Proposed Centre-based Child Care Facility Noise Impact Assessment

Lot 1 DP 795300, 84 Brook Street, Muswellbrook NSW

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Contents

Introduction

Purpose and scope

1. BSE (Acoustics) have prepared a Noise Impact Assessment (NIA) report for JAL Invest Co Pty Ltd in relation to the Muswellbrook Shire Council (council) development application for a proposed Centre-based Child Care Facility at Lot 1 DP 795300, known as 84 Brook Street, Muswellbrook, New South Wales (NSW).

1.1 The environmental noise impact assessment of the proposed Centre-based Child Care Facility shall address council's requirements as per the Pre-lodgement Meeting letter dated 26 September 2022, namely:

> *'Noise Impact Assessment – an Acoustic Engineer should be engaged to prepare a Noise Impact Assessment to consider noise generation related to the proposed development and its potential to impact on the amenity of adjoining residential properties.'*

Furthermore, the assessment shall address specific noise related criteria within *Section 18 Child Care Centres* of the *Muswellbrook Shire Development Control Plan* (refer Section 4.1 of this report).

The aim of the environmental noise impact assessment of the proposed Child Care Centre was to address emitted operational noise levels such as outdoor activities, indoor activities, and mechanical plant noise, on-site traffic and site related traffic influence on the adjoining local road, Brook Street. The assessment also addresses ambient noise impact within the indoor or sleeping areas of the centre as well as road traffic and industrial noise intrusion onto the site.

1.2. Referenced documents

This study was based upon client provided site drawings shown in Table 1.

Table 1: Client Provided Site Drawings

Project	Drawing No.	Revision	Title	Drawn By	Drawn
10186	A000		Cover Page	Janssen Designs	20/07/2022
10186	A001		Calculations Page / LEP Controls		20/07/2022
10186	A002		Site Context Plan		20/07/2022
10186	A003		Site Analysis Plan		20/07/2022
10186	A004		Site Plan		20/07/2022
10186	A006		Ground Floor Plan A		20/07/2022
10186	A006		Ground Floor Plan A		20/07/2022

This study was based upon the following client provided site related documentation shown in Table 2.

Table 2: Client Provided Site Related Documentation

Title	Created By	Dated
Pre-lodgement Meeting, Centre-based childcare facility, Lot 1 DP 795300, 84 Brook Street Muswellbrook	Muswellbrook Shire Council	26 September 2022

Project information

2. Site Description

2.1.

The proposed site location is Lot 1 DP 795300, known as 84 Brook Street, Muswellbrook, NSW (the site). The site location is shown in the map and aerial image of the surrounding area, in Figure 1 and Figure 2 respectively.

The long and thin site is moderately sloped with an overall rise of approximate 5.44 m in site levels between the land's Brook Street frontage and northern boundary. It is proposed that cut and fill is required to reshape the site to support the development. The site is intersected by Possum Gully, a natural watercourse.

Site access is via Brook Street, the local roadway along the southern site boundary. Brook Street has a single lane of travel in each direction, with a designated speed limit of 50 km/h in each direction and parallel parking along both sides. Proximate to the site, Brook Street is split, separated by a sloped grassed island, with the western traffic lane nearest the site being at a lower height than the upper eastern travel direction lane.

The site is approximately 283 m east-south-east of the A15 New England Highway (Bridge Street), the main arterial roadway through the town centre. The site is approximately 400 m from the nearest rail corridor.

The site is situated within the *R1 General Residential* land zoning of the Muswellbrook Shire Council Local Environmental Plan 2009, Land Zoning Map Sheet LZN_008A. The land adjoining each site boundary to the east, north and west, as well as land directly across Brook Street to the south is also zoned *R1*. The land west of Sowerby Street is zoned *B2 Local Centre*.

Figure 1 – Aerial image indicating site location and the surrounding area [Source: Six Maps, The NSW Land and Property Information Division of the Department of Finance and Services, 2022]

