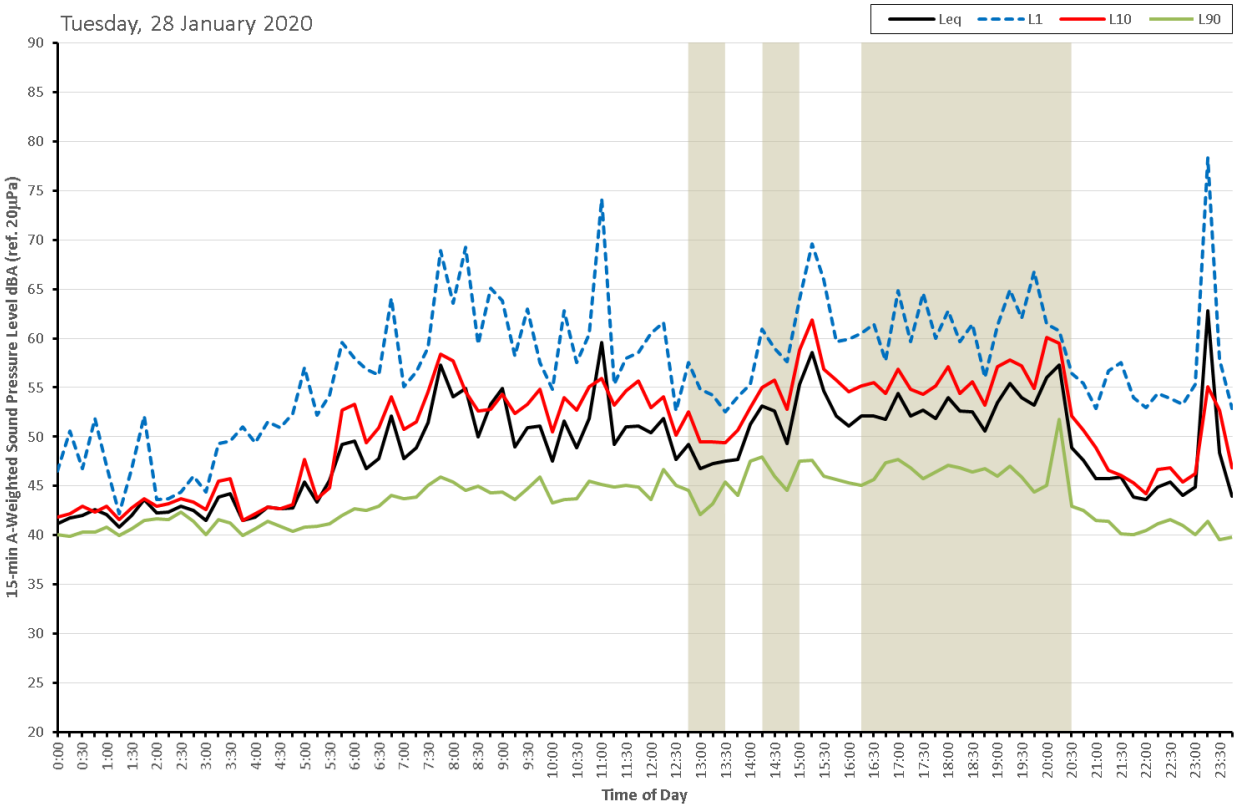

Thursday, 23 January 2020
Leq
L1
L10
L90
15-min A-Weighted Sound Pressure Level dBA (ref. 20µPa)
Time of Day

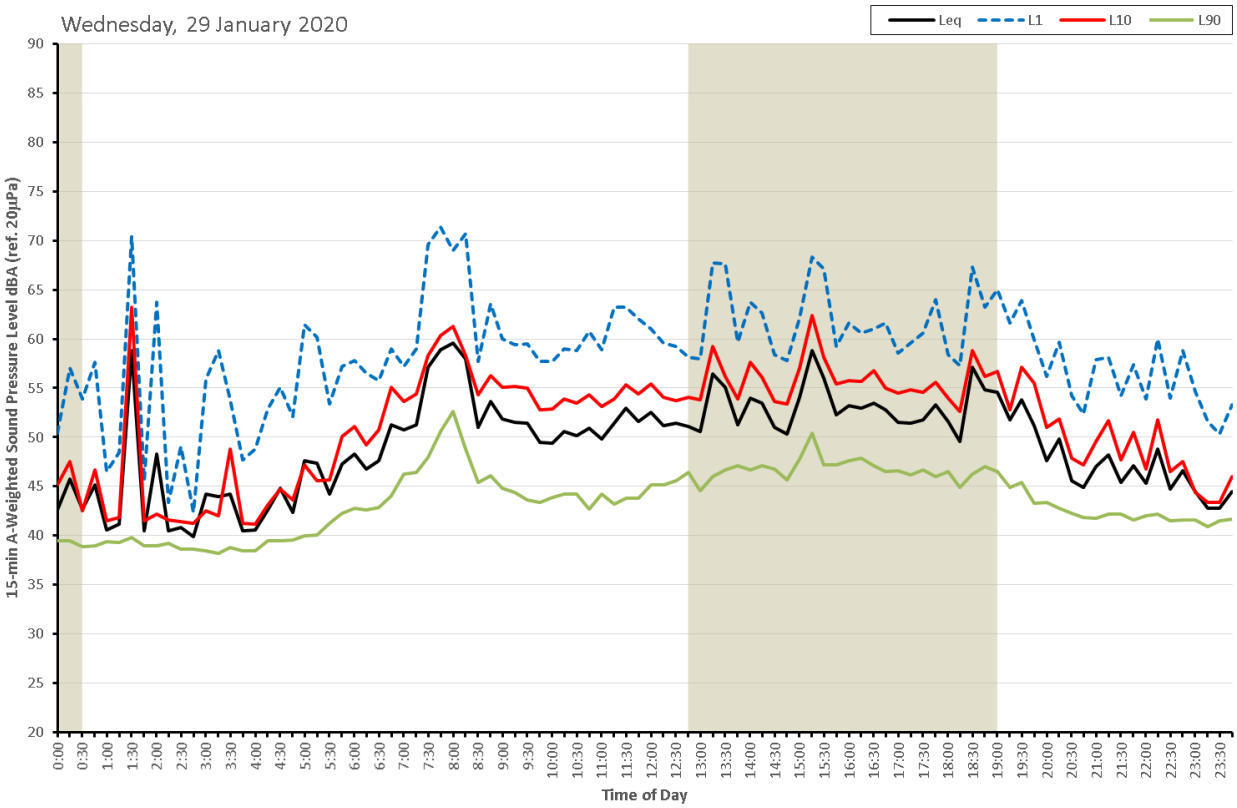

Friday, 24 January 2020
Leq
L1
L10
L90
15-min A-Weighted Sound Pressure Level dBA (ref. 20µPa)
Time of Day

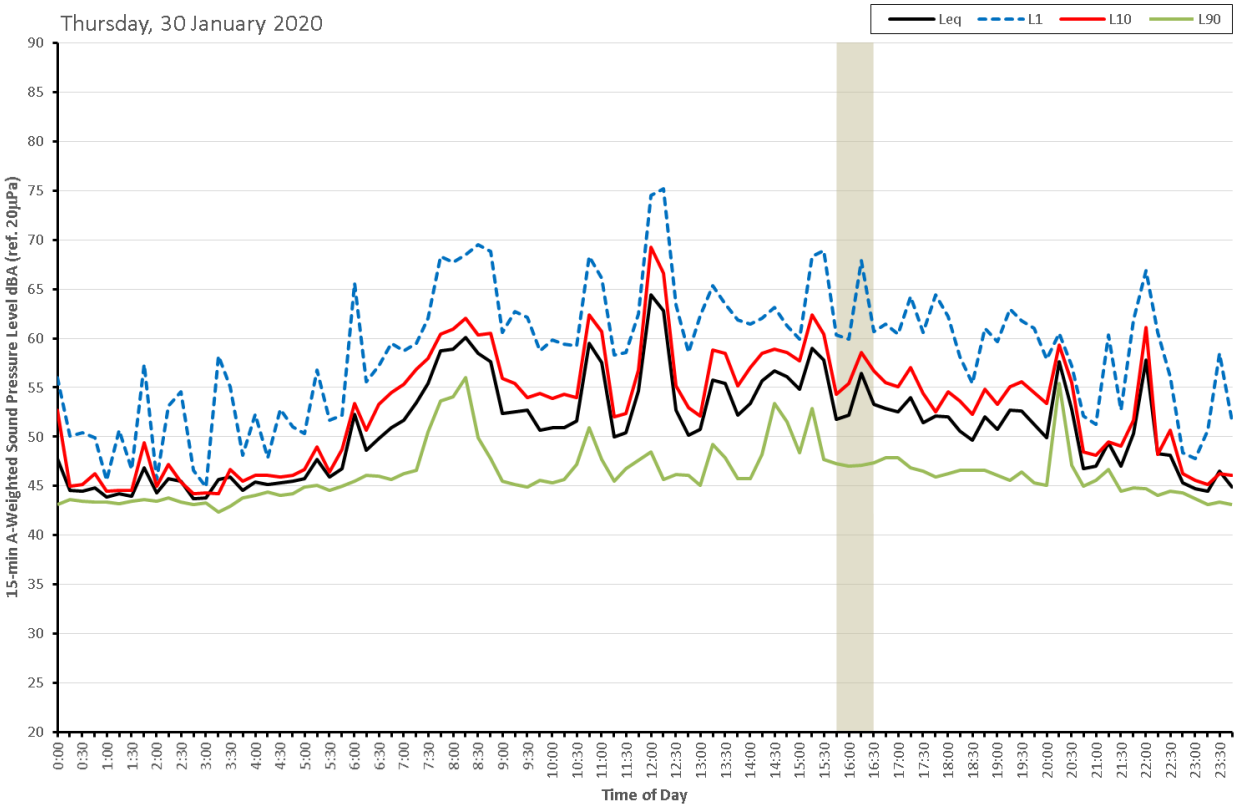

Saturday, 25 January 2020
Leq
L1
L10
L90
15-min A-Weighted Sound Pressure Level dBA (ref. 20µPa)
Time of Day

