

Preliminary Noise Impact Assessment Goulburn Aquatic Centre

Report Number: R317111AC R0 18-04-12



AUSTRALIAN
BUSINESS
AWARDS
2013 ACT BUSINESS OF THE YEAR



Rudds Consulting Engineers Pty Ltd					
Head Office: 5 Bodalla Place Fyshwick ACT 2609 Tel: (02) 6240 2900 Fax: (02) 6280 9951 E-mail: manager@rudds.com.au Web: www.rudds.com.au ABN 16 054 221 162			VIC Office: Suite 29 Level 4, 150 Albert Road, South Melbourne VIC 3205 Tel: (03) 9682 6525 Fax: (03) 9682 6294 E-mail: manager.vic@rudds.com.au Web: www.rudds.com.au ABN 49 141 632 519		
The document may only be used for the purposes for which it was commissioned and in accordance with the Terms of Engagement for the commission. Unauthorised use of this document in any form whatsoever is prohibited.					
Rev No	Reason for Issue	Author		Approver for Issue	
		Name	Date	Name	Date
00	Preliminary – For Discussion Only	Jerremy Lofts	16 April 2018	Jerremy Lofts	16 April 2018
This report has been prepared in accordance with the scope of services described in the contract or agreement between Rudds Consulting Engineers Pty Ltd ABN 16 054 221 162 (Rudds) or Rudds Acoustics Pty Ltd ABN 41 147 203 610 and the client. The report relies upon data, surveys, measurements and results taken at or under the particular times and conditions specified herein. Any findings, conclusions or recommendations only apply to the aforementioned circumstances and no greater reliance should be assumed or drawn by the client. Furthermore, the report has been prepared solely for use by the client and Rudds accepts no responsibility for its use by other parties.					

Contents

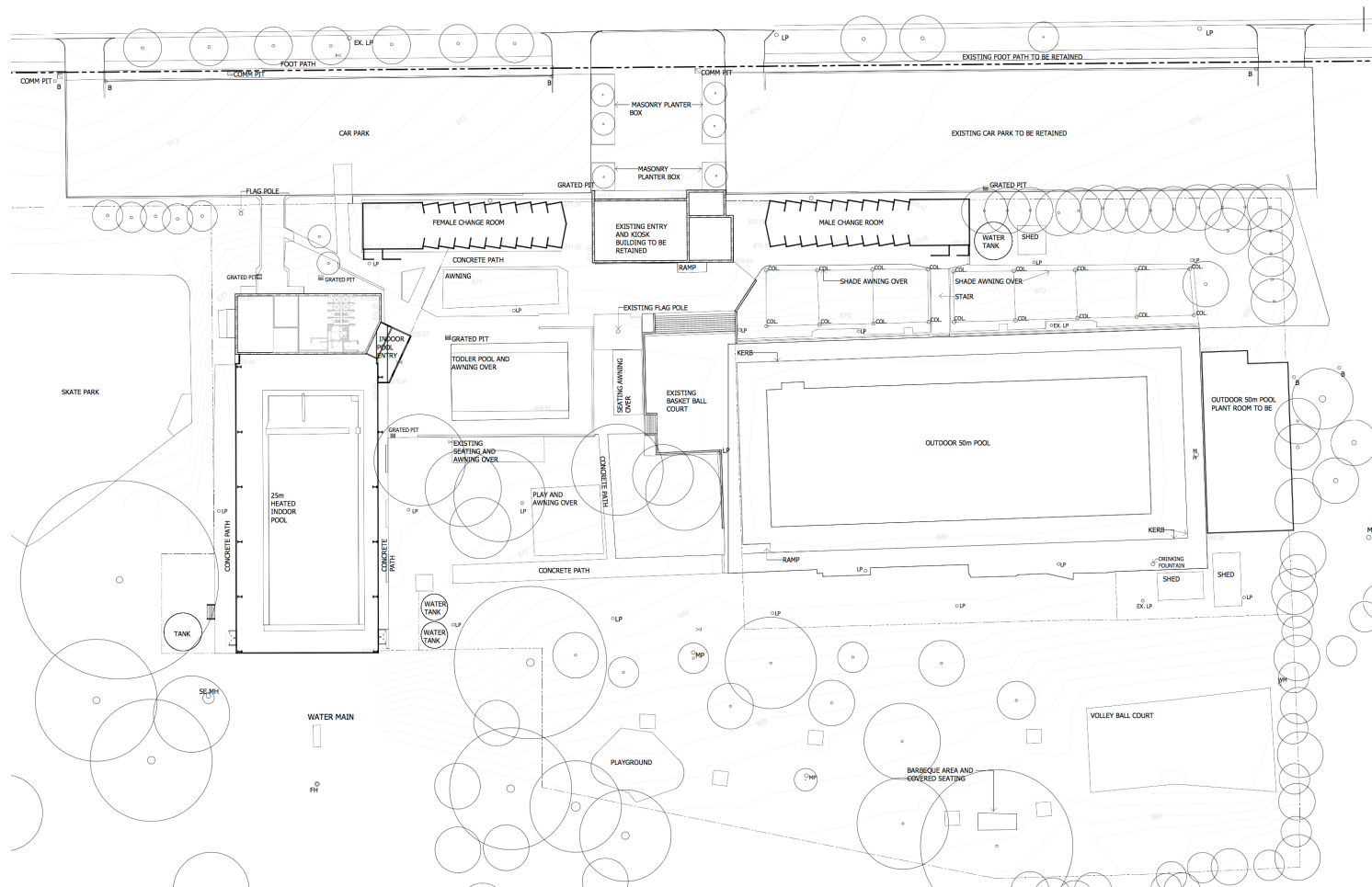
SECTIONS	Page
Section 1 - Introduction	4
Section 2 - Environmental Noise Limits	7
2.1 Nearest Residential Receiver Locations	7
2.2 Determination of Offensiveness of Noise	8
2.3 NSW Industrial Noise Policy	9
2.4 Road Traffic Noise Limits.....	12
2.5 Construction Noise	13
2.6 Work Health and Safety Noise Limits	14
Section 3 - Preliminary Noise Impact Assessment	16
3.1 Acoustically Significant Noise Sources	16
3.2 Preliminary Intrusiveness Assessment of Noise impacts	16
3.3 Operational Noise Qualitative Assessment	20
3.4 Preliminary Construction Noise Assessment.....	21
Section 4 - Conclusion.....	23
 TABLES	 Page
Table 1 Amenity Criteria.....	9
Table 2 Long Term Noise Monitoring Results	10
Table 3 Operator Attended Noise Measurements.....	11
Table 4 Project Specific Noise Limits.....	11
Table 5 Road Traffic Noise Assessment Criteria for Residential Land Uses	12
Table 6 Construction Noise Guidance Levels at Residences	13
Table 7 Construction Noise Guidance Levels at Other Noise Sensitive Areas	14
Table 8 Determination of Offensiveness	20
 FIGURES	 Page
Figure 1 Existing Site Plan.....	4
Figure 2 Proposed New Site Plan – Stage 1	5
Figure 3 Proposed New Site Plan – Stage 2	6
Figure 4 Location Plan	8
Figure 5 Likely School Group Congregation Area	19
 APPENDICES	 Page
Appendix A Noise Logging Results.....	24
Appendix B Glossary of Acoustic Terminology	31

Section 1 - Introduction

The Goulburn Mulwaree Council has identified the current aquatic centre facilities as being less-than-adequate to meet the needs of the community for several reasons, including the age of the assets and changing needs of the community. For this reason, an upgrade to the facility is proposed.

The existing site plan is shown in Figure 1, with the existing carpark to the north-west, a main entry / kiosk / gym area, change rooms, two outdoor pools and an indoor pool, play areas and covered entertaining areas. From an acoustic perspective the primary noise-producing infrastructure includes the main pool plant room, located on the north-eastern boundary of the site and the indoor pool plant room, located in the northern end of the existing indoor pool building on the western corner of the site.

FIGURE 1 EXISTING SITE PLAN



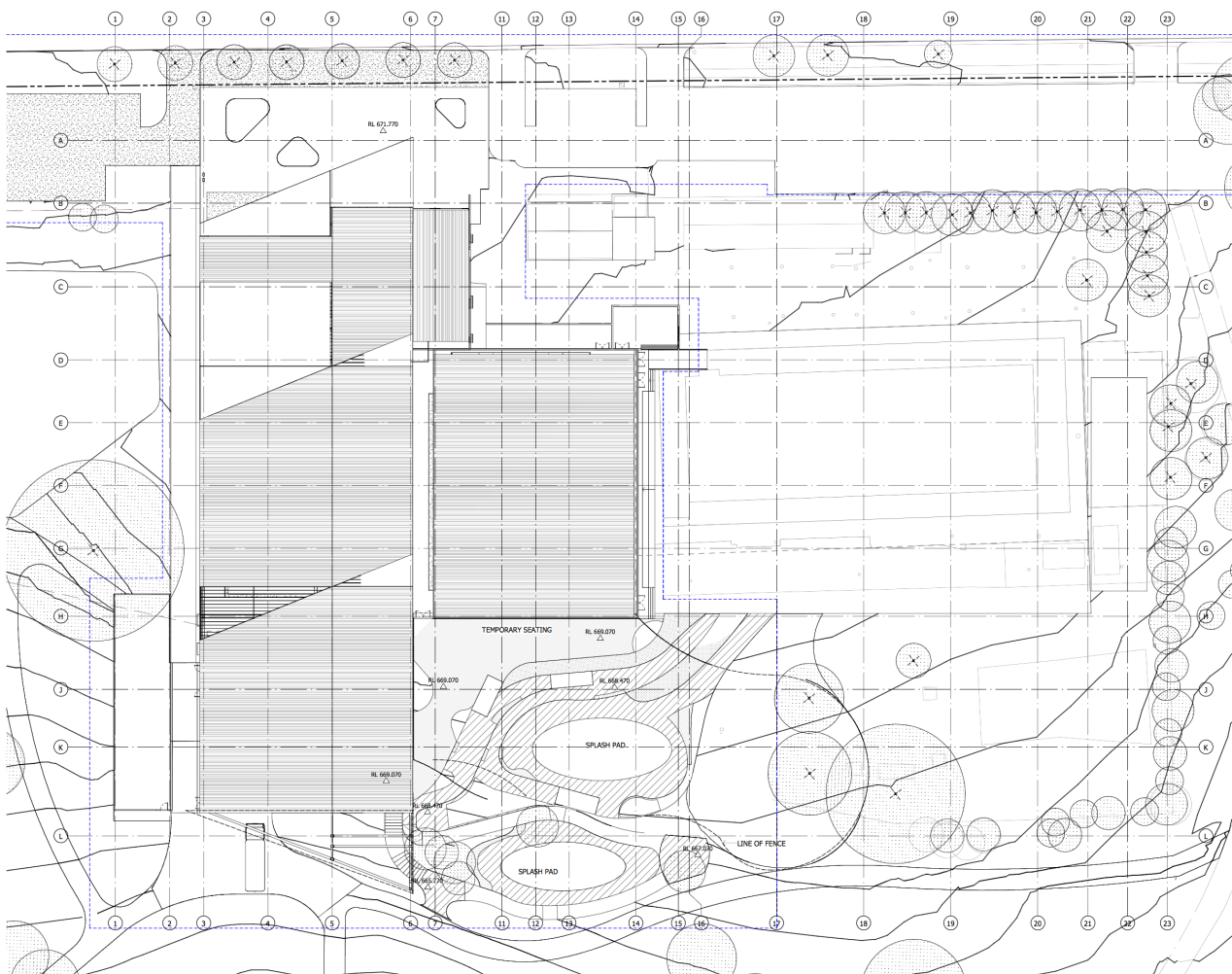
As part of this upgrade, there will be an extensive redevelopment of the site with the following areas being identified as being the primary inclusions outside a general upgrade of the existing facilities:

- new 8 lane (2.5m) x 50m pool with access ramp and stair
- new concourses to perimeter of new 50m pool
- new shade structures to 50m pool viewing area (one side of pool)
- new pool plant room for 50m pool (180sqm), with concourse showers and group change (allow approx 100 sq.m) and store room (allow 40sqm)
- new gymnasium (500 sqm)
- gym reception and assessment rooms (30sqm)
- two group exercise rooms (120sqm and 180sqm) with store room (15sqm)

- dry change rooms (approx 80sqm - male, female and 1 x accessible)
- circulation allowance of ~100sqm on the gym and group fitness areas
- new beach volleyball court in approximate location of existing
- new BBQ's in location of existing
- new BBQ seating with associated shade / shelter - allow 8 tables / benches
- new outdoor play space (climbing structure with slides, etc)
- new outdoor exercise station
- general landscaping to open space, including extension of 50m pool viewing mound (assumed to be formed from excavated material on site)
- additional car park for ~40 spaces
- upgrade access to 50m pool plant room.

