



DesignInc
palvarez@sydney.designinc.com.au

Lindfield Learning Village Phase 2 & 3

Revised Noise Impact Assessment

White Noise Acoustics
303, 74 Pitt Street,
Sydney NSW 2000

ABN: 35 632 449 122

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1 Introduction

This Revised Noise Impact Assessment has been prepared by White Noise Acoustics on behalf of the NSW Department of Education and School Infrastructure NSW (the Applicant). It accompanies a Response to Submissions Report in support of State Significant Development Application (SSD 16_8114) for Lindfield Learning Village (the site).

On 24 October 2018 the Minister for Planning granted partial development consent to SSD 8114 for Phase 1 construction and operation of a new school for 350 students. The remainder of SSD 8114 (as originally proposed) has not yet been granted consent and has been subject to further investigation, assessment and engagement with the relevant agencies (DPE, RFS, OEH, RMS, TfNSW) and Council.

The Response to Submissions and supporting documents seek approval for the remainder of SSD 8114, being:

Phase 2(b)

- Works to accommodate 1,050 students (including the approved 350 in Phase 1 and 35 in the modification to Phase 1).
- Repurposing of the Phase 1 area.
- An extended driveway for car and bus access within the eastern portion of the site from Eton Road. A fire trail linking the new extended driveway to Dunstan Grove is proposed for access by emergency vehicles.

Phase 3

- Works to accommodate an additional 950 students in the western wing of the building.

The SSD does not seek approval for vegetation management outside the site boundary. Any vegetation management outside the site boundary is the subject of separate approval.

The purpose of this Noise Impact Assessment is to investigate the suitability of the site regarding acoustic impacts on surrounding receivers.

Response to Submissions

This Revised Noise Impact Assessment has considered the issues raised by agencies during exhibition of SSD 8114 and subsequent Response to Submissions for Phase 1. This table identifies the agency issue and where it has been addressed within this report.

Table 1 - Agency Comment and Relevant Reference

Agency Comment	Report Reference	Comments
EPA	SSD 8114 – Lindfield Learning Village- Response to Submissions (RtS) Report (Date: 26/7/2018)	The SSD Acoustic report for Phases 2 and 3 includes the background noise levels previously recorded at the site and detailed within the site wide Noise Impact Assessment.
		Noise from the proposed use of the school for operational noise including the gymnasium, auditorium and squash courts which may be used outside of normal school hours as well as maintenance equipment have been assessed in this report and is detailed in Section 6.6, 6.7 and 6.8 of this report.
		Construction noise impacts including periods when high noise intrusive appliances should be used are included in Section 7.4 of this report.
EPA	SSD 8114 – Lindfield Learning Village - EIS	Construction noise is to be controlled including the control of truck not to be parked out side of the residential receivers as detailed in Section 7.4.
NSW Planning and Environment	Response to Submissions, Lindfield Learning Village – 100 Eton Road, Lindfield (SSD8114) Dated: 16 August 2017	The SSD Acoustic report for Phases 2 and 3 includes the background noise levels previously recorded at the site and detailed within the site wide Noise Impact Assessment.

NSW Planning and Environment and EPA	Phases 2 and 3 comments – In the Letters dated 27 th December 2019 and 11 th December 2019.	The loop road no longer forms part of the proposal with revised vehicle access accommodated within the eastern portion of the site.
		Nosie logger results have been based on the results previously undertaken as part of the masterplan for the site. Additional supplementary measurement has been undertaken to confirm that the previously recorded noise levels remain suitable for this assessment.
		A quantitative assessment of the expected construction noise impacts has been included in this report.
		The detailed assessment of mechanical equipment and required treatment to ensure noise emission criteria is achieved will be undertaken as part of the detailed design process of the project once plant sections have been completed.

This assessment includes the acoustic investigation into the potential for noise impacts from the operation of the Lindfield Learning Village Phase 2 and 3 project, including the previously approved site wide noise emissions criteria detailed within the *'Lindfield Learning Village, Noise Impact Assessment'* Ref: 20160433.2/0303A/R6/HP and dated 13th June, 2018.

2 Site Location

The Lindfield Learning Village is located on the site located to the south of Dunstan Grove on the old UTS Kuring-Gai Campus.

The site location is detailed in Figure 1 below.

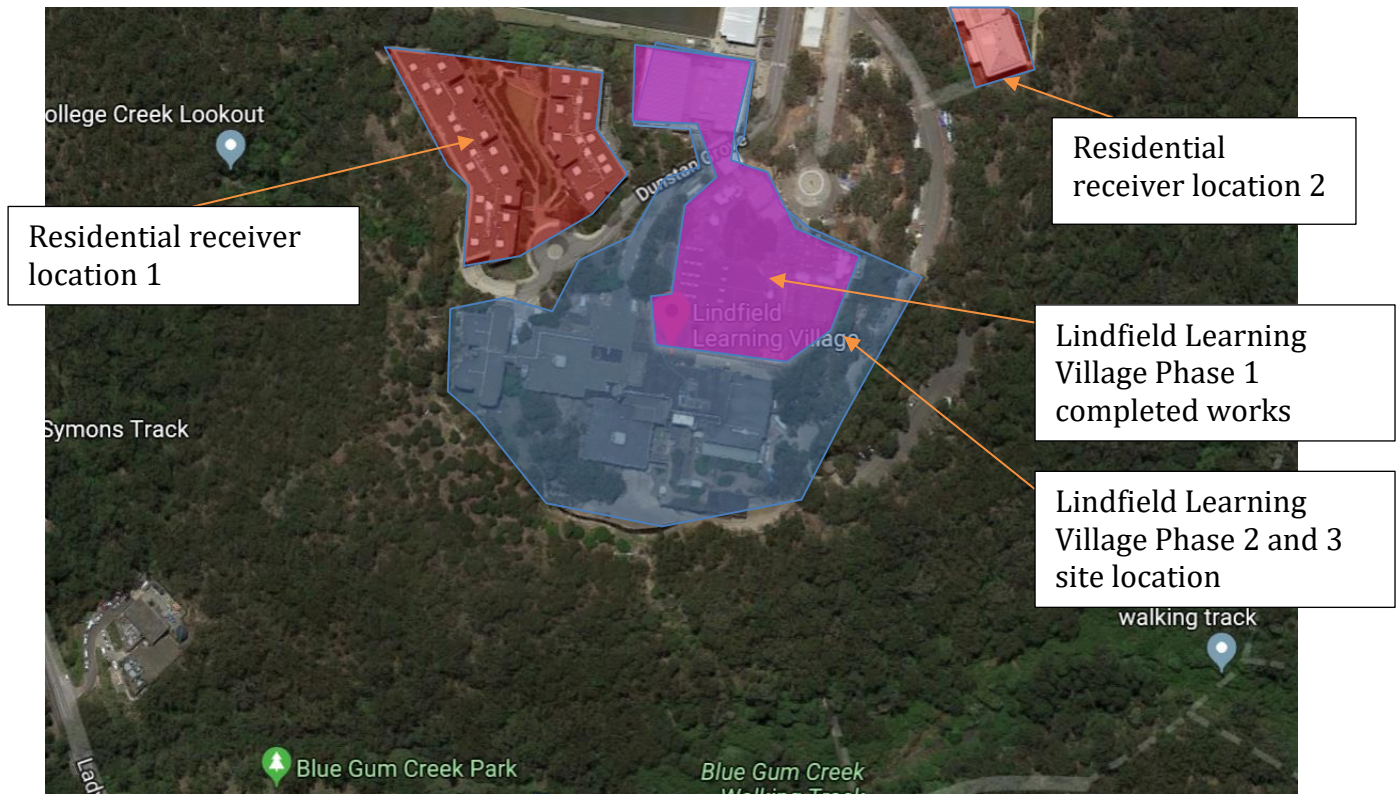


Figure 1 – Site Location including surrounding residential receivers

The proposed Lindfield Learning Village Phase 2 and 3 project includes the reuse of the existing building fabric to include the future learning facility. The proposed development includes areas for external play and a extended driveway for the use of buses for extended driveway and pick up that are located to the south and east of the existing building and screened from the residential receivers which are located to the north of the site.

The architectural plans for Phases 2 and 3 are included in Appendix B.

3 Proposed Development

The proposed Lindfield Learning Village Phase 2 and 3 project includes the redevelopment of the existing building structure located on the site to include the future Lindfield Learning Village. The proposed development includes a number of areas with the potential to generated noise emissions from the operation of the site and have been assessed as part of this report. These areas include the following:

1. Mechanical Plant and Equipment.
2. Noise from the use of outdoor play areas.
3. Noise from the use of the extended driveway by buses and cars for morning and afternoon drop off/pick up.
4. Noise from other areas of the site including internal areas of the project.

The proposed Phase 2 and 3 project includes 5 Homebase including the following student numbers and operational conditions:

1. Phase 1:
 - School Staff: 45
 - OOSH Staff: 3
 - Aurora Staff: 0
 - Total: 48
2. Phase 2:
 - School Staff: 135
 - OOSH Staff: 8
 - Aurora Staff: 21
 - Total: 164
3. Phase 3:
 - School Staff: 275
 - OOSH Staff: 16
 - Aurora Staff: 21
 - Total: 312

4 Existing Acoustic Environment

The Lindfield Learning Village site is located on the site formally used as the UTS Ku-Ring-Gai Campus. The site is located within an area which does not include significant transportation industrial or commercial noise sources.

