Project No: 201937R

Noise Assessment
Proposed Child Care Centre
Thorncliffe Avenue, Thornton, NSW

Prepared for:

Landlink
28 to 30 Bolton Street
Newcastle NSW 2300

Author:

Ross Hodge
B.Sc.(Hons), MAAS
Principal / Director

Review:

Neil Pennington
B.Sc., B. Math.(Hons), MAAS
Principal / Director

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1.0 - INTRODUCTION

This report presents the results, findings and recommendations arising from an acoustic assessment of the proposed operation of a child care centre at Lots 722, 723 and 724, D.P. 10419, Thorncliffe Avenue, Thornton, NSW. The proposal is to construct a purpose built child care centre on the site.

The investigation was requested by Landlink Property Pty Ltd to support a Development Application to Maitland City Council (MCC).

Under the proposal the centre will cater for up to 132 children with normal operating hours being Monday to Friday between 6.30 am and 6.30 pm.

Modern child care centres function as early learning facilities rather than simply for child minding. As such, there is emphasis on the guided development of children with organised activities and set objectives. Typically, children will be distributed throughout play areas in supervised groups. From an acoustic point of view this means there is no unrestricted play time during which children could create excessive noise. Activities are supervised at all times by qualified and trained staff members.

The Department of Family and Community Services ensures that child care centres comply with the Children's Services Regulation 2004. Under this regulation services must comply with the NSW Cancer Council guidelines which state "Care should be taken to minimise the time spent outdoors between 11 am and 3 pm daylight saving time (10 am and 2 pm Eastern Standard Time), when daily UVR levels are generally at their peak".

As a result of these guidelines children are not typically outside during the hours outlined or if they are then usually for relatively short periods. The time spent outdoors is also subject to weather conditions.

The indoor areas of the buildings will be mechanically ventilated. For security reasons all doors and windows will remain closed whilst the children are indoors.

A car park will be located at the eastern side of the site with access from Thorncliffe Avenue.

2.0 - TERMS AND DEFINITIONS

Table 1 contains the definitions of commonly used acoustical terms and is presented as an aid to understanding this report.

TABLE 1 DEFINITION OF ACOUSTICAL TERMS	
Term	Definition
dB(A)	The quantitative measure of sound heard by the human ear, measured by the A-Scale Weighting Network of a sound level meter expressed in decibels (dB).
SPL	Sound Pressure Level. The incremental variation of sound pressure above and below atmospheric pressure and expressed in decibels. The human ear responds to pressure fluctuations, resulting in sound being heard.
STL	Sound Transmission Loss. The ability of a partition to attenuate sound, in dB.
Lw	Sound Power Level radiated by a noise source per unit time re 1pW.
Leq	Equivalent Continuous Noise Level - taking into account the fluctuations of noise over time. The time-varying level is computed to give an equivalent dB(A) level that is equal to the energy content and time period.
L1	Average Peak Noise Level - the level exceeded for 1% of the monitoring period.
L10	Average Maximum Noise Level - the level exceeded for 10% of the monitoring period.
L90	Average Minimum Noise Level - the level exceeded for 90% of the monitoring period and recognised as the Background Noise Level. In this instance, the L90 percentile level is representative of the noise level generated by the surrounds of the residential area.

3.0 – NOISE CRITERIA

3.1 Child Care Centre

In the absence of specific council DCP's in NSW, there are no detailed regulations or guidelines that cover the operation of a child care centre. The facility will operate as a commercial enterprise and, as such, guidance for the assessment of noise impacts has been taken from the Noise Policy for Industry (NPfI). Guidance is also taken from the Association of Australian Acoustical Consultants (AAAC) "Child Care Centre Noise Assessment Technical Guideline".

The NPfI advises that noise emissions from commercial premises should ideally not exceed the ambient background noise levels by more than 5 dB, with a maximum recommended level of ambient background level + 10 dB at residential receivers.

The issue of noise emissions from child care centres was included in a discussion paper prepared by the Southern Sydney Regional Organisation of Councils (SSROC) in 2005. As stated in the discussion paper, an assessment of 13 Land and Environment Court cases relating to child care centres revealed the following quotation from a Court judgement:

Council may require that a suitably qualified acoustic consultant undertake an acoustic assessment, which includes recommended noise attenuation measures.

Noise readings (measured at any point on the boundary of the site between the proposed Child Care Centre and adjoining property), should not exceed 10 dB(A) above the background noise levels during the hours of operation of the Centre. The noise measurements are to be measured over a 15-minute period and are to be undertaken in accordance with the requirements of the NSW Department of Environment and Conservation (now OEH).

The setting of 'background + 10dB' as a maximum noise limit does not conflict with OEH recommendations as set out in the NPI and will be adopted in this assessment. (For a theoretical assessment, the recommendations apply to noise *calculations* instead of noise *readings*).

The assessable noise level is a 15-minute 'average' (Leq) level and is applicable to the total of all noise emissions from within the site boundary, including children playing, cars on the on-site section of the access driveway and the car park itself.

A criterion of 'background + 5dB' will be applied to constant daytime noise sources (i.e. mechanical plant), in line with the normal OEH requirement, to allow for the 'background + 10dB' emissions from the playground and car park without significantly exceeding the overall criterion.

The SSROC discussion paper also noted that:

Noise from children playing was a common issue before the court. The court generally imposed a condition that noise not exceed background noise + 10dB.

In order to achieve this standard, several acoustic reports submitted to the court recommended that the time spent by children in the outdoor play areas be limited. Some consents limited outdoor play to 2 hours per half day.

In order to establish suitable noise limits, ambient noise monitoring was conducted at the site between 11 and 18 March 2020, as part of the assessment of noise impacts for the proposed subdivision in which the child care centre is to be located.

