Air Noise Environment
Environmental Monitoring and Assessment

Acoustic Assessment - Proposed Visitor Function Centre, Scone Airport

Upper Hunter Shire Council

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The validity and comprehensiveness of supplied information has not been independently verified and, for the purposes of this report, it is assumed that the information provided to Air Noise Environment Pty Ltd for the purposes of this project is both complete and accurate.

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1 Introduction

1.1 Scope of Report

Air Noise Environment (ANE) was commissioned by Upper Hunter Shire Council to conduct a noise impact assessment for the proposed visitor function centre at Scone Regional Airport. The proposed function centre is to comprise of two function halls, a foyer area, a kitchen space, an outdoor deck area and a car parking facility.

The purpose of this study is to assess whether noise associated with car park activity, patron noise and amplified music will have any major impact onto the surrounding residential receivers. Based on the assessment, the minimum building facade treatments have been identified and recommendations to achieve the internal noise levels as specified in AS2107:2000 are presented in this report.

The assessment is based on the building plans prepared by STEA Astute Architecture in April 2019.

1.2 Site Description

The proposed development site is located within the Scone Airport precinct. The development site is surrounded by the following land uses:

- North and Northeast – Bunnan Road, Satur Veterinary Clinic and vacant land;
- Southeast – Satur Road and then residential dwellings;
- Northeast – Flying school and then residential dwellings;
- South, Southwest and Northwest – Scone Airport Precinct.

The location of the site and surrounding land uses are shown below in Figure 1.1.

Figure 1.1 - Location of the Proposed Development and Surrounding Area

1.3 Proposal

The proposed visitor function centre will consist of the following:

- A car parking area;
- Ground floor – Theatre, admin, office space, cafe and terminal; and,
- Upper floor – Function 1, Function 2, Foyer and Outdoor deck area.

Based on preliminary drawings, noise sources associated with the development that may impact the surrounding residential receivers include patron activity, mechanical plant operation and amplified speaker/s (for music).

Nominated patron numbers for each area are listed below:

- Conference/functions – 280 patrons,
- Cafe – 40 patrons,
- Terminal – 20 patrons,
- Theatre – 30 patrons.

Figures 1.2 to 1.4 present layouts of the proposed car park and function centre.