The previously conducted '*Lindfield Learning Village, Noise Impact Assessment*' Ref: 20160433.2/0303A/R6/HP and dated 13th June, 2018 has undertaken a noise survey at the site and the resulting noise emissions criteria approved in this report has been used as the basis of this assessment.

An additional assessment of background noise levels has been undertaken and is detailed within the *Lindfield Learning Village - Response to EPA Queries* dated 13/8/2018. The results of background noise level monitoring presented in this report are also included in this assessment.

The site is located to the south of Dunstan Grove and the surrounding areas include the following receivers:

1. Residential receivers located to the north of the site on Dunstan Grove – Residential Receiver Location 1
2. Residential receivers located to the east of the site on Tubbs View – Residential Receiver Location 2.

Providing noise level emissions comply at the locations detailed in the points above compliance at all surrounding receivers will be achieved.

The previously conducted '*Lindfield Learning Village, Noise Impact Assessment*' Ref: 20160433.2/0303A/R6/HP and dated 13th June, 2018 has investigated the potential for noise associated from additional traffic on surrounding roadways and generated from the entire site (including carparking and school pick up and drop offs). This assessment does not include a future assessment of additional traffic noise generated from the proposed Phase 2 and 3 project as the previous assessment includes the potential of additional traffic generated from the entire site and includes the assessment required for Phases 2 and 3 (and has previously been approved).

4.1 Noise Survey Results

The previously conducted '*Lindfield Learning Village, Noise Impact Assessment*' Ref: 20160433.2/0303A/R6/HP and dated 13th June, 2018 and *Lindfield Learning Village - Response to EPA Queries* dated 13/8/2018 has undertaken a noise survey at the site and the resulting noise emissions criteria approved in this report has been used as the basis of this assessment.

A summary of the existing background noise levels at the site (as detailed within the '*Lindfield Learning Village, Noise Impact Assessment*') are detailed in the Table 1 below.

Table 2 – Summary of Existing Site Noise Levels

Location	Time of Day	L _{AeqT} , dB(A)	<i>Lindfield Learning Village, Noise Impact Assessment</i> L _{A90, 15min} dB(A)	<i>Lindfield Learning Village - Response to EPA Queries</i> L _{A90, 15min} dB(A)
Residential Receiver Location 1 – Dunstan Grove	Day – 7am to 6pm	56 (15 hour) 59 (worst 1 hour)	42	42
	Evening – 6pm to 10pm	56 (15 hour) 59 (worst 1 hour)	41	40
	Night – 10pm to 7am	47 (9 hour) 52 (worst 1 hour)	39	38
Residential Receiver Location 2 – Tubbs View	Day – 7am to 6pm	56 (15 hour) 59 (worst 1 hour)	44	40
	Evening – 6pm to 10pm	51 (15 hour) 53 (worst 1 hour)	42	39
	Night – 10pm to 7am	47 (9 hour) 51 (worst 1 hour)	38	35

To supplement the previously conducted noise survey an additional acoustic survey of the site has been undertaken as part of this assessment to confirm the noise levels detailed in the '*Lindfield Learning Village, Noise Impact Assessment*' remain accurate for the assessment of Phases 2 and 3. As part of this assessment additional noise level measurements were conducted at the site on the 12th May, 2019. The results of the additional noise level measurements are detailed in the table below.

Table 3 – Results of Additional Noise Survey at the Site

Measurement Location	Time of Measurement	L _{Aeq, 15min} dB(A)	L _{A90, 15min} dB(A)	Comments
Residential Receiver Location 1 – Dunstan Grove	6.45pm to 7.00pm	56	41	Noise levels at this location as a result of general noise levels from sources not within close proximity to the site and the surrounding natural environment
Residential Receiver Location 2 – Tubbs View	7.10pm to 7.25pm	53	40	Noise levels at this location as a result of general noise levels from sources not within close proximity to the site and the surrounding natural environment

Based on the results of the additional noise level measurements conducted at the site the noise levels and resulting noise emission criteria detailed within the '*Lindfield Learning Village, Noise Impact Assessment*' remain accurate for the site.

5 Operational Noise Level Criteria

This section of the report details the relevant noise level criteria for noise emissions from the site once completed.

As the site includes a facility containing a school or learning centre there are no relevant Environmental Protection Authority (EPA) criteria. There are a number of relevant authority and guidelines which provide suitable acoustic criteria for noise emissions from a school site, including the following:

1. The Educational Facilities Standards design Guide.
2. NSW Environmental Protection Authority, Noise Policy for Industry (formally the Industrial Noise Policy) – Suitable for the assessment of mechanical services noise emissions from the site.
3. The Ku-ring-gai Local Environmental Plan 2015.
4. Association of Australian Acoustical Consultants (AAAC) guideline for Child Care Centre Acoustic Assessment, October 2013 – Including recommended criteria for noise emissions generated from use of Outdoor Play Areas.

Details of the resulting acoustic criterion based on the standards detailed above are included in the following sections.

5.1 Ku-ring-gai Local Environmental Plan 2015

A review of the Ku-ring-gai Local Environmental Plan 2015 has been undertaken and there no relevant controls for potential noise emission from the operation of schools or learning facilities within the plan.

5.2 NSW Environmental Protection Authority, Noise Policy for Industry

The NSW Environmental Protection Authority (EPA) Noise Policy for Industry (NPI), previously Industrial Noise Policy, details noise criteria for the control of noise generated from the operation of developments and the potential for impact on surrounding receivers.

The NPI includes both intrusive and amenity criteria which are summaries below that have been used for the assessment of services noise including mechanical equipment and the used of the extended driveway by buses in this assessment.

1. Intrusive noise level criteria, The NPI states the following:

‘The intrusiveness of an industrial noise source may generally be considered acceptable if the level of noise from the source (represented by the LAeq descriptor), measured over a 15minute period, does not exceed the background noise level by more than 5 dB when beyond a minimum threshold. This intrusiveness noise level seeks to limit the degree of change a new noise source introduces to an existing environment.’

2. Amenity noise level criteria, The NPI states the following:

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

Consequently, the resulting noise level criteria are summarised in Table 4 below. The criteria are nominated for the purpose of determining the operational noise limits for the operation of the site including mechanical plant associated with the development which can potentially affect noise sensitive receivers and operational noise levels from the future phases. For each assessment period, the lower (i.e. the more stringent) of the amenity or intrusive criteria are adopted. These are shown in bold text in the table below.

Table 4 – External Noise Level Criteria in Accordance with the NSW NPI

Location	Time of Day	Project Amenity Noise Level, LAeq, period ¹ (dBA)	LA90, 15 min (RBL) ² (dBA)	LAeq, period Noise Level (dBA)	Intrusive LAeq, 15 min Criterion for New Sources (dBA)
Residential Receiver Location 1 – Dunstan Grove	Day	55	42	56	47
	Evening	45	40	56	45
	Night	40	38	47	43
Residential Receiver Location 2 – Tubbs View	Day	55	40	56	45
	Evening	45	39	51	44
	Night	40	35	47	40
Note 1: Project Amenity Noise Levels corresponding to “Suburban Residential” areas, recommended noise levels.					
Note 2: LA90 Background Noise or Rating Background Level					
Note 3: Project Noise Trigger Levels are shown in bold					

5.3 AAAC Guideline for Child Care Centre Acoustic Assessment

Noise from the use of the external play areas on the site can not be assessed using the standard EPA or council guidelines. Noise generated from the use of outdoor play areas does not include noise that is similar to typical industrial noise sources such as mechanical equipment, heavy vehicles, manufacturing or the like. Noise associated from the use of outdoor play areas associated with schools is generally assessed to a less stringent requirement than the noise emission criteria detailed within the EPA NPI (detailed in the section above) or a number of reasons including the following:

1. Noise generated from the use of outdoor play areas from schools is identified as being for the benefit of the general community.
2. Noise generated from outdoor play areas will be generated during limited periods of day, typically non-teaching period of the day including lunch breaks and after school. Organised play and use of the school will generally be limited to Monday to Friday.
3. Noise generated from the use of outdoor play areas does not result in noise with the potential to impact on the reasonable amenity of residential receivers compared to industrial or commercial noise emissions. Noise from the use of students during normal operating hours will include supervision by teaching staff.
4. Methods of noise control from outdoor play areas can be limited. The treatments required to reduce noise from outdoor play areas to within EPA NPI noise criteria would result in significant impact as a result of acoustic screenings, buildings or the like. Providing possible acoustic treatments are applied to the use of outdoor play areas noise levels from the use of the outdoor areas can be mitigated where possible.

The Association of Australian Acoustical Consultants (AAAC) Child Care Centre Acoustic Assessment includes recommended acoustic criteria for the assessment of noise from outdoor play areas. This is not a mandatory criteria, but includes guidance for the assessment of noise from outdoor play areas in the absence of criteria within any other standards or guidelines.

The Association of Australian Acoustical Consultants (AAAC) Child Care Centre Acoustic Assessment includes the following with regards to the assessment of noise emissions from the use of outdoor play areas within childcare centres.

Residential Receptors

Outdoor Play Area

For most centres as the duration of time that children are allowed to play outside is reduced then the overall noise impact reduces. Therefore, it is reasonable to allow a higher level of noise impact for a shorter duration of outdoor play. AAAC members regard that a total time limit of approximately 2 hours outdoor play per day (eg 1 hour in the morning and 1 hour in the afternoon) should allow an additional emergence above the background of 5 dB.