A Rion EL 215 noise logger was located in the free field on the vacant block adjacent to Raymond Terrace Road at a distance of approximately 12m from the edge of the closest lane of traffic. This

location had full line of sight to both lanes of traffic on Raymond Terrace Road.

The logger was programmed to continuously register environmental noise levels over 15 minute intervals with internal software calculating and storing L_n percentile noise levels for each sampling period.

Observations made during a site investigation indicated that the acoustic environment of the area was dominated by traffic noise from nearby roads. The logger data shows that the noise levels in the area increase relatively sharply from early morning, corelating to an increase in commuter traffic.

The proponent has indicated that the facility will only operate from Monday to Friday, during the day, early evening and night (early morning) time periods.

Procedures in the NPfI detail that, in setting noise criteria for a particular project, the background noise levels need only be considered for those times when the project entity will be operating.

For the current assessment, the child care centre will only operate at night during the period from 6.30 to 7.00am. The background noise level for "night time" shown in **Table 2** represents the measured logger data for that period only.

All further discussion on night time noise levels and the derivation of a noise criterion for that period is also based on the data for that period only.

Table 2 shows a summary of the relevant measured data (in light of the discussion above). The data is shown graphically in **Appendix I**. A full set of logged data is not included in this report but is available on request.

TABLE 2
LOGGED NOISE LEVELS

	Ambient Noise Levels dB(A)		
Percentile	Day	Evening	Night
L_{90}	52	41	54[1]
L_{eq}	68	64	62

1 - see text in relation to "night time"

As indicated above, the noise levels shown in Table 2 were measured in March 2020 for the assessment of traffic noise impacts on the, then, proposed subdivision. That assessment was detailed in Spectrum Acoustics report number 201937R/28883, dated March, 2020. The assessment concluded that a 2.1m acoustic barrier should be

constructed along the boundary of the site with Raymond Terrace Road.

With the barrier in place there would be a 9 dB(A) reduction in traffic noise at the facade of the closest proposed residences to Raymond Terrace Road. Applying his noise reduction to the measured levels would give the adopted noise levels shown in **Table 3**. It should be noted that the reduction in the background noise (L90) would be less than 9 dB (A), but applying this will afford a degree of conservatism to the overall assessment of impacts.

TABLE 3
ADOPTED NOISE LEVELS

	Ambient Noise Levels dB(A)		
Percentile	Day	Evening	Night
L_{90}	43	32	44[1]
L_{eq}	59	55	53

1 - 6.30 to 7.00 am, see text

In relation to determining noise goals for the operation of mechanical plant at the site the NPfI sets out two separate sets of criteria designed to ensure developments meet environmental noise objectives. The first criteria account for intrusive noise and the others apply to the protection of amenity of particular land uses. A new development is assessed by applying both criteria to the situation and adopting the more stringent of the two.

Amenity criteria are dependent upon the nature of the receiver area and the existing level of industrial noise. The most potentially affected receiver area is best described as “suburban”. The adopted amenity criterion is, therefore, equal to the recommended amenity limit for a suburban area.

Table 4 specifies the noise criteria determined for the site.

TABLE 4
NOISE CRITERIA

Location	Criterion	Day (7am-6pm)	Evening (6pm-10pm)	Night (10pm-7am)
Thornton	Intrusiveness dB(A),Leq(15-min.)[1]	48	37	49
	Amenity dB(A),Leq(15 min)[2]	53	43	38
	Project Noise Trigger Levels	**48 (15 min.)**	**37 (15 min)**	**49 (15 min)**

1 Rating Background Level (RBL) + 5dB. RBL is the median value of each ABL (Assessment Background Level) over the entire monitoring period. The ABL is a single figure representing the “L_{90} of the $L_{90's}$” for each separate day of the monitoring period.
2. Project amenity noise level (ANL) is suburban ANL (NPI Table 2.1) minus 5 dB(A) plus 3 dB(A) to convert from a period level to a 15-minute level.

The project noise trigger levels (applicable to mechanical plant) are, therefore,

Day	**48 dB(A) Leq (15 min)**
Evening	**37 dB(A) Leq (15 min)**
Night	**49 dB(A) Leq (15 min)**

As per the discussion detailed above in relation to the limited duration of the noise events from children in the playground and the car park noise emissions from these will be assessed against the shorter duration criterion of "background + plus 10" or;

Day	**53 dB(A) Leq (15 min)**
Evening	**42 dB(A) Leq (15 min)**
Night	**54 dB(A) Leq (15 min)**

3.2 Road Traffic

In relation to traffic generated by the development, the NSW Road Noise Policy (RNP) as adopted by Roads and Maritime Services (RMS) NSW, recommends various criteria for different road developments and uses.

Traffic generated by the current proposal will travel along local roads (initially Thorncliffe Avenue and then onto the local road network). An extract from Table 3 of the RNP relating to land use developments with the potential to create traffic on local roads is shown in **Table 5**.

TABLE 5
TRAFFIC NOISE CRITERIA

Situation	Recommended Criteria	
	Day - (7am - 10pm)	Night (10pm – 7am)
6. Existing residences affected by additional traffic on existing local roads generated by land use developments	55 Leq(1hr) External	50 Leq (1 hr) External

4.0 - NOISE ASSESSMENT

4.1 Child Care Centre

To assess potential noise impacts from the proposed child care centre, noise levels were taken from the Spectrum Acoustics technical database. This contains measurements made at existing child care

facilities that are similar in acoustic nature to the proposed child care centre.

The database contains noise measurements made in outdoor play areas as well as indoor areas. All sound levels have been measured with a Bruel & Kjaer Type 2260 Precision Sound Level Analyser with calibration performed before and after the survey.

One set of outdoor measurements was made over a 15 minute interval during a morning activity session whilst 15 children aged up to 3 years old were in an outdoor playground. The measurements were made from the veranda of the facility at the end of the playground. The noise source (i.e. the children) was in motion about the area with an average distance of approximately 15m from the sound level meter.