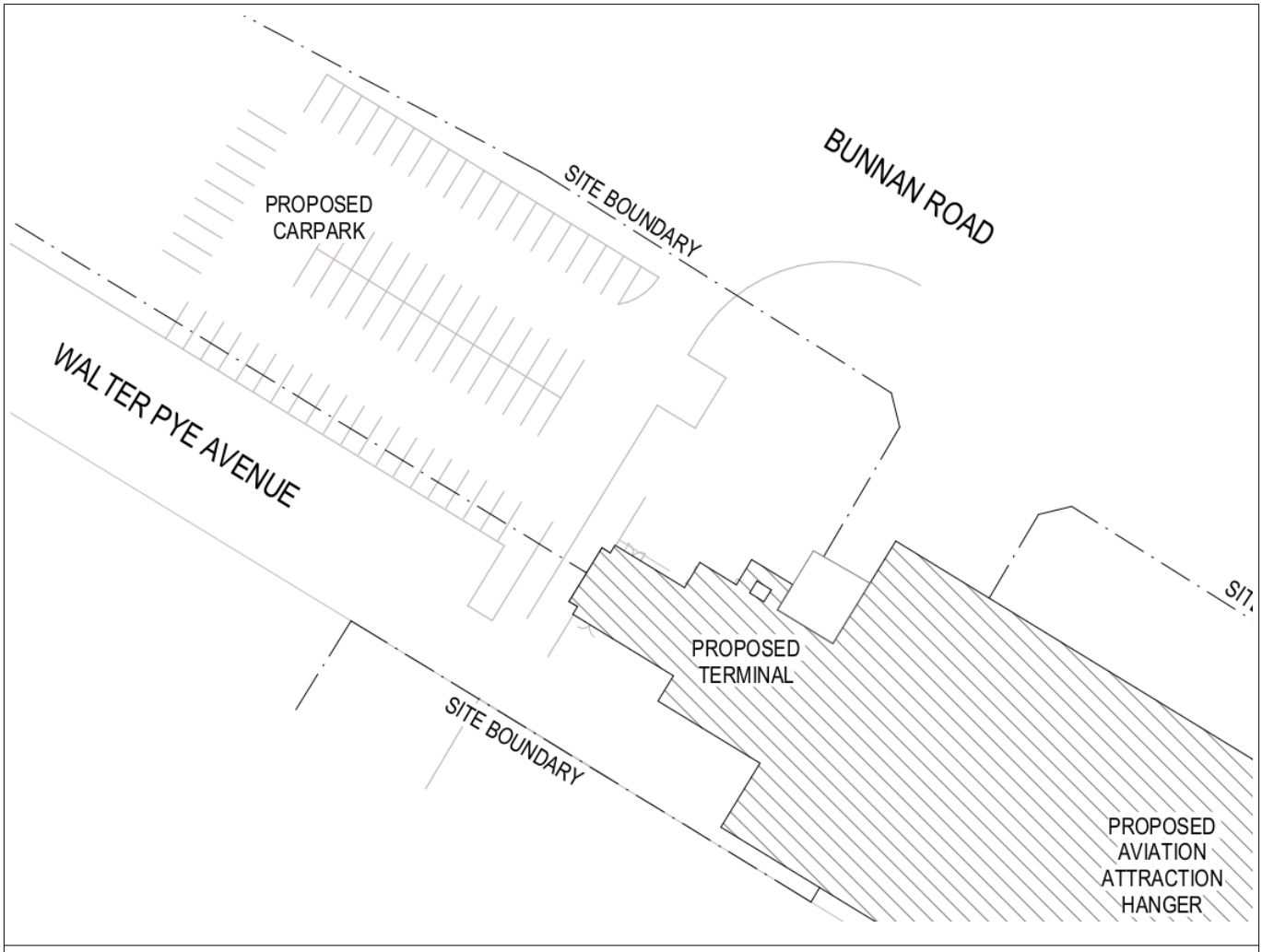


Figure 1.2 - Proposed Car Park Area

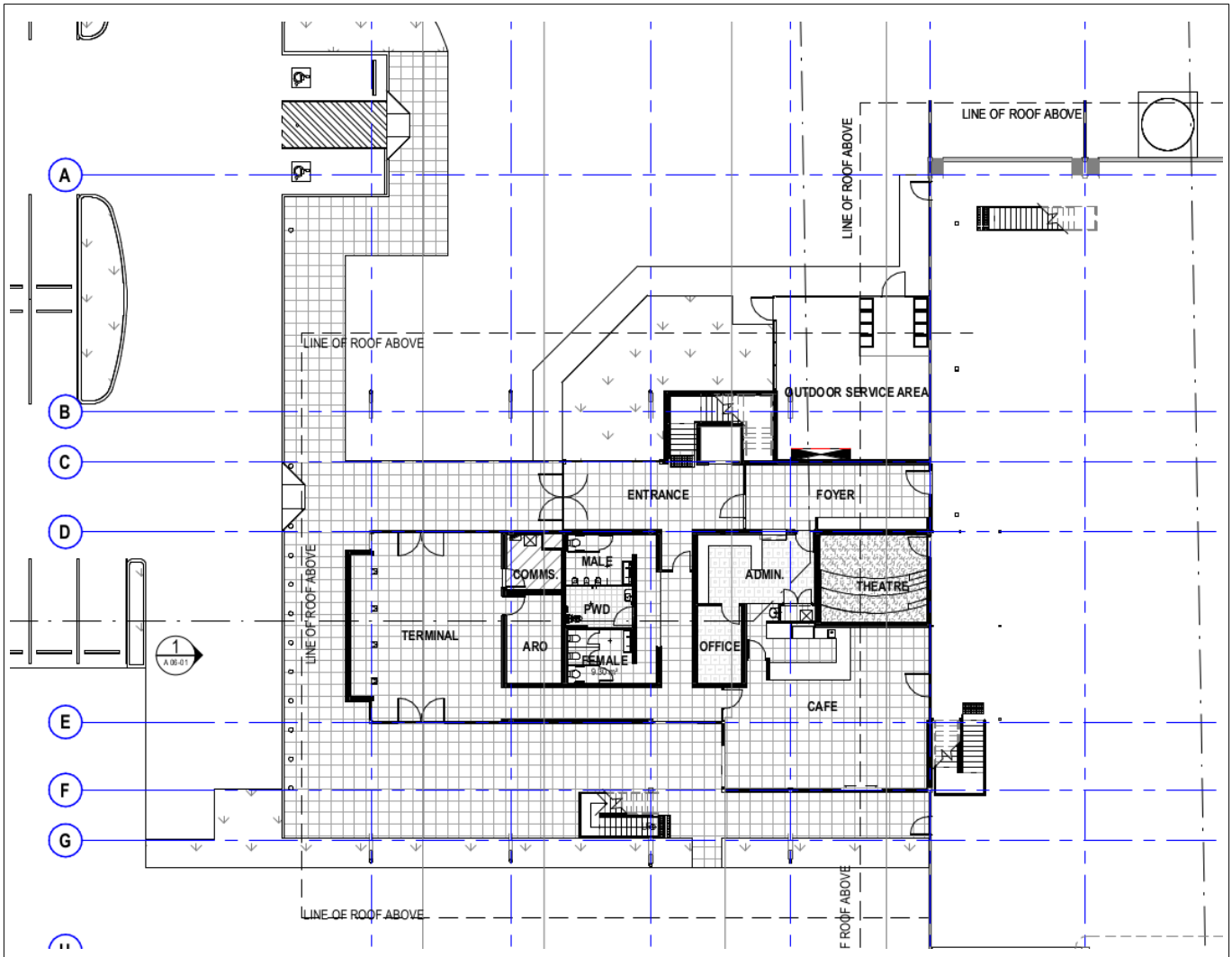


Figure 1.3 - Proposed Ground Floor Layout

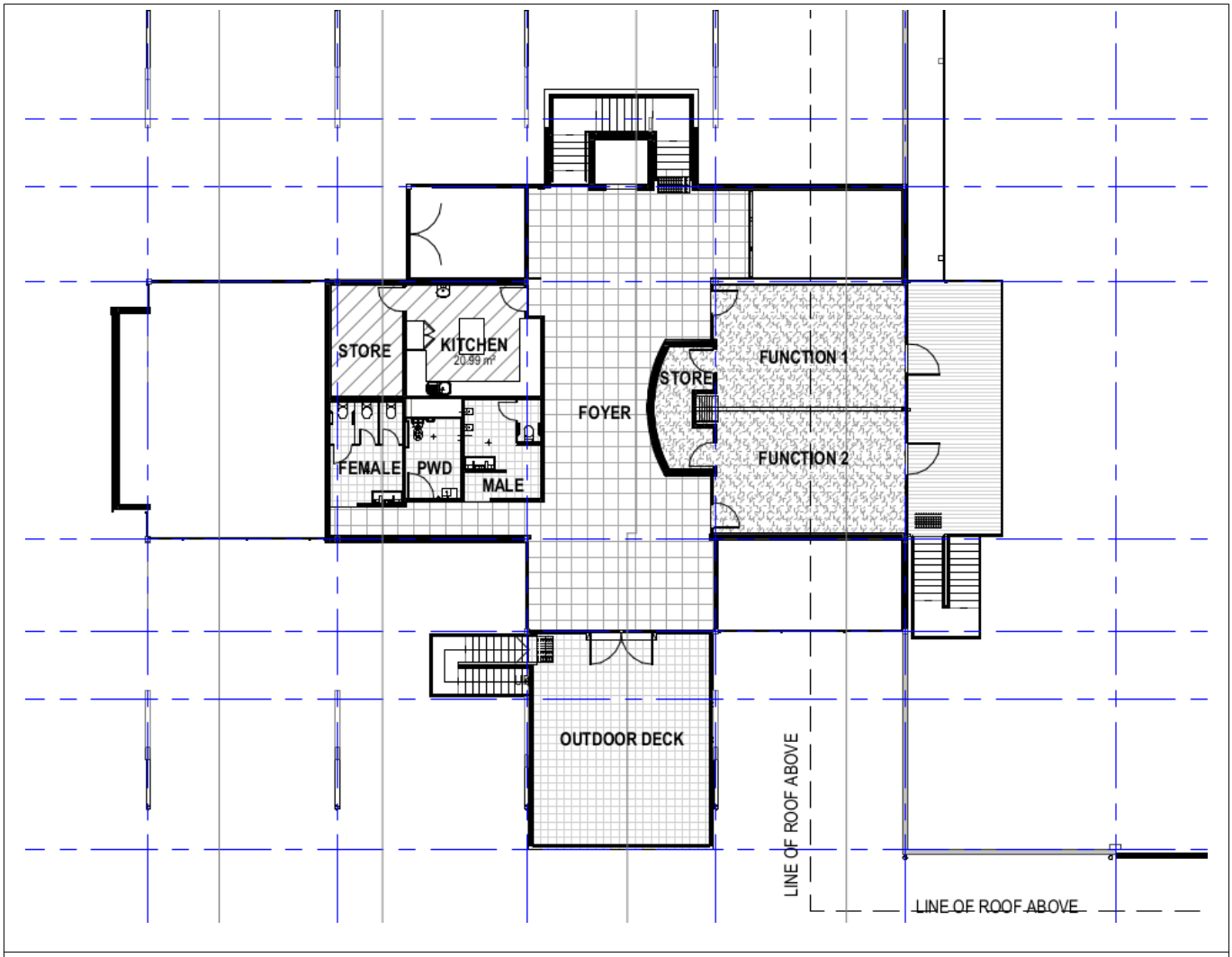


Figure 1.4 - Proposed Upper Floor Layout

The assessment has been based on the drawing list presented below in Table 1.1.

Table 1.1 - List of Drawings Used for the Assessment

Sheet Title	Drawing Number	Revision	Date
Site Plan	A 01-02	5	05.04.19
General Arrangement Plan Ground Part 1	A 02-21	6	05.04.19
General Arrangement Plan Level 1 Part 1	A 02-21	6	05.04.19
Partition Setout Plan Ground Part 1	A 03-31	6	05.04.19
Partition Setout Plan Level 1 Part 1	A 03-33	6	05.04.19
Building Elevations	A 06-01	6	05.04.19
Building Section 1 & 2	A 07-01	6	05.04.19
Building Section 3 & 4	A 07-02	6	05.04.19
Building Section 5	A 07-03	6	05.04.19
Building Section 7 & 8	A 07-04	6	05.04.19

2 Existing Acoustic Environment

2.1 Introduction

ANE completed noise monitoring between 10 August and 17 August 2019 to measure existing background noise levels at the surrounding residential receivers. Details of the noise monitoring are discussed in the following sections.

2.2 Equipment

The following equipment was used to measure the existing ambient noise levels:

- Ngara Environmental Noise Logger, SN 87808A
- Pulsar 105 Sound Level Calibrator, SN 62686

