

# St Ives Indoor Sports Complex

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## Stage 2 Acoustics DA report

### Ki-Ring-Gai Council




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# 1.0

## Introduction

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## 1.0 Introduction

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Cundall has been engaged by JDH Architects for the St Ives Indoor Sports Complex (SIISC) development application. The project proposes to develop a council sports complex on the St Ives Sports Complex (SISC) site.

### 1.1 Proposed development

The proposed development consists of a new three storey building and includes:

- 2 floors (lower ground and ground) plus one level of parking;
- Sports facilities (courts, first aid, store room)
- Offices
- Multipurpose room
- Café.

### 1.2 Design criteria

In this report, acoustic design targets are established for:

- noise impact of the surrounding community on the development, including internal noise levels;
- noise impact of the development on the surrounding community.

The proposed development location is in the local government area of Ku-ring-gai Council. A review of the Ku-ring-gai Council policies has found no specific requirement with respect to the acoustic design. In the absence of Council's requirement, the design targets and guidance have been derived from relevant Australian codes, standards, and guidance, including the following:

- NSW Educational Facilities Standards and Guidelines [EFSG], DG11 – Acoustics;
- EPA 'NSW Noise Policy for Industry' [NPfI] (October 2017);
- State Environmental Planning Policy – (Infrastructure) 2007 [SEPP Infrastructure];
- Australian Standard AS2107 'Acoustics – Recommended design sound levels and reverberation times for building interiors' (2016);
- Interim construction noise guideline (NSW Environment Protection Authority, 2009);
- Australian Standard AS 2436-1981 *Guide to Noise Control on Construction, Maintenance and Demolition Sites*.

A glossary of acoustic terminology used in this report is included in Appendix A.

# 2.0

## Site description

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## 2.0 Site description

### 2.1 Existing site and general observations

The existing St Ives High School is surrounded by residential receivers. Roads with significant contribution to the proposal has been identified as Horace Street (west).

Figure 2.1 indicates the site and the immediate surrounds, the approximate location of the proposed new building and noise monitoring locations (refer to Section 3.0).



Figure 2.1 Existing site location and surrounds (Google Maps)

### 2.2 Proposed development

Figure 2.2 shows a detailed plan of the proposed location for the new three storey building within the existing school grounds, adjacent to the southwest boundary of the school.

Figure 2.3 provide a section through the proposed building.