Similar measurements were made over 15 minute intervals during a morning activity session whilst 15 children aged between about 2 and 6 years old were in an outdoor playground. Measurements were made near the ends of the playground, which had dimensions of approximately 5 x 15 m. The noise source (i.e. the children) was in motion about the area with an average distance of approximately 8m from the sound level meter.

Calculated Leq sound power levels based on the measured noise levels are shown in **Table 6**. As can be seen the two measured levels are very similar.

TABLE 6
MEASURED NOISE LEVELS dB(A) Leq (15 min)

		Octave Band Centre Frequency (Hz)							
Source	dB(A)	63	125	250	500	1K	2K	4K	8K
15 x < 3 y.o.	88	63	68	74	81	83	82	78	72
15 x 2 to 6 y.o.	88	61	69	77	81	84	81	74	64

Under the proposal children will, at times, play in the outdoor areas. Potential noise issues arise primarily when children are engaged in outdoor play activities. When outdoors, loud vocalisations generally indicate a distressed or over excited child. Under these circumstances the normal practise is to take the child inside, or away from other children, to calm them.

The proposed layout of the child care centre is shown in **Figure 1**.

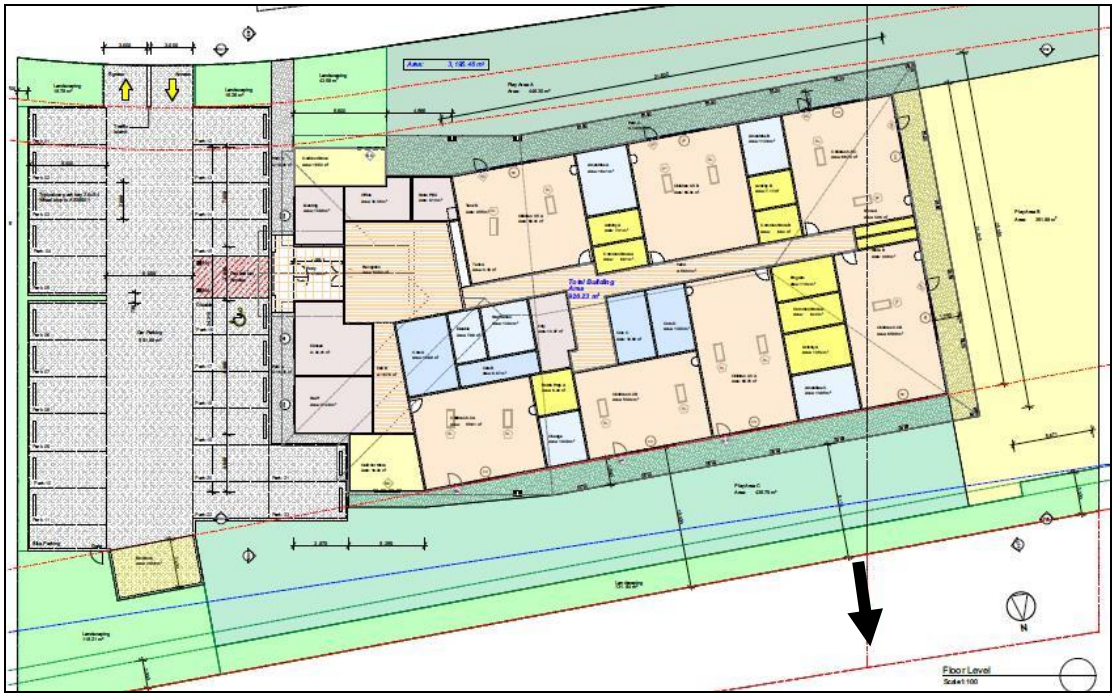


Figure 1 – Proposed Site Layout (north as marked)

Figure 1 shows that there are to be three outdoor plays on the south, west and north sides of the building.

Regulations governing the operation of child care centres mean that children are rarely outside together in large groups. The children are typically outside in small supervised groups at various times throughout the day. Children are seldom in the playground in large numbers and with free choice of activities.

The centre will cater for up to 132 children. Of these it is proposed that 32 will be younger than two years old, 40 will be between two and three years old and 60 will be three or older.

There are existing and proposed residential lots to the south, west and east.

As detailed previously, the management of the children in the playgrounds is such that particularly noisy events are quickly controlled and emissions minimised. Whilst many of the children may be in the play areas at some times, it is unlikely that all of them will be creating noise at the same time.

For logistical reasons it is unlikely that all children will be in the same play areas at the same time. To consider a worst case it was assumed that between 90 and 100 children aged between two and six years old were playing at various parts of the three outdoor play areas.

A scenario where ten groups of children with sound power levels of 86 dB(A) Leq (15min) (i.e. representing eight to ten children making a noise) were considered to be located at various representative locations in the playground as shown as sources 1 to 10 in **Appendix II**.

The calculation of potential impacts has been carried out to the most potentially affected receiver locations at the boundary of the nearest residences in Thorncliffe Avenue (at Lot 610 to the west and Lot 613, across the road to the south).

The above was considered to represent a worst case scenario for noise prediction of a 15 minute Leq. That is, the various measurements shown in Table 6 were deliberately taken whilst all children in the playground were engaged in activities. At other times, children are variously sitting quietly or listening to instruction etc.

The noise sources were propagated to the receiver locations, taking into account loss for distance and barrier effects of proposed fences, to predict the sound pressure levels at the boundary. The received noise from each source was logarithmically added to determine the total received noise from the playground.

The noise criteria are external, and they apply at the property boundaries. The calculation of barrier insertion loss, therefore, determined to a single reception point at 3m inside the neighbouring yard, but the distance loss is determined to the boundary (as per procedures in the NPfI). The reception point is considered representative of a location near the neighbouring residence.

For the calculation, a source height of 1.1m was used to approximate the height of a child. The calculations were performed to a theoretical receiver located at the boundary of the nearest receivers in each direction. The ground level of the receivers was assumed to be the same as that of the play area.