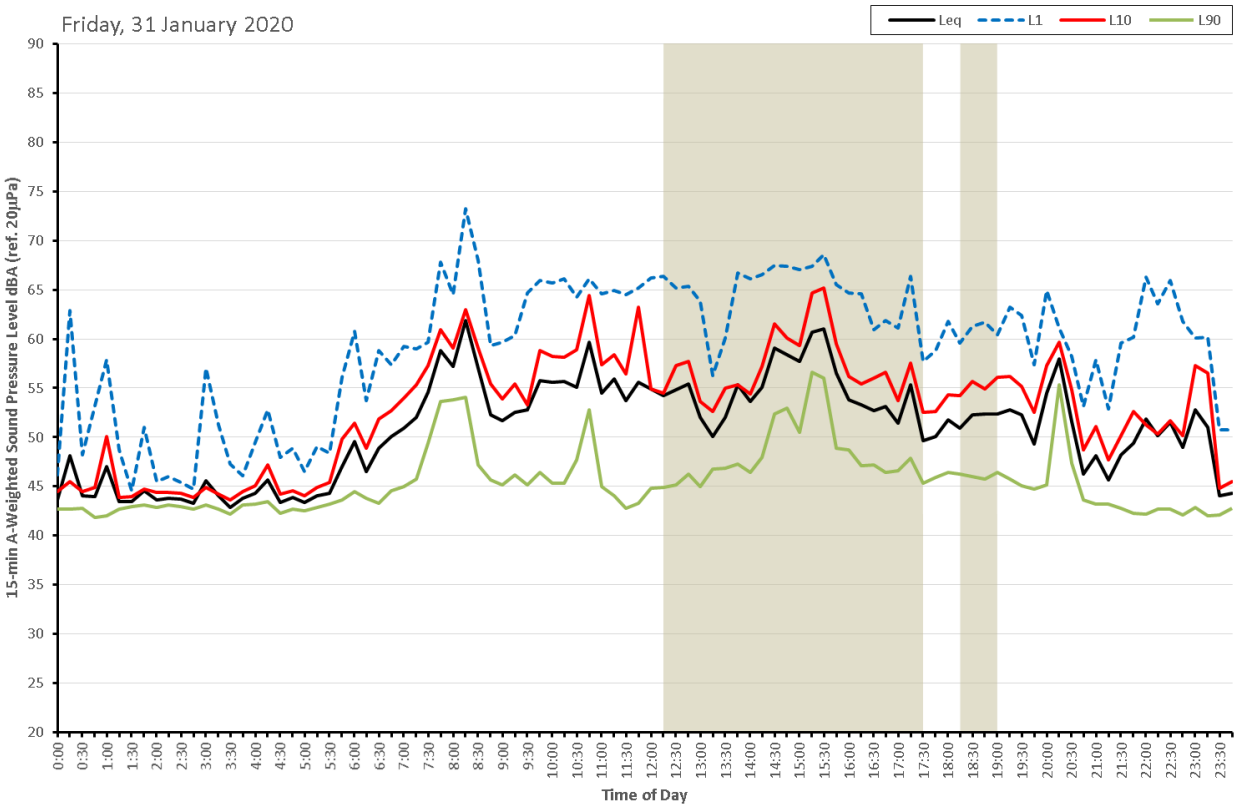

Sunday, 26 January 2020
Leq
L1
L10
L90
15-min A-Weighted Sound Pressure Level dBA (ref. 20µPa)
Time of Day

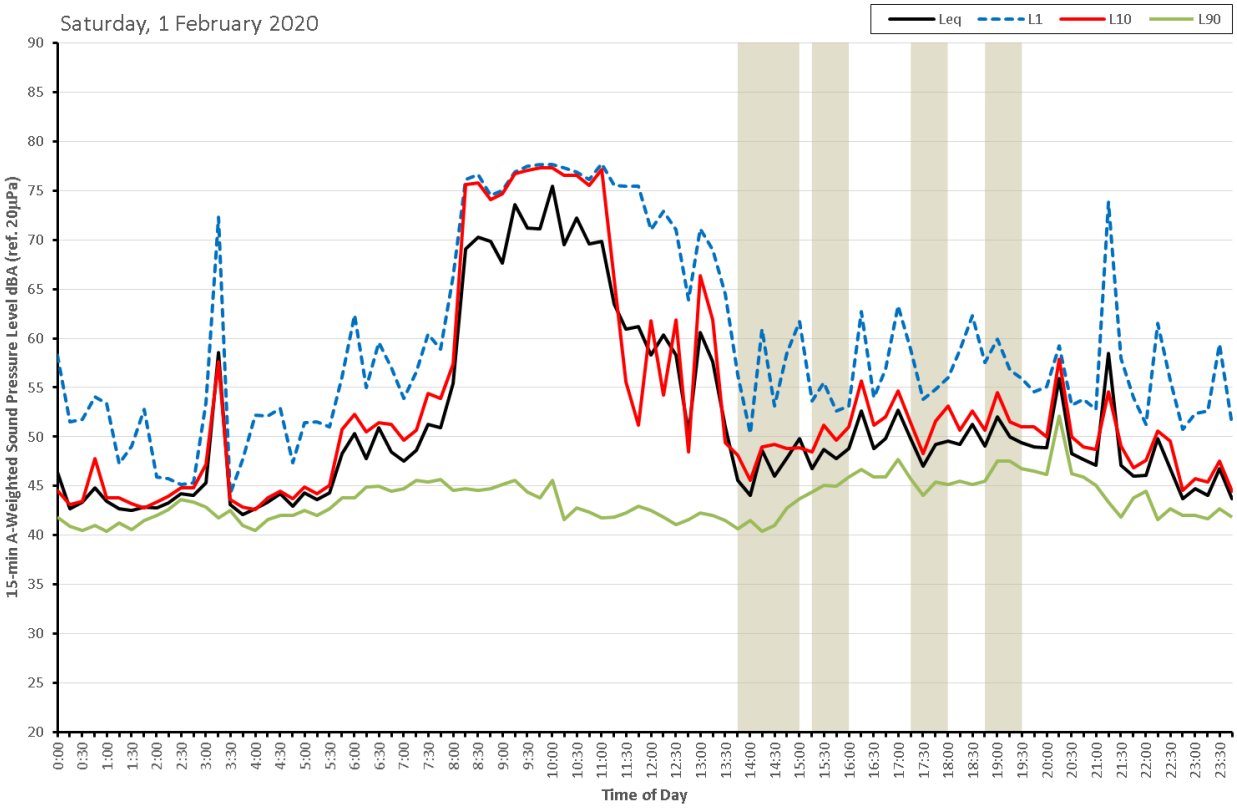

Monday, 27 January 2020
Leq
L1
L10
L90
15-min A-Weighted Sound Pressure Level dBA (ref. 20µPa)
Time of Day

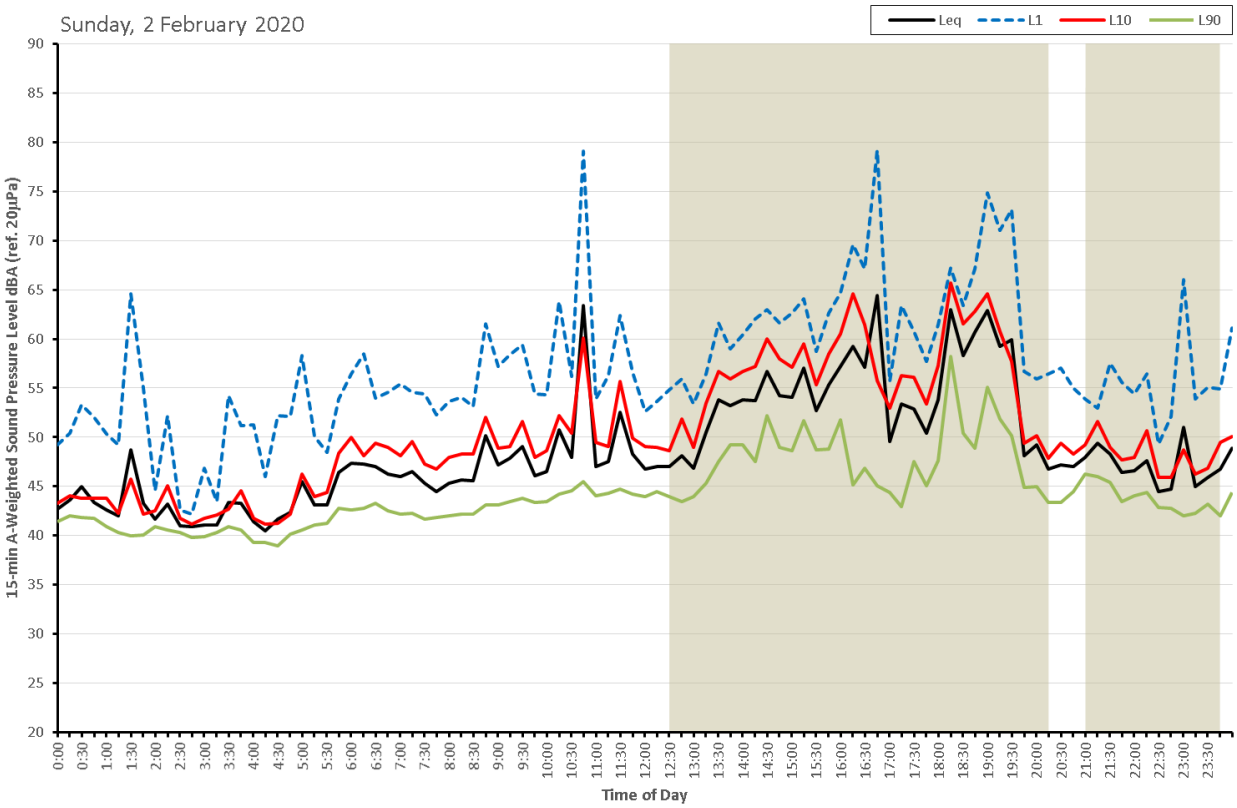

Tuesday, 28 January 2020
Leq
L1
L10
L90
15-min A-Weighted Sound Pressure Level dBA (ref. 20µPa)
Time of Day