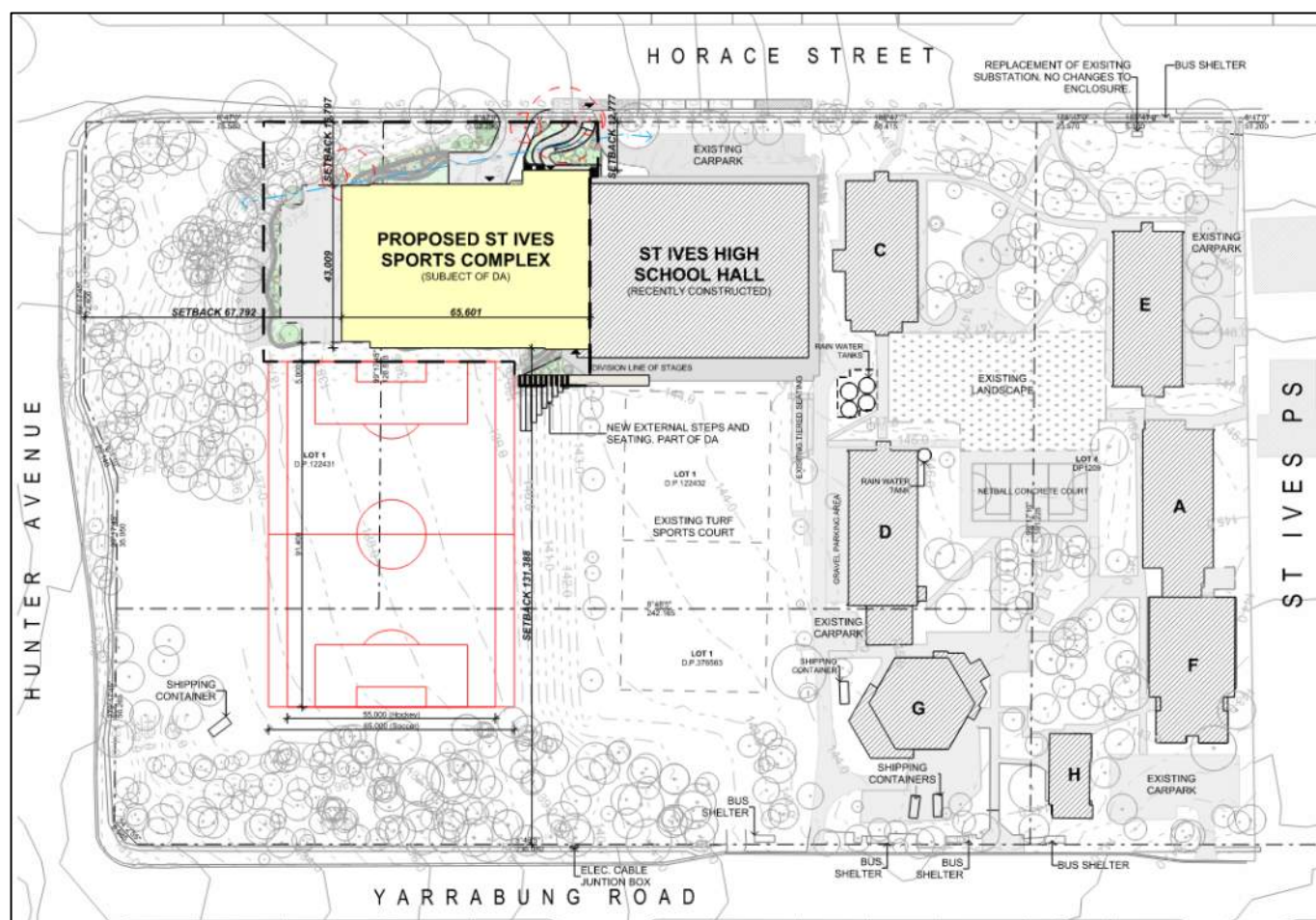


Figure 2.2 Proposed site plan (St Ives Indoor Sports Complex, dated 8 April 2021, JDH Architects)