Up to 2 hours (total) per day - The $L_{eq,15 \text{ minute}}$ noise level emitted from the outdoor play area shall not exceed the background noise level by more than 10 dB at the assessment location.

More than 2 hours per day - The $L_{eq,15 \text{ minute}}$ noise level emitted from the outdoor play area shall not exceed the background noise level by more than 5 dB at the assessment location.

The assessment location is defined 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.

Based on the recommended noise levels for the use of outdoor play areas from childcare centres within the AAAC Child Care Centre Assessment the use of a background + 10 dB(A) criteria for noise generated from the use of outdoor play areas associated with the Lindfield Learning Village Phase 2 and 3 phases.

Based on the existing background noise levels recorded at the site as part of the *'Lindfield Learning Village, Noise Impact Assessment'* Ref: 20160433.2/0303A/R6/HP and dated 13th June, 2018 the resulting noise emission criteria use in this assessment are detailed in the following table.

Table 5 – Summary of Outdoor Play Areas Noise Emission Criteria

Location	Time of Day	Background Noise Level L_{A90, 15min} dB(A)	Noise Emission Goals for Outdoor Play Areas L_{AeqT}, dB(A)
Residential Receiver Location 1 – Dunstan Grove	Day – 7am to 6pm	42	52
Residential Receiver Location 2 – Tubbs View	Day – 7am to 6pm	40	50

Note: As outdoor play areas will only be used during daytime hours the noise emission criteria for the corresponding criteria has been presented in the table above.

6 Noise Emissions Assessment

An assessment of noise generated on the site has been undertaken on this section of the report. The assessment of noise levels generated on the site are summaries below:

1. Mechanical Plant and Equipment.
2. Noise from the use of outdoor play areas.
3. Noise from the use of the extended driveway by buses and cars for morning and afternoon drop off/pick up.
4. Noise from other areas of the site including internal areas of the project.

The detailed assessment of the items detailed above are included in the following sections.

6.1 Mechanical Plant and Equipment

The proposed development will include various items of mechanical plant and equipment including heating and cooling equipment, supply and exhaust fans.

The proposed development includes a plantroom area on Level 6 of the project which is detailed in the figure below.

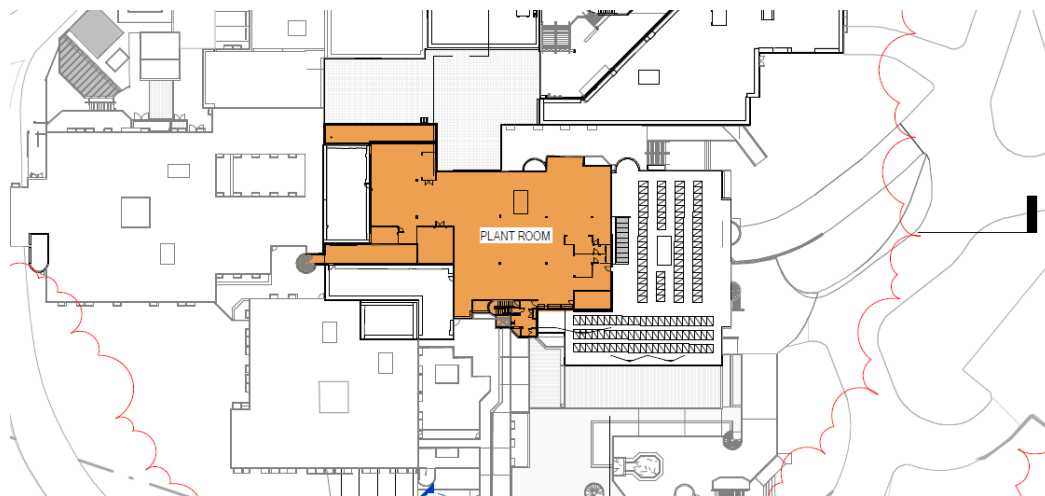


Figure 2 – Proposed Level 6 Plantroom area

As the project is currently in the initial design Phases details of plant and equipment has not yet been undertaken and therefore a detailed assessment of the required acoustic treatments required to ensure noise levels comply with noise emission criteria detailed in Section 5.2 above cannot be provided at this time.

Experience with similar projects confirms that compliance with the relevant noise emission criteria for the site can be achieved. Details of the specific acoustic treatments will be undertaken as part of the ongoing project design and provided as part of the CC submission of the project.

Possible acoustic treatment to the major plant items expected on the site are summaries below:

1. Cooling equipment – acoustic silencers and or louvers may be required to the intake and exhaust of cooling equipment. Equipment will be installed with Variable Speed Devices (VSD) to reduce capacity and noise levels as required.
2. Supply fans – supply fans on the site will include acoustic treatments including internally lined ductwork and/or silencers as required to ensure noise emission criteria is achieved.
3. Exhaust fans – exhaust fans on the site will include acoustic treatments including internally lined ductwork and/or silencers as required to ensure noise emission criteria is achieved.
4. Emergency Equipment – mechanical services equipment associated with the site will be acoustically treated using lined ductwork and/or silencers such that the requirements of AS1668 are complied with.
5. Pumps, heaters, boilers and the like – other general equipment such as pumps, heaters, boilers and the like will be housed within the level 6 plantroom or other internal areas. Treatment to the building façade including linings and/or treatment to openings in the building such as acoustic louvers or lined ducting will be included to ensure noise levels comply with the projects noise emission criteria.

Experience with similar projects confirms that all proposed plant and equipment required on the site can be acoustically treated using those detailed in the points above. Selections of the plant and equipment items and the resulting acoustic treatments will be undertaken as part of the ongoing design of the project and provided as part of the CC submission of the project.

As detailed selections of mechanical equipment is not possible at this Phase of the project noise levels of the proposed equipment is not known. As such details of the required acoustic treatments is not possible to be specified at this Phase of a project.

The relevant project noise emission criteria are detailed in this report to which all future design of the mechanical equipment is required to comply with and includes the Background + 5 dB(A) criteria.

Details of the specific acoustic treatments and controls will be completed as part of the normal ongoing design phase of the project and provided as part of the CC documentation for the project.

The EPA has indicated that the early phases of the design of the project does not allow for the detailed acoustic design of the mechanical services.

6.2 Noise from Outdoor Play Areas

The proposed Lindfield Learning Village Phase 2 and 3 project includes a number of outdoor play areas (including the covered outdoor learning area on Level 2) which are located to the south and east of the site as detailed in the Figures below.

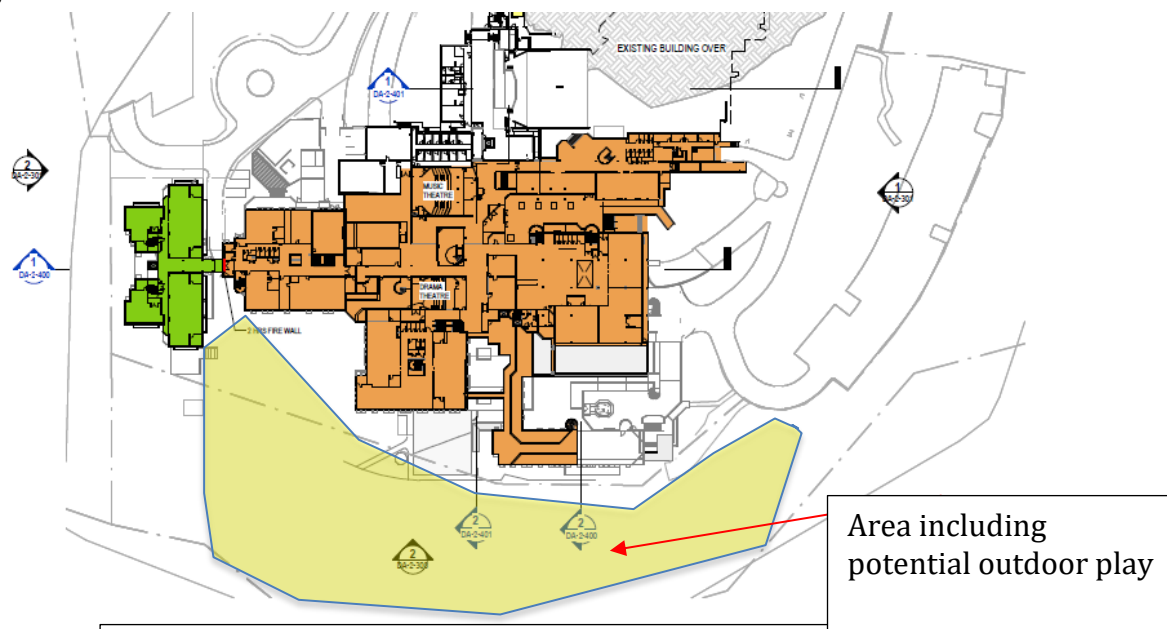


Figure 3 – Areas with Potential Outdoor Play



Figure 4 – Proposed area of outdoor play

There are a number of courtyard areas which will include outdoor play areas on Levels 2, 3, and 4 of the project and are detailed in the Figures below.