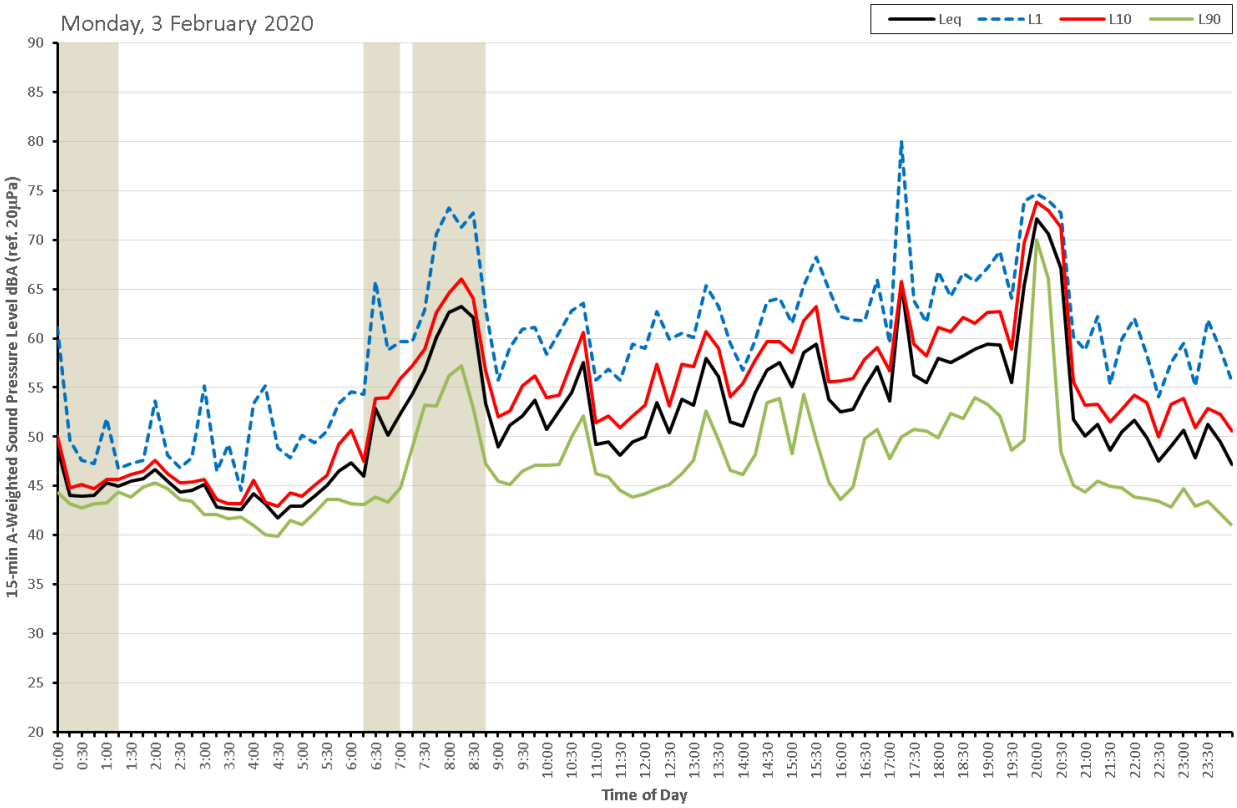

Wednesday, 29 January 2020
Leq
L1
L10
L90
15-min A-Weighted Sound Pressure Level dBA (ref. 20µPa)
Time of Day

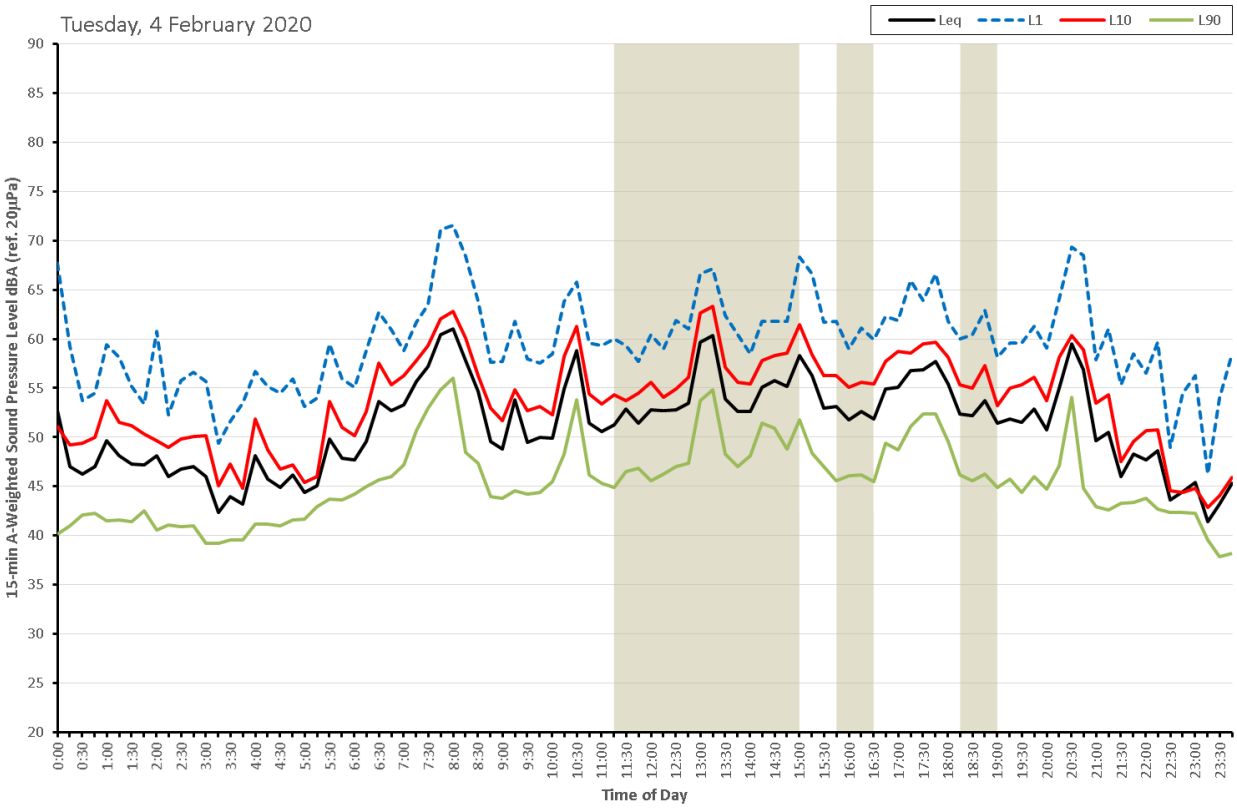

Thursday, 30 January 2020
Leq
L1
L10
L90
15-min A-Weighted Sound Pressure Level dBA (ref. 20µPa)
Time of Day

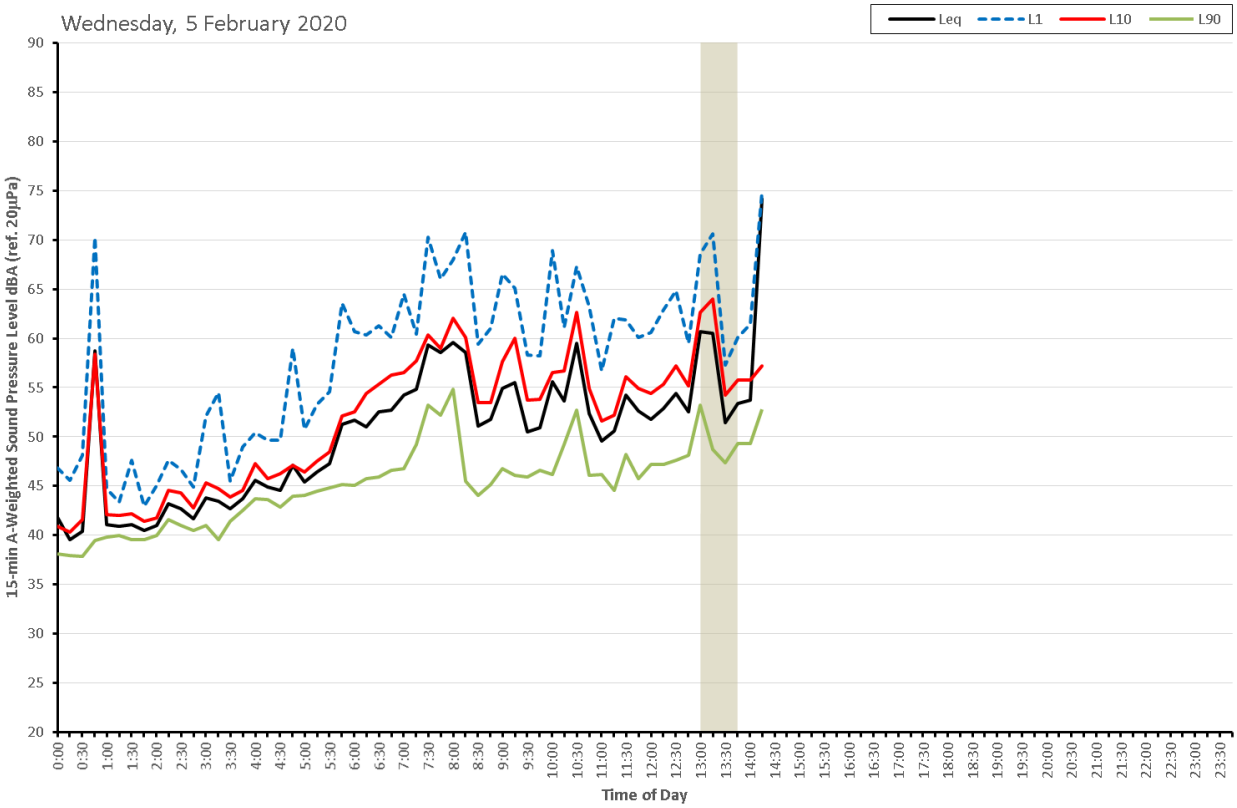

Friday, 31 January 2020
Leq
L1
L10
L90
15-min A-Weighted Sound Pressure Level dBA (ref. 20µPa)
Time of Day