The development will be staged so as to allow use of existing facilities while demolition and construction occurs.

FIGURE 2 PROPOSED NEW SITE PLAN – STAGE 1



[illegible]

- Environmental noise limits in accordance with the NSW Protection of the Environment Operations (Noise Control) Regulation 2008
- The NSW Industrial Noise Policy (INP)
- The NSW Noise Guide for Local Government (NGLG)
- The NSW Interim Construction Noise Guideline (ICNG)
- Work Health and Safety Act (2011)

Section 2 - Environmental Noise Limits

There is a comprehensive noise control framework in NSW, with several government departments and local authorities able to regulate noise. The primary legal framework is provided by the Protection of the Environment Operations Act 1997 (POEO Act) and the Protection of the Environment Operations (Noise Control) Regulation 2008 (Noise Control Regulation).

The POEO Act identifies the authority responsible for regulating noise, defines the meaning of offensive noise and provides a range of regulatory tools to manage noise.

Section 6 of the POEO Act makes local councils responsible for regulating noise in their local government areas, unless the activities carried out on the premises are scheduled activities listed in Schedule 1 of the POEO Act, are the subject of an environment protection licence for the purpose of regulating water pollution, or are activities conducted by state or public authorities, in which case the Office of Environment and Heritage is likely to be the regulating authority. Office of Environment and Heritage is also the regulating authority for certain non-scheduled activities, none of which are relevant to this project.

In this case, we understand that this is not a scheduled activity under the POEO Act. Guidance on the type of assessment that is required can be found in the Noise Guide for Local Government, published by the Department of Environment, Climate Change and Water (DECCW). Table 3 of this document recommends that an offensive noise test be carried out, or that an assessment be undertaken against any relevant council policy to determine whether the noise is considered to be intrusive and/or offensive. It also refers to the NSW Industrial Noise Policy (INP) for consideration of the definition of intrusive noise.

In this case, we understand that this is not a scheduled activity under the POEO Act. Guidance on the type of assessment that is required can be found in the Noise Guide for Local Government (NGLG), published by the Environmental Protection Authority. Table 3 of this document recommends that an offensive noise test be carried out, or that an assessment be undertaken against any relevant council policy to determine whether the noise is considered to be intrusive and/or offensive. It also refers to the NSW Industrial Noise Policy (INP) for consideration of the definition of intrusive noise.

Environmental noise can be assessed according to its offensiveness and/or its intrusiveness. The offensiveness of noise is a qualitative assessment discussed in the NGLG. It is based upon the level, character, time and duration of the noise, whether it is in character with the area, how often it occurs and the number of people affected. The intrusiveness of noise is a quantitative measure relating to the level of noise against a pre-determined target or compliance noise level.

Both intrusiveness and offensiveness are defined in the NGLG. This document contains an **offensive** noise checklist (qualitative) and information on measurement and assessment of **intrusive** noise (quantitative), which generally follows the methodology set out in the NSW Industrial Noise Policy. Also within the INP and following on from the intrusiveness noise criteria is an amenity noise criteria which is essentially a recommended maximum L_{eq} level for the cumulative impact of several industrial noise sources in the one area.

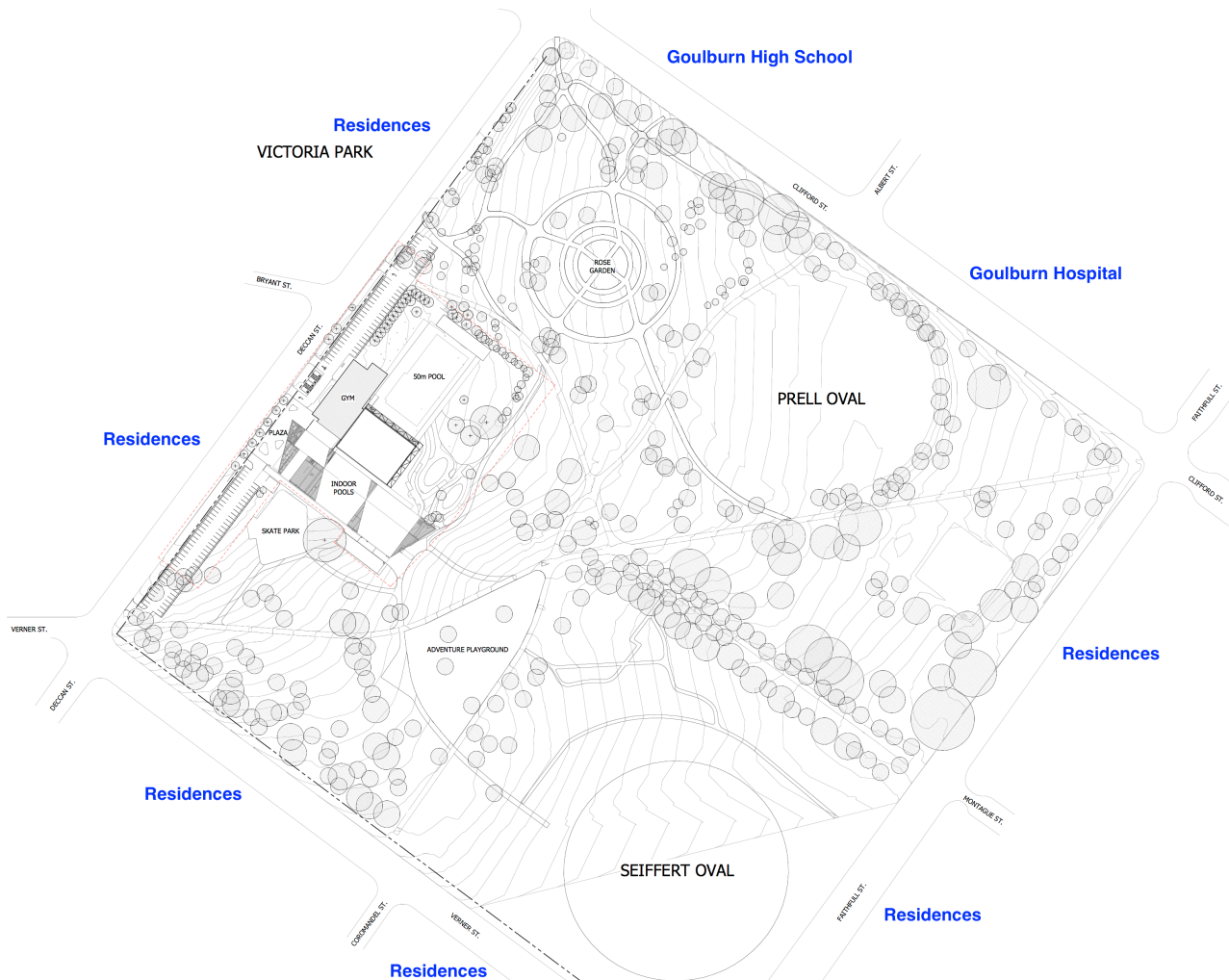
2.1 Nearest Residential Receiver Locations

Figure 4 shows the location of the aquatic centre. The rest of the block on which it is located is also recreational in nature, with the rose gardens of Victoria Park to the north-east, Prell and Sieffert Ovals to the east and south and an adventure playground and a skate park to the south and south-west. This means there are no residential receivers in close proximity to the north-east, south-east or south-west.

Across Deccan Street to the north-west are the nearest residential receivers. These will be the most critical receivers for this assessment, with the nearest houses being approximately 50 metres from the front of the existing buildings. Distances to nearest residential receivers are as follows:

- Buildings are 50 metres to residences in Deccan Street
- Carpark is approximately 35 metres to nearest residences in Deccan Street
- Minimum 200 metres to residences in Verner Street
- Minimum 200 metres to Goulburn High School to the north-east across Clifford Street
- Minimum 350 metres to nearest residences in Faithfull Street

There are also both passive and active recreation areas adjacent to the site which need to be considered.

FIGURE 4 LOCATION PLAN

2.2 Determination of Offensiveness of Noise

The offensive noise checklist provided within the Noise Guide for Local Government is as follows:

1. Is the noise loud in an absolute sense? Is it loud relative to other noise sources in the area?
2. Does the noise include characteristics that make it particularly irritating?
3. Does the noise occur at times when people expect to enjoy peace and quiet?
4. Is the noise atypical for the area?
5. Does the noise occur often?
6. Are a number of people affected by the noise?

By answering these questions, it can be qualitatively determined whether the noise is offensive. It is important to understand that answering "Yes" to one (or several) of these questions does not automatically mean the noise is offensive.

For example, Answering "yes" to questions 3 and 5, meaning the noise does occur often, but answering "no" to questions 1 and 2 means that, although the noise occurs often, it is unlikely to be offensive because it is not loud and does not contain annoying characteristics. The offensive noise assessment must be undertaken in context with the area. This also demonstrates why an intrusive noise test must also be undertaken. The noise level must be determined in an absolute sense relative to existing noise in the area to determine whether it is likely to be significantly audible at the residential receiver locations.

Determining whether noise from the external plant is offensive is a very subjective assessment, and the preference is toward a more quantitative assessment such as that presented by the NSW INP and the OLGR.

2.3 NSW Industrial Noise Policy

2.3.1 Determination of Amenity Noise Limits

The industrial noise policy states the following on page 15, Section 2.2:

“To limit continuing increases in noise levels, the maximum ambient noise level within an area from industrial noise sources should not normally exceed the acceptable noise levels specified in Table 2.1. Meeting the acceptable noise levels in Table 2.1 will protect against noise impacts such as speech interference, community annoyance and, to some extent, sleep disturbance. These levels represent current best practice for assessing industrial noise sources, based on research and a review of assessment practices used overseas and within Australia.

Table 2.1 also includes recommended maximum noise levels for different land uses. These recommended maximum values provide guidance on an upper limit to the level of noise from industry. In all cases it is expected that all feasible and reasonable mitigation measures would be applied before the recommended maximum noise levels are referenced.”

It is important to understand that this is a noise limit for the cumulative impact of ALL industrial-type noise sources in the area, not just the noise emissions of one site. Where there is a significant existing industrial noise contribution, any new noise sources need to achieve lower levels of emissions so that the overall noise level of the area does not exceed these limits. This adjustment factor can be found in the NSW INP, Table 2.2, Page 17. The following Table 1 is a summary of the NSW INP Table 2.1 with only areas specific to this site being included.

TABLE 1 AMENITY CRITERIA

Type of Receiver	Indicative Noise Amenity Area	Time of Day	Recommended LAeq Noise level (dBA)	
			Acceptable	Recommended Maximum
Residence	Suburban	Day	55	60
		Evening	45	50
		Night	40	45
Active Recreation Area	All	When in Use	55	60

In NSW INP, the definition of Suburban is an area with an acoustical environment that has local traffic with characteristically intermittent traffic flows or with some limited commerce or industry. This area often has the following characteristics:

- decreasing noise levels in the evening period (1800–2200); and/or
- evening ambient noise levels defined by the natural environment and infrequent human activity.

This area may be located in either a rural, rural-residential or residential zone, as defined on an LEP or other planning instrument.

2.3.2 Intrusiveness Noise Limits

Intrusiveness is assessed at residential receiver locations. The INP states that a noise is intrusive if the LAeq noise level of that noise, as measured over a 15 minute period, exceeds the LA90 Rating Background Level (RBL), in the absence of the noise source to be assessed, by more than 5 dBA. There are two ways to determine the background noise level:

1. Measure the ambient noise level of the area and undertake an assessment of at least 7 days of valid data (wind speeds less than 5 m/s and no rainfall). Use the measured LA90 (15 minute) noise levels to determine a LA90 RBL.
2. Assume the RBL is 30 dBA, which is the minimum allowable RBL as determined by the INP.

In this case, measurement of background noise has been undertaken at one of the nearest residential locations to the site, which is No.100 Deccan Street, to the north of the site. Monitoring was undertaken for

more than 7 days and was supplemented with operator attended noise measurements at the noise logger location.