Preliminary calculations determined that noise control in the form of an acoustic barrier would be necessary to achieve compliance. A barrier height of 2.5m was used in all of the determination of impacts at Lot 610 and 1.8m for Lot 613, as shown in the following tables.

The predicted received noise levels are then compared to the adopted noise goals to determine noise impacts.

Table 7 shows the total theoretical received noise level at the boundary of the residence to the west at Lot 610. The assessed scenario is of the six noise sources at various locations that are most exposed to the receiver, with a barrier in place on the boundary of the site.

TABLE 7 – TOTAL RECEIVED NOISE LEVEL PLAYGROUND NOISE – LOT 610 (WEST) BOUNDARY (dB(A) Leq (15 min))									
		Octave Band Centre Frequency, Hz							
Propagation Elements	**dB(A)**	**63**	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**
Source 4 Lw Leq (15 min)	86	61	66	72	79	81	80	76	70
Distance loss (20m)		34	34	34	34	34	34	34	34
Barrier Loss (2.5m)		6	7	9	11	14	17	20	23
Received Noise 4	**38**	**21**	**24**	**29**	**34**	**33**	**29**	**22**	**13**
Source 5 Lw Leq (15 min)	86	61	66	72	79	81	80	76	70
Distance loss (14 m)		31	31	31	31	31	31	31	31
Barrier Loss (2.5m)		6	7	9	11	14	17	20	23
Received Noise 5	**41**	**24**	**28**	**32**	**37**	**36**	**32**	**25**	**16**
Source 6 Lw Leq (15 min)	86	61	66	72	79	81	80	76	70
Distance loss (10 m)		28	28	28	28	28	28	28	28
Barrier Loss (2.5m)		6	8	9	12	15	18	21	24
Received Noise 6	**43**	**26**	**30**	**34**	**39**	**38**	**34**	**27**	**18**
Source 7 Lw Leq (15 min)	86	61	66	72	79	81	80	76	70
Distance loss (6 m)		24	24	24	24	24	24	24	24
Barrier Loss (2.5m)		7	8	10	13	16	19	22	24
Received Noise 7	**47**	**30**	**34**	**38**	**42**	**41**	**37**	**30**	**22**
Source 8 Lw Leq (15 min)	86	61	66	72	79	81	80	76	70
Distance loss (16 m)		32	32	32	32	32	32	32	32
Barrier Loss (2.5m)		6	7	9	11	14	17	20	23
Received Noise 8	**40**	**23**	**27**	**31**	**36**	**35**	**31**	**24**	**15**
Source 9 Lw Leq (15 min)	86	61	66	72	79	81	80	76	70
Distance loss (25m)		36	36	36	36	36	36	36	36
Barrier Loss (2.5m)		6	7	9	11	14	17	20	23
Received Noise 9	**36**	**18**	**22**	**26**	**31**	**30**	**26**	**19**	**10**
Combined Total	**50**								
Noise Goal - Day	**53**								

The results show that, with a 2.5m barrier in place along the western boundary of the playgrounds, the total received noise, at Lot 610, will be 50 dB(A), Leq (15 min) which will comply with the noise criterion adopted for the operation of the playgrounds.

Table 8 shows the total theoretical received noise level at the boundary of the most potentially affected residence to the south at Lot 613 Thorncliffe Avenue (i.e., across the road from the child care centre).

These calculations assume there is a minimum 1.8m high acoustic barrier on the southern boundary of the child care centre site.

TABLE 8 – TOTAL RECEIVED NOISE LEVEL PLAYGROUND NOISE – Lot 613 (SOUTH) BOUNDARY (dB(A) Leq (15 min))									
		Octave Band Centre Frequency, Hz							
Propagation Elements	**dB(A)**	**63**	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**
Source 4 Lw Leq (15 min)	86	61	66	72	79	81	80	76	70
Distance loss (55 m)		43	43	43	43	43	43	43	43
Barrier Loss (1.8m)		5	5	5	5	6	6	8	9
Received Noise 4	**37**	**13**	**18**	**24**	**31**	**32**	**31**	**26**	**18**
Source 5 Lw Leq (15 min)	86	61	66	72	79	81	80	76	70
Distance loss (47 m)		41	41	41	41	41	41	41	41
Barrier Loss (1.8m)		5	5	5	6	6	7	8	10
Received Noise 5	**38**	**14**	**19**	**25**	**32**	**34**	**32**	**26**	**18**
Source 6 Lw Leq (15 min)	86	61	66	72	79	81	80	76	70
Distance loss (36 m)		39	39	39	39	39	39	39	39
Barrier Loss (1.8m)		5	5	5	6	7	8	10	12
Received Noise 6	**40**	**17**	**22**	**27**	**34**	**35**	**33**	**27**	**19**
Source 7 Lw Leq (15 min)	86	61	66	72	79	81	80	76	70
Distance loss (40 m)		40	40	40	40	40	40	40	40
Barrier Loss (1.8m)		5	5	5	6	6	7	9	11
Received Noise 7	**39**	**16**	**21**	**26**	**33**	**35**	**33**	**27**	**19**
Source 8 Lw Leq (15 min)	86	61	66	72	79	81	80	76	70
Distance loss (26 m)		36	36	36	36	36	36	36	36
Barrier Loss (1.8m)		5	6	6	7	9	11	14	16
Received Noise 8	**41**	**19**	**24**	**30**	**36**	**36**	**33**	**26**	**17**
Source 9 Lw Leq (15 min)	86	61	66	72	79	81	80	76	70
Distance loss (26 m)		36	36	36	36	36	36	36	36
Barrier Loss (1.8m)		5	6	6	7	9	11	14	16
Received Noise 9	**41**	**19**	**24**	**30**	**36**	**36**	**33**	**26**	**17**
Source 10 Lw Leq (15 min)	86	61	66	72	79	81	80	76	70
Distance loss (31 m)		38	38	38	38	38	38	38	38
Barrier Loss (1.8m)		5	5	6	6	7	9	11	14
Received Noise 10	**40**	**18**	**23**	**29**	**35**	**36**	**33**	**27**	**19**
Combined Total	**48**								
Noise Goal - Day	**53**								

The results in Table 8 show that, with a 1.8m high barrier on the boundary, the received noise, at Lot 613, will be 48 dB(A) Leq (15 min) which will comply with the noise criterion adopted for the operation of the playgrounds.