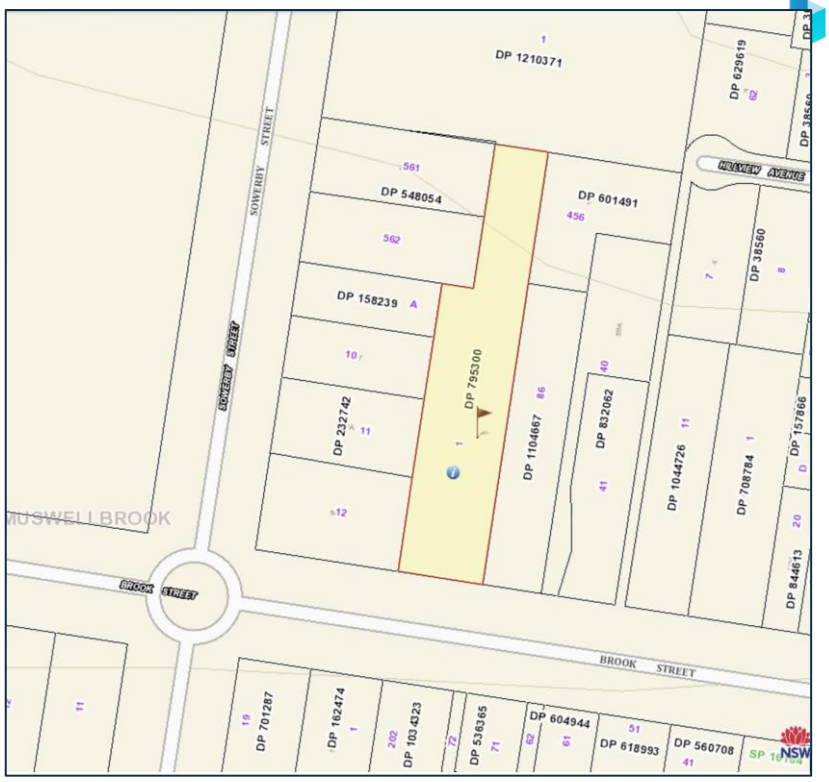

Figure 2 – Map indicating site location and the surrounding area [Source: Six Maps, The NSW Land and Property Information Division of the Department of Finance and Services, 2022]

BSE understand that the centre is proposing to service 90 children: 0-2 years, 20 places; 2-3 years, 20 places; and, 3-6 years, 50 places. BSE understand that the centre staff numbers shall be 14 care giving staff and other ancillary staff (management, clerical, kitchen, cleaning). BSE understand that the hardstand parking area accessed via Brook Street is to provide 26 car-spaces.

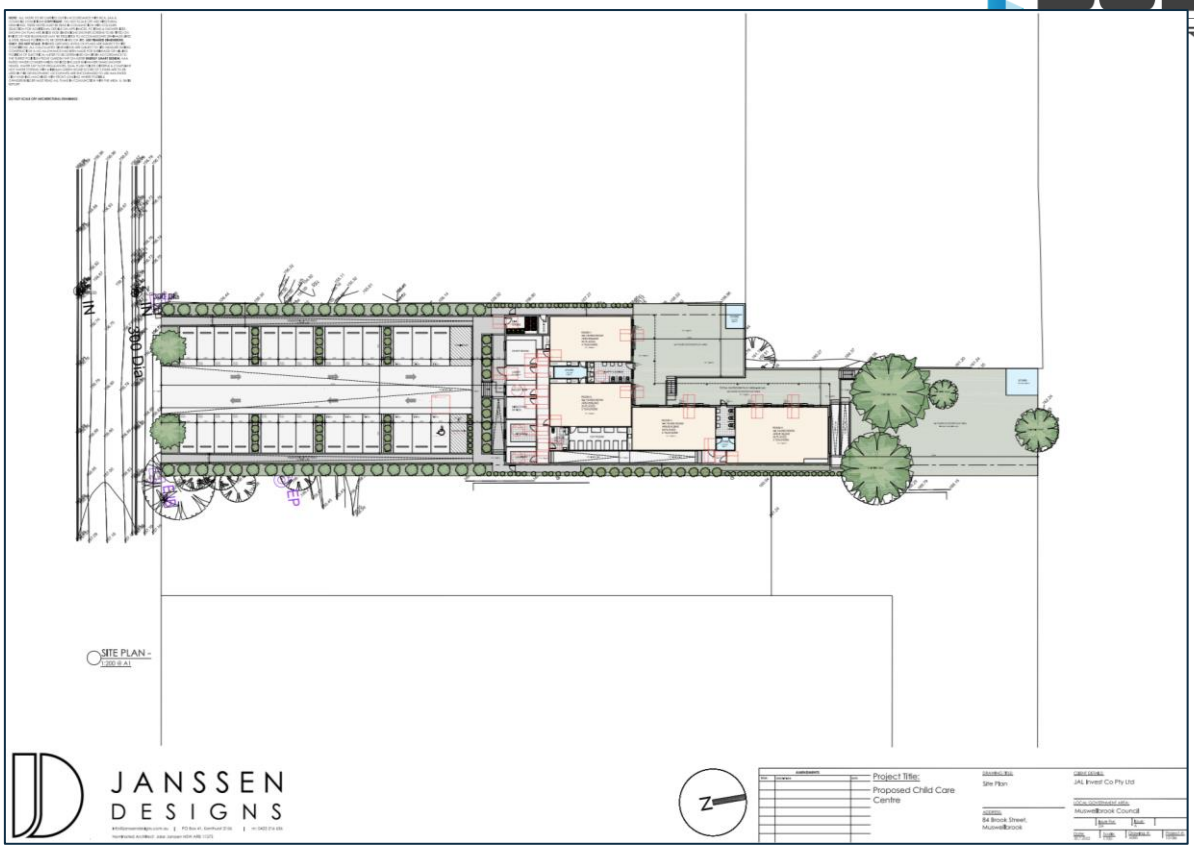

Figure 3 – Extract of 'Site Plan' [Source: Janssen Designs, Project # 10186, Dwg # A000, Issue A, 20/07/2022]

Existing Acoustic Environment

Potentially Affected Receivers

3. The sensitive receivers potentially most affected from noise from the source under consideration are listed in Table 3 and shown in the aerial image of the surrounding area in Figure 4.