Equipment used for the noise monitoring included the following:

1. *NTI Audio Type XL2 Acoustic Analyser, Serial Number A2A-12903-E0. NATA calibration date 28 August 2017. Due for calibration 28 August 2019.*
2. *ARL EI316 Type 1 environmental noise logger, serial number 16-207-006. NATA calibration date 05 December 2016. Due for calibration 05 December 2018.*
3. *Rion NC74 acoustic calibrator, serial number 34372753. NATA calibration date 2 December 2016. Due for calibration 2 December 2017.*

Field calibration was conducted before and after the testing, with the drift in calibration falling within acceptable limits.

The results of long term noise monitoring are contained in Table 2. The Rating Background noise level (RBL) has been determined in general accordance with INP methodology.

TABLE 2 LONG TERM NOISE MONITORING RESULTS

Date	LAeq (Period)			LA90 (Period)		
	Day	Evening	Night (before)	Day	Evening	Night (before)
Saturday, 2 September 2017	54	50	45	39	33	34
Sunday, 3 September 2017	58	52	49	42	41	32
Monday, 4 September 2017	59	52	53	47	37	36
Tuesday, 5 September 2017	61	58	59	51	48	41
Wednesday, 6 September 2017	59	53	49	50	40	49
Thursday, 7 September 2017	58	52	48	45	38	37
Friday, 8 September 2017	56	54	47	45	43	34
Saturday, 9 September 2017	54	49	49	39	34	34
Sunday, 10 September 2017	54	49	49	36	35	32
Monday, 11 September 2017	55	50	46	41	33	32
Tuesday, 12 September 2017	56	51	52	42	39	32
Wednesday, 13 September 2017	57	52	47	46	39	40
Totals	57	53	51	44	38	34

Note: Night (before) means the time period from 10:00 pm to 12:00 pm on the date a day before the date identified in the first column, then including 12:00 midnight to 7:00 am on the date identified in the first column.

Rudds also undertook operator attend noise measurements at the noise logging location. The results of this measurement are shown in Table 3.

TABLE 3 OPERATOR ATTENDED NOISE MEASUREMENTS

Date, Time and Weather	Measured Statistical Noise Levels (dBA)				Comments
	L ₉₀	L _{eq}	L ₁₀	L ₁	
15/9/17 1:15 PM to 1:30 pm	49	56	59	63	The primary noise source was road traffic noise. There were also occasional birds and some wind in trees.

Based upon observations on-site, Rudds has identified the primary noise source as being road traffic noise and wind in trees. There was negligible industrial noise at the site.

Daily noise monitoring graphs presented in Appendix A. The graphs show variable noise levels that do not show a consistent pattern across weekdays, apart from quieter weekends to weekdays. Detailed analysis indicates that there was significant influence from wind during the monitoring period, with weather data downloaded from Goulburn Airport indicating high winds through most of the noise monitoring. While Rudds expects wind speeds in this location to be lower than at the Goulburn Airport due to the site being hilly and having a high degree of tree cover and built form, the data is still obviously wind affected. Therefore, Rudds considers the data to be weather affected and this needs to be taken into account with the proposed assessment criteria.

Therefore, consideration was given to using the night-time intrusiveness criteria, which shows much less influence from wind, for all assessment periods. However, this seems to result in an unduly stringent daytime criteria for the site. Therefore, Rudds has set the daytime limit at 5 dBA above the night-time limit to reflect the fact that the daytime is typically a less sensitive time period for noise than the night-time, and the daytime also has higher background noise levels. The evening period has been set as the half way point between the daytime and night-time noise limits, rounded up to the nearest decibel.

This gives a conservatively low assessment level that will provide a high degree of protection to the residents of the area. Based on this methodology, intrusiveness and amenity noise limits for the site will be as shown in Table 4.

TABLE 4 PROJECT SPECIFIC NOISE LIMITS

Location	Time Period	Day	Evening	Night
Residential	Amenity ¹	55	45	40
	Intrusiveness ¹	44 ²	42 ²	39
Selected Residential Noise Limit	Lowest of above	44²	42²	39
Active Recreation Area	Amenity ¹	55	55	55

Notes:

1. For the intrusiveness level this will be the LAeq(15 minute) noise level. For the amenity level this will be the LAeq (period) noise level, whether it be day, evening or night.
2. These levels have been reduced due to being influenced by high winds. Rudds has set the daytime limit at 5 dBA above the night-time limit and the evening period has been set as the half way point between the daytime and night-time noise limits, rounded up to the nearest decibel.

2.4 Road Traffic Noise Limits

The NSW Road Noise Policy (RNP) was introduced on 1 July 2011 to replace the Environmental Criteria for Road Traffic Noise (ECRTN). The RNP provides strategies to address road traffic noise, determines different road categories and defines clear criteria for each of the road categories. The document also defines the management responsibility that applies to each road category as follows:

1. State government is responsible for freeways, motorways and arterial roads
2. Local councils are responsible for sub-arterial roads and local roads.

Table 5 contains road traffic noise assessment criteria for residential land uses. This assessment is a façade corrected criteria when measured at 1 metre from the most exposed façade of the building.

TABLE 5 ROAD TRAFFIC NOISE ASSESSMENT CRITERIA FOR RESIDENTIAL LAND USES

Road Category	Type of project and land use	Assessment Criteria - dB(A)	
		Day (7 a.m.-10 p.m.)	Night (10 p.m.-7 a.m.)
Freeway/ arterial/ sub-arterial roads	1. Existing residences affected by noise from new freeway/arterial/sub-arterial road corridors	L _{Aeq} (15 hour) 55 (external)	L _{Aeq} (9 hour) 50 (external)
	2. Existing residences affected by noise from redevelopment of existing freeway/arterial/sub-arterial roads	L _{Aeq} (15 hour) 60 (external)	L _{Aeq} (9 hour) 55 (external)
	3. Existing residences affected by additional traffic on existing freeway/arterial/sub-arterial roads generated by land use developments		
Local Roads	4. Existing residences affected by noise from new local road corridors	L _{Aeq} (1 hour) 55 (external)	L _{Aeq} (1 hour) 50 (external)
	5. Existing residences affected by noise from redevelopment of existing local roads		
	6. Existing residences affected by additional traffic on existing local roads generated by land use developments		

Source: NSW Road Noise Policy, Page 11, Table 3.

In addition to the requirements outlined in Table 5, there are two specific “relative” road traffic noise increase criteria. These are described as follows:

1. Any increase in road traffic noise from an existing or proposed freeway/ arterial/ sub-arterial road or transitway must not exceed 12 dB. For the purpose of determining the relative increase, any existing noise level below 30 dBA is deemed to be 30 dBA.
2. Wherever the road traffic noise level without the development is within 2 dB of, or exceeds, the relevant day or night assessment criterion, the increase in road traffic noise as a result of the development must not exceed 2 dB above the existing road traffic noise level.

Where the criteria are exceeded it does not automatically mean the development cannot go ahead. It means that careful and thorough consideration of feasible and reasonable noise mitigation options must be undertaken in order to reduce the acoustic impact of the development.

Decan Street is currently a local road. However, it is understood that there is a proposal to reclassify this road as a state road.

2.5 Construction Noise

The NSW Interim Construction Noise Guideline (ICNG) provides detailed advice on construction noise guidance levels for construction projects. As this project will extend beyond 3 weeks of work, a quantitative noise assessment relating to construction works will be required. The noise limits for construction works are shown in Table 6.

TABLE 6 CONSTRUCTION NOISE GUIDANCE LEVELS AT RESIDENCES

Time of Day	Management Level (LAeq(15 minutes))*	How to apply
Recommended standard hours: Monday to Friday 7 am to 6 pm Saturday 8 am to 1 pm No work on Sundays or public holidays	Noise Affected RBL+10dB	<p>The noise affected level represents the point above which there may be some community reaction to noise.</p> <ul style="list-style-type: none"> Where the predicted or measured LAeq (15 min) is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level. The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.
	Highly Noise Affected 75 dB(A)	<p>The highly noise affected level represents the point above which there may be strong community reaction to noise.</p> <ul style="list-style-type: none"> Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities can occur, taking into account: Times identified by the community when they are less sensitive to noise (such as before and after school for works near schools, or mid-morning or mid-afternoon for works near residences if the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.
Outside recommended standard hours	Noise Affected RBL+5dB	<ul style="list-style-type: none"> A strong justification would typically be required for works outside the recommended standard hours. The proponent should apply all feasible and reasonable work practices to meet the noise affected level. Where all feasible and reasonable practices have been applied and noise is more than 5 dB(A) above the noise affected level, the proponent should negotiate with the community. For guidance on negotiating agreements see section 7.2.2.

Note * Noise levels apply at the property boundary that is most exposed to construction noise, and at a height of 1.5 m above ground level. If the property boundary is more than 30 m from the residence, the location for measuring or predicting noise levels is at the most noise-affected point within 30 m of the residence. Noise levels may be higher at upper floors of the noise affected residence.

In this case, the construction noise guidance level will be as follows:

- 49 dBA during recommended standard hours, excluding public holidays.
- 42 dBA between 6 pm and 10 pm Monday to Friday and 8 am to 1 pm Saturday, excluding public holidays.
- 39 dBA at all other times.

There is also a requirement to achieve a satisfactory noise level at other potentially noise-sensitive areas and developments. These requirements are shown in Table 7.

TABLE 7 CONSTRUCTION NOISE GUIDANCE LEVELS AT OTHER NOISE SENSITIVE AREAS

Land Use	Management Level, LAeq(15 minute) when properties are in-use
Classrooms at schools and other educational institutions	Internal noise level 45 dB(A)
Hospital wards and operating theatres	Internal noise level 45 dB(A)
Places of worship	Internal noise level 45 dB(A)
Active recreation areas (characterised by sporting activities and activities which generate their own noise or focus for participants, making them less sensitive to external noise intrusion)	External noise level 65 dB(A)
Passive recreation areas (characterised by contemplative activities that generate little noise and where benefits are compromised by external noise intrusion, for example, reading, meditation)	External noise level 60 dB(A)
Community centres	Depends on the intended use of the centre. Refer to the recommended 'maximum' internal levels in AS2107 for specific uses.

2.6 Work Health and Safety Noise Limits

The Work Health and Safety Act (2011) defines a duty of care for all persons conducting a business or undertaking. Division 2 of the Act provides an extensive explanation of the primary duty of care. In summary, this primary duty of care includes providing a workplace that ensures the health and safety of workers and other persons.

It is important to understand that a "person conducting a business or undertaking" includes not only the employer of the employees at the site, but also the building owner, if the business or undertaking is occurring on leased premises. Therefore, the person conducting the business or undertaking does include the owner of the premises to the extent that they are able to control the workplace and the plant and equipment provided as part of the workplace. This includes providing a work environment that does not expose persons to excessive noise levels that are above the noise exposure standard.

The Work Health and Safety Regulation (2017), Chapter 4 *Hazardous Work*, Part 4.1 *Noise* sets a clear exposure standard as follows:

56 Meaning of exposure standard for noise

(1) In these Regulations, **exposure standard for noise**, in relation to a person, means:

- $L_{Aeq,8h}$ of 85 dB(A); or
- $L_{C,peak}$ of 140 dB(C).

(2) *In this clause:*

$L_{Aeq,8h}$ means the eight-hour equivalent continuous A-weighted sound pressure level in decibels (dB(A)) referenced to 20 micropascals, determined in accordance with AS/NZS 1269.1:2005 (Occupational noise management—Measurement and assessment of noise immission and exposure).

$L_{C,peak}$ means the C-weighted peak sound pressure level in decibels (dB(C)) referenced to 20 micropascals, determined in accordance with AS/NZS 1269.1:2005 (Occupational noise management—Measurement and assessment of noise immission and exposure).

When managing the potential for hearing loss due to noise the primary goal is to eliminate the risk. If the risk cannot be practically eliminated, then there is a hierarchy of control measures that need to be considered. Section 36 of the Regulation states the following:

36 Hierarchy of control measures

- (1) *This clause applies if it is not reasonably practicable for a duty holder to eliminate risks to health and safety.*
- (2) *A duty holder, in minimising risks to health and safety, must implement risk control measures in accordance with this clause.*
- (3) *The duty holder must minimise risks, so far as is reasonably practicable, by doing one or more of the following:*
 - (a) *substituting (wholly or partly) the hazard giving rise to the risk with something that gives rise to a lesser risk;*
 - (b) *isolating the hazard from any person exposed to it;*
 - (c) *implementing engineering controls.*
- (4) *If a risk then remains, the duty holder must minimise the remaining risk, so far as is reasonably practicable, by implementing administrative controls.*
- (5) *If a risk then remains, the duty holder must minimise the remaining risk, so far as is reasonably practicable, by ensuring the provision and use of suitable personal protective equipment.*

Note A combination of the controls set out in this regulation may be used to minimise risks, so far as is reasonably practicable, if a single control is not sufficient for the purpose.