The proposed location of acoustic barriers is shown in **Appendix II**.

It is noted that the worst case assessment is based on all groups of children all generating the maximum sound emissions at the same time. It is considered unlikely that this will occur often throughout any given day, or for extended periods during the day.

During the evening (i.e. between 6.00 and 6.30 pm) the only activity in the playgrounds will be that of children being picked up. Noise emissions from any activity during the evening will be significantly lower than that for day time and, as such, no further assessment is considered warranted.

The playgrounds will not be in use at night.

The proponent has indicated that the facility will not have a designated crying room. Nor will there be any loud amplified music played throughout the facility.

Any music that is played will be at low levels and only played inside the building with all windows and doors closed. Similarly, whilst the children are inside the building the windows and doors will, typically, be closed for security reasons. Any noise emissions from play activities inside the building will, therefore, be adequately attenuated by the elements of the building and not result in any adverse noise impacts at any receivers.

4.2 Traffic Noise Ingress

In the absence of specific criteria in relation to the potential for traffic noise impacts at the site, guidance has been taken from the AAAC guideline which states;

The Leq (1 hr) intrusive noise level from road, rail traffic or industry at any location within the indoor play or sleeping areas of the Centre during the hours when the centre is operating shall not exceed 40 dB(A).

The Leq (1hr) intrusive noise level from road, rail traffic or industry at any location within the outdoor play or activity area during the hours when the Centre is operating shall not exceed 55 dB(A).

The data presented in Table 3 shows that, with a 2.1m acoustic barrier on the boundary the day time traffic noise level would be 59 dB(A) Leq (15 hr).

The plans for the site show a 2m landscaping zone along the roadside boundary of the centre. Additional calculations (presented in the Spectrum Acoustics report number 201937R/28883) showed that, with the acoustic barrier in place on the boundary, the traffic noise level would decrease to 56 dB(A) at 5m from the boundary (which would effectively be 3m into the playground.

In other parts of the play grounds the noise would be lower than this (i.e., being further removed from the traffic noise sources and/or shielded by elements of the building).

The noise levels used for the prediction of potential impacts from the playground (Tables 7 and 8) were 86 dB(A) Leq (15 min) for a group of children playing.

This would equate to a sound pressure level of just over 64 dB(A) at a distance of 5m from the source. This means that, whilst children are outdoors playing, the noise level would generally be at about 60 to 65 dB(A) Leq throughout most of the playground and at higher levels in some parts.

Traffic noise at 56 dB(A) would, therefore, be up to 9dB(A) lower than this and would be unlikey to create adverse reactions amongst the children.

Tables presented in the Environmental Noise Management Manual indicate that the façade of a single glazed, masonry building will attenuate approximately 25 dB(A) of traffic noise. This will provide adequate traffic noise reduction and achieve a satisfactory internal acoustic amenity in the building.

4.3 Car Park

The car park on the eastern side of the centre will be used for staff parking and by people picking up and dropping off children at the centre.

Noise in car parks typically comes from people walking to and from cars, doors opening and closing etc., as well as vehicles moving at slow speeds. Each noise event is characterised by a brief peak which when averaged out over a 15 minute period has a relatively low Leq.

The impact of each noise event on any single receiver is also variable depending upon the location of individual cars within a car park and as they move in and out. In addition to this, staff arriving or departing a child care centre would normally be expected to do so in a quiet and orderly fashion.

Noise measurements made in the car park of a child care facility were taken from the Spectrum Acoustics technical database. The noise from a series of vehicles arriving and departing the car park and parents bringing their children into the centre was measured over a representative period to ascertain a typical noise level from these activities.

The measurements were made at varying distances from each car to approximate the situation in relation to an adjacent residence over a 15 minute interval. That is, at any time throughout each 15 minute interval various parking spaces in the driveway, at different distances from the nearest residences, will be in use.

A noise level of 53 dB(A) Leq was measured, at an average distance of 7m, over a relatively busy 5 minute period where six vehicles used the car park. This equates to an Leq sound power level of 78 dB(A) for six car parks in use.

The proposed centre will have 23 car parking spaces, approximately half of which will be for use of staff. All staff will not arrive and depart at the same as each other. Similarly, people dropping off and picking up children will do so at varying times and rates with the peak times being first thing in the morning and during the late afternoon. For most of the day there will be very little activity in the car park.

To determine potential impacts the car park noise was considered to be from four "banks" of up to six car parks with an Lw of 78 dB(A) Leq (15 min), as described above. Car park numbers shown in the tables of results are as shown in Appendix II).

Potential impacts from car park noise have been calculated to the nearest potentially affected receiver boundary to the east, with the results shown in **Table 9**. The barrier insertion loss is for a 1.8m high acoustic fence on the boundary (as indicated in Appendix II).

TABLE 9
CAR PARK NOISE – LOT 730 (EAST) BOUNDARY - (dB(A) Leq (15 min))

Propagation Element	**dB(A)**			
Car Park Annotation	CP 1 (10m)	CP 2 (10m)	CP 3 (18m)	CP 4 (20m)
Car Park Noise	78	78	78	78
Distance loss	28	28	33	34
Barrier Loss	9	9	9	8
SPL at boundary	41	41	36	36
Combined SPL	45			
Noise Goal - Day	**53**			

The results in Table 9 show that, under the assessed conditions, with a 1.8m high barrier in place on the boundary of Lot 730, the received noise will be 45 dB(A) Leq (15 min) which will comply with the noise criterion adopted for the operation of the car park.