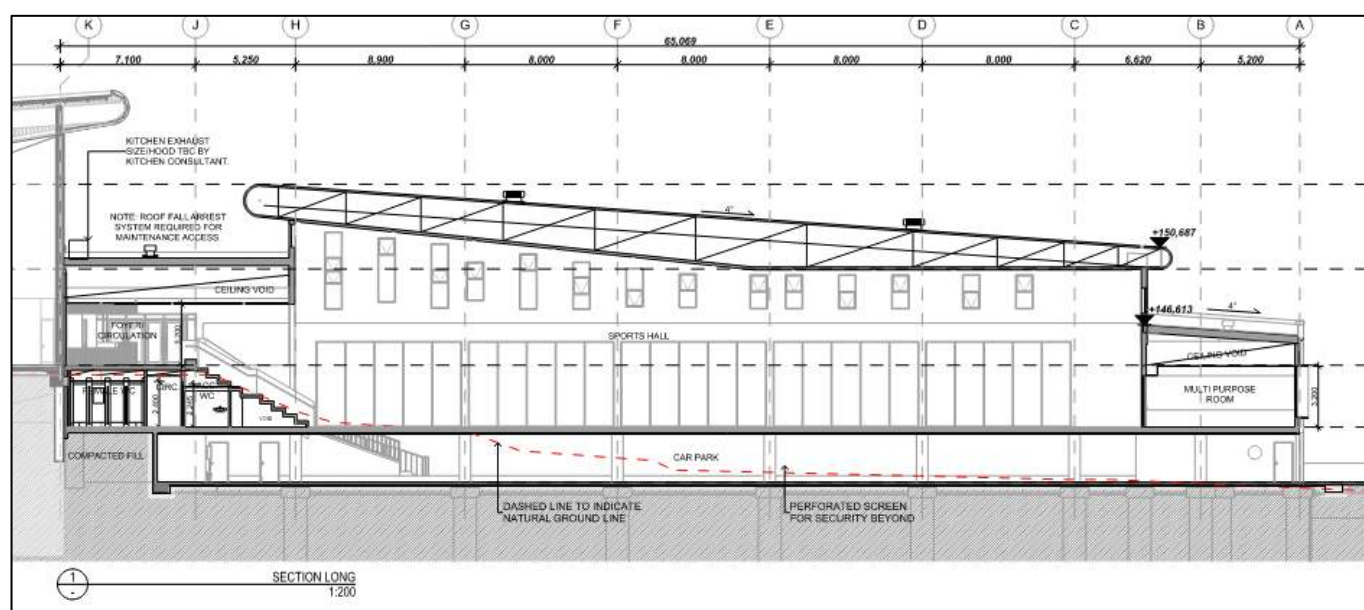


Figure 2.3 Section of proposed development (St Ives Indoor Sports Complex, dated 8 April 2021, JDH Architects)



# 3.0

## Noise survey

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## 3.0 Noise survey

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Cundall completed long term noise monitoring at the site in 2018 as part of Stage one of the school's current redevelopment in October-November 2018. Background noise levels from vehicle traffic will not typically increase significantly over a period of 2-3 years, and we consider the results of this survey to be representative of the overall background noise environment in April 2021. Further, due to the ongoing health crisis, it is likely that reduced traffic volumes may result in lower than previously measured noise levels, which would not be an accurate representation of normal conditions.

The purpose of the noise survey is primarily to:

- identify sources of noise that are likely to affect the development and their expected levels;
- quantify existing ambient noise levels, to assist in setting appropriate noise criteria to assess the impact of the proposed development on the surroundings;
- identify potential noise sensitive receivers in the vicinity.

### 3.1 Weather conditions

Weather conditions at the nearest weather station (Observatory Hill<sup>1</sup>) have been monitored throughout the logging period. Overall weather conditions were observed to be acceptable over the unattended logging period. Any weather affected periods have been excluded as per guidance within the NPfI.

### 3.2 Monitoring results and observations

#### 3.2.1 Unattended monitoring results

The Figure 3.1 illustrates the recorded  $L_{Aeq}$  and  $L_{A90}$  noise levels over the long-term monitoring period, based on the 15-minute survey data.

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<sup>1</sup> Ref: <http://www.bom.gov.au/products/IDN60901/IDN60901.94768.shtml>