Section 3 - Preliminary Noise Impact Assessment

Strictly speaking, it is too early to undertake a comprehensive noise impact assessment. This is primarily because equipment locations and selections have not been made, and will not be made until detailed design progresses. Therefore, the following is a series of preliminary considerations to ensure minimal noise emissions to the environment.

Rudds has undertaken predictions of known noise sources to the nearest residential receiver locations and has undertaken a compliance assessment and provided recommendations to minimise the impact of the development. There is also an active and passive recreation area surrounding the site that should be considered. Rudds believes that this recreation area is a suitable buffer to protect noise sensitive receivers from noise associated with the aquatic centre, and that noise from patrons, etc. to these recreation areas should be considered part of normal operation. Noise from large groups of people could sometimes exceed the LAeq (period) 55 dBA noise limits. It will be important, however, to ensure the mechanical systems design is compliant with the noise limits because these systems will run continuously.

3.1 Acoustically Significant Noise Sources

Rudds has identified the following as being the most acoustically significant noise sources when considering environmental noise:

- Plant and equipment associated with operation of the facility, including air handling services for indoor areas, exhaust fans and plant rooms associated with pool pumps and the like.
- The public address system
- Vehicular traffic in the carpark
- Noise from groups of people using the facility.

While road traffic noise is a potential contributor to noise levels at the site, Rudds has not undertaken a road traffic noise assessment at this stage. Further information is required to determine whether a road traffic noise assessment is necessary, including whether this is a development that has the potential to increase road traffic on the primary traffic routes.

If such an assessment is considered to be required, Rudds will prepare the assessment in accordance with the NSW RNP.

It should be noted that specific plant and equipment will be chosen during detailed design and at this stage the list of plant and equipment is indicative only. As the design progresses, the location and equipment will be assessed and appropriate noise mitigation measures will be put in place to ensure compliance with the noise limits for the development.

3.2 Preliminary Intrusiveness Assessment of Noise impacts

This assessment has been undertaken assuming predominantly daytime operation, from 7 am to 6 pm. While there will be some operation outside these hours, patron numbers of an evening are expected to be far lower than what Rudds has assessed as peak daytime operation during a school swimming carnival or similar. Night-time operation of the venue is not expected. Pumps and mechanical equipment will operate at night-time to maintain conditions, especially of the pool water, and this will be taken into account in the design of plant areas. Evening operation is expected to be limited to indoor areas, including the indoor gym and pool areas. As such, no significant noise is expected from people of an evening.

3.2.1 Plant and Equipment

3.2.1.1 Mechanical Services

Mechanical services will include:

1. Heating and ventilation of the pool halls, change rooms and ancillary spaces (administration, offices and retail areas). Two options - an air handling unit or reverse cycle packaged units
2. General exhaust and ventilation systems for store rooms, toilets etc. which will typically use fans.
3. Hot water system. Heat pumps proposed

In all cases, fans will be scattered throughout the development and there will be a number of outdoor units, either being condensers or chillers. The location and noise level of this equipment will be critical to minimising environmental noise emissions.

Loud equipment, where possible, should be located within dedicated plant rooms, where noise can be controlled by providing appropriate inlet and outlet acoustic attenuators to the rooms to meet noise limit requirements.

Where condenser units, etc. cannot be located in plant rooms, noise levels should be minimised and the units should be placed in a location that maximises the sound reduction to residents.

3.2.2 Public Address System

It is understood that a public address system will be required and is likely to consist of pole mounted speakers around outdoor pool areas as well as an internal speaker system in the buildings. Internal speakers within buildings will not be an environmental noise issue because they will be set at levels that will not result in excessive noise outside the buildings, and the building envelope will help to contain noise levels.

Pole mounted external speakers need to be carefully controlled to ensure noise is contained to the area in which it is required without excessive noise to the neighbours.

The location and number of speakers will be important. The following is Rudds preliminary recommendation:

- Place speakers low on poles so they are near the intended listeners.
- Speakers are only to be used during the daytime periods. No outdoor speaker operation of an evening or a night-time is permitted.
- Locate the speakers so they face away from the nearest residences, or are otherwise physically shielded so direct noise from the speakers does not reach the residents. Under no circumstances can speakers be placed on the north-western façade of the building (the front of the building facing Deccan Street).
- Assuming up to 10 speakers are required in the outdoor areas, and the directivity and/or shielding result in at least 10 dBA attenuation of each speaker, the maximum speaker noise level should be set at LAeq 65 dBA at 3 metres from the speaker. Once speaker locations and orientations are known, this preliminary recommendation can be further refined.

3.2.3 Vehicular Traffic and Carpark Noise

It is understood that busses will not enter the premises. Any bus drop-off will be kerbside. Therefore, the carpark will be used for light vehicles only.

Rudds has undertaken a review of the Traffic Impact Assessment report prepared by Ontoit. Their assessment is that the carpark is currently significantly underutilised and high vehicle numbers are infrequent. Nevertheless, there are likely to be between 160 and 200 vehicular trips to the site during the peak period, which would not occur frequently. Assuming a peak period to be approximately 1 hour, this would equal 40 to 50 vehicles in a 15 minute period. Of this, Rudds would assume approximately 50% would park or drop-off on-site within one carpark, with others stopping and dropping off on the road from either direction, or in the other carpark. Therefore, we have based our assessment of carpark noise on a turnover of 20 to 25 vehicles in a 15 minute period.

The noise modelling has assumed a car door opening and closing, a car starting and moving-off. A noise level of LAeq(15 minute) 72 dBA per vehicle has been used for this assessment. This is derived from the BayLfU Parking Area Noise model measured parking noise level of LAeq(1 hour) 63 dBA for 1 vehicle, increased by 3 dBA to account for a rough parking surface.

Based on 25 vehicles in a 15 minute period, this would result in a noise level of LAeq(15 minute) 56 dBA. This assumes no shielding from adjacent vehicles and no shielding from other vehicles parked on the road, so represents a potentially worst-case situation. When the carpark is substantially full, the vehicles will provide some acoustic shielding to noise from other cars.

This exceeds the recommended LAeq(15 minute) 44 dBA noise limit by 12 dBA. Therefore, Rudds recommends that acoustic shielding of the carpark be provided to minimise the acoustic impact on neighbouring residents across Deccan Street.

This shielding could take the form of raised planters or a low wall along the front of the carparking area. As most noise will be from engine and tyres, the screening need only be at low level – to a maximum height of approximately 800 mm above the carpark surface.

For evening activities, the number of cars is expected to be substantially less, and are primarily likely to be staff leaving or people using the gym. Assuming $\frac{1}{4}$ of peak period cars, or approximately 7 cars per 15 minutes, the noise level is predicted to be LAeq(15 minute) 50 dBA. This exceeds the evening LAeq(15 minute) 42 dBA noise limit by 8 dBA. Again, acoustic screening will help to reduce this to below the evening noise limit.

3.2.4 Noise from People

It is understood that regular school swimming carnivals occur at the pool over the summer season from February to April each year. Rudds expect that the loudest noise events are likely to occur when there are activities such as these school carnivals occurring at the site. This typically results in noise due to large groups entering and leaving the venue and crowds cheering, etc. during the events. These two items will be treated separately.

To undertake a noise assessment, Rudds has referred to the study Prediction of Crowd Noise, published by M. J. Hayne, R. H. Rumble and D. J. Mee and presented at the Acoustics 2006 Conference, Christchurch, New Zealand. In this study, the author have presented the following typical voice levels at 1 metre from the persons mouth:

- Relaxed normal speaking 54 dBA
- Raised normal speaking 60 dBA
- Raised speaking 66 dBA
- Loud speaking 72 dBA
- Very Loud Speaking 78 dBA
- Shouting 84 dBA

It would also be reasonable to assume a 5 dBA adjustment to the measured level would be applied for crowd noise as it is likely to be considered impulsive.

3.2.4.1 Noise from People Entering/Leaving Venue

This is where the people are on the verge between the new buildings and the road. The residential noise receivers that are most likely to be impacted will be across Deccan Street to the northwest of the site.

Rudds has assumed a group of up to 60 school children leaving a bus and entering the venue, with approximately 30 of these students talking at a raised voice level of 66 dBA at 1 metre from their mouths. Rudds has also assumed worst-case in which all of these people are facing out from the building toward the residences and there is no shielding for vehicles, busses, etc. reducing the overall noise level.

Based upon these assumptions, the noise level of the children could be up to LAeq 49 dBA at the residences across the street, assuming continuous raised speaking. The proposed noise limit is LAeq(15 minute) 44 dBA of a daytime, when such children are expected to be at the venue. Therefore, the noise limit is likely to be exceeded by up to 5 dBA if the children are allowed to speak in a loud voice constantly for 15 minutes. Moderating the voices will reduce overall noise levels, and if children are well controlled and voice levels are nearer to normal levels, being relaxed normal speaking at LAeq 54 dBA or raised speaking at LAeq 60 dBA, compliance can be achieved. Therefore, it will be critical to employ management procedures so that any large groups of people do not create excessive noise outside the venue.

Of course, there will be some shielding from traffic and the like, and groups of people will be mingling, typically facing in various orientations, with the bodies of other people providing additional shielding, but conversely, there may be a few in the group that talk louder for short periods, so this assessment is expected to be representative of a large group outside the venue.

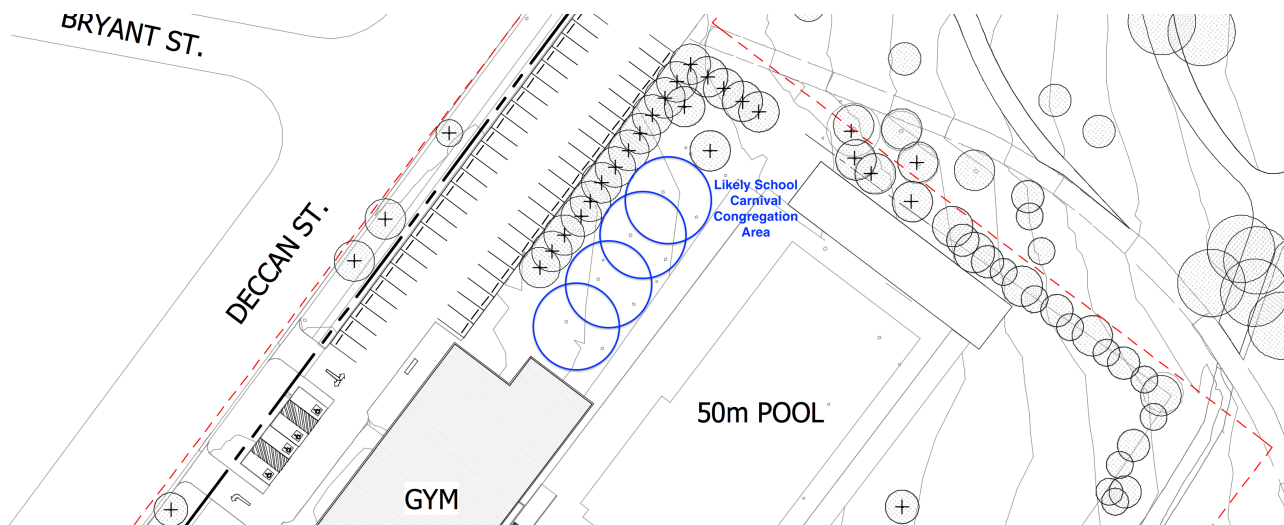
3.2.4.2 Crowd Noise Within the Venue

Crowd noise within the venue is likely to be different from that outside, primarily because it is likely to consist of larger groups of people in viewing areas and it is likely that some cheering will occur, possibly with the people in the groups cheering, chanting or singing in unison with one another. Rudds understands that the most likely area for school groups to congregate will be at the eastern grassed area to the north of the 50 metre outdoor pool. This area is shown in Figure 5. The area to the south-east of the pool is less likely to be used when spectating because the land slopes away and the view to the pool becomes limited, but this area is likely to be used for general congregation, games and the like.

Therefore, the residences most likely to be impacted by noise from this area are still the residences to the north west across Deccan Street, but there may also be an acoustic impact to the south, for residences in

Verner Street and Faithful Street. To the north is the Victoria Park rose garden, then beyond this the Goulburn High School and Goulburn Hospital on Clifford Street.