Table 10 details the results of the assessment of car park noise at the boundary of Lot 708 (to the south across Thorncliffe Avenue). There is no barrier in this direction.

TABLE 10 CAR PARK NOISE – LOT 708 (SOUTH) BOUNDARY - (dB(A) Leq (15 min))				
Propagation Element	**dB(A)**			
Car Park Annotation	CP 1 (31m)	CP 2 (47m)	CP 3 (31m)	CP 4 (47m)
Car Park Noise	78	78	78	78
Distance loss	38	41	38	41
SPL at boundary	40	37	40	37
Combined SPL	45			
Noise Goal - Day	**53**			

The results in Table 10 show that, under the assessed conditions, the received noise, at Lot 708, will be 45 dB(A) Leq (15 min) which will comply with the noise criterion adopted for the operation of the car park.

The calculations in Tables 9 and 10 are based on the use of the car park during a particularly busy period during the day. The car park will also be in use at night and in the evening, but that use will be with a significantly lower number of vehicle movements.

For example, a 50% reduction in car park usage, in a 15 minute period, would result in compliance with the most stringent evening time criterion of 42dB(A) at both receivers.

4.4 Mechanical Plant

The centre will be mechanically ventilated with split system air conditioners. The location for the condenser units for these is yet to be finalised.

Due to the size and configuration of the building it is likely, however, that the condensers could be located at the car park end of the building, near car park number “4”, as shown in Appendix II.

Condenser units for this type of application, typically, have sound power levels in the range 65 to 70 dB(A) when they are operating at full capacity.

For three condensers operating at 70 dB(A), this would equate to a combined Lw of 75 dB(A) Leq.

Locating the condensers at the front of the building would also result in acoustic shielding from the barrier fence around the car park.

If the condensers are located near car park “4”, they would be over 50m from the nearest boundary to the east, at Lot 730. **Table 11** shows a sample calculation of the a/c noise, based on the assumptions detailed above.

TABLE 11 RECEIVED NOISE LEVEL, A/C CONDENSERS (dB(A) Leq (15 min))	
Propagation Element	**dB(A)**
3 x condensers	75
Distance loss (50m)	42
Barrier loss	8
SPL at boundary	25
Noise Goal - Evening	**37**

The results in Table 11 show that, under the assessed conditions, there will be no adverse noise impacts due to the worst case operation of the air conditioners (i.e., during the evening).

Locating the condensers at the front of the building would also result in acoustic shielding from the barrier fence around the car park.

It is considered reasonable that there the a/c plant can be located such that it doesn't create adverse impacts. It is recommended that the final type and location of the mechanical plant to be used should be approved by an acoustic consultant prior to installation.

4.5 Road Traffic

Equation 1 outlines the mathematical formula used in calculating the Leq,T noise level for intermittent traffic noise.

$$L_{eq},T = L_b + 10\log\left[1 + \frac{ND}{T}\left(\frac{10^{(L\max - Lb)/10} - 1}{2.3} - \frac{(L_{\max} - L_b)}{10}\right)\right]$$

Equation 1

Where

L_b is background noise level, dB(A)

L_{MAX} is vehicle noise, dB(A)

T is the time for each group of vehicles (min)

N is number of vehicle trips

D is duration of noise of each vehicle (min)

Vehicles arriving and departing the site will do so via Thorncliffe Avenue. Vehicle movements during a typical day will involve the arrival and departure of parents dropping off and picking up children and of staff.

A scenario of 120 vehicle movements in an hour has been used for the assessment (i.e. representing 60 vehicles in and out of the car park). This is based on a conservative assumption and has not necessarily been reflected in any traffic studies for the project.

Noise levels from the vehicles have been assessed to a theoretical point 1m from the facade of residences at a nominal distance of 10m from the centre of traffic. Results are shown in **Table 12**.

TABLE 12 ROAD TRAFFIC NOISE – (Leq (1 hour))	
Element	dB(A)
No. of Vehicles (peak hourly period)	120
Lw per vehicle (at 50 kph)	90
Distance Loss (10m)	28
Received Noise (from eqn. 1)	50
Noise Goal - Day	55

The results shown in Table 12 indicate that noise from traffic generated by the proposal will not exceed the RMS criterion.

5.0 - DISCUSSION AND RECOMMENDATIONS

5.1 Child Care Centre

Noise from the outdoor playgrounds will not exceed the site noise goal with acoustic barriers (fences) in place at the location and heights shown in Appendix II.

An acoustic barrier is one which is impervious from the ground to the recommended height with a minimum surface density of 15 kg/m^2. No significant gaps should remain in the barrier to allow the passage of sound below the recommended height.

Staff at the centre must be made aware of the need to maintain noise at appropriate levels and move quickly to minimise possible outbursts. Potentially noisy activities should be located in areas that are furthest from boundaries and or are screened from these by intervening structures. Staff should be made aware of the potential for impact noise as objects are hit on hard surfaces and move quickly to avoid such instances.

There will be no adverse impacts as a result of any other of the assessed activities in the child care centre.

5.2 Traffic Noise Ingress

There will be no adverse noise impacts due to the ingress of traffic noise into the play areas or the building of the child care centre.

5.3 Car Park

Calculations have shown that, with acoustic barriers (fences) in place at the location and heights shown in Appendix II, noise from the car park will not exceed the adopted noise goal during peak periods of use.

Staff should be made aware of the need to minimise noise from their use of the car park.

5.4 Mechanical Plant

Calculations have shown that by locating the mechanical plant near the front of the building there should be no adverse impacts as a result of its operation under the assessed conditions. It is recommended that the final selection and location of all mechanical plant be approved by an acoustic consultant prior to installation.