Table 3 Table of potential affected receivers

3.1

Receiver ID	Receiver Type	Address
R01	Commercial	Hunter Medical Practice, Lot 12 DP 232742, 80 Brook Street, Muswellbrook
R02	Residential	Lot 11 DP 232742, 17A Sowerby Street, Muswellbrook
R03	Residential	Lot 10 DP 232742, 17 Sowerby Street, Muswellbrook
R04	Residential	Lot A DP 158239, 19 Sowerby Street, Muswellbrook
R05	Residential	Lot 562 DP 548054, 21 Sowerby Street, Muswellbrook
R06	Residential	Lot 561 DP 548054, 23 Sowerby Street, Muswellbrook
R07	Active recreation area (playground)	Muswellbrook Pre-School Kindergarten Inc., Lot 1 DP 1210371, 109-111 Hill Street and 25-27 Sowerby Street, Muswellbrook
R08	Residential	Lot 456 DP 601491, 6 Hillview Avenue, Muswellbrook
R09	Residential	Lot 40 DP 832062, 88A Brook Street, Muswellbrook
R10	Residential	Lot 86 DP 1104667, 86 Brook Street, Muswellbrook
R11	Residential	Lot 41 DP 832062, 88 Brook Street, Muswellbrook
R12	Residential	Lot 61 DP 604944, 87 Brook Street, Muswellbrook
R13	Residential	Lot 71 DP 536365, 85 Brook Street, Muswellbrook
R14	Residential	Lot 202 DP 1034323, 83 Brook Street, Muswellbrook
R15	Residential	Lot 1 DP 162474, 81 Brook Street, Muswellbrook
R16	Commercial / Residential	Sivanart Holistic Living, 1/79 Brook Street, Muswellbrook

Figure 4 – Existing site allotment (shaded) and surrounding area, potentially affected receivers, and monitoring location [Source: Spatial Services, NSW Department of Finance and Services, 2022]

3.2. Unattended Sound Measurement Location

To determine the required appropriate site-specific sound levels of the project, one unattended sound logger was left on-site for seven days, from 3 November 2022 to 10 November 2022. The sound monitoring location in the southern portion of the site is shown in Figure 4 and Figure 5. The intent of this location was to determine the ambient noise levels – local road traffic, domestic and commercial mechanical plant, urban activity, and natural sounds – and to determine site specific Rating Background Noise Levels (RBLs).

Figure 5 Logger Location – 84 Brook Street, Muswellbrook

3.3. Sound Monitoring Equipment

BSE have undertaken unattended sound measurements in preparing this assessment using a Class 1 instrument, compliant with *IEC61672-1:2013 Electroacoustics – Sound level meters – Part 1: Specifications*, and within current NATA calibration at the time of the monitoring.

The sound logger was set to the "A-weighted" frequency weighting, the "Fast" time response, and was calibrated before and after use, using a NTi CAL200 S/N:17897 94 dB, 1 kHz tone, with no significant drift occurring. The sound logger serial number and calibration information are presented in Table 4.

Table 4 Noise Logger Calibration Information

Instrument model	Serial number	NATA Calibration certificate: issue date	Pre-Calibration [dB]	Post-Calibration [dB]
Rion NL-52EX	00710353	Nov 2021	94.0	93.8
NTi CAL200	17897	Feb 2021	-	-

Meteorological data for the project was sourced from the Bureau of Meteorology's Scone Airport Automatic Weather Station (AWS), IDN61363 and Singleton Defence AWS, IDN061430. As required by the NSW Environmental Protection Authority's (EPA), all weather affected measurements with wind speeds > 5 m/s and rainfall events were deleted from the data set.

Following analysis, the overall L_{eq} ambient levels and Rating Background Levels (RBL) measured for day, evening, and night periods are shown in Table 5.

Table 5 Overall L_{eq} ambient levels and Rating Background Levels (RBL)

	Day	Evening	Night
RBL [$L_{90, period}$ dB(A)]	42	35	28
Leq [$L_{eq, period}$ dB(A)]	55	52	49

Measurement and determination of the existing road traffic noise levels, $L_{Aeq, 1 hour}$, $L_{Aeq, 9 hour}$ and $L_{Aeq, 15 hour}$ are shown in Table 6.

Table 6 L_{eq} Road Traffic Noise levels

Day period 07:00 – 22:00		Night period 22:00 – 07:00	
$L_{eq, 15 hours}$ dB(A)	**$L_{eq, 1 hour}$ dB(A)**	**$L_{eq, 9 hours}$ dB(A)**	**$L_{eq, 1 hour}$ dB(A)**
54	56	48	53

Measurement and determination of the $L_{A90, 24hr}$ sound pressure level, as shown in Table 7, was required to assess against council's DCP, section 18.2.2.

Table 7 $L_{90, 24 hours}$ sound pressure level

$L_{90, 24 hr}$ dB(A)
29

4. Muswellbrook Shire Council Development Consent Condition

Under the *NSW Protection of the Environment Operations Act* 1997 (POEO), the NSW EPA, has the responsibility to issue policy statements to set out criteria and methods of management for noise within the state. Muswellbrook Shire Council continues to use its powers under the PEOA to enforce noise controls in the community.