FIGURE 5 LIKELY SCHOOL GROUP CONGREGATION AREA



Rudds understands that typical daily patronage is approximately 165 people and this may increase to 628 people upon completion of the redevelopment. However, Rudds does not have specific detail on the likely number of people likely to be present at a school swimming carnival. For this exercise we have assumed a group of approximately 300 people at the poolside, cheering in unison for approximately 30 seconds out of every 15 minutes, assuming this occurs at a race finish or similar (3 races in 15 minutes, cheering at start and finish of each race), or that there are multiple different shouts throughout a race.

Rudds expects that the maximum noise level (L_{Amax}) at the nearest residences in Deccan Street is likely to be approximately 70 dBA at the nearest residences and that the L_{Aeq} level, assuming some shouting and regular raised voice talking, is likely to be approximately L_{Aeq} (15 minute) 56 dBA at the nearest residences assuming the crowd is facing away from the residences, which is likely to be the case here.

Understanding that the compliance limit is L_{Aeq}(15 minute) 44 dBA, it is likely that some significant exceedances of this noise limit will occur in Deccan Street. For this reason, consideration should be given to providing a solid acoustic fence along the north-western fence line, between the gym and the corner of the block, returning along the north-eastern boundary as far as the change rooms. This will act as an acoustic barrier which is expected to reduce crowd noise levels by approximately 10 dBA. The minimum height of the fence is to be 1.8 metres above finished ground surface and it is to be constructed from a solid material with no gaps that acts as a barrier to sound. Colorbond would be suitable, but Rudds will work with the design team to determine a suitable solution.

The nearest residences in Verner Street will be shielded by the buildings and the 200 metre plus distance will mean that the noise level at these residences is expected to be no more than L_{Aeq}(15 minute) 37 dBA, which will be compliant with the daytime noise limit of L_{Aeq}(15 minute) 44 dBA.

Residences in Faithfull Street are approximately 350 metres away. When there is a crowd at the venue, facing down the hill toward these residences, and assuming no acoustic screening to the residences, the noise level is predicted to be up to L_{Aeq} 42 dBA which will be compliant with the daytime noise limit of L_{Aeq}(15 minute) 44 dBA.

3.2.5 Road Traffic Noise

Rudds has undertaken a review of the Traffic Impact Assessment report prepared by Ontoit. This report identifies Deccan Street as currently being a local road, but there is a proposal to change the road to a state road.

Vehicle traffic counts indicate that the current traffic count is relatively consistent at approximately 4500 vehicles per day. The report also indicates that the redevelopment of the centre is likely to contribute an additional 554 vehicles per day to the total traffic flow, of approximately 120 to 133 additional peak volume trips per day.

Taking into account the difference between existing and proposed future traffic flows, and all else being equal, Rudds estimate the increase in road traffic noise levels to be 0.5 dBA.

Assuming the local road criteria as being applicable, the target level will be LAeq(1 hour) 55 dBA or *wherever the road traffic noise level without the development is within 2 dB of, or exceeds, the relevant day or night assessment criterion, the increase in road traffic noise as a result of the development must not exceed 2 dB above the existing road traffic noise level.*

Rudds predicts that the expected increase in road traffic noise levels of LAeq(1 hour) 0.5 dBA will be compliant with the RNP requirements.

3.3 Operational Noise Qualitative Assessment

3.3.1 Determination of Offensiveness

Determining whether noise from the development is offensive is a very subjective assessment. Table 8 contains a subjective assessment based upon the methodology outlined in the NGLG.

TABLE 8 DETERMINATION OF OFFENSIVENESS

Question	Answer
1. Is the noise loud in an absolute sense? Is it loud relative to other noise sources in the area?	<p>Noise from the development is expected to be audible at some times. The primary noise sources are expected to be vehicles out the front of the buildings in the carpark and people talking as they are moving from vehicles to the entry of the buildings (especially groups of school children). Once inside the facility, the buildings will provide significant acoustic shielding to the nearest residents and the noise levels are expected to be low.</p> <p>Mechanical equipment plant rooms can easily be addressed to make mechanical noise near inaudible at the residences. As equipment is expected to operate 24 hours per day, 7 days per week, it will need to be designed to meet the most stringent night-time noise limits, which provides a degree of safety when operating of a daytime and evening, which have higher noise limits.</p> <p>To minimise the likelihood of disturbance careful consideration of any public address system will need to be considered. The location and orientation of speakers will be considered to ensure noise is directed away from the residences and will be compliant with the intrusiveness noise limits for the site.</p>
2. Does the noise include characteristics that make it particularly irritating?	<p>This is a very subjective question. Mechanical noise levels will be very low and are unlikely to be annoying. The primary annoyance factor will be people using the facility and entering/leaving the facility. Some people like the sound of children playing and some people do not. If the primary activity areas are controlled by staff it is unlikely that there will be significant noise that would be considered irritating to most people.</p>
3. Does the noise occur at times when people expect to enjoy peace and quiet?	<p>The noise will occur during the daytime period, with large groups such as school groups, etc. expected to use the facility typically between 8:30 am and 3:30 pm. These are typically work hours for most people. During the evening and night-time periods the facility will most likely operate, but at a lower capacity, meaning less noise.</p> <p>Mechanical equipment will operate continuously, but will be designed to minimise noise emissions to the environment.</p>
4. Is the noise atypical for the area?	<p>The usage of the area will essentially be the same as it is now. No new noise sources are expected to be introduced, so the duration and character of the noise is expected to be similar to the current situation. Therefore, the noise is not atypical for the area.</p>
5. Does the noise occur	Noise from mechanical equipment will essentially be continuous, but will

often?	be at a level that is unlikely to be an issue. Noise from patrons will be sporadic and will depend on what is occurring at any one time. There will be periods, such as school swimming carnivals, etc. when noise occurs regularly throughout the day, but the noisiest periods are expected to be upon entry and exit from the facility.
6. Are a number of people affected by the noise?	There are many houses on the north-western side of the street that could be potentially affected by the noise.
Based upon the preceding 6 questions, is the noise considered offensive	Again, this is very subjective and open to interpretation. However, considering the operation will be very similar to the existing operation, Rudds considers that with proper planning and management, the noise is unlikely to be considered offensive in this particular situation. There are many such facilities, and facilities such as schools ,etc. which will display similar noise levels, in close proximity to residential dwellings that operate successfully.

If the guidance levels are exceeded, it is a requirement to consider feasible and reasonable noise mitigation measures to control noise and protect the community. The definition of feasible and reasonable can be broadly defined as discussed in the ICNG as follows:

- *A work practice or abatement measure is feasible if it is capable of being put into practice or of being engineered and is practical to build given project constraints such as safety and maintenance requirements.*
- *Selecting reasonable measures from those that are feasible involves making a judgment to determine whether the overall noise benefits outweigh the overall adverse social, economic and environmental effects, including the cost of the measure.*

3.4 Preliminary Construction Noise Assessment

When Rudds attended site to deploy the environmental noise logger during a mid-morning on a weekday, we door-knocked the residences in Deccan Street across from the Goulburn Aquatic Centre between Verner and Clifford Streets. We found that either most residences were not home, or did not wish to answer. We then had to move further along Deccan Street to find a resident that was home and willing to accept the noise monitor in their property. This indicates Rudds that most residents are likely to be away from their properties during business hours and the likelihood of large numbers of people being disturbed is small.

The stages are likely to include external works for services reticulation and bulk earthworks, primary structure erection and internal fitout. Bulk earthworks and services reticulation is likely to be the noisiest activity at the nearest residences, followed by structure erection, depending on the location of any cranes, etc. required for this activity. Once at lock-up stage, the internal fitout is not expected to generate large amounts of noise.

The sound reduction afforded to the residences will depend on where on the site construction is occurring. The closest part of the site (the main carpark) is approximately 30 metres from the nearest residences in Deccan Street. This will be an area likely to be receiving deliveries, etc. and there will be works associates with the carpark upgrade that will occur. Assuming a single point source, the sound reduction afforded over 30 metres is 30 dBA. To be below the guidance levels, the noise source, therefore, should not exceed a noise level of 79 dBA at 1 metre.

Taking into account a probable worst-case situation, where an activity such as concrete cutting is occurring out the front of the site, which can have a noise level in the order of 105 dBA at 1 metre, it is clear that the guidance level will be exceeded, in this case by up to 26 dBA, with the expected noise level at the residences being up to 75 dBA.

The nearest residents in Verner Street are some 200 metres away from the site, which would result in a point source sound reduction of 46 dBA, and a reduction to acoustically shielded sources of at least 56 dBA. Therefore, noise source levels up to LAeq(15 minute) 95 dBA at 1 metre (if out in open) and 105 dBA at 1 metre (if acoustically screened) will comply with the construction noise guidance level of LAeq(15 minute) 49 dBA.

The nearest residents in Faithfull Street to the south are at least 350 metres away from the construction site, which would result in a point source sound reduction of 51 dBA, and a reduction to acoustically shielded

sources of at least 61 dBA. Therefore, noise source levels up to LAeq(15 minute) 100 dBA at 1 metre (if out in open) and 110 dBA at 1 metre (if acoustically screened) will comply with the construction noise guidance level of LAeq(15 minute) 49 dBA.

The Goulburn High School in Clifford Street is at least 200 metres away from the construction site which would result in a point source sound reduction of 46 dBA, and a reduction to acoustically shielded sources of at least 56 dBA. As the target level is an internal level within a classroom or the like, assuming the window to be open would result in an additional 10 dBA reduction. Therefore, the minimum reduction to the nearest high school classrooms would be 56 dBA for open sources and 66 dBA for acoustically shielded sources. Therefore, compliance with the LAeq(15 minute) 45 dBA internal recommended noise level would occur with noise source levels up to 101 dBA at 1 metre if not acoustically shielded and 111 dBA at 1 metre if acoustically shielded.

Noise emissions to Victoria park will be high, and are likely to exceed the LAeq(15 minute) 60 dBA guidance level for a passive recreation area at times throughout the construction programme. A buffer area around the site could be established, and consideration could be given to providing solid hoarding as acoustic screening, but the actual level of impact is difficult to gauge with respect to how many people are likely to be affected. The area looks to be primarily a thoroughfare, with no specific passive activity areas seemingly designated.

Based upon these predictions, the likely acoustic impact for construction activities to noise sensitive receivers in Verner, Faithfull and Clifford Streets is relatively low and no special acoustic attenuation is expected to be required for normal construction activities. This said, some localised screening around particularly noisy activities, such as those above LAeq 85 dBA is recommended for both reducing the impact on residents and minimising the likelihood of excessive noise on adjacent workers.

The noise impact for residents in Deccan Street is significantly higher, primarily due to the short distance to the nearest residents.

Therefore, Rudds recommends, as a minimum, that the hoarding that will be provided to the northern boundary of the site be constructed using a solid material, like plywood or similar, that can act as a noise barrier to the nearest residents in Deccan Street. The minimum height of the hoarding is to be 2.4 metres, pending a review of the construction programme when it is prepared.

A 2.4 metre high fence is expected to reduce noise levels from such activities as concrete cutting by approximately 10 dBA. Providing such a barrier is expected to result in compliance with the noise limits when activities with a noise level up to LAeq(15 minute) 89 dBA for activities shielded by such barrier. This is expected to provide protection for most regular construction activities on-site. For the noisier activities, ones that exceed LAeq(15 minute) 89 dBA, consideration should be given to providing additional localised screening of the activity to minimise disturbance to neighbouring residents.

Noisy activities should also be scheduled to occur during times that are less likely to be sensitive to neighbouring residents. This would typically be between 10:00 am and 3:00 pm.

Section 4 - Conclusion

The Goulburn Mulwaree Council has identified the current aquatic centre facilities as being less-than-adequate to meet the needs of the community. For this reason, an upgrade to the facility is proposed.

Rudds has prepared a Preliminary Noise Impact Assessment to address the likely impact of the development on nearby noise sensitive residential receiver locations. This NIA details Rudds understanding of the project requirements, provides advice on suitable design target levels and addressed the primary on-site noise sources, which Rudds expects to be:

- Mechanical equipment noise
- Carpark traffic noise
- Noise from patrons
- Noise from construction activities.

Each of these activities/noise sources has been addressed in-turn and an assessment of expected noise emissions has been prepared. Rudds expects that carpark traffic, noise from crowds and construction noise activities will be the most significant noise sources on the site. Where a significant impact has been identified, Rudds has provided preliminary advice on suitable noise mitigation measures that could be employed to limit noise emissions to the noise sensitive receivers.