Care must be taken to avoid creating solid connections between air conditioning systems and any part of the building as vibrations from the operation of the system can create structure borne noise. Resilient mounts and fittings should be used for all mechanical plant items.

5.5 Road Traffic

Calculations have shown that noise from traffic using the centre will not exceed the relevant criterion.

6.0 - CONCLUSION

An acoustical assessment of theoretical noise emissions has been carried out for a proposed child care centre at Lots 722, 723 and 724, D.P. 10419, Thorncliffe Avenue, Thornton, NSW.

The noise impacts at the nearest residential boundaries have been assessed, due to the operation of the child care centre, car park and traffic.

Calculations were carried out assuming minimum 2.5m and 1.8m fences acting as an acoustic barrier were in place around the playground a minimum 1.8m barrier was in place along the eastern side of the car park.

Results of all calculations showed that with these fences in place there will be no exceedance of the adopted noise goals under the assessed conditions.

With a 2.1m barrier in place along the northern boundary of the site there will be no adverse noise impacts due to traffic noise ingress (from traffic on Raymond Terrace Road).

Other recommendations have been made in regards to ensuring noise from other parts of the facility are kept to acceptable levels. These are:

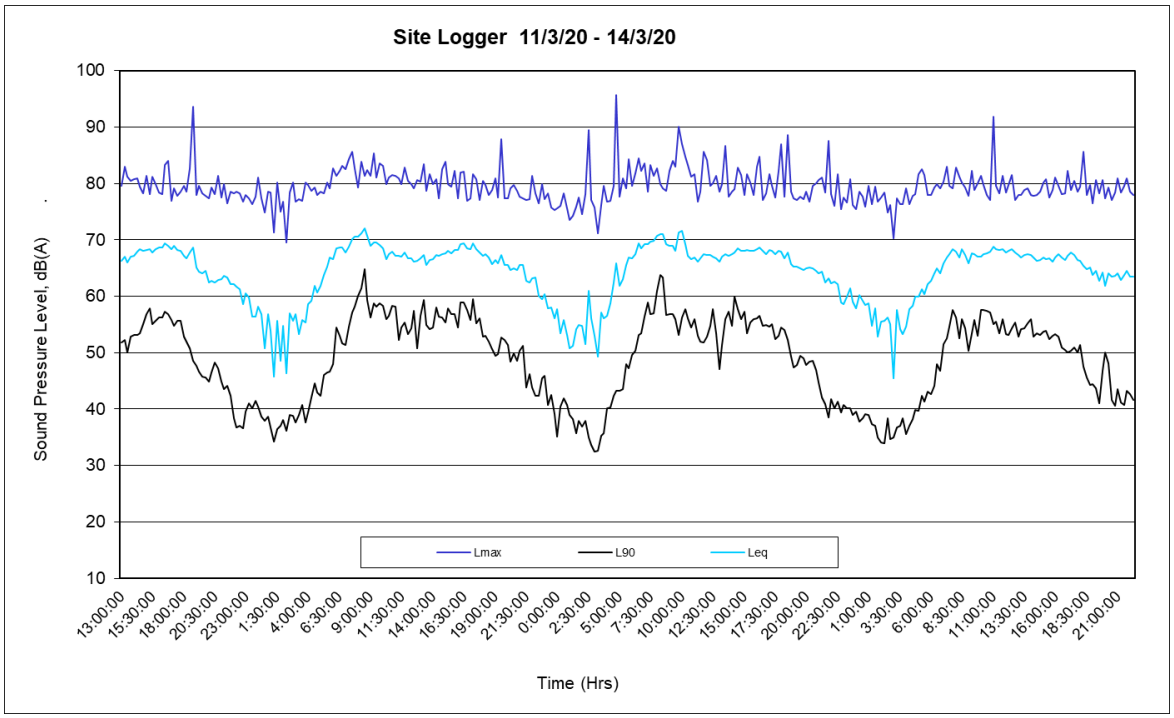
Staff should be made aware of the need to respect the amenity of neighbours and minimise noise whilst using the car park; and

Staff at the centre must be made aware of the need to maintain noise at appropriate levels and move quickly to minimise possible outbursts. Potentially noisy activities should be located in areas that are furthest from boundaries and or are screened from these by intervening structures.

Results of this assessment have shown that the relevant noise level criteria will not be exceeded, provided these recommendations are implemented and, therefore, there is no acoustic reason can be seen why the development should not be approved.