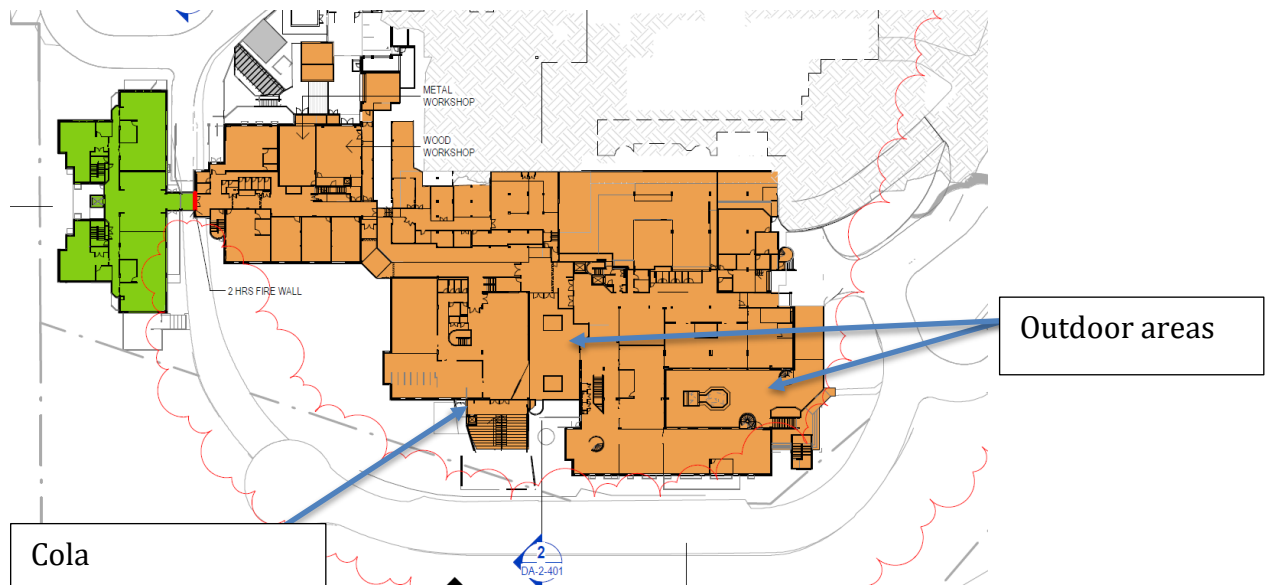


Figure 5 – Level 2 Cola and Terrace Play Area

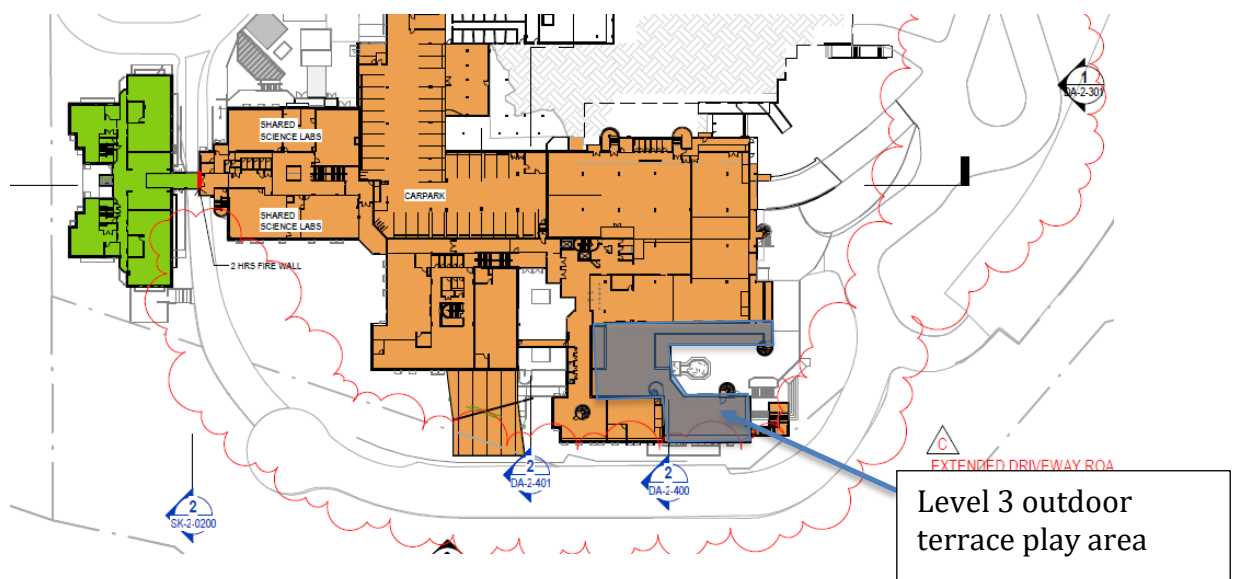


Figure 6 – Level 3 Outdoor Terrace Area

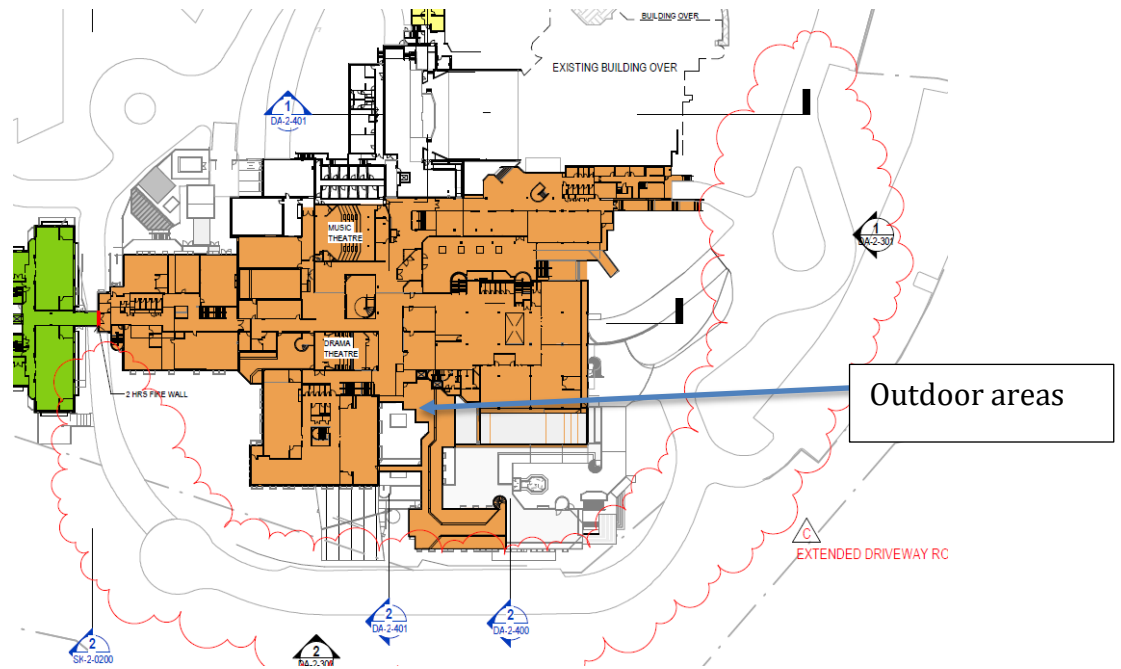


Figure 7 – Level 4 Outdoor Terrace Play Area

A detailed assessment for the potential noise impact from the use of the areas with potential outdoor play has been undertaken in this section of the report. The location of the proposed areas for outdoor play are located to the south of the Lindfield Learning Village building. The location of the areas of outdoor play are such that the building will act as an acoustic screen to the residential receivers located to north of the site on Dunstan Grove and Tubbs View.

Based on the outdoor play areas the following assumptions regarding noise generated from these areas has been used in this assessment:

1. The outdoor terrace play areas on level 2, 3 and 4 are located to the south of the building structure and such that there is no line of sight to neighbouring residential receivers and the building structure will provide significant acoustic screening to these receivers.
2. Outdoor play areas will be used during periods of the day and can include the total number of students which are housed within the Lindfield Learning Village.
3. All areas of outdoor play will include supervision by teaching staff during the daytime hours of the school breaks.
4. Noise generated from the use of the outdoor play areas is based on the following:
 - a. Source noise levels from active play based on SWL of 80 dB(A) Leq.

The source noise level is within the range detailed within the AAAC's Guideline for Child Care Centre Acoustic Assessment, for groups of children playing age group including 3-6.

The proposed source noise level is in the lower range of the AAAC expected source noise level for 3 to 6 year old's of 84-90 dB(A) for

10 children. Based on experience with similar school facilities to that of the Lindfield Learning Centre, the proposed source noise level of 80 dB(A) is suitable for the proposed use at the site as the site will include older students and will be supervised.

- b. A source noise levels will be based on 1 in 2 children generating noise at any time.
- c. Source noise levels have been based on population number on each of the external play areas including the following:
 - i. Level 3 roof area – up to 60 students
 - ii. Level 5 roof areas – up to 150 students
 - iii. External Play areas to the South on ground level – up to 1500 students.

Based on the assumptions above an acoustic assessment of noise emission impacts to the surrounding residential receives has been undertaken and compared to the project noise level criteria for outdoor play of background + 10 dB(A). The results of the acoustic assessment are detailed in the table below.