Mechanical noise emissions cannot be adequately addressed at this stage because a detailed equipment list and equipment noise level have not been prepared. During the detailed design stage, this equipment will be assessed and appropriate noise mitigation measures will be put in place to ensure compliance with environmental noise limits for the site.

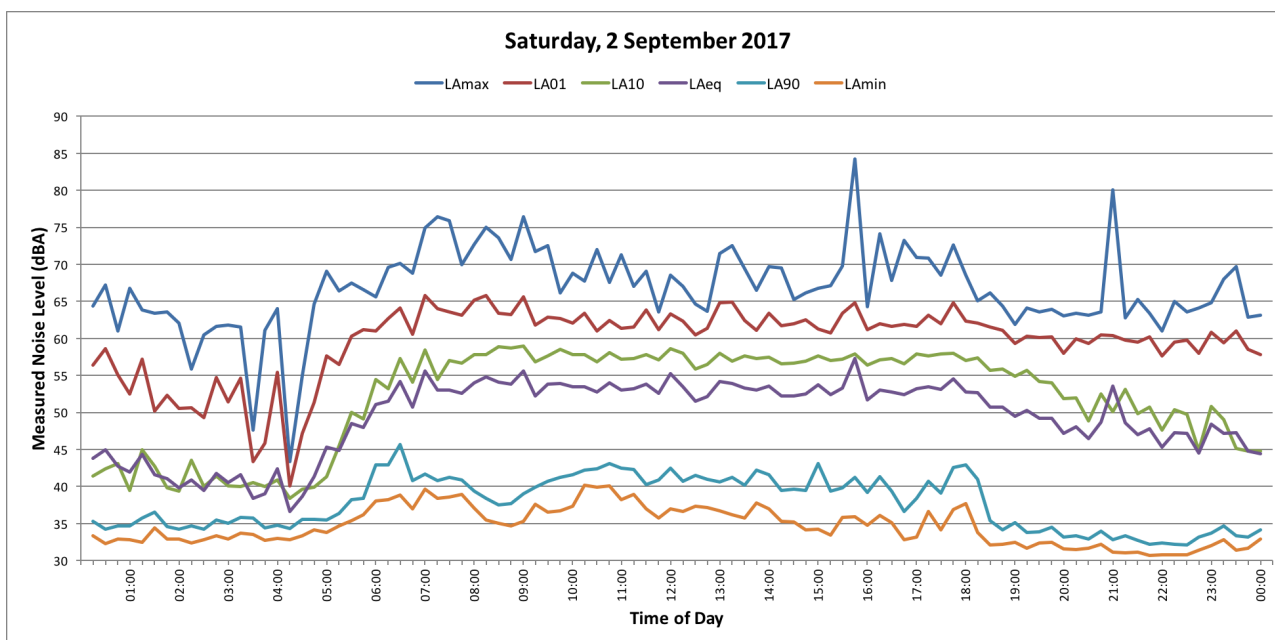
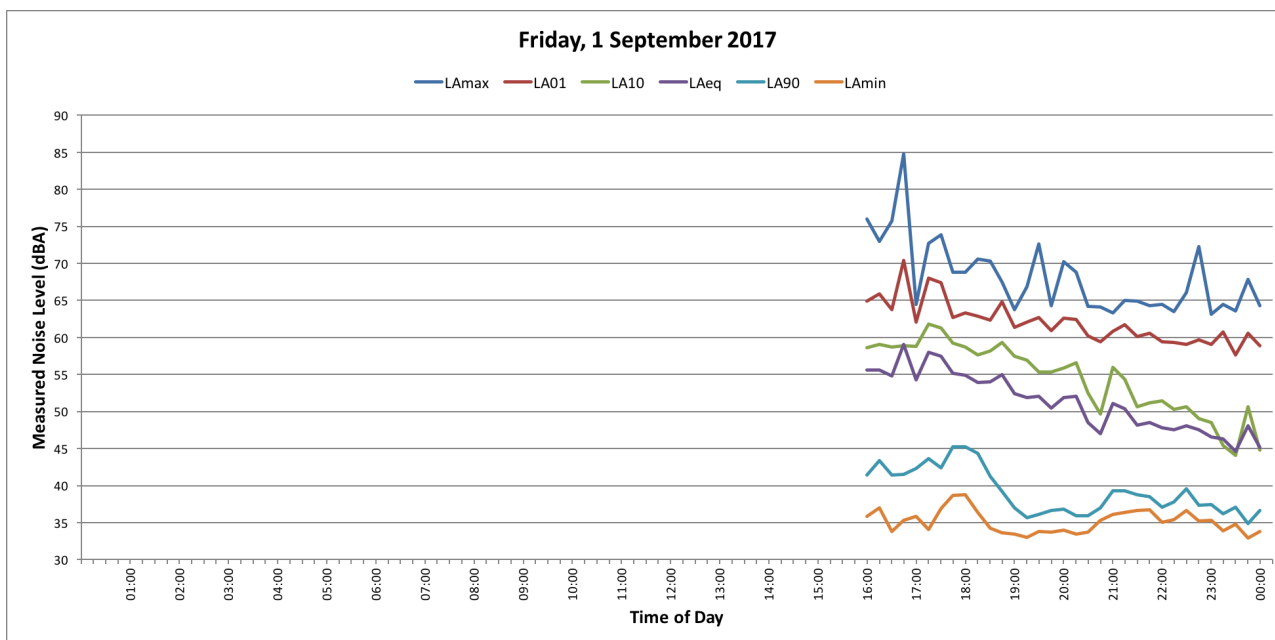
The following has been referred to in this NIA:

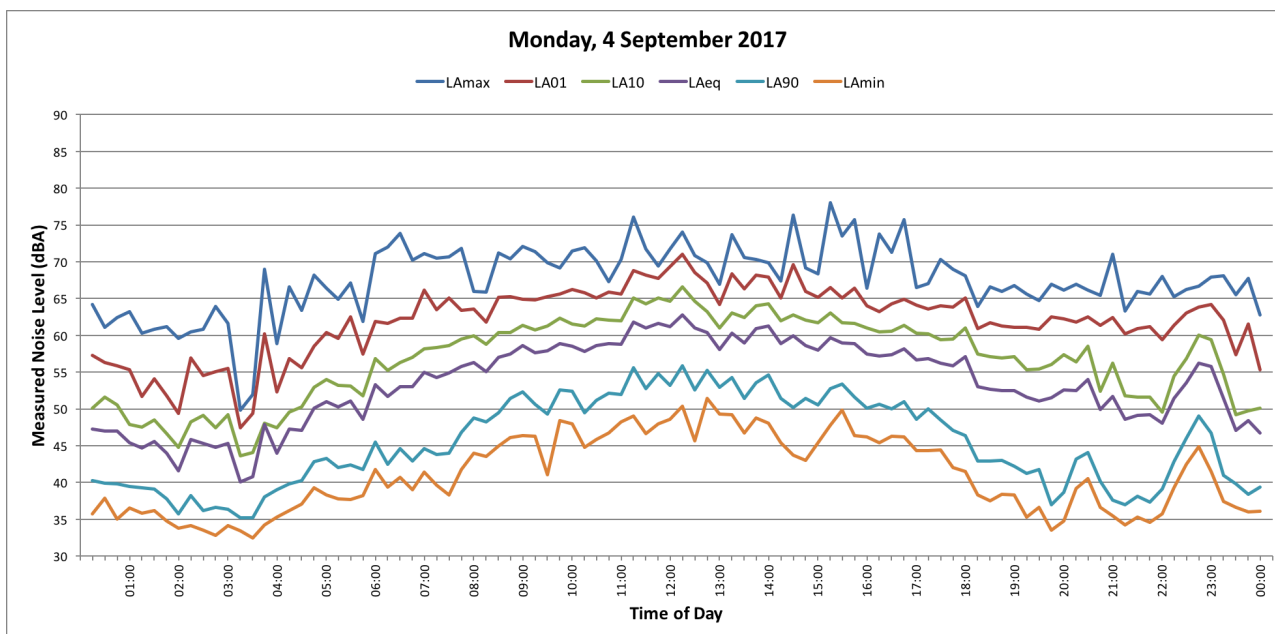
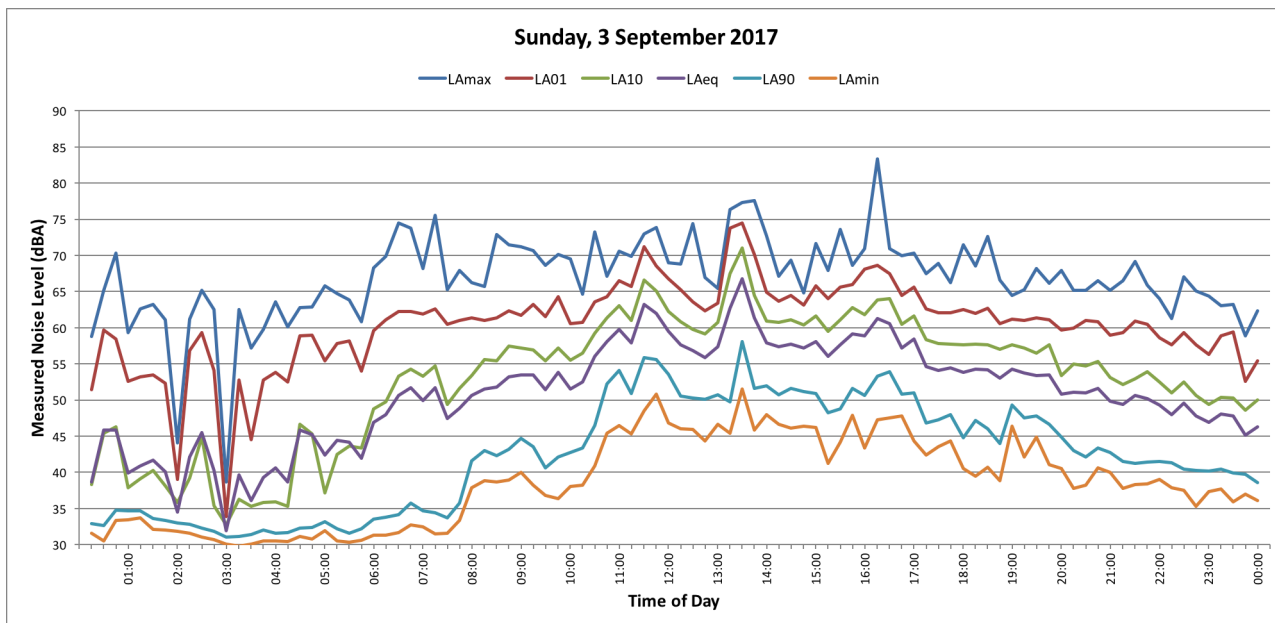
- Environmental noise limits in accordance with the NSW Protection of the Environment Operations (Noise Control) Regulation 2008
- The NSW Industrial Noise Policy (INP)
- The NSW Noise Guide for Local Government (NGLG)
- The NSW Interim Construction Noise Guideline (ICNG)
- Work Health and Safety Act (2011)