APPENDIX I

NOISE LOGGER CHARTS


Site Logger 11/3/20 - 14/3/20
Sound Pressure Level, dB(A)
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90
80
70
60
50
40
30
20
10
Lmax
L90
Leq
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15:30:00
18:00:00
20:30:00
23:00:00
1:30:00
4:00:00
6:30:00
9:00:00
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19:00:00
21:30:00
0:00:00
2:30:00
5:00:00
7:30:00
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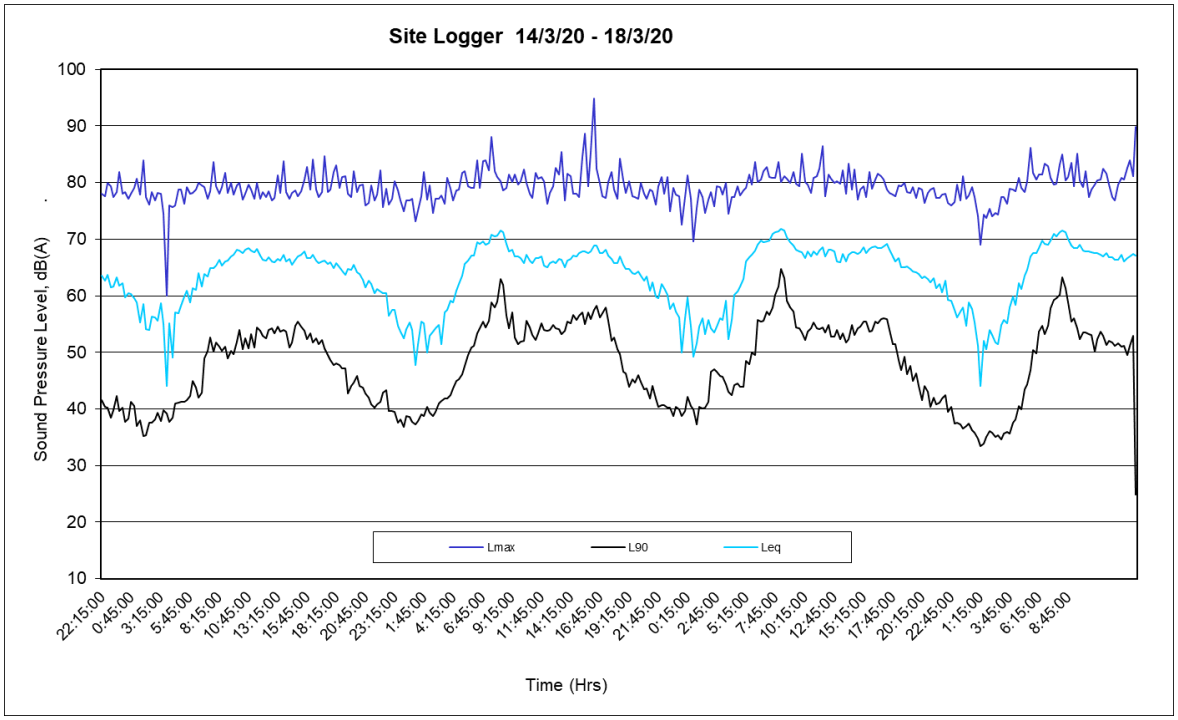
16:00:00
18:30:00
21:00:00
Time (Hrs)


Site Logger 14/3/20 - 18/3/20
Sound Pressure Level, dB(A)
100
90
80
70
60
50
40
30
20
10
Lmax
L90
Leq
22:15:00
0:45:00
3:15:00
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17:45:00
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22:45:00
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6:15:00
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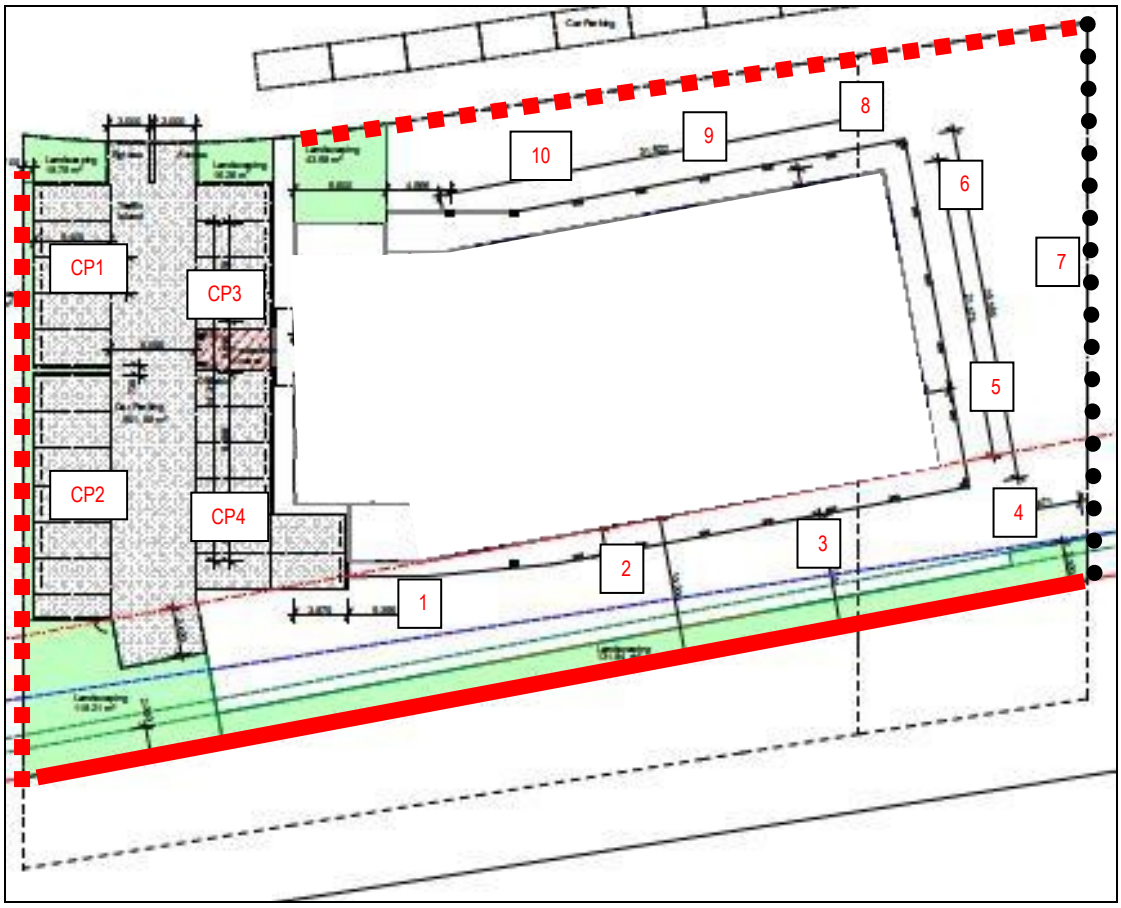
Time (Hrs)

APPENDIX II

NOISE SOURCE and ACOUSTIC BARRIER LOCATIONS



Key

2.5m Acoustic Barrier

2.1m Acoustic Barrier

1.8m Acoustic Barrier

1 Children Playing Noise Source Locations

CP2 Car Park Noise Source Locations