4.1. The assessment is required to address specific noise related criteria within *Section 18 Child Care Centres* of the *Muswellbrook Shire Development Control Plan*. So that the childcare centres fit within the context of Muswellbrook Shire and any potential impacts are minimised, Section 18 supplements the performance-based standards of the State Government Children's Services Regulation 2004, the Building Code of Australia (Child Care Centres, class 9b buildings) and Australian Standard 1428.3.

4.1.1. Section 18.2.2 Air Quality

To meet the objectives of '*no exposure to pollutants that could have an adverse health impact'* it is required to demonstrate reduction measures for Child Care Centres located on *'…sites where the external noise level exceeds 55 dB(A) (L90 24 hours).'* Where required, the reduction measures to be demonstrated are:

- double glazing on windows
- mechanical ventilation and air-conditioning systems
- play areas located away from noise and pollution

4.1.2. Section 18.4 Acoustic Privacy

The objectives for acoustic privacy are '*Noise levels (measured at any point on the boundary of the site between the proposed Centre and adjoining property) do not exceed 5 dB(A) above the L90 background level during the hours of operation.'*

Controls include:

(i) Locate noisy areas such as outdoor space, vehicle access and pathways away from windows of adjoining dwellings
(ii) Appropriate noise reduction measures are utilised
(iii) Demonstrate compliance with operating noise levels by providing a report on noise levels prepared by a suitably qualified consultant.

4.2.

The Association of Australian Acoustical Consultants Guideline for Child Care Centre Acoustic Assessment

4.2.1. Site Emitted Noise Criteria

The Association of Australian Acoustical Consultants (AAAC) Guideline for Child Care Centre Acoustic Assessment (the GCCCAA), Version 3.0, September 2020, assists Councils in the assessment of the potential noise impacts from Child Care Centres accurately and fairly. Council Compliance Services divisions give credence to and adopt the AAAC guideline method for acoustic assessment of childcare centres.

'The objectives of the guideline are:

- *To protect the reasonable acoustic privacy of nearby residents in their dwellings and private open spaces;*

- *To provide noise goals and noise control recommendations to ensure that a child care centre in a residential area does not generate unacceptable noise levels to adversely impact on residents within adjoining properties and other properties close to the site; and*
- *To protect children from excessive noise which may be experienced due to the close proximity to high noise environments, including busy roads, aircraft or rail operations, and commercial and industrial premises.'*

Childcare centres typically operate from 7:00 am to 6:00 pm, Monday to Friday for up to 52 weeks per year, however, operational hours can vary slightly from centre to centre.

To protect the acoustic amenity of specific land uses, the GCCCAA establishes separate noise criteria based around an emergence above the background noise level, to meet environmental noise objectives to account for noise resulting from external play activities, indoor play activities, pick-up and drop-off activities, mechanical plant, and site related traffic noise on local roads. The site emitted noise assessment criteria are summarised in Table 8, below.

For Residential receptors, the assessment location of the emergent noise is defined within the GCCCAA as *'the most affected point on or within any residential receiver property boundary. Examples of this location may be:*

- *1.5 m above ground level;*
- *On a balcony at 1.5 m above floor level;*
- *Outside a window on the ground or higher floors.'*

To account for line-of-sight obscuring that may potentially arise from building façades adjacent to fences and as a refinement to the stated 1.5 m above floor level assessment location, the accepted noise intrusion assessment location at potentially affected receiver windows proximate to fences is taken at 300 mm down from the top window-sill.

For Commercial receptors, the assessment location of the emergent noise is defined within the GCCCAA as *'the most affected point at or within any commercial property boundary.'*

Based upon the criteria determined from the unattended measured RBL noise levels shown in Table 5, the derived operational noise criteria for the project are shown in Table 8.

Table 8 Summary of noise assessment criteria [the AAAC GCCCA, 2020]

Noise Source Type	Rating background level (RBL), $L_{A90,\ 15\ minute}$ Day Period (7:00 – 18:00)	Assessment criteria, dB(A)	
		Condition	Criterion
Residential Receivers			
Outdoor Play Area	42	≥ 2 hours outdoor play per morning and afternoon; Up to 4 hours (total) per day [≤ RBL_{period} plus 10 dB]	52 $L_{Aeq,\ 15\ minute}$
		More than 4 hours outdoor play per day [≤ RBL_{period} plus 5 dB]	47 $L_{Aeq,\ 15\ minute}$
Internal play area, mechanical plant, on-site traffic (drop off and pick up), other activities/operations (not including outdoor play)[1]		Cumulative noise impact [≤ RBL plus 5 dB]	47 $L_{Aeq,\ 15\ minute}$
Road Traffic Noise[2]		Site associated road traffic noise on local roads	50 $L_{Aeq,\ 1\ hour}$ (external)
Commercial Receivers			
Outdoor Play Area, Internal Play Area, Mechanical Plant and On-site Traffic[3]	-	Individual and/or cumulative noise impact	65 $L_{Aeq,\ 15\ minute}$
Other Sensitive Receivers			
Other sensitive uses including schools, hospitals, places of worship and parks (active and passive) From all activities (including outdoor play)	-	Assessed at the most affected point on or within the sensitive property boundary	65 $L_{Aeq,\ 15\ minute}$
		Internally, with windows or doors of the sensitive receiver open	45 $L_{Aeq,\ 15\ minute}$

Note: 1. The cumulative $L_{Aeq,15\ minute}$ noise emission level resulting from the use and operation of the childcare centre, except for noise emission from outdoor play.