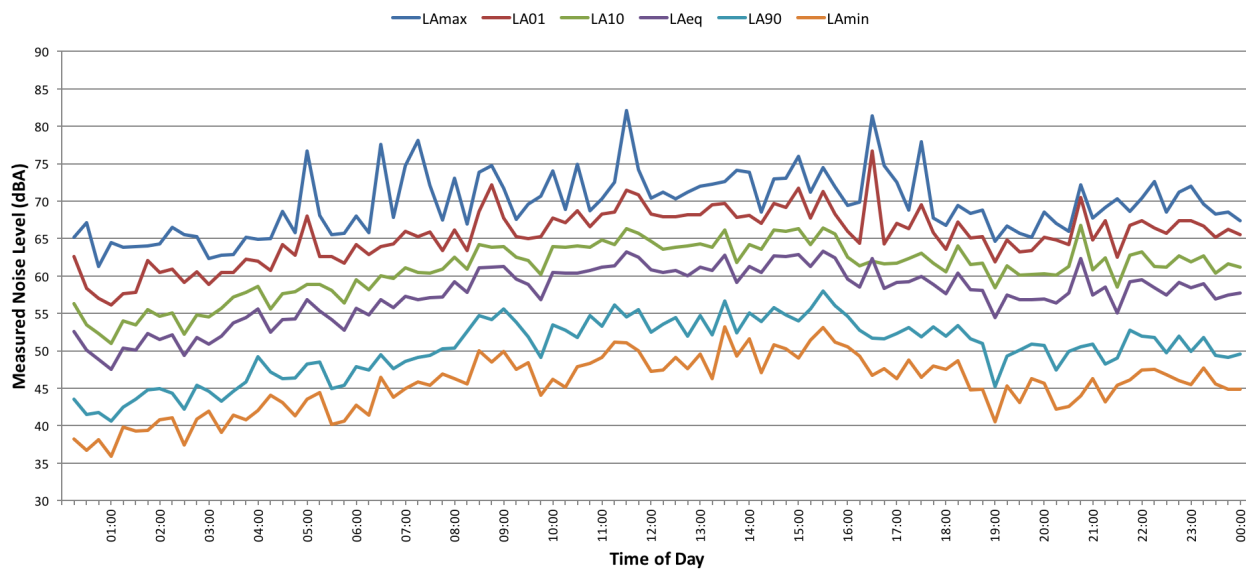
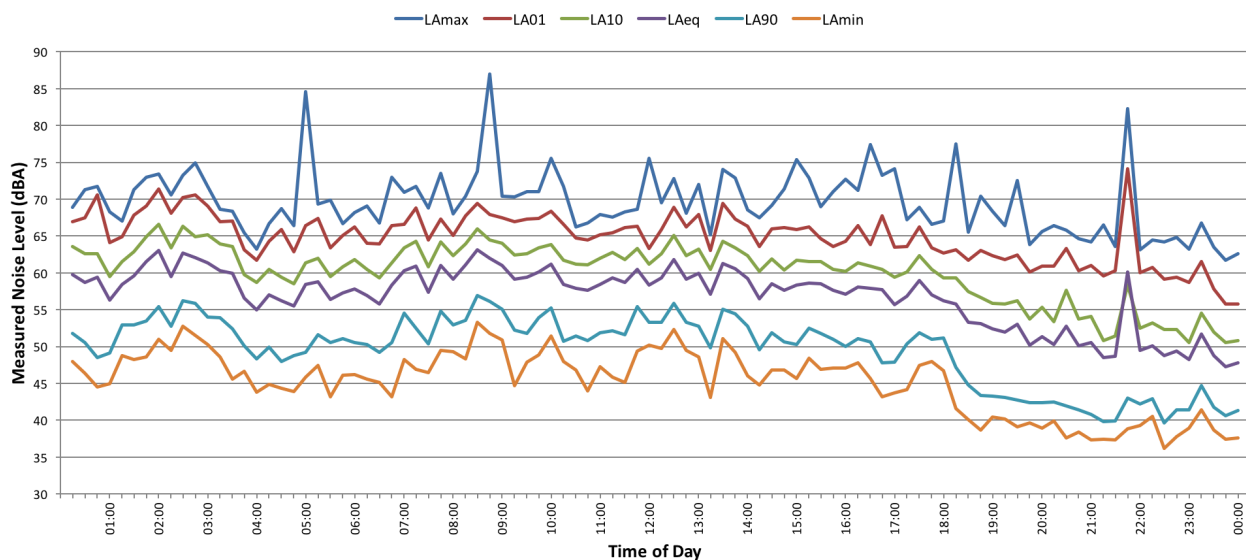
This Brief is primarily for discussion purposes, to inform the design as it moves forward.