Calibration checks of the noise instrument were carried out at the commencement and completion of the monitoring. No variation was recorded between the pre and post calibration measurements. All instruments used to conduct the noise monitoring for this project carry traceable calibration certificates (NATA). The serial numbers and calibration information are presented in Table 2.1.

Table 2.1 - Noise Instrument Calibration Information

Instrument/ Serial No.	Monitoring Dates	Field Pre and Post Calibration	NATA Calibration Current to:
Ngara 4 (87808A)	10/08/19 – 17/08/19	94.3 dB(A)	08/03/2020
Pulsur 105 Sound Level Calibrator, SN 62686	-		28/02/2020

2.3 Noise Monitoring Locations

The unattended noise monitor was configured to measure noise levels as follows:

- 'A' weighting
- 15 minute statistical interval
- Measurement descriptors L_{Amax}, L_{Aeq}, L_{A10}, L_{A90}

All monitoring was conducted in accordance with Australian Standard AS1055.1-2018 *Acoustics – Description and measurement of environmental noise.* The noise monitoring location is shown below in Figure 2.1.

Figure 2.1 - Noise Monitoring Locations

2.4 Weather Conditions

Based on the review of the weather data from the Scone Airport weather station, rainfall events were recorded on the following listed days:

- 0.2mm rain on 10-August-2019;
- 0.8mm rain on 11-August-2019;
- 3.0mm rain on 12-August-2019.