2. *'Traffic noise on local roads generated by vehicles associated with the childcare centre arriving and leaving the site (for example vehicles travelling on public roads)...'* GCCCAA.

3. As per the NSW Government Department of Environment, Climate Change (at the time), A*pplication notes – NSW Industrial Noise* Policy. The section titled, *How to account for operations that only occur for part of the day, evening or night*, outlines that the assessment and applicable criteria are based on only the hours that the activity occurs. In this case, the childcare centre is open from 7:00 to 18:00, so the applicable criteria are derived from background noise levels within this period equating to the entire 'day' period of 7:00 – 18:00, resulting in a Rating Background Level (**RBL**) of **42 $L_{A90,\ period}$**.

To account for the potential worst-case operational scenario, this NIA predicts the noise levels emitted from children playing outside for more than four hours a day. Therefore, the applicable outdoor play area criterion for residential receivers is $L_{Aeq,\ 15\ minute}$ ≤ RBL plus 5 dB, in this case equating to **47 $L_{Aeq,\ 15\ minute}$**.

4.2.2. External Noise Impact on Children

4.2.2.1 GCCCAA external noise intrusion impacts on children in the centre

For proposals that are located within 60 meters of an arterial road, railway line, industry or within close proximity to an airport, a noise assessment should be submitted with the development application. The AAAC GCCCAA 2020 also sets out criteria for the assessment of external noise intrusion impacts on children in the centre. The external noise impact assessment criteria are summarised in Table 9.

With consideration to Council's noise intrusion criterion as stated in Section 4.1.1, the most critical noise intrusion criterion is adopted herein.

Table 9 Summary of external noise impact assessment criteria [Association of Australian Acoustical Consultants Guideline for Child Care Centre Acoustic Assessment, 2020]

Noise Source Type	Assessment criteria, dB(A)	
	Condition	**Criterion**
Receivers within the outdoor play or activity area		
Road traffic, and/or rail traffic, and/or industry	Any location within the *outdoor* play or activity area of the Centre during the hours when the Centre is operating	≤ 55 $L_{Aeq,\ 1\ Hour}$
Receivers within the indoor play or sleeping areas		
Road traffic, and/or rail traffic, and/or industry	Any location within the *indoor activity* areas of the Centre during the hours when the Centre is operating shall be capable (i.e., with doors and/or windows closed)	≤ 40 $L_{Aeq,\ 1\ Hour}$
	Any location within the *indoor sleeping* areas of the Centre during the hours when the Centre is operating shall be capable (i.e., with doors and/or windows closed)	≤ 35 $L_{Aeq,\ 1\ Hour}$
Aircraft	In accordance with Australia Standard AS 2021, the L_{ASmax} (i.e., the A-weighted, maximum, sound pressure level, measured at the 'slow' sample rate) noise level contribution from aircraft at any location within the *indoor play* or *sleeping areas* of the centre during the hours when the Centre is operating	≤ 50 L_{ASmax}

4.2.3. Noise assessment requirement trigger discussion

As noted above, Section 7 of the AAAC GCCCAA 2010 states that, '*For proposals that are located within 60 meters of an arterial road or railway line a noise assessment should be submitted with the development application.*' In this case, the site is situated greater than 60 m from the nearest arterial road (~283 m east of A15 New England Highway) and rail corridor (~400 m) and therefore the requirement for the assessment of external noise intrusion impacts on children in the centre is not triggered.

The surrounding road network, classification under the Roads and Maritime Services' (RMS) *Schedule of Classified Roads and Unclassified Regional Roads'* (the Schedule) and site offset distance are as follows:

- Brook Street, along the southern site boundary is classified as a *local road* and does not trigger the noise assessment requirement. Local Roads are unclassified roads and therefore are not included in the Schedule.
- Bridge Street (New England Highway) is an *arterial road* as it is a Classified Road in the Schedule as a 'Highway,' however, it is situated approximately 283 m from the site and does not trigger the noise assessment requirement.

5.1.1. Methodology and Assumptions

5.

Based on site specific circumstances – the topography of intervening terrain, meteorological conditions, ground types and appropriate absorption, foliage, existing and proposed infrastructure, buildings and structures, and attenuation factors – a 3D computer environmental noise model was created of predicted site activities using ISO 9613−2 (1996) outdoor propagation methodology. Modelling parameters included: temperature 10°C (winter), humidity 85%; per receiver, wind direction from source to receiver enhancements and temperature inversions – where applicable.

On-site boundary fence heights were modelled as per those existing and proposed on site plans. The proposed boundary fences were modelled at 1,800 mm high.

The sound power levels (L_W re: 1 pW) of the various noise sources assumed for the childcare centre were taken from those outlined in the GCCCAA and from company databases.