Table 6 – Result of the Acoustic Assessment of Outdoor Play

Location	Time of Day	Calculated Noise Emissions from Outdoor Play Areas L _{Aeq} 15min, dB(A)	Noise Emission Goals for Outdoor Play Areas L _{Aeq} 15min, dB(A)	Comments
Residential Receiver Location 1 – Dunstan Grove	Day time play periods	Up to 65	52	See Comments Details in Section 6.3 below
Residential Receiver Location 2 – Tubbs View	Day time play periods	Up to 60	50	See Comments Details in Section 6.3 below

Based on the results of the noise impact assessment from external play areas noise from the used of the outdoor play areas have the potential to exceed noise goals. The resulting impact to the surrounding receivers and possible acoustic mitigations to future reduce noise from external play areas are discussed in Section 6.3 below.

6.3 Mitigation of Outdoor Play Area Noise including Bells and PA Systems

The detailed acoustic assessment of noise generated from outdoor play areas detailed above has revealed the potential for noise goals to be exceeded. Based on this exceeded and additional assessment including the potential impact of the predicted noise level and possible mitigations has been undertaken and are detailed in this section of the report.

Based on the results of the noise assessment noise associated with the use of the outdoor play areas is discussed below:

1. Predicted noise levels are based on possible maximum student numbers using the outdoor areas. It is likely that that all students will not use external areas simultaneously, but rather a significant number will utilise internal areas of the facility during breaks including libraries, indoor breakout areas, cafeterias and the like. Although it is not possible to calculate the number of students who will use external areas it is possible there would be significantly less than the possible maximum number that would use external areas during breaks and hence a significant reduction in the predicted noise levels at the affected receivers would also result.
2. Noise from the use of the external areas would be limited to periods of breaks used within the Lindfield Learning Village and would not impact receivers for extended periods of the day.
3. Noise levels from the used of the external play areas are based on theoretical maximum levels being experienced for a continuous 15-minute period. During the use of the play areas the possible maximum noise levels generated by students would be limited to a short period and would be significantly less than 15 minutes. This is expected to be the case within the Lindfield Learning Village as the external play areas will include supervision by staff during the scheduled breaks in the school day.
4. The nature of noise generated from children at play is generally not as annoying in characteristic to that of mechanical equipment, movement of vehicles or use of industrial equipment. Additionally, the magnitude of the predicted noise levels at the affected residential receivers of up to 65 dB(A) Leq is similar to that of a normal human conversation.

Based on the predicted possible maximum noise impacts to the surrounding residential receivers and the comments detailed in the points above, noise from the use of the outdoor play areas within the Lindfield Learning Village are not significant and would not result in a negative acoustic amenity at the surrounding residential receivers and are therefore acoustically acceptable.

The predicted noise levels from the proposed outdoor play areas are similar to noise levels generated from other schools within the area and are considered to be acoustically acceptable.

To further mitigate noise the use of the proposed outdoor play areas of the site the following acoustic treatments and controls are possible:

1. All audible bells and speaker are to be located such that they face away from the residential receivers and set to an appropriate noise level of 70-75dB(A) @ 3m.
2. The use of directional speakers should be utilised on the external areas of the site.
3. No additional acoustic treatments required to the level 2, 3 and 4 external bus coal or terrace areas.

6.4 Noise from use of the Extended Driveway

This section of the report details the acoustic assessment of noise generated from the extended driveway for bus and car access to the east and south of the site.

The expected use of the proposed extended driveway will include the following:

1. Morning Peak periods – 227 student drop-off + 95 staff + 14 buses.
2. Morning peak exit – 22 student drop-off cars departing + 14 buses.
3. Afternoon peak entry – 165 student pick-up cars entering + 14 buses.
4. Afternoon peak exit – 165 student pick-up cars + 60 staff + 14 buses.
5. Evening peak entry – nil
6. Evening peak exit – 60 staff.

The proposed location of the 'extended driveway' is detailed in the figure below.

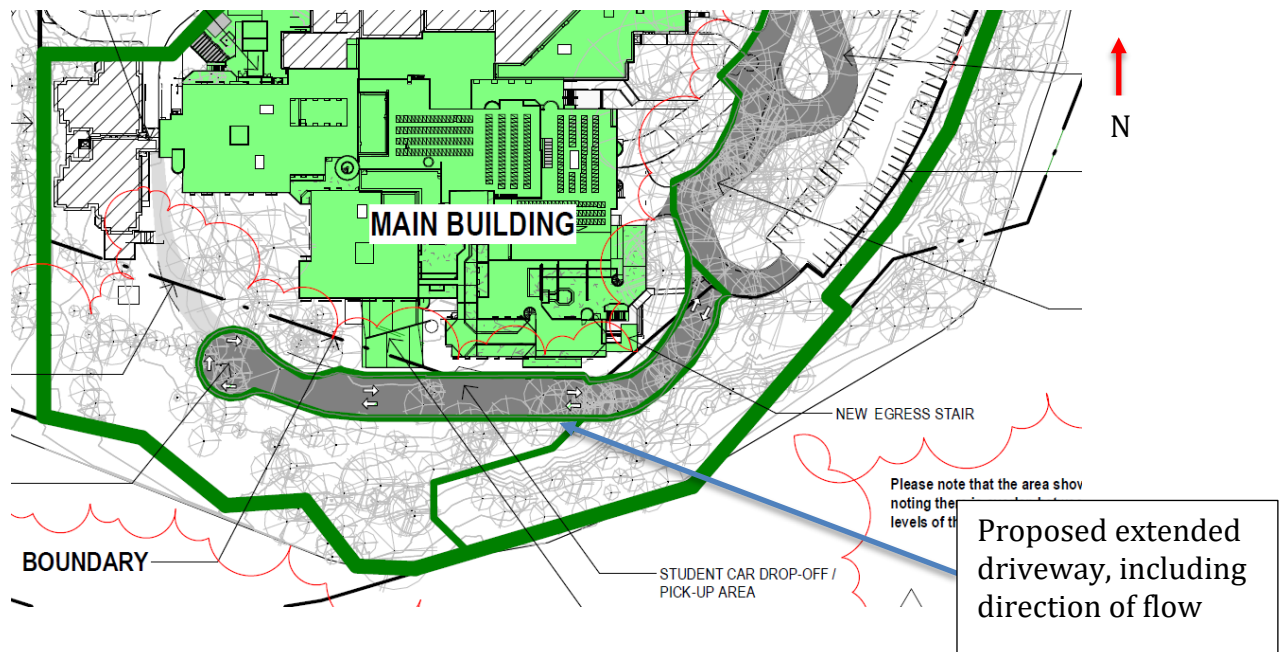


Figure 8 – Proposed Extended Driveway

The assessment of noise from the use of the extended driveway has been undertaken using both the EPA's NPfI and the EPA's Road Noise Policy for New Local Road as a guide. The EPA's Road Noise Policy recommends noise levels from the operation of new local roads on existing residential receivers which is detailed in Section 2.3.1 of the policy, Table 3, which is included below.

Table 3 Road traffic noise assessment criteria for residential land uses

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

Suitable application of the proposed extended driveway

The results of the acoustic assessment as a result of cars and buses using the extended driveway on the potentially affected residential receivers is detailed in the table below.

Table 7 – Result of the Acoustic Assessment of Buses using Extended Driveway

Location	Time of Day	Calculated Noise Emissions from Buses and cars using Extended Driveway Road L _{Aeq} 15min, dB(A)	EPA's Road Noise Policy for new Local Roads L _{Aeq} 1hour, dB(A)	Comments
Residential Receiver Location 1 – Dunstan Grove	Day time Pick Up and Drop off	Up to 54	55	Compliant
Residential Receiver Location 2 – Tubbs View	Day time Pick Up and Drop off	Up to 54	55	Compliant

Based on the results of the assessment of noise generated from the use of the proposed extended driveway will be acoustically acceptable and will not result in an unacceptable acoustic impact of the amenity of the surrounding residential receivers.

In addition to the assessment detailed above comments regarding the resulting noise levels resulting from the use of the extended driveway as a result of the morning and afternoon peak periods follow:

1. The noise associated with the morning and afternoon peak periods will be limited to a period of generally 7.30am to 9am and an afternoon period of 2.30pm to 3.30pm.
2. During the peak periods noise generated from a bus passing will result in a noise impact on the residential receivers on Tubbs Way as each bus travels along the extended driveway. Based on the expected travel speeds of a bus of 10-15km/h the resulting period when noise from each bus passing will be approximately 30 seconds. Based on the proposed 14 bus movements entering and 14 movements exiting (28 total movements) the noise from bus movements will be approximately 14 minutes in any given peak morning or afternoon period
3. Noise levels generated from vehicles using the extended driveway will be mitigated from the distance separation between the driveway and the residence which is approximately 30m.
4. The Proposed car drop-off and pick-up area is located to the south of the site which is well away from residents in Tubbs View and Dunstan Grove.
5. The resulting external noise levels from the use of the proposed extended driveway are compliant with the relevant noise emission criteria as well as including a level of noise which will not negatively impact on the acoustic amenity of the residential units such that the activities including reading or conducting quiet conversations will not be impacted.
6. The assessment includes the resulting noise level to the external areas of the residential receivers which are compliant with the relevant noise level criteria. As an additional mitigation in the event residence of the building choose to have the external building openings closed (including windows and doors) then a future reduction in the resulting noise level to the internal areas of the residential dwellings will result.

Based on the detailed assessment included in this section of the report and the comments above the proposed extended driveway will be acoustically acceptable based on the proposed future use as part of the Phase 2 and 3 project.