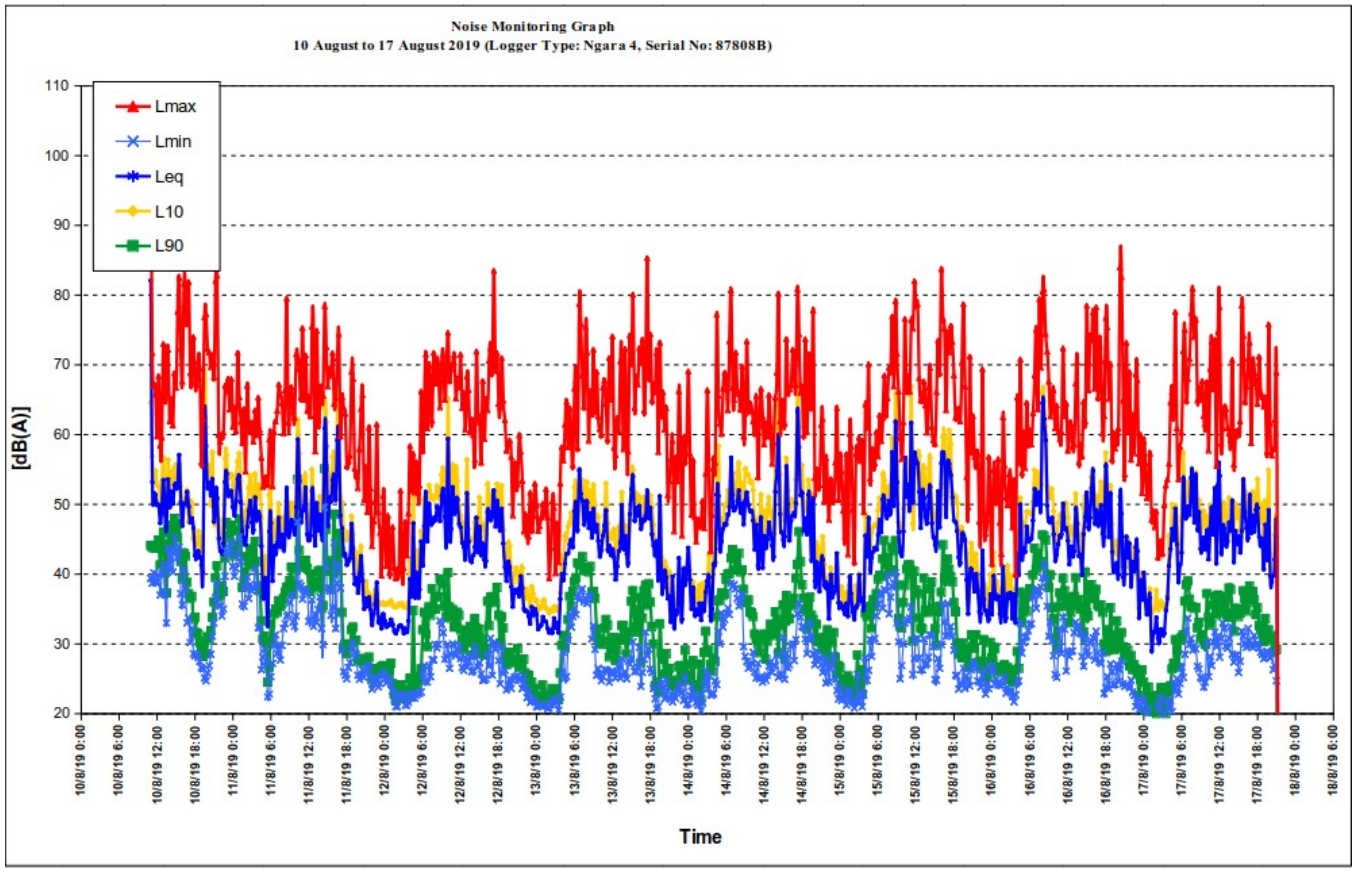
No rainfall was recorded between 13 August and 20 August 2019. Based on weather observations and the completed noise monitoring data, no noise monitoring data was affected by any adverse weather conditions (rainfall and wind).

2.5 Noise Monitoring Results

Results from the continuous noise monitoring are provided below in Table 2.2.

Table 2.2 - Measured Noise Levels – Logger Location L1

Measurement Type	Measurement Descriptor	Time Period	Measured Noise Levels, dB(A)
Average Background Noise Level (L_{A90})	Day	7 am – 6 pm	36
	Evening	6 pm – 10 pm	30
	Night	10 pm – 7 am	30
Rating Background Noise Level (L_{A90})	Day	7 am – 6 pm	34
	Evening	6 pm – 10 pm	29
	Night	10 pm – 7 am	24
Average L_{Aeq} Noise Level	Day	7 am – 6 pm	51
	Evening	6 pm – 10 pm	46
	Night	10 pm – 7 am	44



3 Design Criteria

3.1 Overview

The Upper Hunter Shire Council Local Environmental Plan 2013 (LEP) does not specify noise criteria for new developments. Therefore, reference has been made to the NSW Noise Policy for Industry (NPI) (2017) and AS 2107:2016 *'Acoustics – Recommended design sound levels and reverberation times for building interiors'.*

The NSW NPI does not specifically apply to function premises which include patron noise and music. Nonetheless, the noise criteria presented in the NSW NPI (specifically, Background + 5 limit) is still relevant to the assessment of noise emissions from any type of development, whether commercial or industrial in nature.