5.1.2. $L_{eq,\ 15min}$ dB(A) Acoustic Descriptor Discussion

The modelling of the site emitted noise as per the acoustic descriptor, $L_{eq,\ 15\ min}$ dB(A), as specified in Section 5.5, requires discussion. The $L_{eq,\ 15\ min}$ dB(A) descriptor represents the logarithmic sound energy average – energy equivalent – over any 15-minute period of the modelled site sound contribution that is received at an assessed receiver.

For short-term discontinuous noise sources that also vary in sound pressure level (SPL) over time, such as child play activity, the received SPL over time is the logarithmic average cumulation of the acoustic contribution of each individual sound event.

When assessing annoyance from noise, humans are not able to process $L_{eq,\ 15\ min}$ contributions in their head taking account of all the variable components including event time duration, SPL level per event, frequency contribution per event and respective contribution to the ambient at that time.

The nature of children play activity noise is short-term, intermittent, and discontinuous source events that also vary in sound pressure level per event. The representative sound power level of children play activity noise was sourced from the GCCCAA.

To provide Council with confidence in the potential site noise predictions, a Monte Carlo probability simulation methodology has been applied to the site modelling outcomes resulting from the children play areas. In the simulation, per play area, the uncertain inputs (which of all the possible children may make noise in any second, and if so, then at what loudness level) are described using probability distributions. The output (the predicted $L_{eq,\ 15\ min}$ dB(A), refer Table 13) also becomes a probability distribution. Each iteration is repeated 900 times (to represent *each second* in a 15-minute period, that is, the $L_{eq,\ 1\ sec}$ dB(A)) to result in the cumulative $L_{eq,\ 15\ min}$ dB(A). The output is then repeated multiple times further to ensure a robust prediction and confidence in the received site noise contribution.

5.1.3. Children – Play Activity

The effective sound power levels for groups of ten children playing, within different age groups, is given below in Table 10. The modelled noise sources were assumed to be approximately 1 m above the relative ground height equating to the children's average height.

Table 10 Effective Sound Power Levels for Groups of 10 Children Playing [$L_{Aeq,\ 15\ minutes}$ dB(A)]

Number and Age of Children	Overall Sum [dB(A)]	Sound Power Levels [dB] at Octave Band Centre Frequencies [Hz]							
		63	125	250	500	1K	2K	4K	8K
10 Children - 0 to 2 years	78	54	60	66	72	74	71	67	64
10 Children - 2 to 3 years	85	61	67	73	79	81	78	74	70
10 Children - 3 to 5 years	87	64	70	75	81	83	80	76	72

As the criterion for outdoor play is assessed over a 15-minute period, the worst-case scenario over the four hours cumulative external play activities equates to any 15-minute period where the maximum number of children are outside and playing continuously.

The worst-case proposed external play activities were modelled by a representative array of the maximum number of children, per age group, distributed evenly throughout the specific external playing areas of the centre. As the sound power levels provided within the GCCCAA are for groups of ten children playing, to obtain a representative noise level for a group of children of less than 'ten', the individual sound power from a single child was derived from the group of ten result by assuming a logarithmic equivalent contribution from ten separate sources then calculating the contribution from the required number of children.

Internal activities of the centre were modelled as noise radiating from building element components based on the building plans and proposed building layout and room usage configuration. The worst-case internal play activities were modelled by a representative array of the proposed maximum number of children within each of the playrooms.

5.1.4. Mechanical Plant

Ideally the proposed mechanical plant should be designed and selected specifically for the project, however, it is not uncommon for the mechanical plant to not be selected prior to submitting a development application. Mechanical plant may include air-conditioning, exhaust systems, and heat pumps. A typical range of sound power levels for mechanical plant is given below in Table 10.

Table 11 Sound Power Levels for Mechanical Plant [L_{Aeq}]

Mechanical Plant Item	SWL [L_{Aeq} dB, re: 1 pW]
Small (single fan) condenser (outdoor unit)	65
Medium (double fan) condenser (outdoor unit)	70
Large (double fan) condenser (outdoor unit)	80
Small exhaust fan (toilet, garbage room)	60
Small kitchen exhaust fan	70
Carpark exhaust fan	85

As the location of proposed location of mechanical plant units was not shown on the site plans, mechanical plant noise shall be addressed in the detailed design stage informed by the site-specific criteria derived herein. Available acoustic attenuation measures include selection – of the quietest plant to suit operation requirements – and orientation, cowlings, screens and/or partial acoustic enclosures.
Further to required detailed design considerations and subject to the location and selection of final plant items, it is anticipated that mechanical plant noise can be achieved through typical engineering measures such as:

- Selection of suitable setback distances / distance attenuation
- Selection of quiet plant and equipment
- The use of building shielding or rooftop shielding
- The use of barriers and/or screens
- The use of variable speed plant/equipment
- The use of attenuators and or internally lined ductwork, where applicable.

This will be further developed during the detailed design phase of the project; however, it is anticipated that these measures will be sufficient to meet project specific noise levels for this development.