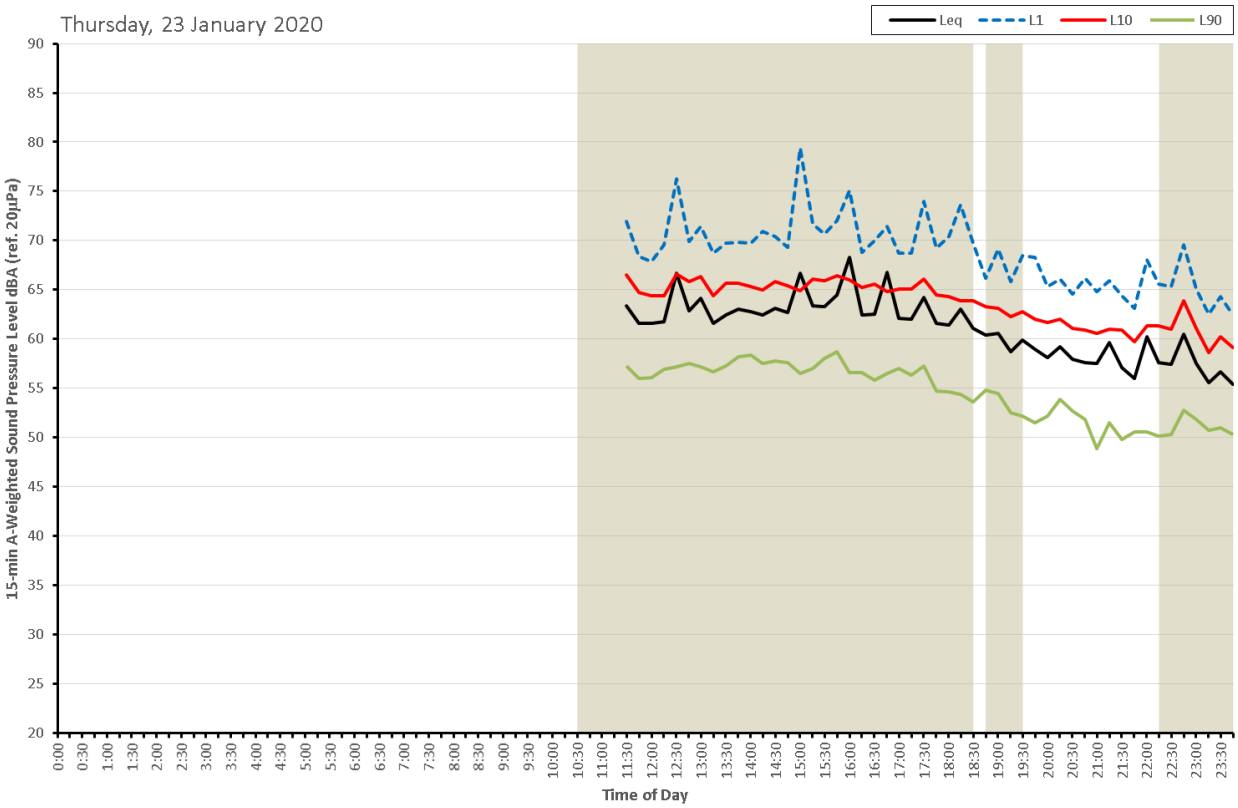

Saturday, 1 February 2020
Leq
L1
L10
L90
15-min A-Weighted Sound Pressure Level dBA (ref. 20µPa)
Time of Day

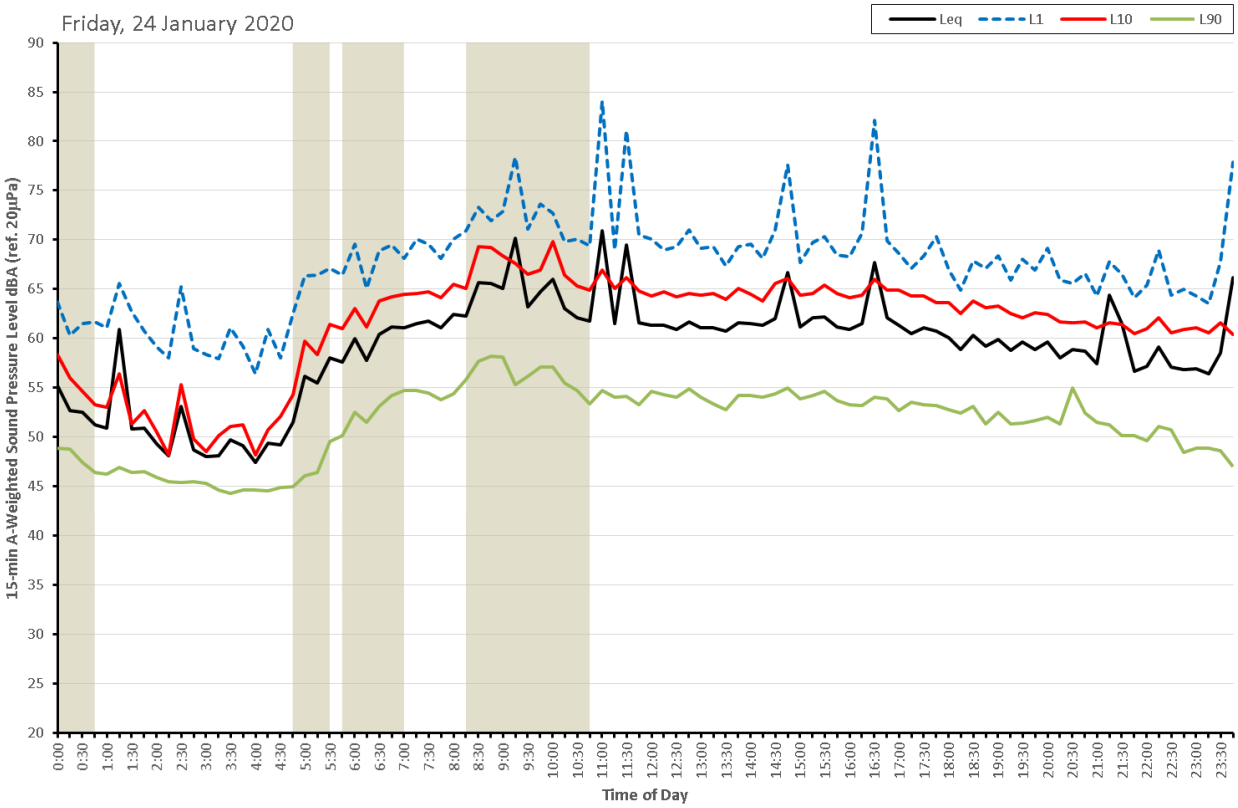

Sunday, 2 February 2020
Leq
L1
L10
L90
15-min A-Weighted Sound Pressure Level dBA (ref. 20µPa)
Time of Day

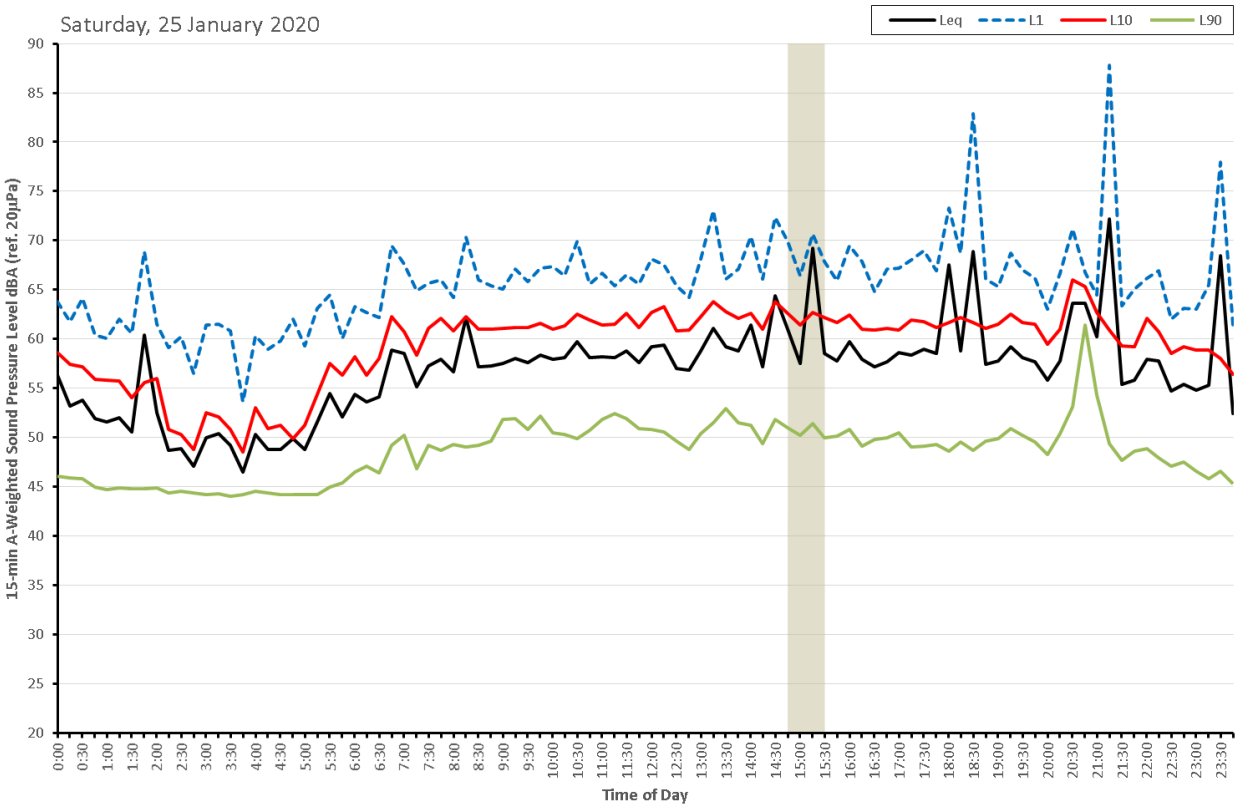

Monday, 3 February 2020
Leq
L1
L10
L90
15-min A-Weighted Sound Pressure Level dBA (ref. 20µPa)
Time of Day