6.5 Noise from Internal Areas

This section of the report details the assessment of noise emissions from the internal noise from the Lindfield Learning Village.

All internal areas of the Lindfield Learning Village will be located within the building envelope including a closable external façade with a minimum acoustic performance of R_w 35 which includes 6.38mm laminated glazing (or greater) and solid leigh weight or concrete building elements.

The potentially high noise generating sources within the building including the music and drama theatres are located without external opening to the external environment.

Providing the external façade openings of the building are closed during periods which high noise activities are being generated, such as the metal/wood work shop then noise levels at all surrounding receivers including the residence on Dunstan Grove and Tubbs View will comply with the noise emission criteria detailed in Section 5.2 of this report and will be acoustically acceptable.

6.6 Use of the Gymnasium, Squash Courts and Auditorium

The proposed gymnasium, squash courts and auditorium located within the site are proposed for use outside of normal school hours. The proposed use of the areas are summaries below:

1. Gymnasium – used for general activities by the school or rental by others for sporting activities or the like.
2. Squash courts – use by the school or others for playing of squash.
3. Auditorium – use by the school or others for events or performances such as plays, playing of music, presentations or the like.

All the proposed events detailed above would be conducted within the building structure of the school and would not include use of the external areas of the school. Providing all events are contained within the building envelop and the following management controls are included the use of the gymnasium, squash courts and auditorium will be acoustically acceptable during evening and night-time hours including 6pm to midnight.

1. All proposed activities are to be conducted within the building structure will all external façade openings are closed.
2. No playing of amplified or live music or events external to the building.
3. The departure of patrons from the building is monitored to ensure they leave in a orderly manner and do not congregate outside of the building, including on the street or in the associated car parking areas.
4. Signs reminding patrons that they are existing the building within an area with residential receivers and should leave in a manner generating as little noise as possible should be installed at the exists to the building.
5. During periods when the gymnasium or auditorium is to be used for events there is a site security or management control presence such that the event is undertaken in compliance with the recommendations in this report.

The proposed events to be conducted on the site would not include events similar to a bar or club and as such would not have the potential to generate excessive noise levels which can result from patrons congregating on surrounding external areas under the influence of alcohol.

Providing the events are conducted within the building envelope with the external openings of the building closed noise levels will comply with the relevant noise level criteria detailed in this report.

6.7 Use of the Playground area

The use of the playground area in front of the school (to the south of the building) is proposed to be use between 6pm and 9pm. The use of the playground area during the proposed extended hours period is to be undertaken in association with the use of the auditorium and gymnasium detailed in the section above (and will not include the maximum numbers of the school). Based on the capacity of the gymnasium and auditorium the maximum expected numbers of children using the playground area during the proposed hours of 6pm to 9pm is up to 150 children. The location of the playground are to the south of the site will result on the building structure being an effective acoustic screen to the surrounding residential receivers to the north f the site.

The use of the playground area to the front of the building will be acoustically acceptable and resulting noise levels will comply with the relevant noise level criteria at the residential receivers to the north of the site during evening hours providing the following acoustic controls are included:

1. During periods when the playground is used by children during the proposed extended hours period there should be monitoring from a suitable adult or school staff member such that play does not result in unreasonable noise levels resulting from shouting or the like.
2. External openings to the play areas should include self-closing mechanisms.
3. No playing or recorded or live music on the external play areas.

6.8 Other Impacts

The control of noise generated on the site from a number of other activities has been undertaken and the following management is required to mitigate noise impacts on surrounding receivers.

1. Waste collection from the site is required to be undertaken in compliance with councils policies including times when waste is removed from the site. Where possible waste should be collected from the site during daytime hours.
2. The use of noise generating equipment for ground maintenance and upkeep (such as leave blowers, brush cutters, lawn mowers and the like) are only to be used on the site during daytime hours.

7 Construction Noise Assessment

This section of the report details the assessment of noise associated with the proposed demolition activities associated with the development. The assessment has been undertaken to assess the potential noise impacts from construction and demolition on surrounding receivers to the site.

The proposed construction and demolition activities to be undertaken on the site include the strip out of the existing areas of the existing building and demolition limited areas of the external façade elements. The development will then be constructed using normal construction processes.

The EPA's Interim Construction Noise Guideline defines normal day time hours as the following:

2.2 Recommended standard hours

The recommended standard hours for construction work are shown in Table 1; however, they are not mandatory. There are some situations, as described below, where construction work may need to be undertaken outside of these hours. The likely noise impacts and the ability to undertake works during the recommended standard hours should be considered when scheduling work.

Table 1: Recommended standard hours for construction work

Work type	Recommended standard hours of work*
Normal construction	Monday to Friday 7 am to 6 pm Saturday 8 am to 1 pm No work on Sundays or public holidays
Blasting	Monday to Friday 9 am to 5 pm Saturday 9 am to 1 pm No blasting on Sundays or public holidays

* The relevant authority (consent, determining or regulatory) may impose more or less stringent construction hours.

7.1 Proposed Appliances

The proposed appliances which will be used as part of the demolition required as part of the development are detailed in the table below (including internal strip out/demolition):

Table 8 – Noise Level from Expected Demotion Appliances

Tasks	Equipment	Sound Power Levels per task dB(A) L ₁₀	Aggregate Sound Power Level per Task dB(A) L ₁₀
Site Demolition works	Jack hammer mounted on skid steer	118	122
	Hand held jack hammer	111	
	Concrete saw	119	
	Skid steer	110	
	Power hand tools	109	
Construction Works	Piling	115	120
	Welder	101	
	Saw cutter	109	
	Dump truck	109	
	Concrete saw	119	
	Power hand tools	109	
	Cranes	110	

Notes: Noise levels of proposed equipment to be used on the site based on the Australian Standard AS2436-2010 and noise level measurements previously undertaken of similar equipment on construction sites.

7.2 Construction Noise Criteria

This section of the report details the relevant construction noise criteria which is applicable to the site.

7.2.1 Interim Construction Noise Guideline

Noise criteria for construction and demolition activities are discussed in the *Interim Construction Noise Guideline* (ICNG). The ICNG also recommends procedures to address potential impacts of construction noise on residences and other sensitive land uses. The main objectives of the ICNG are summarised as follows:

- Promote a clear understanding of ways to identify and minimise noise from construction works;
- Focus on applying all “feasible” and “reasonable” work practices to minimise construction noise impacts;
- Encourage construction to be undertaken only during the recommended standard hours unless approval is given for works that cannot be undertaken during these hours;
- Streamline the assessment and approval phases and reduce time spent dealing with complaints at the project implementation phase; and

- Provide flexibility in selecting site-specific feasible and reasonable work practices in order to minimise noise impacts.

The ICNG contains a quantitative assessment method which is applicable to this project. Guidance levels are given for airborne noise at residences and other sensitive land uses.

The quantitative assessment method involves predicting noise levels at sensitive receivers and comparing them with the Noise Management Levels (NMLs). The NML affectation categories for receivers have been reproduced from the guideline and are listed in the table below.

Table 9 – Noise Management Levels from Construction – Quantitative Assessment

Receiver Type	Time of Day	Noise Management Level LAeq(15minute) ^{1,2}	How to Apply
Residential	Recommended standard hours: Monday to Friday 7 am to 6 pm Saturday 8 am to 1 pm No work on Sundays or public holidays	Noise affected RBL + 10 dB	<p>The noise affected level represents the point above which there may be some community reaction to noise.</p> <ul style="list-style-type: none"> • Where the predicted or measured LAeq(15minute) is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level. • The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.
		Highly noise affected 75 dBA	<p>The highly noise affected level represents the point above which there may be strong community reaction to noise.</p> <ul style="list-style-type: none"> • Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities can occur, taking into account: <ol style="list-style-type: none"> 1. Times identified by the community when they are less sensitive to noise (such as before and after school for works near schools, or mid-morning or mid-afternoon for works near residences. 2. If the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.
	Outside recommended standard hours	Noise affected RBL + 5 dB	<ul style="list-style-type: none"> • A strong justification would typically be required for works outside the recommended standard hours. • The proponent should apply all feasible and reasonable work practices to meet the noise affected level. • Where all feasible and reasonable practices have been applied and noise is more than 5 dB above the noise affected level, the proponent should negotiate with the community.

Table 9 – Continued

Receiver Type	Time of Day	Noise Management Level LAeq(15minute) ^{1,2}	How to Apply
offices, retail outlets: external	When is use	LAeq (15 min) 70 dB(A)	During construction, the proponent should regularly update the occupants of the commercial and industrial premises regarding noise levels and hours of work.
<p><i>Note 1 Noise levels apply at the property boundary that is most exposed to construction noise, and at a height of 1.5 m above ground level. If the property boundary is more than 30 m from the residence, the location for measuring or predicting noise levels is at the most noise-affected point within 30 m of the residence. Noise levels may be higher at upper floors of the noise affected residence.</i></p> <p><i>Note 2 The RBL is the overall single-figure background noise level measured in each relevant assessment period (during or outside the recommended standard hours). The term RBL is described in detail in the NSW Industrial Noise Policy (EPA 2000).</i></p>			

Based on the table above the suitable construction noise management levels for works undertaken on the site is detailed in Table 10 below.