5.1.5. Vehicles Within Premises

The noise from cars and small delivery vans arriving at the centre may be a significant source of noise and should be considered. Typical sound power levels for vehicles within the car park area of a childcare centre, sourced from the GCCCAA, are given below in Table 12. On-site car park movements were modelled assuming a worst-case scenario where all proposed centre staff arrive/depart within the same assessment period in either the morning or afternoon, resulting in 17 vehicle activity sources.

Table 12 Sound Power Levels for Mechanical Plant [L_{Aeq}]

Mechanical Plant Item	SWL [L_{Aeq} dB, re: 1 pW]
Car	81
Delivery Van	86

5.1.6. Modelled Vehicle Noise

As above, site related traffic road traffic noise along Brooks Street were modelled assuming a worst-case scenario where all arrive/depart en masse, within a one-hour period in either the morning or afternoon, resulting in 17 additional vehicle trips along the local road. This is a worst-case scenario, as there are fewer visitor car spaces – nine – and it is likely that some children shall arrive and depart the site as pedestrian traffic.

5.1.7. Sleep Disturbance – Night Period

As no site activity is proposed to occur within the night period, no sleep disturbance assessment was undertaken.

Site Emitted Noise Impacts

6.1.1. Outdoor Play Activities

6.

6.1

The results of the worst-case proposed external play activities modelled by a representative array of the maximum number of children allocated for that area, distributed evenly throughout the specific external playing area, are shown in Table 13. That is, the cumulative noise impact from 20 children in the 0-2 years outdoor play area, 20 children in the 2-3 years outdoor play, and 50 children in the 3-6 years outdoor play area, respectively.

The modelling results of external playground activities indicate that compliance with adopted noise goals is predicted at the assessed receivers.

Table 13 – Modelled noise contribution of external play activity for more than 4-hours a day at potentially noise affected receivers, $L_{Aeq,\ 15\ min}$, dB(A).

ID	Receiver Type	Criterion $L_{Aeq,\ 15\ min}$, dB(A)	Predicted Noise Level $L_{Aeq,\ 15\ min}$, dB(A)	Compliance
R01	Commercial	65	-	Yes
R02	Residential	47	-	Yes
R03	Residential	47	26	Yes
R04	Residential	47	29	Yes
R05	Residential	47	29	Yes
R06	Residential	47	26	Yes
R07	Active recreation area (playground)	65	27	Yes
R08	Residential	47	29	Yes
R09	Residential	47	18	Yes
R10	Residential	47	-	Yes
R11	Residential	47	-	Yes
R12	Residential	47	-	Yes
R13	Residential	47	-	Yes
R14	Residential	47	-	Yes
R15	Residential	47	-	Yes
R16	Residential / Commercial	65	-	Yes

6.1.2. Internal Play Area, Mechanical Plant & On-site Traffic

The results of the modelled site noise contribution at the potentially worst affected receivers, resulting from the cumulative impact from internal play area, site mechanical plant (refer section 5.1.4) and on-site traffic noise are shown in Table 14.

Table 14 – Modelled internal play area, mechanical plant, and on-site traffic noise contribution at potentially noise affected residential receivers, $L_{Aeq,\ 15\ min}$, dB(A)

ID	Receiver Type	Criterion LAeq, 15 min, dB(A)	Predicted Noise Level LAeq, 15 min, dB(A)	Compliance
R01	Commercial	65	34	Yes
R02	Residential	47	37	Yes
R03	Residential	47	33	Yes
R04	Residential	47	27	Yes
R05	Residential	47	24	Yes
R06	Residential	47	19	Yes
R07	Active recreation area (playground)	65	18	Yes
R08	Residential	47	23	Yes
R09	Residential	47	22	Yes
R10	Residential	47	39	Yes
R11	Residential	47	29	Yes
R12	Residential	47	35	Yes
R13	Residential	47	37	Yes
R14	Residential	47	37	Yes
R15	Residential	47	37	Yes
R16	Residential / Commercial	65	37	Yes

The results of modelled internal play area, mechanical plant (refer section 5.1.4) and on-site traffic noise contribution at potentially noise affected residential receivers indicate predicted compliance to the noise criteria.

6.1.3. Site Road Traffic Noise on Local Roads

The results of the modelled site related road traffic noise contribution at the residential receivers along Brooks Street are shown in Table 15.

Table 15 – Modelled site related road traffic noise contribution at Brooks Street residential receivers [$L_{Aeq,\ 1\ Hour}$, dB(A)]

ID	Receiver Type	Criterion LAeq, 1 Hour, dB(A)	Existing Noise Level contribution LAeq, 1 Hour, dB(A)	Predicted Noise Level contribution LAeq, 1 Hour, dB(A)	Cumulative existing and predicted façade noise level LAeq, 1 Hour, dB(A)
R10	Residential	50	56	43	56
R11	Residential	50	56	44	57
R12	Residential	50	59	46	59
R13	Residential	50	60	47	61
R16	Residential	50	60	48	60

Note: There are currently no dwellings constructed at locations R14 and R15.

The results of modelled site related road traffic noise contribution at the residential receivers along Brooks Street indicate predicted compliance to the noise criteria. Note that existing road traffic noise levels along Brooks Street already exceed the local road noise criterion. The cumulative impact including the worst-case site noise contribution results in a negligible increase to existing levels.