3.2 NSW Noise Policy for Industry (NPI)

3.2.1 Project Intrusiveness Noise Level

The NSW NPI project intrusiveness noise level is considered relevant to assess the cumulative noise impact from the patron noise and the amplified speaker associated with the proposed development.

As specified in Section 2.3 of the NSW NPI document, the intrusiveness of an industrial noise source may generally be considered acceptable if the level of noise from the source, measured over a 15-minute period, does not exceed the background noise level by more than 5 dB when beyond a minimum threshold.

3.2.2 Maximum Noise Level Event Assessment

In order to assess the noise impact from a car door closure event at the proposed car parking area, the following listed noise limit for an L_{AFmax} event as specified in the NSW NPI document has been adopted for this project:

- L_{AFmax} 52 dB(A) or the prevailing RBL plus 15 dB, whichever is greater

3.3 Australian Standard (AS2107) - Internal Noise Levels

AS/NZS 2107:2016 'Acoustics – Recommended design sound levels and reverberation times for building interiors' sets out the design noise criteria for steady state noise such as noise emission from air-conditioning systems and road traffic depending on the type/use of different rooms. Recommendations for each space in terms of an averaged A-weighted sound pressure level (L_{Aeq}) have been referenced from Table 1 of AS/NZS 2107:2016 and summarised in Table 3.1.

Table 3.1 - ASA2107 Specified Noise Design Criteria

Type of Occupancy/Activity	AS/NZS 2107 – 2000 Design Sound Level – L_{Aeq}, dB(A)\		Reverberation Time RT60 (Sec)
	Satisfactory	Maximum	
Health Building			
Consulting rooms	40	45	0.4 to 0.6
Intensive care wards	40	45	0.4 to 0.6
Office areas	40	45	0.4 to 0.7
Surgeries	40	45	0.4 to 0.7
Wards	40	50	0.4 to 0.7
Office Buildings			
Board and Conference Rooms	30	40	0.6 to 0.8
General office areas	40	45	0.4 to 0.6
Residential Building			
House and apartments near minor roads			
Living areas	30	40	-
Sleeping areas	30	35	-

3.4 Adopted Assessment Noise Criteria

Based on the noise criteria presented in Section 3.2 and 3.3 and noise monitoring results presented in section 2.5, applicable project specific noise limits are listed in Table 3.2. As shown in Table 3.2, NSW NPI noise limits are lower than the AS 2107 specified noise limits for L_{Aeq} noise levels.

As such, NSW NPI specified noise limits have been adopted to assess both L_{Aeq} and L_{Amax} noise levels associated with the proposed development.

Table 3.2 - Adopted Noise Limits (dBA)

Noise Criteria	Residential Building Area/Space	Period	Proposed Outdoor L_{Aeq}, Noise Limits dB(A)	Proposed Outdoor L_{Amax}, Noise Limits dB(A)
NSW NPI	Residential Dwellings and the adjacent Veterinary Clinic	Day	39 (RBL+5)	-
		Evening	34 (RBL+5)	-
		Night	29 (RBL+5)	52
AS 2107	Residential Dwellings	Day and Evening	45[1]	-
		Night	40[1]	-
	Veterinary Clinic	Day, Evening and Night	50[1]	-

[1] Outdoor limit based on indoor design sound level and assuming a 10 dB facade attenuation (partially opened window)

1 Based -10 dB outdoor to indoor attenuation correction factor

4 Noise Modelling

4.1 Overview

As shown in Figure 1.3 and Figure 1.4, noise from the theatre space, function rooms (function 1 and 2) and cafe area has potential to impact the surrounding sensitive receivers. Noise sources from the theatre space is likely to include amplified speakers, and noise sources from the function rooms and the cafe area are likely to include patron activity.

The Cadna/A noise modelling software has been used to predict the noise impact of the proposed development. Using the Cadna/A noise modelling software, predictions were made at the surrounding residential receivers. Details of the prediction methodology and predicted noise levels are discussed in this section. The location of the nearest existing residential receivers are as shown in Figure 4.1 and in Table 4.1.

Figure 4.1 - Location of the Identified Closest NSRs

Table 4.1 - NSR ID and Number of Storey

NSR ID	NSR Type	Number of Storeys (Approximately)
R1	Veterinary Clinic	1
R2	Residential	1
R3	Residential	1
R4	Residential	1
R5	Residential	1
R6	Residential	1

4.2 Noise Impact Modelling Methodology

The Cadna/A 3D noise modelling software was used to predict the the cumulative noise from patron activity and amplified speakers associated with the cafe, function area and theatre for the proposed development.

The noise model was constructed based on the assumptions and inputs listed below.

Table 4.2 - Noise Model Input Assumption

Modelling Element	Input/Assumption
Methodology	Industrial Noise Impact : ISO 9613.2_1996 - *"Acoustics – Attenuation of Sound During Propagation Outdoors".*
Weather Conditions	Default light downwind or temperature inversion conditions as specified by ISO 9613.
Receiver Height	Assumed to be 1.5 meters above finished floor level.
Receiver Location	Refer to Figure 4.1 for the receiver locations.
Source Sound Power Level	Refer to Table 4.3 for the modelled noise sound power levels and refer to Table 4.4 for assumed transmission loss for each facade component of the proposed function centre. <u>Cafe</u> In order to assess noise impact from the cafe area, noise from 88 patrons having normal conversation was modelled. Refer to Table 4.3 for the modelled noise sound power levels and refer to Table 4.4 for assumed transmission loss for each facade component. <u>Terminal</u> In order to assess noise impact from the terminal area, noise from 20 patrons having normal conversation was modelled. <u>Theatre</u> It is assumed that amplified speakers will be used in the theatre area and that noise from the speakers will be louder than patron noise from the area. As such, in order to assess potential noise impacts from the theatre area, speaker noise data (based on previous measurement by ANE at an entertainment area) was entered in the computer model. It is assumed that theatre ceiling will be at least two layers plasterboard with cavity insulation and ceiling space for function area above will have a layer of plasterboard with ceiling insulation.