Table 10 – Site Construction Noise Management Levels

Noise Source	Time Period	Receiver Type	Construction Noise Management Level	'High Noise Affected' Level
Construction Noise	Recommended standard hours: Monday to Friday 7 am to 6 pm Saturday 8 am to 1 pm No work on Sundays or public holidays	Residential	52 dB(A) LAeq (15min)	75 dB(A) LAeq (15min)
		Commercial	-	70 dB(A) LAeq (15min)
	When in Use	Schools, internally	45 dB(A) Leq (15 min)	
<i>Note 1: Construction noise management levels based on the Interim Construction Noise Guideline</i>				

7.3 Construction Vibration Criteria

Effects of ground borne vibration on buildings may be segregated into the following three categories:

- Human comfort – vibration in which the occupants or users of the building are inconvenienced or possibly disturbed. Refer to further discussion in Section 7.3.1.
- Effects on building contents – where vibration can cause damage to fixtures, fittings and other non-building related objects. Refer to further discussion in Section 7.3.2 and 7.3.3.
- Effects on building structures – where vibration can compromise the integrity of the building or structure itself. Refer to further discussion in Section 7.3.2 and 7.3.3.

7.3.1 Vibration Criteria – Human Comfort

Vibration effects relating specifically to the human comfort aspects of the project are taken from the guideline titled “*Assessing Vibration – A Technical Guideline*”. (AVTG) This type of impact can be further categorised and assessed using the appropriate criterion as follows:

- Continuous vibration – from uninterrupted sources (refer to Table 11).
- Impulsive vibration – up to three instances of sudden impact e.g. dropping heavy items, per monitoring period (refer to Table 12).
- Intermittent vibration – such as from drilling, compacting or activities that would result in continuous vibration if operated continuously (refer to Table 13).

Table 11 Continuous vibration acceleration criteria (m/s²) 1 Hz-80 Hz

Location	Assessment period	Preferred Values		Maximum Values	
		z-axis	x- and y-axis	z-axis	x- and y-axis
Residences	Daytime	0.010	0.0071	0.020	0.014
	Night-time	0.007	0.005	0.014	0.010
Offices, schools, educational institutions and places of worship	Day or night-time	0.020	0.014	0.040	0.028
		0.04	0.029	0.080	0.058
Workshops	Day or night-time	0.04	0.029	0.080	0.058

Table 12 Impulsive vibration acceleration criteria (m/s²) 1 Hz-80 Hz

Location	Assessment period	Preferred Values		Maximum Values	
		z-axis	x- and y-axis	z-axis	x- and y-axis
Residences	Daytime	0.30	0.21	0.60	0.42
	Night-time	0.10	0.071	0.20	0.14
Offices, schools, educational institutions and places of worship	Day or night-time	0.64	0.46	1.28	0.92
Workshops	Day or night-time	0.64	0.46	1.28	0.92

Table 13 Intermittent vibration impacts criteria (m/s^{1.75}) 1 Hz-80 Hz

Location	Daytime		Night-time	
	Preferred Values	Maximum Values	Preferred Values	Maximum Values
Residences	0.20	0.40	0.13	0.26
Offices, schools, educational institutions and places of worship	0.40	0.80	0.40	0.80
Workshops	0.80	1.60	0.80	1.60

7.3.2 Vibration Criteria – Building Contents and Structure

The vibration effects on the building itself are assessed against international standards as follows:

- For transient vibration: British Standard BS 7385: Part 2-1993 “Evaluation and measurement for vibration in buildings Part 2: Guide to damage levels from ground borne vibration” (BSI 1993); and
- For continuous or repetitive vibration: German DIN 4150: Part 3 – 1999 “Effects of Vibration on Structure” (DIN 1999).

7.3.3 Standard BS 7385 Part 2 - 1993

For transient vibration, as discussed in standard BS 7385 Part 2-1993, the criteria are based on peak particle velocity (mm/s) which is to be measured at the base of the building. These are summarised in Table 14 and illustrated in the Figure below.

Table 14 Transient vibration criteria as per standard BS 7385 Part 2 - 1993

Line in Figure below	Type of Building	Peak Component Particle Velocity in Frequency Range of Predominant Pulse	
		4 Hz to 15 Hz	15 Hz and Above
1	Reinforced or framed structures Industrial and heavy commercial buildings	50 mm/s at 4 Hz and above	
2	Unreinforced or light framed structures Residential or light commercial type buildings	15 mm/s at 4 Hz increasing to 20 mm/s at 15 Hz	20 mm/s at 15 Hz increasing to 50 mm/s at 40 Hz and above

Standard BS 7385 Part 2 – 1993 states that the values in Table 14 relate to transient vibration which does not cause resonant responses in buildings. Where the dynamic loading caused by continuous vibration events is such as that results in dynamic magnification due to resonance (especially at the lower frequencies where lower guide values apply), then the values in Table 14 may need to be reduced by up to 50% (refer to Line 3 in the Figure below).

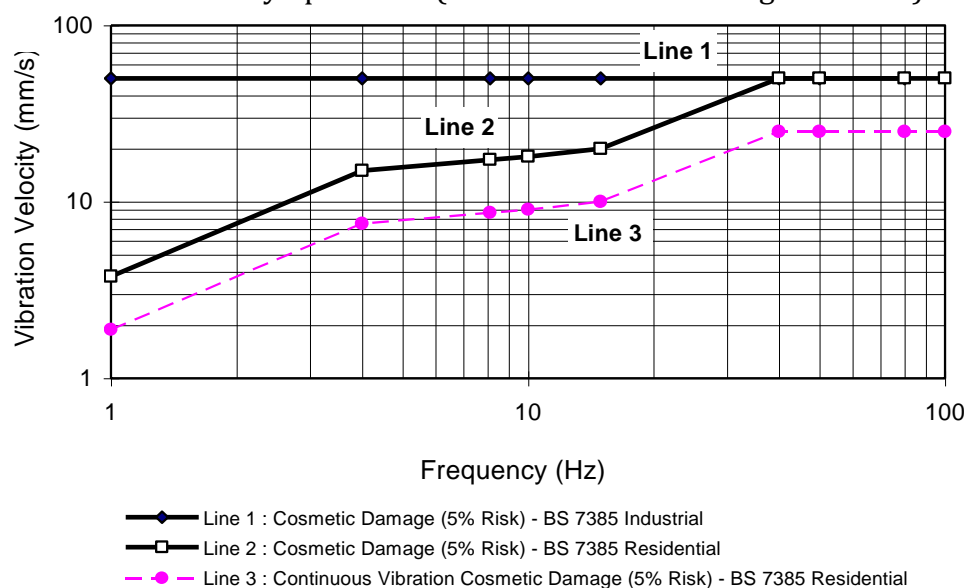


Figure 10 - BS 7385 Part 2 – 1993, graph of transient vibration values for cosmetic damage

In the lower frequency region where strains associated with a given vibration velocity magnitude are higher, the recommended values corresponding to Line 2 are reduced. Below a frequency of 4 Hz where a high displacement is associated with the relatively low peak component particle velocity value, a maximum displacement of 0.6 mm (zero to peak) is recommended. This displacement is equivalent to a vibration velocity of 3.7 mm/s at 1 Hz.

The standard also states that minor damage is possible at vibration magnitudes which are greater than twice those given in Table 14, and major damage to a building structure may occur at values greater than four times the tabulated values.

Fatigue considerations are also addressed in the standard and it is concluded that unless calculation indicates that the magnitude and number of load reversals is significant (in respect of the fatigue life of building materials) then the values in Table 14 should not be reduced for fatigue considerations.

7.3.3.1 Standard DIN 4150 Part 3 - 1999

For continuous or repetitive vibration, standard DIN 4150 Part 3-1999 provides criteria based on values for peak particle velocity (mm/s) measured at the foundation of the building; these are summarised in Table 15. The criteria are frequency dependent and specific to particular categories of structures.

Table 15 Structural damage criteria as per standard DIN 4150 Part 3 - 1999

Type of Structure	Peak Component Particle Velocity, mm/s			
	Vibration at the foundation at a frequency of			Vibration of horizontal plane of highest floor at all frequencies
	1 Hz to 10 Hz	10 Hz to 50 Hz	50 Hz to 100 Hz ¹	
Buildings used for commercial purposes, industrial buildings and buildings of similar design	20	20 to 40	40 to 50	40
Dwellings and buildings of similar design and/or use	5	5 to 15	15 to 20	15
Structures that, because of their sensitivity to vibration, do not correspond to those listed in lines 1 and 2 and are of great intrinsic value (e.g. buildings that are under a preservation order)	3	3 to 8	8 to 10	8
Note 1: For frequencies above 100Hz, at least the values specified in this column shall be applied.				

7.4 Construction Noise Management – Qualitative Assessment

Based on the assessment conducted of the expected construction noise levels generated from the Lindfield Learning Village site noise levels are generally expected to require the building contractor to engage in management of activities on the site and engagement with the local community.

Notwithstanding, the following management controls are recommended to mitigate construction noise levels on the site:

1. All plant and equipment are to be maintained such that they are in good working order.
2. A register of complaints is to be recorded in the event of complaints being received, including location, time of complaint, nature of the complaint and actions resulting from the complaint.
3. If required a noise level measurement of the offending plant item generating complaints is to be conducted and noise mitigations undertaken to reduce noise levels to within Noise Management levels in the event magnitude of noise levels is found to be above suitable levels.
4. The use of percussive and concrete sawing should be undertaken behind a closed façade when possible.
5. For works undertaken outside of normal day time hours (proposed to include the period 6pm to 6am) the external façade of the building should be closed. In the event there are temporary openings in the façade these should be closed using a solid material such as 6mm FC sheet or 12mm plywood.
6. The use of high noise generating equipment including hydraulic hammers, rock cutters or the like should not be undertaken prior to 8am Monday to Friday or 8.30am Saturdays.
7. The loading of trucks should be conducted such that there is not a requirement to stack truck on the roadways adjacent to the residence on Dunstan Grove and or Tubbs view.
8. Where possible to use of squawkers or the like should be used in place of reversing alarms.