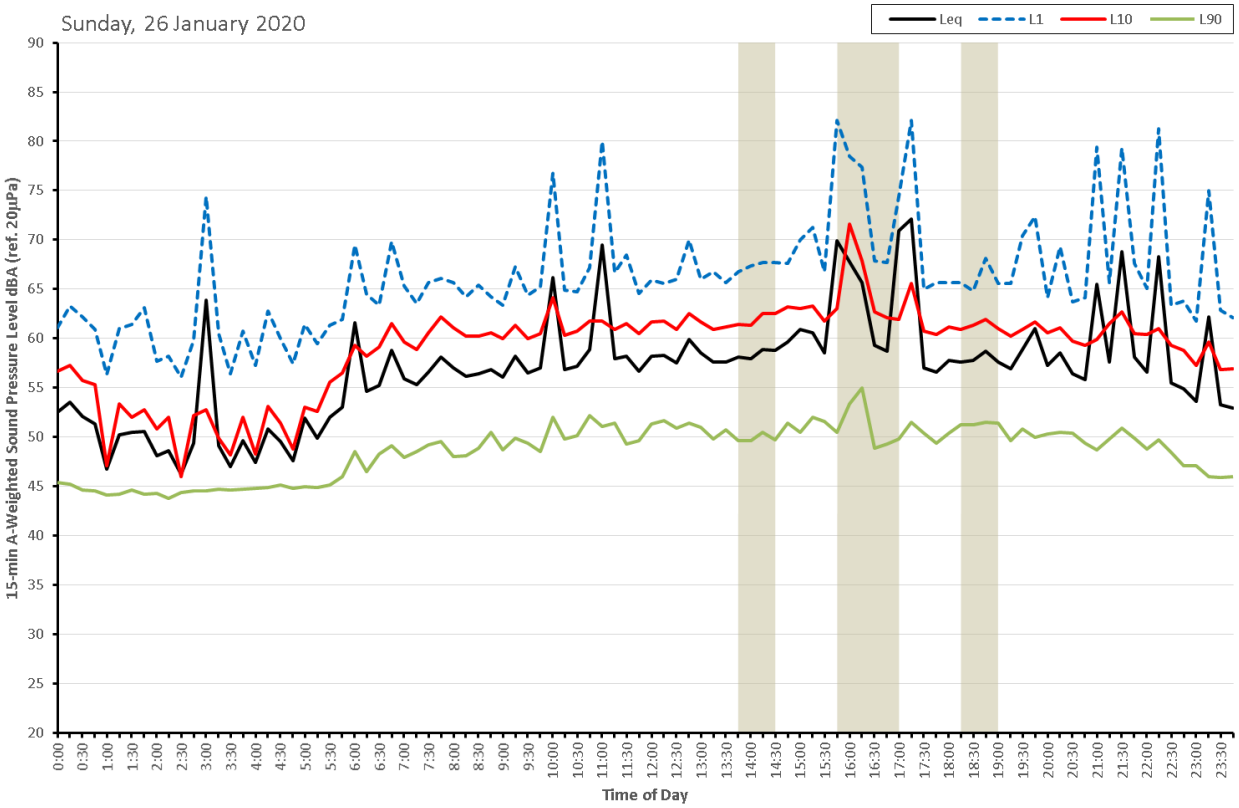

Tuesday, 4 February 2020
Leq
L1
L10
L90
15-min A-Weighted Sound Pressure Level dBA (ref. 20µPa)
Time of Day

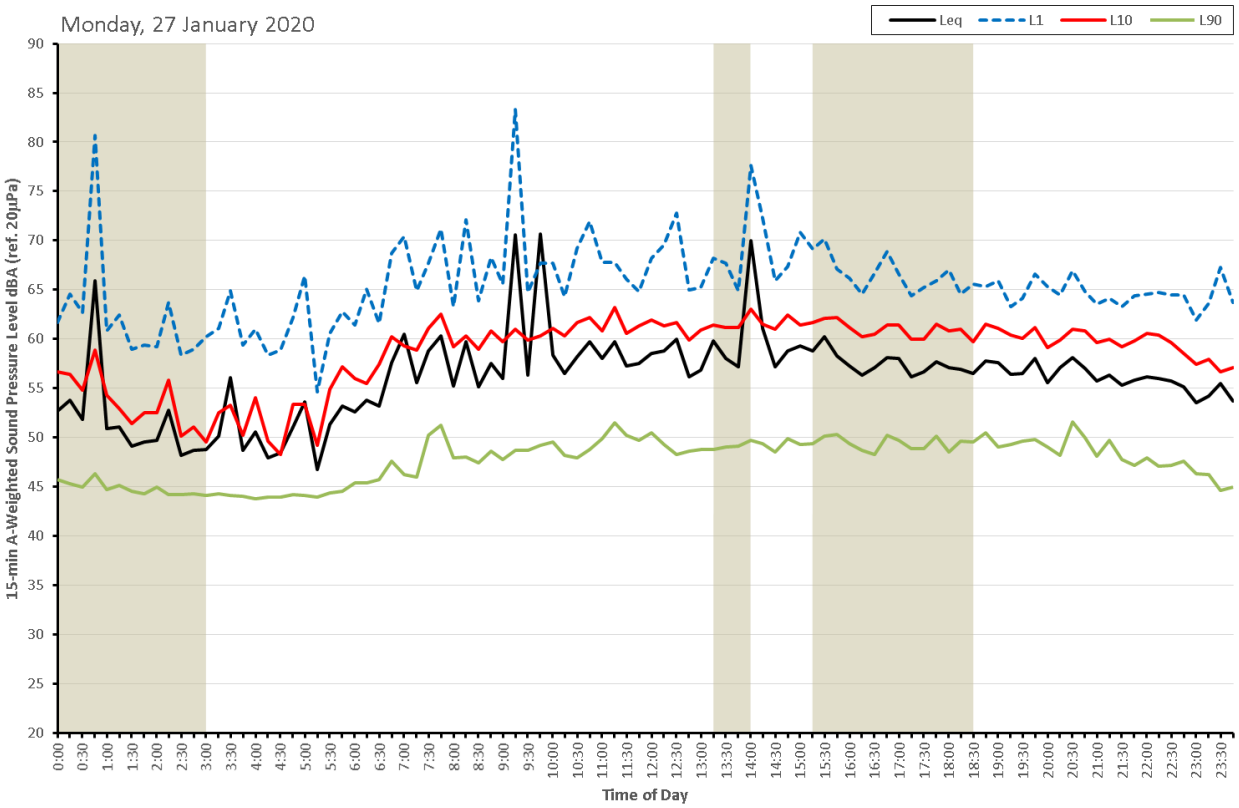

Wednesday, 5 February 2020
Leq
L1
L10
L90
15-min A-Weighted Sound Pressure Level dBA (ref. 20µPa)
Time of Day