APPENDIX A

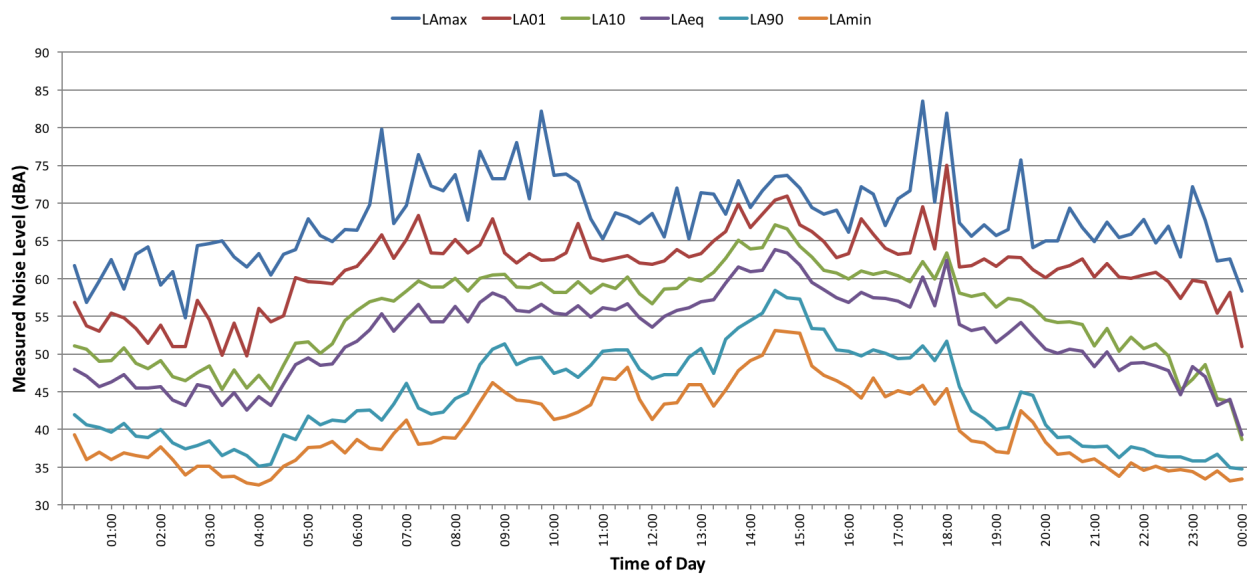
NOISE LOGGING RESULTS



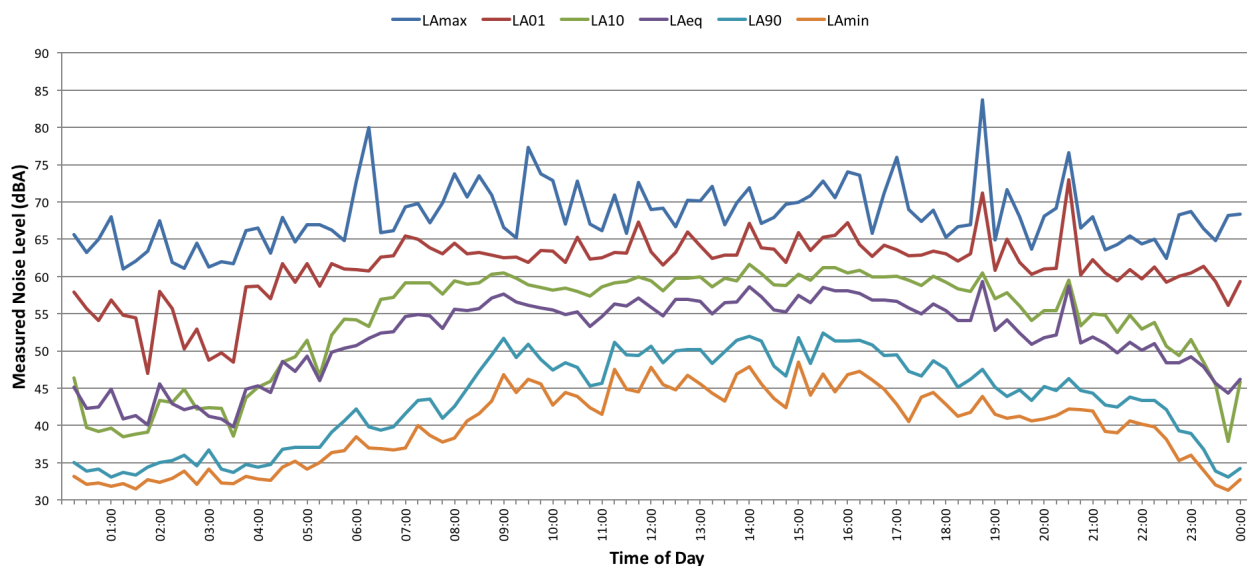


Tuesday, 5 September 2017**Wednesday, 6 September 2017**

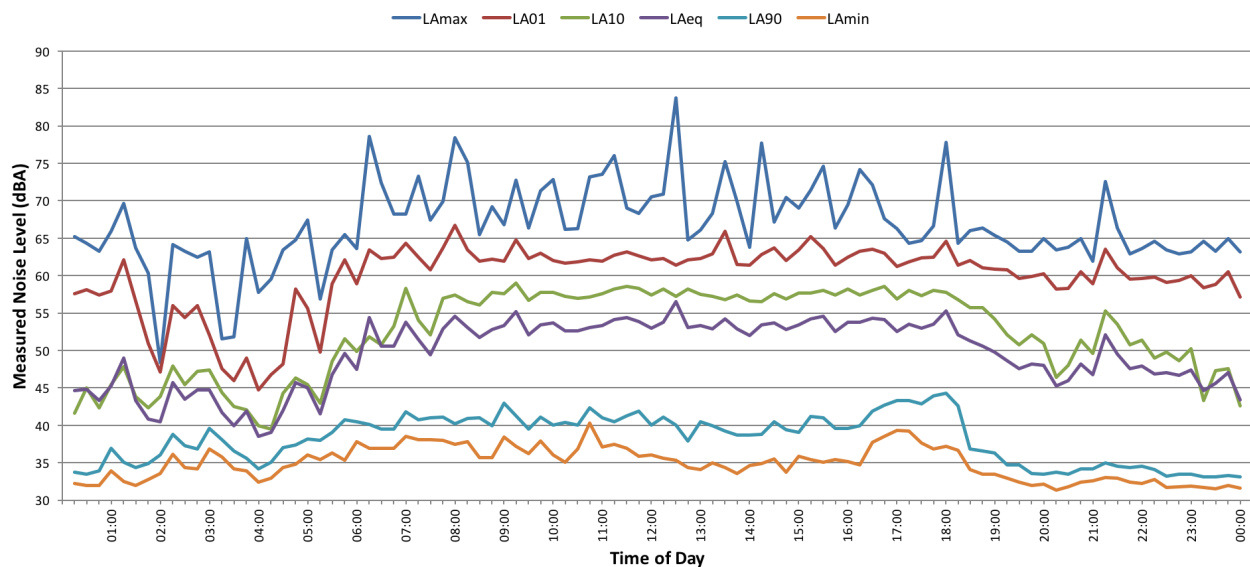
Thursday, 7 September 2017



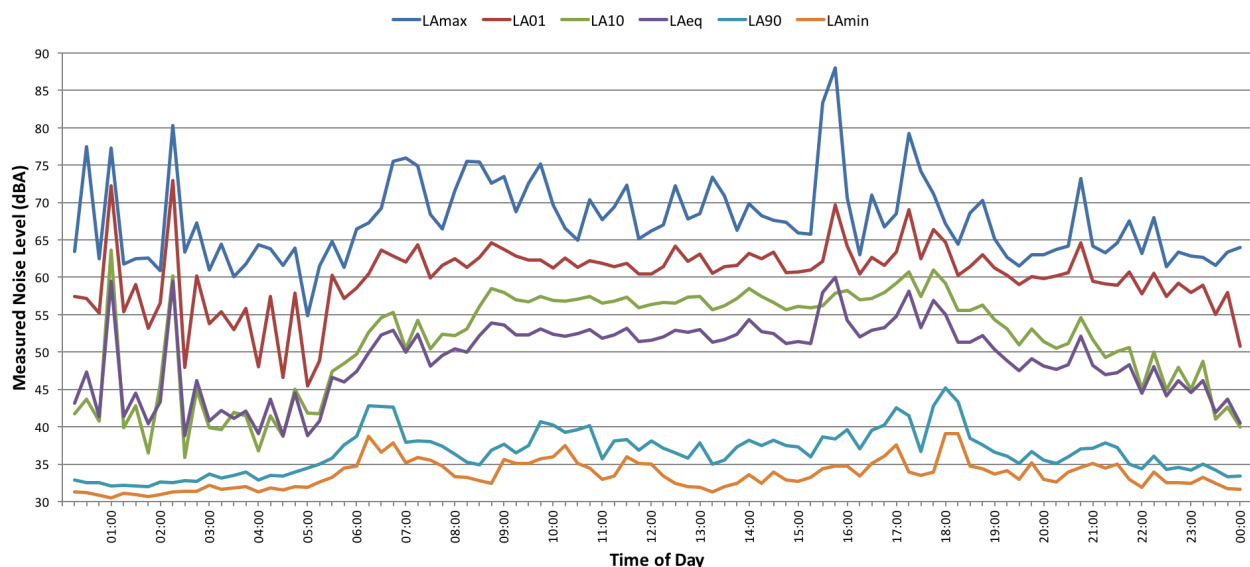
Friday, 8 September 2017

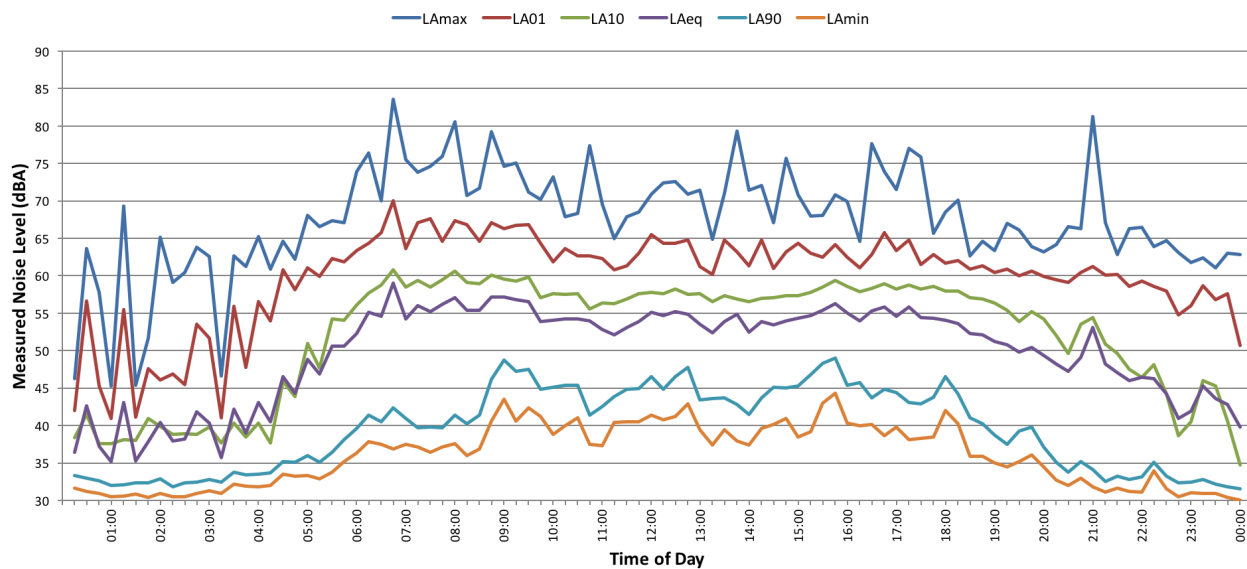
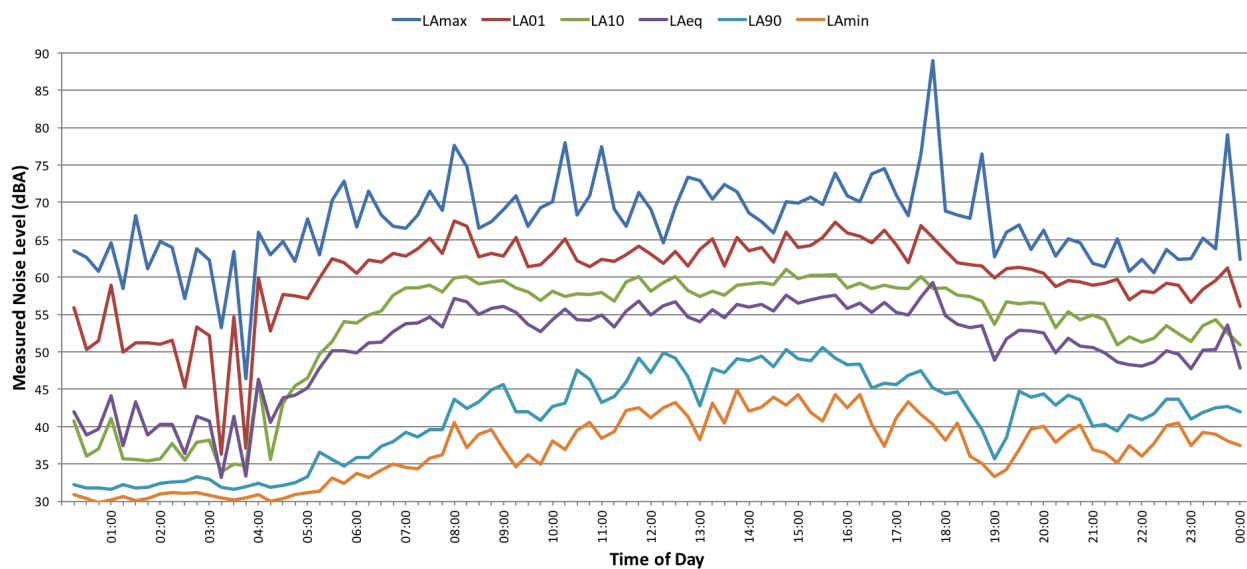


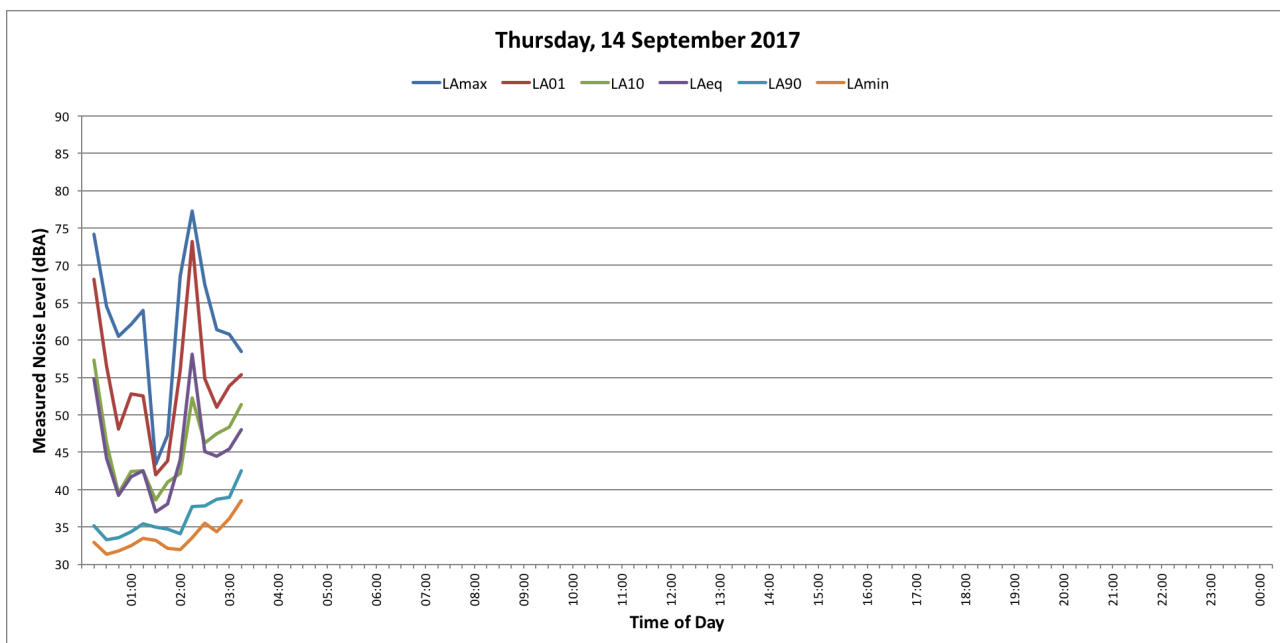
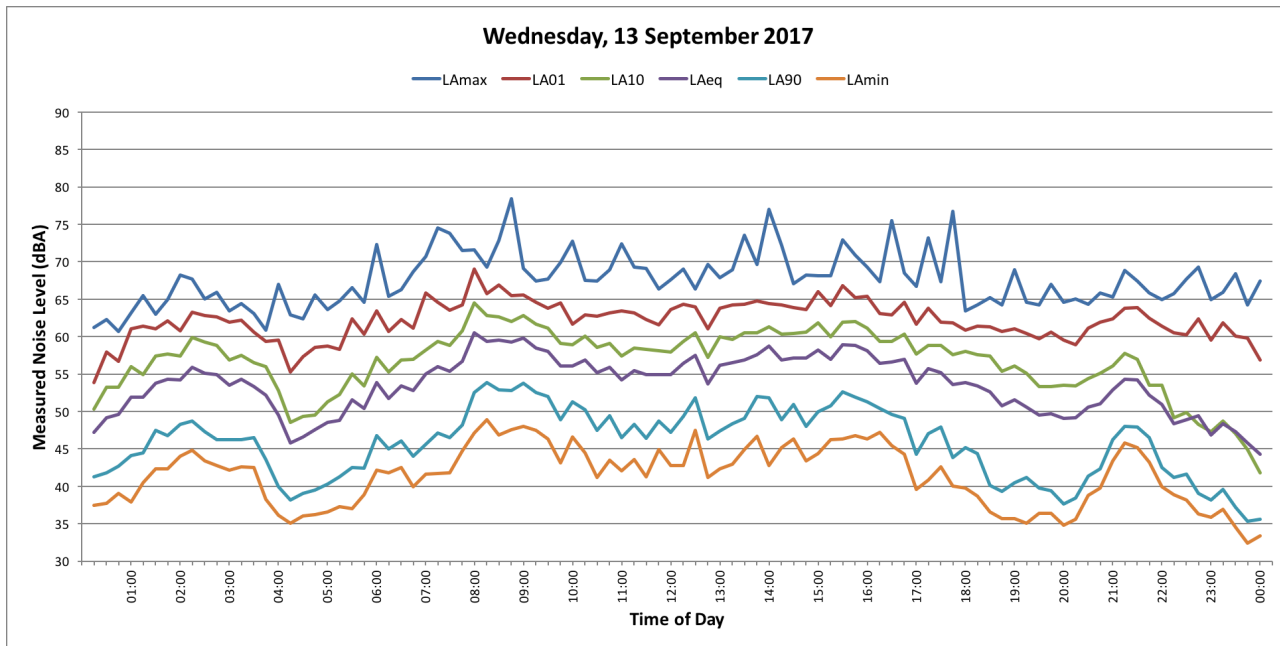
Saturday, 9 September 2017



Sunday, 10 September 2017



Monday, 11 September 2017**Tuesday, 12 September 2017**



APPENDIX B**GLOSSARY OF ACOUSTIC TERMINOLOGY**

dB	Decibel. This is the unit measurement of sound.
dBA	A weighted decibel is the most commonly used descriptor. The A weighting is an adjustment to the raw sound level to approximate what the average human ear can hear, which is less sensitive at very low and very high frequencies.
Lw or SWL	Sound power level. This is the total radiated sound energy.
Lp or SPL	Sound pressure level. This is the measurable sound level at a given distance from an item.
L _{max}	The RMS maximum noise level of a measurement
L ₁₀	90 th percentile sound level of a measurement. Often called the average maximum noise level
L _{eq}	The energy average noise level of a measurement.
L ₉₀	10 th percentile sound level of a measurement. Often called the average background noise level
L _{min}	The minimum noise level of a measurement
L _{eq(T)}	The time (T) equivalent energy noise level. The time interval is often in blocks of 10 or 15 minutes for short term measurements, or hours for long-term measurements. Common increments for long term measurements are 1 hour, day, night, 18 hours and 24 hours.
L _{eq(8h)}	The 8 hour equivalent energy noise level. Primarily used for occupational noise assessments
LC _{peak}	The C weighted peak noise level. Primarily used for occupational noise assessments
Dw	The Weighted Level Difference as defined in AS/NZS ISO 717.1:2004. This is the single number rating describing the ability of a partition to reduce noise as measured in the field with no standardisation or normalisation.
Rw	The Weighted Sound Reduction Index. This is the single number rating describing the ability of a building element to reduce noise as measured in a laboratory. Assessed in accordance with AS/NZS ISO 717.1:2004.
NRC	Noise Reduction Coefficient. The NRC defines how much sound is absorbed by a surface. An NRC of 0 means it absorbs no sound while an NRC of 1 means it will absorb most sound.
CAC	Ceiling Attenuation Class. The CAC determines how much cross-talk will occur between one room and another through the ceiling cavity where both rooms have the tested ceiling tile. This is an ideal situation, with no wall head leaks and no services penetrations in the ceiling. Therefore, it defines the ideal, best possible result as tested in a laboratory.