In addition to the recommended mitigations above details of the proposed construction (including demolition) works to be conducted on the site, including type of activities to be conducted as well as the expected duration of activities should be provided to the neighbouring receivers.

A detailed construction noise and vibration management plan is to be provided by the building contractor.

7.5 Construction Noise Assessment – Quantitative Assessment

A quantitative assessment of the construction noise levels resulting from the proposed works to be undertaken as part of the Lindfield Learning Village project on surrounding residential receivers has been undertaken.

The assessment has been based on the expected noise levels to be generated on the site including those detailed in Section 7.1 above. Calculations of the resulting construction noise levels of the residential receivers within proximity to the site is detailed in the table below.

Table 16 Quantitative Assessment of Construction Noise to Neighboring Residence

Source Noise	Equipment	Sound Power Levels dB(A) L ₁₀	Aggregate Sound Power Level dB(A) L ₁₀	Calculated Construction Noise Level – Dunstan Grove	Calculated Construction Noise Level – Tubbs View
Site Demolition works	Jack hammer mounted on skid steer	118	122	Up to 75 dB(A) when items used externally	Up to 70 dB(A) when items used externally
	Hand held jack hammer	111		Up to 50 dB(A) when items used within the building with a closed façade	Up to 45 dB(A) when items used within the building with a closed façade
	Concrete saw	119			
	Skid steer	110			
	Power hand tools	109			
Construction Works	Piling	115	120	Up to 73 dB(A) when items used externally	Up to 68 dB(A) when items used externally
	Welder	101			
	Saw cutter	109			
	Dump truck	109		Up to 48 dB(A) when items used within the building with a closed façade	Up to 43 dB(A) when items used within the building with a closed façade
	Concrete saw	119			
	Power hand tools	109			
	Cranes	110			
Notes: Calculated qualitative noise levels are based on the overall Aggregate Sound Power Level for the expected demolition and construction works to be undertaken in the site.					

Based on the qualitative assessment of construction noise suitable management controls and community notifications are required to be conducted.

The required management of construction noise impacts are include in Section 7.4 above.

8 Conclusion

This report details the Revised Noise Impact Assessment of the proposed Lindfield Learning Village Phase 2 and 3 project.

Based on the results of this assessment noise levels associated with the future operation of the project, including the proposed outdoor play areas, future extended driveway, mechanical plant and equipment and internal areas of the project.

The assessment undertakes the required investigations, including EPA Noise Policy for Industry (previously the Industrial Noise Policy) and Road Noise Policy.

Providing the recommended treatments and controls detailed in this report are included in the design and operation of the Lindfield Learning Village noise emissions from the site will be acoustically acceptable at all surrounding receivers including the residential receivers on Dunstan Grove and Tubbs View.

Additionally, noise and vibration generated during the proposed construction period of the project (including demolition activities) can be suitably managed in accordance with the EPA's Interim Construction Noise Guideline.

For any additional information please do not hesitate to contact the person below.

Regards



Ben White
Director
White Noise Acoustics

9 Appendix A – Glossary of Terms

<i>Ambient Sound</i>	The totally encompassing sound in a given situation at a given time, usually composed of sound from all sources near and far.
<i>Audible Range</i>	The limits of frequency which are audible or heard as sound. The normal ear in young adults detects sound having frequencies in the region 20 Hz to 20 kHz, although it is possible for some people to detect frequencies outside these limits.
<i>Character, acoustic</i>	The total of the qualities making up the individuality of the noise. The pitch or shape of a sound's frequency content (spectrum) dictate a sound's character.
<i>Decibel [dB]</i>	The level of noise is measured objectively using a Sound Level Meter. The following are examples of the decibel readings of every day sounds; <ul style="list-style-type: none"> 0dB the faintest sound we can hear 30dB a quiet library or in a quiet location in the country 45dB typical office space. Ambience in the city at night 60dB Martin Place at lunch time 70dB the sound of a car passing on the street 80dB loud music played at home 90dB the sound of a truck passing on the street 100dB the sound of a rock band 115dB limit of sound permitted in industry 120dB deafening
<i>dB(A)</i>	<i>A-weighted decibels</i> The ear is not as effective in hearing low frequency sounds as it is hearing high frequency sounds. That is, low frequency sounds of the same dB level are not heard as loud as high frequency sounds. The sound level meter replicates the human response of the ear by using an electronic filter which is called the "A" filter. A sound level measured with this filter switched on is denoted as dB(A). Practically all noise is measured using the A filter. The sound pressure level in dB(A) gives a close indication of the subjective loudness of the noise.
<i>Frequency</i>	Frequency is synonymous to <i>pitch</i> . Sounds have a pitch which is peculiar to the nature of the sound generator. For example, the sound of a tiny bell has a high pitch and the sound of a bass drum has a low pitch. Frequency or pitch can be measured on a scale in units of Hertz or Hz.
<i>Loudness</i>	A rise of 10 dB in sound level corresponds approximately to a doubling of subjective loudness. That is, a sound of 85 dB is twice as loud as a sound of 75 dB which is twice as loud as a sound of 65 dB and so on
<i>L_{Max}</i>	The maximum sound pressure level measured over a given period.
<i>L_{Min}</i>	The minimum sound pressure level measured over a given period.
<i>L₁</i>	The sound pressure level that is exceeded for 1% of the time for which the given sound is measured.
<i>L₁₀</i>	The sound pressure level that is exceeded for 10% of the time for which the given sound is measured.
<i>L₉₀</i>	The level of noise exceeded for 90% of the time. The bottom 10% of the sample is the L ₉₀ noise level expressed in units of dB(A).
<i>L_{eq}</i>	The "equivalent noise level" is the summation of noise events and integrated over a selected period of time.
<i>Background Sound Low</i>	The average of the lowest levels of the sound levels measured in an affected area in the absence of noise from occupants and from unwanted, external ambient noise sources. Usually taken to mean the L _{A90} value
<i>Ctr</i>	A frequency adaptation term applied in accordance with the procedures described in ISO 717.
<i>dB (A)</i>	'A' Weighted overall sound pressure level

<i>Noise Reduction</i>	The difference in sound pressure level between any two areas. The term “noise reduction” does not specify any grade or performance quality unless accompanied by a specification of the units and conditions under which the units shall apply
<i>NR Noise Rating</i>	Single number evaluation of the background noise level. The NR level is normally around 5 to 6 dB below the “A” weighted noise level. The NR curve describes a spectrum of noise levels and is categorised by the level at 1000 Hz ie the NR 50 curve has a value of 50 dB at 1000 Hz. The NR rating is a tangential system where a noise spectrum is classified by the NR curve that just encompasses the entire noise spectrum consideration.
<i>R_w</i>	Weighted Sound Reduction Index - Laboratory test measurement procedure that provides a single number indication of the acoustic performance of a partition or single element. Calculation procedures for R _w are defined in ISO 140-2:1991 “Measurement of Sound Insulation in Buildings and of Building Elements Part 2: Determination, verification and application of precision data”.
<i>R'_w</i>	Field obtained Weighted Sound Reduction Index - this figure is generally up to 3-5 lower than the laboratory test determined level data due to flanked sound transmission and imperfect site construction.
<i>Sound Isolation</i>	A reference to the degree of acoustical separation between any two areas. Sound isolation may refer to sound transmission loss of a partition or to noise reduction from any unwanted noise source. The term “sound isolation” does not specify any grade or performance quality and requires the units to be specified for any contractual condition
<i>Sound Pressure Level, L_p dB</i>	A measurement obtained directly using a microphone and sound level meter. Sound pressure level varies with distance from a source and with changes to the measuring environment. Sound pressure level equals 20 times the logarithm to the base 10 of the ratio of the rms sound pressure to the reference sound pressure of 20 micro Pascals.
<i>Sound Power Level, L_w dB</i>	Sound power level is a measure of the sound energy emitted by a source, does not change with distance, and cannot be directly measured. Sound power level of a machine may vary depending on the actual operating load and is calculated from sound pressure level measurements with appropriate corrections for distance and/or environmental conditions. Sound power levels is equal to 10 times the logarithm to the base 10 of the ratio of the sound power of the source to the reference sound power of 1 picoWatt
<i>Speech Privacy</i>	A non-technical term but one of common usage. Speech privacy and speech intelligibility are opposites and a high level of speech privacy means a low level of speech intelligibility. It should be recognised that acceptable levels of speech privacy do not require that speech from an adjacent room is inaudible.
<i>Transmission Loss</i>	Equivalent to Sound Transmission Loss and to Sound Reduction Index in terminology used in countries other than Australia. A formal test rating of sound transmission properties of any construction, by usually a wall, floor, roof etc. The transmission loss of all materials varies with frequency and may be determined by either laboratory or field tests. Australian Standards apply to test methods for both situations.

10 Appendix B – Staging Drawings