Modelling Element	Input/Assumption
	Function Area In order to assess potential noise impacts from the terminal area, noise from 40 patrons having normal conversation was modelled. Car Park Area In order to assess potential noise impacts from the car parking, noise from a car door closure event was entered in the computer model as a point source to predict L_{Amax} noise levels at the surrounding NSRs. Car door closure noise sources were modelled in an open area and as such no transmission loss correction was relevant.
Source Height	1.5 meters above ground level.
Source Location	Refer to Figure 4.2 and 4.3 for the source locations.

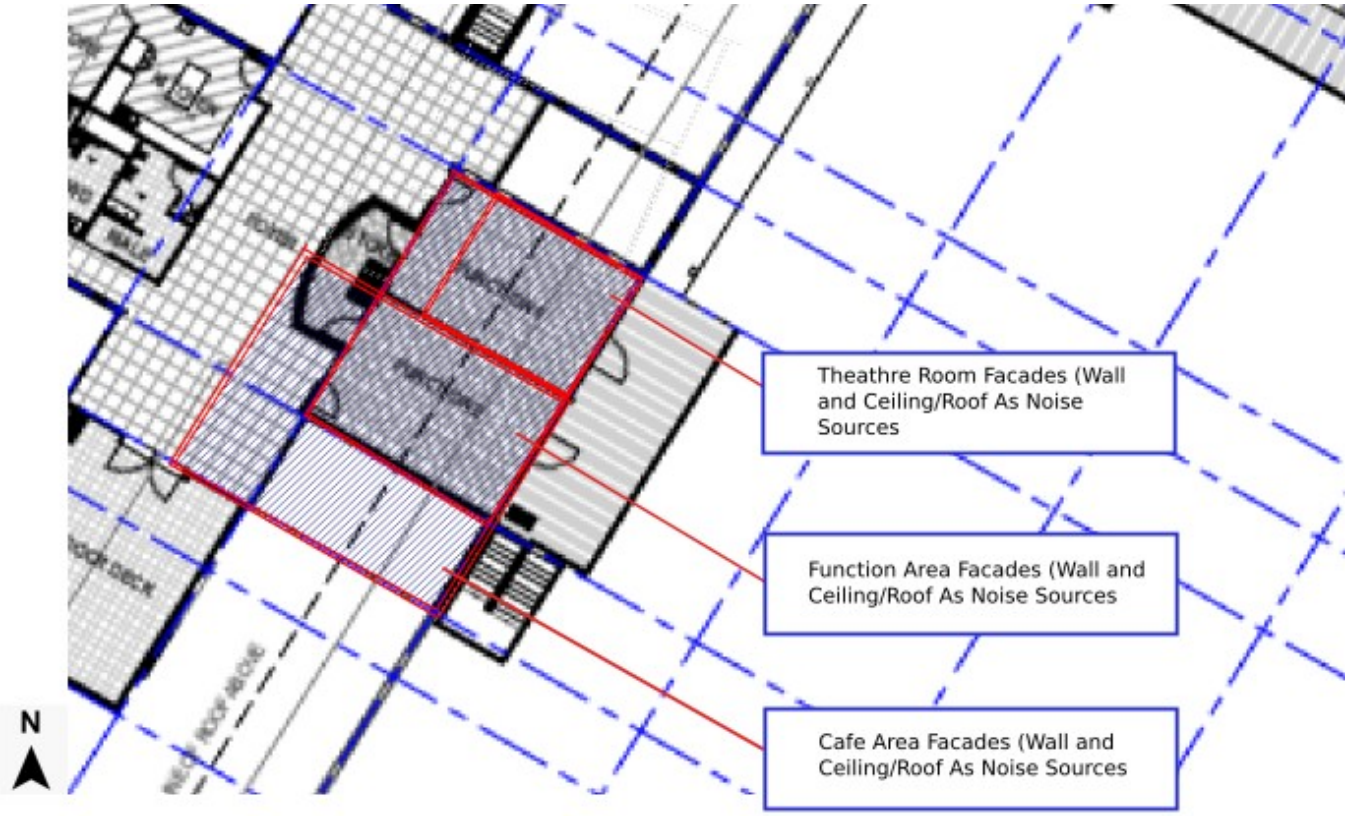


Figure 4.2 - Modelled Vertical and Area Noise Sources to Predict Patron and Speaker Noise from the Proposed Theatre, Cafe and Function Room