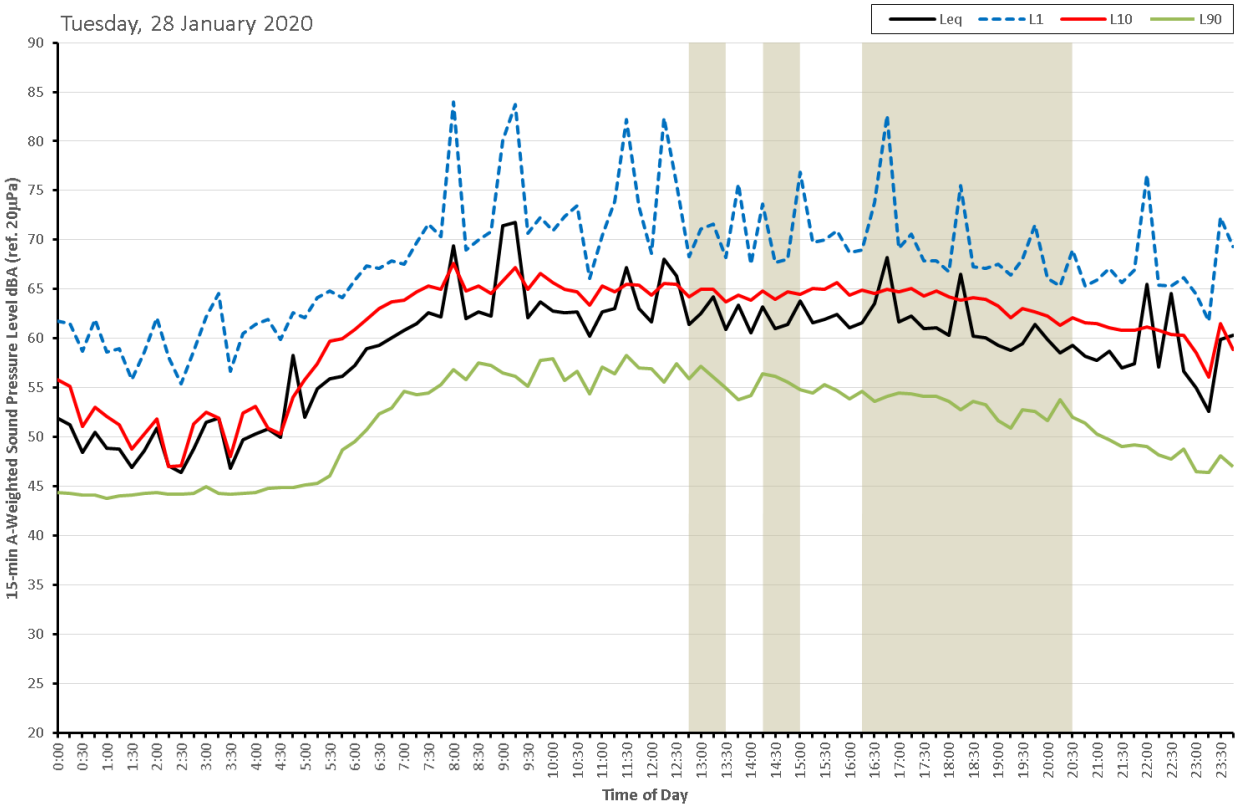

Thursday, 23 January 2020
Leq
L1
L10
L90
15-min A-Weighted Sound Pressure Level dBA (ref. 20µPa)
Time of Day

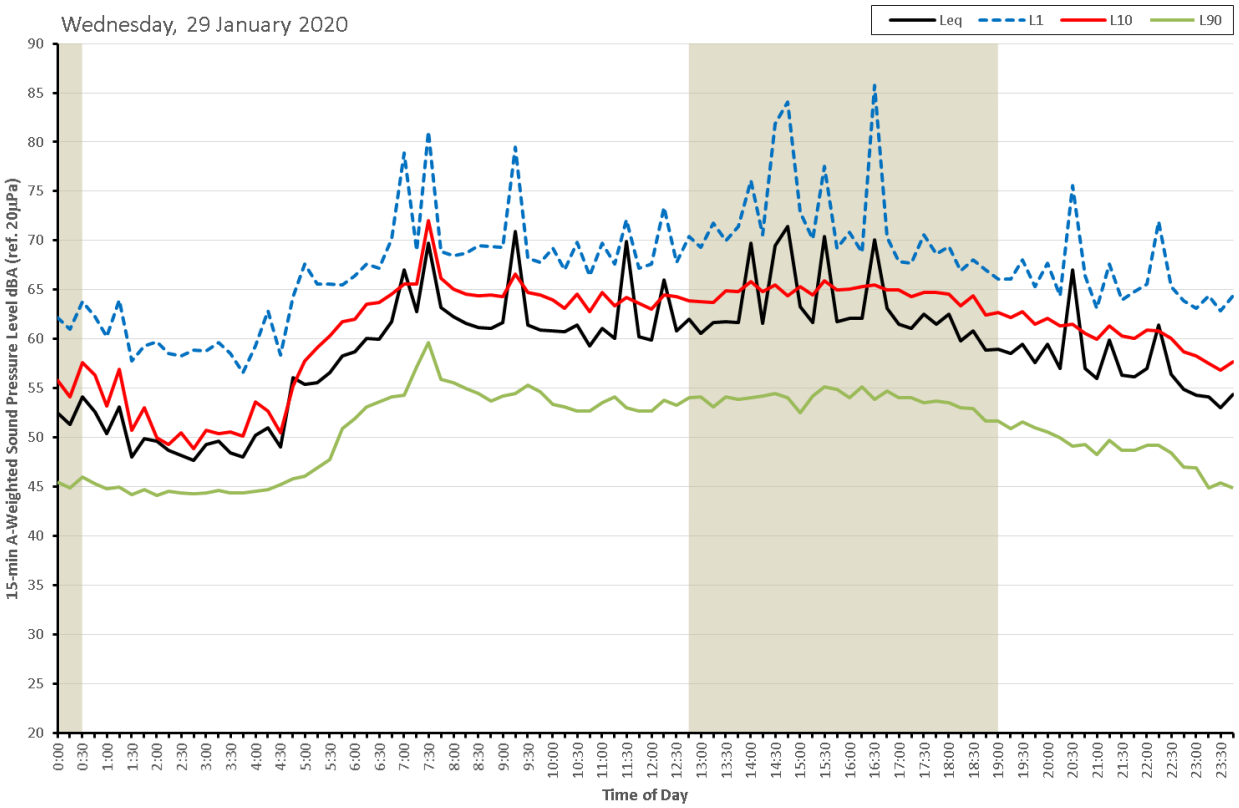

Friday, 24 January 2020
Leq
L1
L10
L90
15-min A-Weighted Sound Pressure Level dBA (ref. 20µPa)
Time of Day

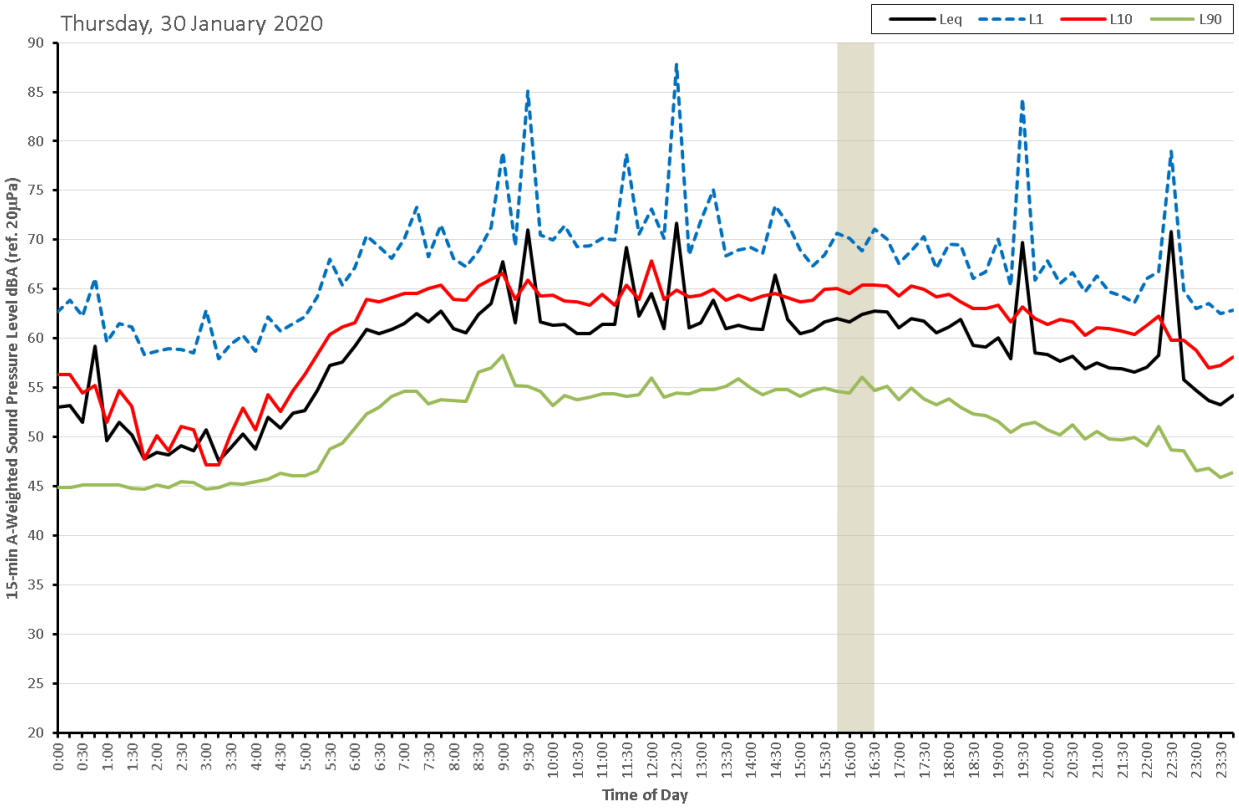

Saturday, 25 January 2020
Leq
L1
L10
L90
15-min A-Weighted Sound Pressure Level dBA (ref. 20µPa)
Time of Day