Noise intrusion impacts on children in the centre

6.2.

As discussed in Section 4.2.3 of this report the proposed development site is not situated within 60 m of an arterial road nor railway corridor and therefore the requirement for the assessment of external noise intrusion impacts on children in the centre is not triggered when assessed against the requirements of Section 7 of the GCCCAA.

The potentially worst affected internal learning / sleeping areas are the playrooms 1 through 4 with road traffic noise intrusion through the external building façades that receive noise from road traffic along Brooks Street.

The modelled worst-case $L_{Aeq,\ 1\ Hour}$ road traffic noise level at the proposed façades of the playrooms was 44 dB(A).

Assuming the windows are closed and even if composed of a minimum thickness float glass construction, the internal road traffic noise level within the playrooms would comply with the 40 dB(A) and 35 dB(A) criteria when used as either as a learning area or sleep room, respectively.

Assuming the windows are opened sufficiently to provide adequate ventilation and adopting the accepted difference of noise level at the centre of the habitable room being 10 dB below external noise levels[1], then the internal road traffic noise level within the playrooms 1 and 2 would comply with the 40 dB(A) and 35 dB(A) criteria when used as either a learning area of sleep room respectively.

[1] NSW Industrial Noise Policy, Section 2.2.1 *Notes to support the noise level tables.*

7. Conclusion

A noise impact assessment was undertaken of the Centre-based Child Care Facility proposed to be situated at 84 Brook Street, Muswellbrook, NSW.

Residential Receivers – Outdoor Play Activities

The results of the modelling of external play activities for more than four hours, indicate predicted compliant noise levels at the assessed receivers.

Residential Receivers – Internal Play Area, Mechanical Plant and On-site Traffic

The results of modelling of the cumulative noise impact of proposed internal activities and on-site traffic at potentially noise affected residential receivers indicate predicted compliance to the noise criteria. As the location of proposed location of mechanical plant units was not shown on the site plans, mechanical plant noise shall be addressed in the detailed design stage informed by the site-specific criteria derived herein.

Residential Receivers – Site related traffic noise on local roads

The results of modelled site related road traffic noise contribution at the residential receivers along Brooks Street indicate predicted compliance to the noise criteria.

External Noise Impact on Children – Road, Rail Traffic, and Industry

The site meets Council's objective of 'no exposure to pollutants that could have an adverse health impact' demonstrating that the external noise level does not exceed 55 dB(A) (L90 24 hours).

The proposed development site is not situated within 60 m of an arterial road nor railway corridor and therefore the requirement for the assessment of external noise intrusion impacts on children in the centre is not triggered when assessed against the requirements of Section 7 of the GCCCAA. Nonetheless, the $L_{Aeq,\ 1\ Hour}$ road traffic noise level within the potentially worst affected internal learning / sleeping areas – playrooms 1 through 4 – was assessed and shown to comply when windows were either open or closed.

A. Appendix A – Acoustic Terminology

Absorption
The properties of a material composition to convert sound energy into heat, thereby reducing the amount of energy that can be reflected.

Airborne Noise
A condition when sound waves are being carried by the atmosphere.

Attenuation
The reduction of sound energy as a function of distance travelled.

A-Weighted Sound Level (Noise level)
A measure of sound pressure designed to reflect the response of the human ear, which does not respond equally to all frequencies. The ear is less efficient at low and high frequencies than at medium or speech-range frequencies. To describe sound in a manner representative of the human ear's response.

Barrier
A material that when placed around a source of noise inhibits the transmission of that noise beyond the barrier. Also, an environment or any physical thing that interferes with communication or listening.

Decibel (dB)
Sound level in Bels as a logarithmic ration. Relative quantity of sound intensity compared to a standard unit used as a reference. The decibel or dB cannot be used by itself. Both the quantity considered (sound power level or sound pressure level) and the standard unit used as a reference must be specified when the decibel is used.

Frequency
The number of oscillations or cycles per unit of time. Acoustical frequency is usually expressed in units of Hertz (Hz) where one Hz is equal to one cycle per second.

Hertz (Hz)
Frequency of sound expressed by cycles per second.

Intensity Level (LI) (IL)
A measure of the acoustic power passing through a unit area expressed on a decibel scale referenced to some standard (usually 10-12) watt per square meter.

Noise Reduction Coefficient (NRC)
The NRC of an acoustical material is the mathematical average, to the nearest multiple of 0.05, of its absorption coefficients at center frequencies of 250,500,1000, 2000 Hertz Octaves.

Octave Bands
Sounds that contain energy over a wide range of frequencies are divided into sections called bands. A common standard division is in 10 octave bands identified by their center frequencies 63, 250, 500, 1000, 2000, 4000 and 8000 Hz.

Sound Level
A subjective measure of sound expressed in decibels as a comparison corresponding to familiar sounds experienced in a variety of situations.

Sound Pressure Level (SPL)
An important measure of sound loudness, the level is calculated in decibels by 20 times the logarithm to the base 10 of the ratio of the measured sound pressure level and the reference point.

Sound Level Meter
A device that converts sound pressure variations in air into corresponding electronic signals. The signals are filtered to exclude sound waves outside the desired frequencies.