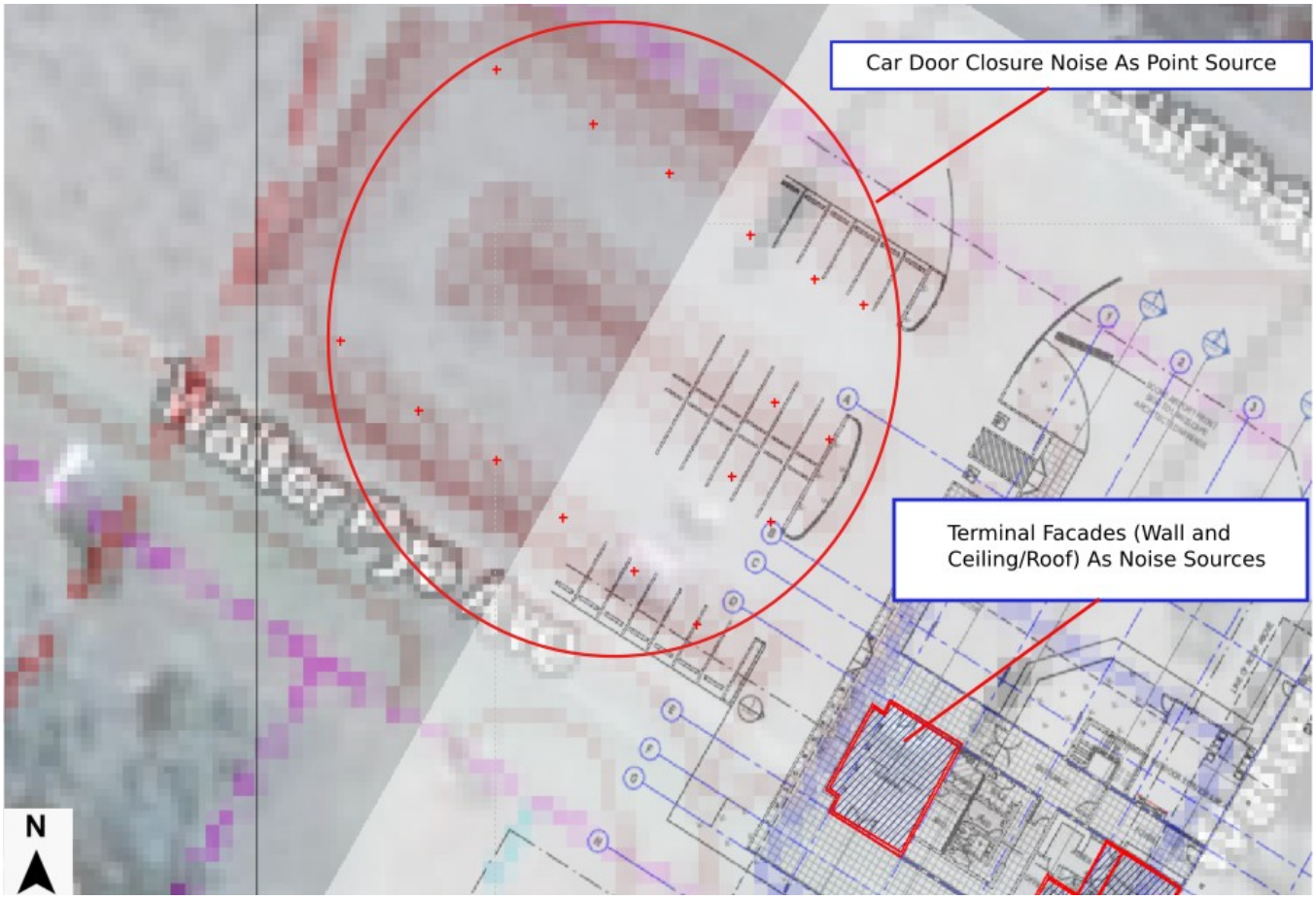


Figure 4.3 - Modelled Vertical and Area Noise Sources to Predict Patron Noise from the Proposed Terminal Area and Modelled Point Sources to Predict Car Door Closure Noise

Table 4.3 - Modelled Patron Noise Level, dB

Area	Noise Source	Frequency Spectrum								Total	
		63	125	250	500	1k	2k	4k	8k	A	Lin
Cafe	L_{Aeq} – patron noise from 88 people	86	85	83	89	88	85	78	65	92	94
Terminal	L_{Aeq} – patron noise from 20 people	77	76	74	80	79	79	69	56	84	86
Theatre	L_{Aeq} – speaker noise	97	97	92	91	90	86	76	76	94	102
Function Room	L_{Aeq} – patron noise from 40 people	81	80	78	84	83	83	73	60	88	90
Car Parking	L_{Amax} - Car Door Closure	70	81	88	90	86	84	78	72	92[2]	94

2 A 3 dB impulsiveness correction factor was added to this value to predict noise from a car door slam event

Table 4.4 - Assumed Transmission Loss for Each Building Facades Component, dB

Facade Component	Frequency Spectrum									R_w
	31.5	63	125	250	500	1k	2k	4k	8k	
190mm Concrete Block Wall	-	44	44	46	53	61	66	71	71	58
Ceiling/Roof	-	14	14	28	41	52	57	43	43	39
10.38mm laminate with acoustic seals	-	28	31	35	39	39	43	53	56	36
Standard door with acoustic seal	-	15	19	23	28	32	30	35	35	31

4.3 Predicted Noise Levels

4.3.1 Cumulative L_{Aeq} Noise Levels (Amplified Speaker and Patron Noise)

Predicted cumulative L_{Aeq} noise levels from patron noise and speaker noise associated with the proposed development are presented below in Table 4.5. The results of the modelling show predicted compliance with the day, evening and night-time noise criteria.