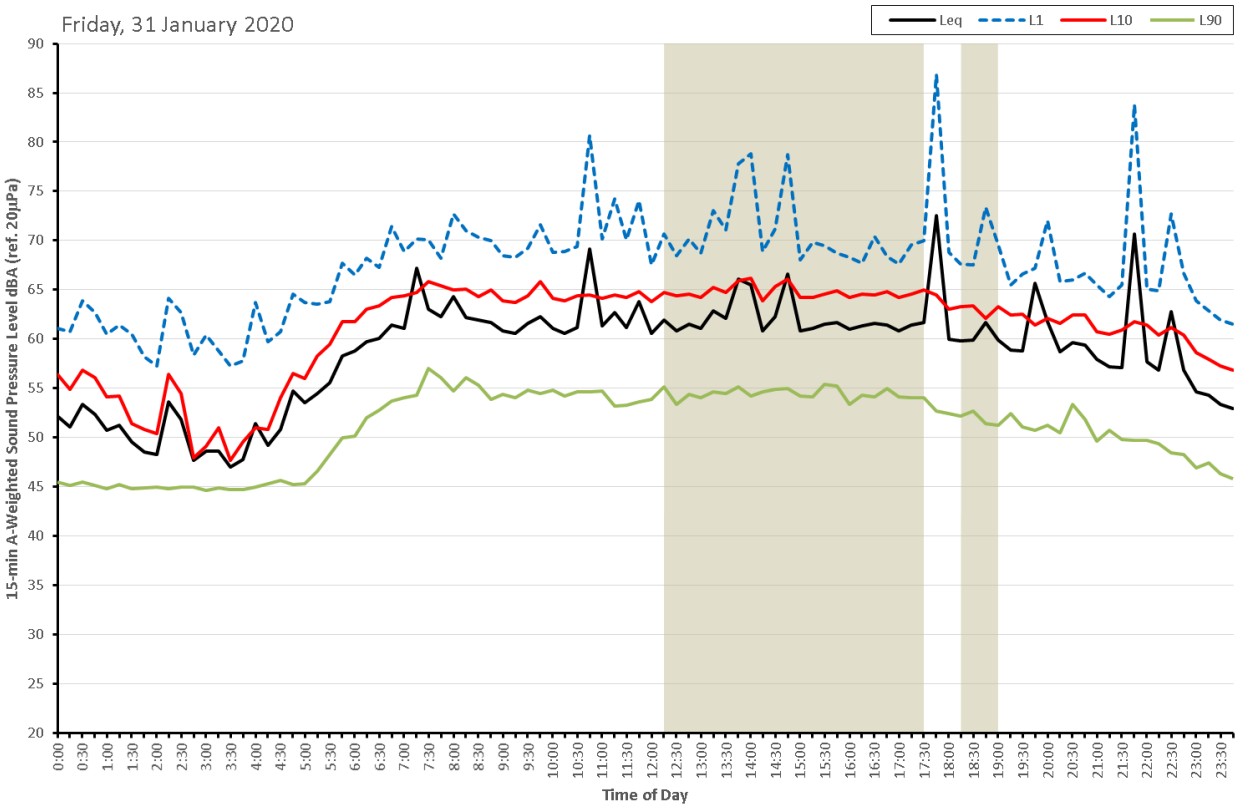

Sunday, 26 January 2020
Leq
L1
L10
L90
15-min A-Weighted Sound Pressure Level dBA (ref. 20µPa)
Time of Day

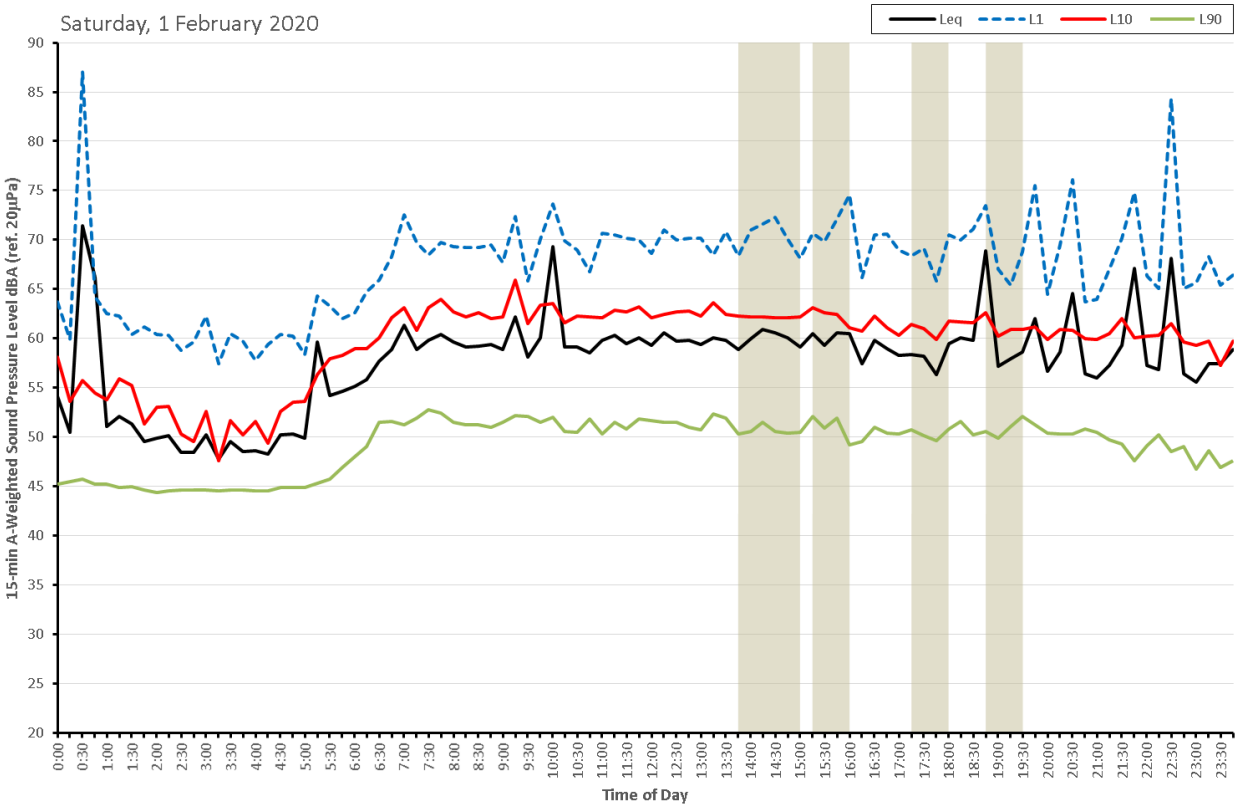

Monday, 27 January 2020
Leq
L1
L10
L90
15-min A-Weighted Sound Pressure Level dBA (ref. 20µPa)
Time of Day

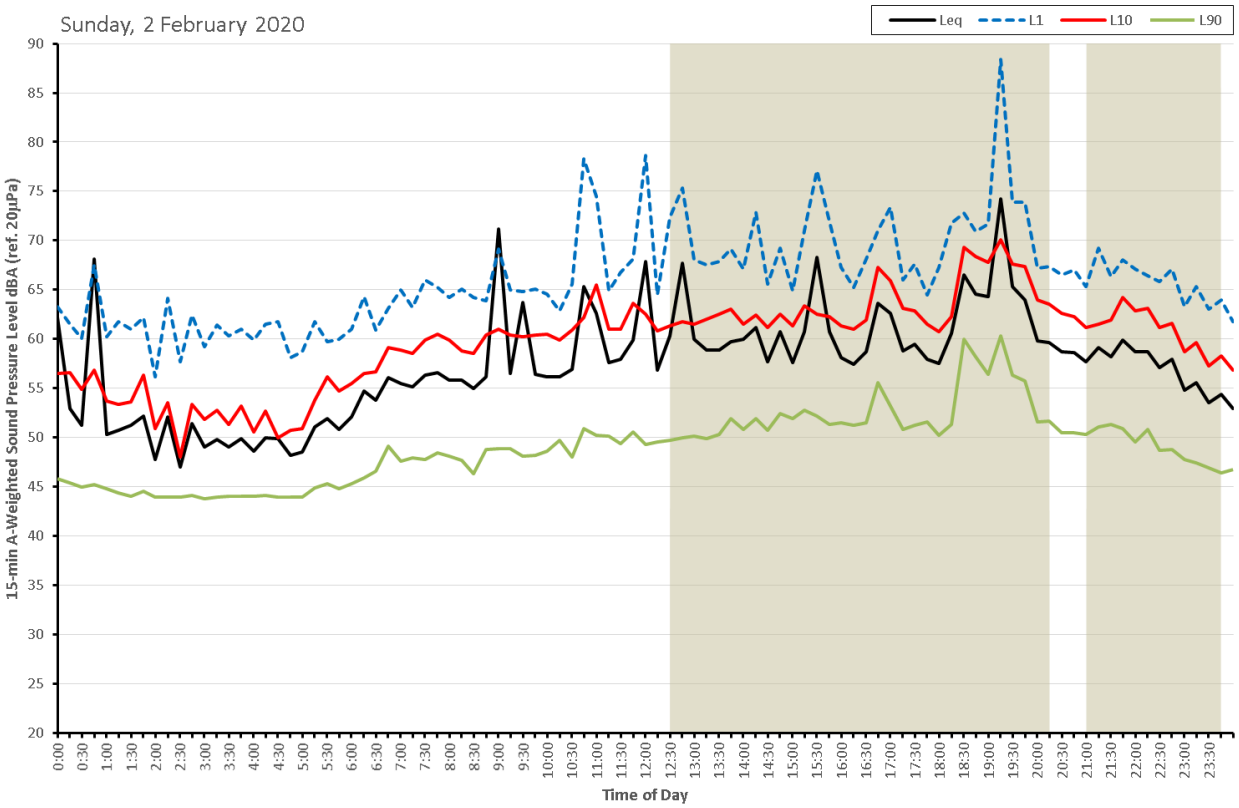

Tuesday, 28 January 2020
Leq
L1
L10
L90
15-min A-Weighted Sound Pressure Level dBA (ref. 20µPa)
Time of Day

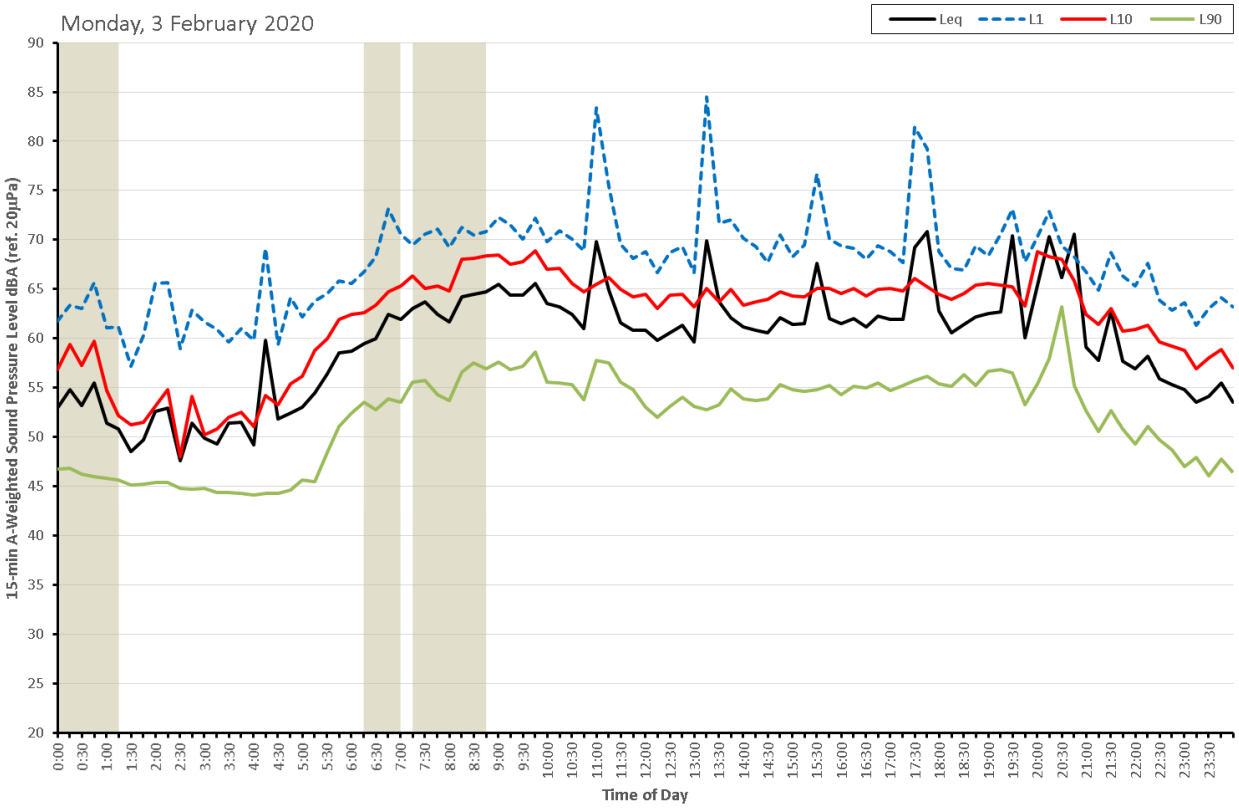

Wednesday, 29 January 2020
Leq
L1
L10
L90
15-min A-Weighted Sound Pressure Level dBA (ref. 20µPa)
Time of Day

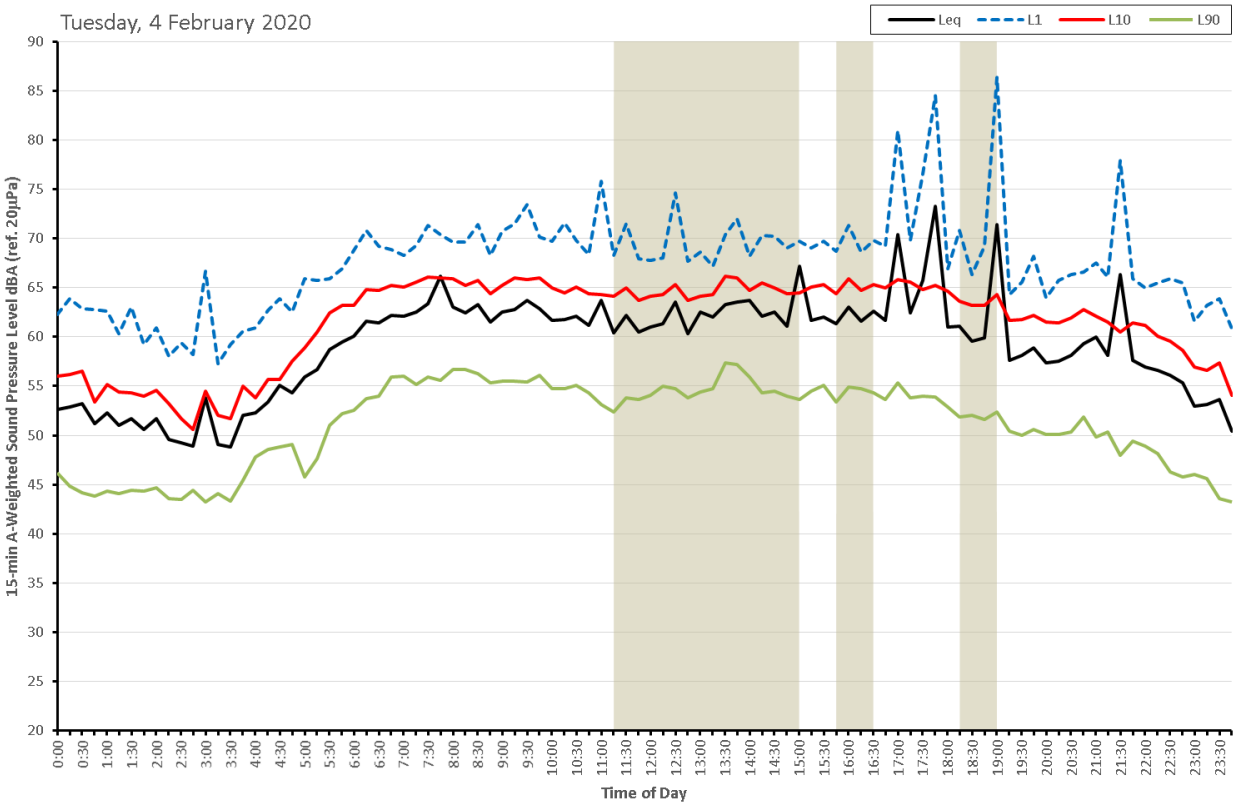

Thursday, 30 January 2020
Leq
L1
L10
L90
15-min A-Weighted Sound Pressure Level dBA (ref. 20µPa)
Time of Day

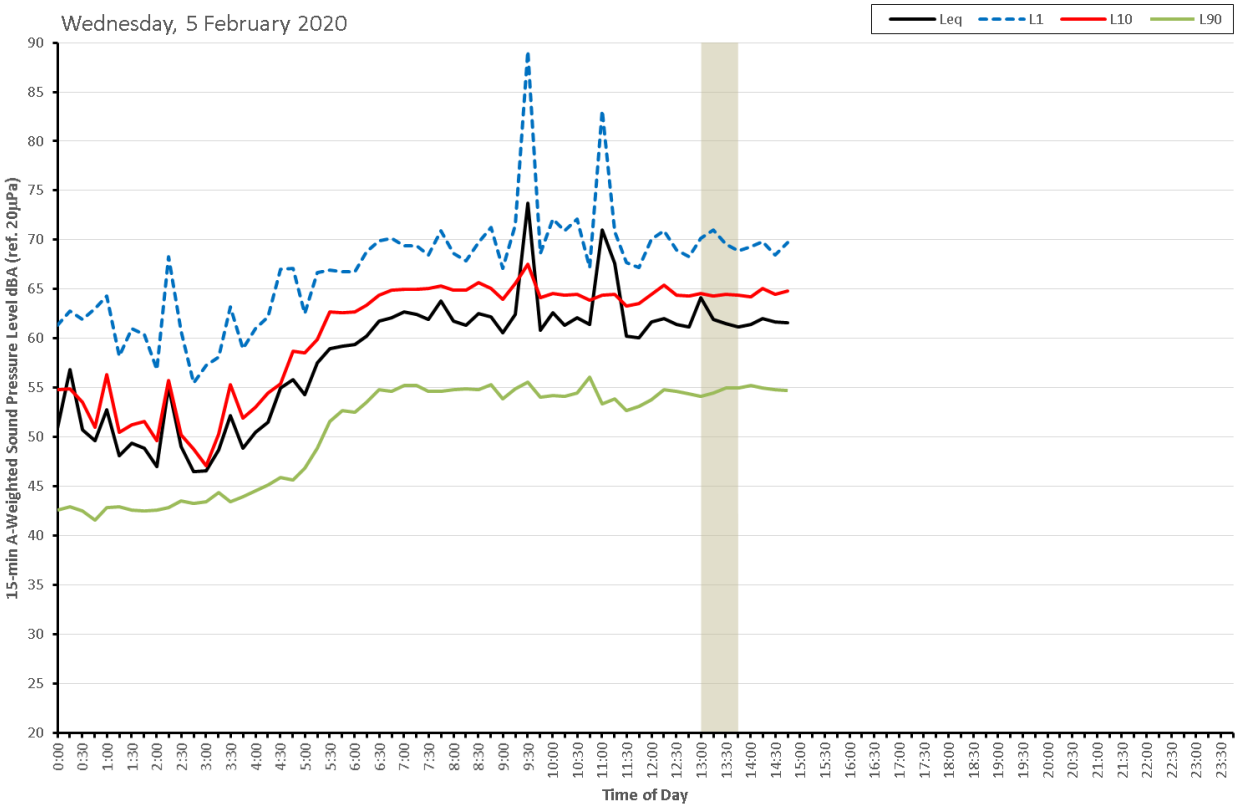

Friday, 31 January 2020
Leq
L1
L10
L90
15-min A-Weighted Sound Pressure Level dBA (ref. 20µPa)
Time of Day


Saturday, 1 February 2020
Leq
L1
L10
L90
15-min A-Weighted Sound Pressure Level dBA (ref. 20µPa)
Time of Day


Sunday, 2 February 2020
Leq
L1
L10
L90
15-min A-Weighted Sound Pressure Level dBA (ref. 20µPa)
Time of Day


Monday, 3 February 2020
Leq
L1
L10
L90
15-min A-Weighted Sound Pressure Level dBA (ref. 20µPa)
Time of Day


Tuesday, 4 February 2020
Leq
L1
L10
L90
15-min A-Weighted Sound Pressure Level dBA (ref. 20µPa)
Time of Day


Wednesday, 5 February 2020
Leq
L1
L10
L90
15-min A-Weighted Sound Pressure Level dBA (ref. 20µPa)
Time of Day