Table 4.5 - Predicted Cumulative L_{Aeq} Noise Levels at the Surrounding NSRs

NSR	Predicted Noise Levels, dB(A)	Compliance Assessment Against NSW NPI Noise Criteria		
		Day, 39 dB(A)	Evening, 34 dB(A)	Night, 29 dB(A)
R1	28	Complies	Complies	Complies
R2	18	Complies	Complies	Complies
R3	12	Complies	Complies	Complies
R4	15	Complies	Complies	Complies
R5	13	Complies	Complies	Complies
R6	15	Complies	Complies	Complies

4.3.2 L_{Amax} Noise Levels from A Car Door Closure (Car Parking Area)

Predicted L_{Amax} noise levels from a car door closure at the car parking area are presented below in Table 4.6. As shown in Table 4.6, predicted L_{Amax} noise levels from a single car door closure is expected to comply with the night-time noise limits.

Table 4.6 - Predicted L_{Amax} Noise Levels from a Single Car Door Closure at the Surrounding NSRs

NSR	Predicted Noise Levels, dB(A)	Compliance Against the NSW NPI L_{Amax} 52 dB(A) Noise Criteria
R1	40	Complies
R2	39	Complies
R3	32	Complies
R4	29	Complies
R5	20	Complies
R6	22	Complies

5 Recommendations

5.1 Building Envelope

As shown in Table 4.5, the predicted L_{Aeq} cumulative noise (patron noise and speaker noise) noise from the proposed development are expected to comply with the adopted noise limits at the surrounding residential receivers. Based on the assumptions made on the completed noise modelling for the external facades construction materials, we make the following recommendations:

- External glazing facades is to achieve minimum acoustic rating of R_w 36. Glazing with typical thickness of 10.38mm laminated with acoustic seals are capable to achieve this requirements.
- The external wall is to achieve a minimum acoustic rating of R_w 58. The proposed 190mm concrete block work is expected to achieve the required acoustic rating;
- The ceiling/roof construction is to achieve a minimum acoustic rating of R_w 42. 1 layer of 13mm plasterboard + 100mm air gap with cavity insulation + 1 layer of 13mm plasterboard is expected to achieve the required acoustic rating.

5.2 Mechanical Plant Noise

No details of the mechanical plant system associated with the proposed development have been finalised at this stage of the project. We recommend that a detailed assessment and review of the mechanical plant design is conducted at a later stage, once the mechanical plant details are finalised. Mechanical plant must be designed to comply with the noise limits presented in Table 3.1.

6 Conclusions

Air Noise Environment (ANE) was commissioned by Upper Hunter Shire Council to conduct a noise impact assessment for the proposed visitor function centre at Scone Regional Airport. The proposed function centre is to comprise of two function halls, a foyer area, a kitchen space, an outdoor deck area and car parking facility.

Based on a review of the provided drawings, the following listed noise sources were considered for this assessment:

- Patron noise from the function area, cafe and the terminal space function;
- Amplified speaker noise from the theatre area; and,
- Car door closure noise from the car parking area.

Based on the completed noise impact assessment of the above listed noise sources, noise impact from the proposed development can be attenuated to an acceptable by incorporating the recommendations provided in this report. These recommendations are summarised below:

- External glazing facades is to achieve minimum acoustic rating of R_w 36. Glazing with typical thickness of 10.38mm laminated with acoustic seals are capable to achieve this requirements.
- The external wall is to achieve a minimum acoustic rating of R_w 58. The proposed 190mm concrete block work is expected to achieve the required acoustic rating;
- The ceiling/roof construction is to achieve a minimum acoustic rating of R_w 42. 1 layer of 13mm plasterboard + 100mm air gap with cavity insulation + 1 layer of 13mm plasterboard is expected to achieve the required acoustic rating.
- Mechanical plant must be designed to comply with the noise limits presented in Table 3.2; and,

We recommend that the external building construction and the mechanical plant specifications are reviewed at the design & construction stage to ensure that the selections of the material meet the required noise limits at the surroundings NSRs. Material supplier data should be sought to confirm minimum acoustic ratings can be achieved.

Appendix A – Images Showing The Noise Monitoring Location

Images Showing Noise Monitoring Location

Appendix B - Acoustic Glossary

APPENDIX B: GLOSSARY OF ACOUSTIC TERMINOLOGY	
A-Weighting	A response provided by an electronic circuit which modifies sound in such a way that the resulting level is similar to that perceived by the human ear.
dB (decibel)	This is the scale on which sound pressure level is expressed. It is defined as 20 times the logarithm of the ratio between the root-mean-square pressure of the sound field and the reference pressure ($0.00002 N/m^2$).
dB(A)	This is a measure of the overall noise level of sound across the audible spectrum with a frequency weighting (i.e. 'A' weighting) to compensate for the varying sensitivity of the human ear to sound at different frequencies.
Facade Noise Level	Refers to a sound pressure level determined at a point close to an acoustically reflective surface (in addition to the ground). Typically a distance of 1 metre is used.
Free Field	Refers to a sound pressure level determined at a point away from reflective surfaces other than the ground with no significant contribution due to sound from other reflective surfaces; generally as measured outside and away from buildings.
Hertz (Hz)	A measure of the frequency of sound. It measures the number of pressure peaks per second passing a point when a pure tone is present.
L_{Aeq} Equivalent Continuous Sound Level	This is the equivalent steady sound level in dB(A) containing the same acoustic energy as the actual fluctuating sound level over the given period. For a steady sound with small fluctuations, its value is close to the average sound pressure level.
$L_{A90,T}$	This is the dB(A) level exceeded 90% of the time, T.
$L_{A10,T}$	This is the dB(A) level exceeded 10% of the time, T.
$L_{A50,T}$	This is the dB(A) level exceeded 50% of the time, T.
L_{WA}	The A-weighted sound power level in dB.