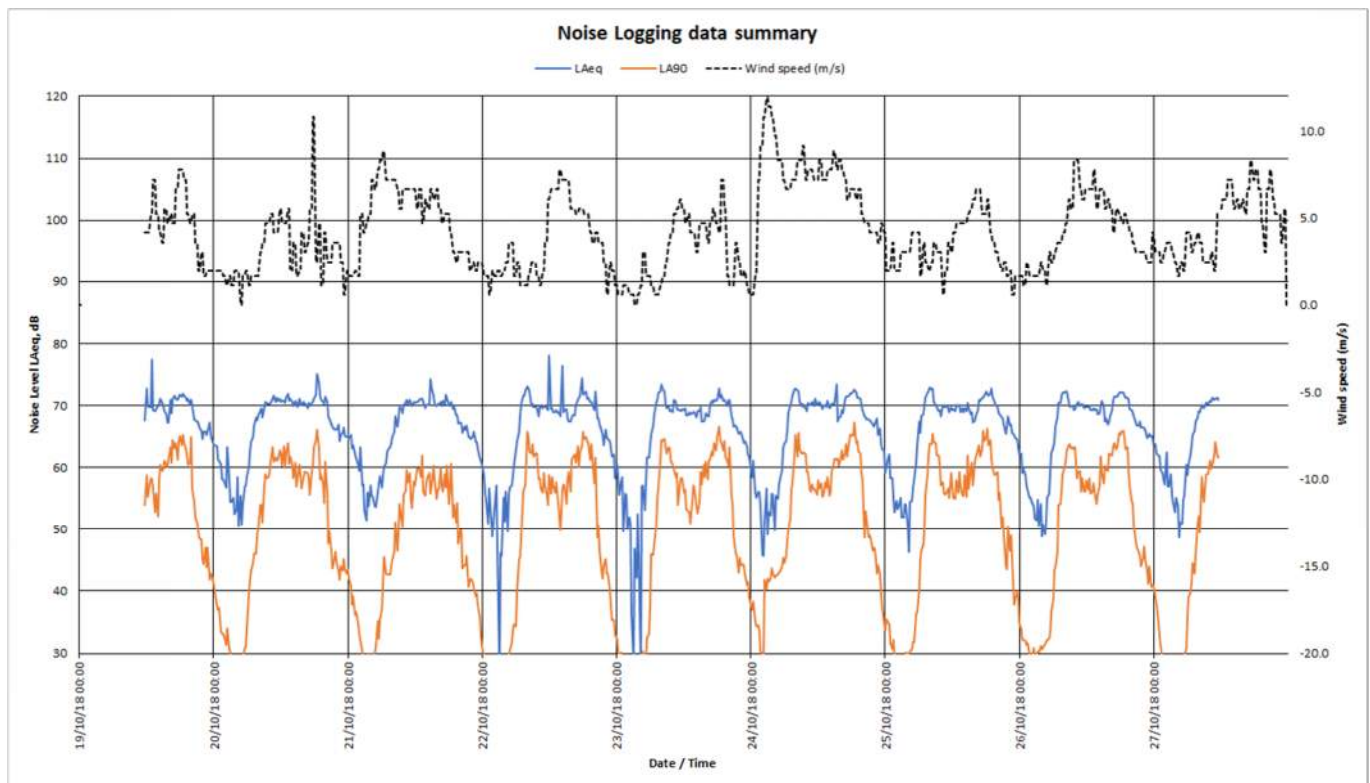


Figure 3.1 Long-term noise level measurements

The Table 3.1 presents the summary of measured ambient noise levels dB,  $L_{Aeq}$  and dB,  $L_{A90}$  across the whole survey period.

Table 3.1 Summary of measured ambient noise levels

Measurement location	Measured Ambient Noise Level (dB, $L_{Aeq}$ )			Measured Background Noise Level (dB, $L_{A90}$ )		
	Daytime	Evening	Night-time	Daytime	Evening	Night-time
BG01	71	69	62	56	45	28

Table 3.2 presents the summary of measured road traffic noise at the noise monitoring location.

Table 3.2 Summary of measured octave band road traffic noise levels

Descriptor	Measured Noise Level									
	Total	Octave band Frequency, Hz (Linear, dB)								
		31.5	63	125	250	500	1000	2000	4000	8000
Daytime peak <sup>2</sup> (6:00 am -8:00 am) $L_{Aeq}(1hr)$	72	66	72	70	66	66	69	65	55	46

1) Free-field noise level

Based on the measurement data and the proposed façade setback distance of approximately 17 m, the noise levels used for the design of the building façade are presented in Table 3.3.

Table 3.3 Summary of design road traffic noise levels

Façade direction	Calculated facade noise level dB L <sub>Aeq</sub> (1hr)
E	55
S	68
W	69

# 4.0

## Environmental noise

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## 4.0 Environmental noise

### 4.1 State Environmental Planning Policy (Educational Establishments and Child Care Facilities) 2017

The State Environmental Planning Policy (Educational Establishments and Child Care Facilities) 2017 [Education SEPP] provide controls of noise from a new building and alteration of existing building which are in line with the intrusive criteria of the NSW Environment Protection Authority's Noise Policy for Industry [NPfI] dated October 2017 (detailed in the following sections).

It should be noted that this design criteria are applicable to the design of the school building and not noise from children.

An extract of the development control provided by Education SEPP, Part 7, Schedule 2 Schools—complying development are presented below:

#### 6 Noise

*A new building or (if the development is an alteration or addition to an existing building for the purpose of changing its use) an existing building that is to be used for the purpose of a school or school-based child care must be designed so as not to emit noise exceeding an  $L_{Aeq}$  of 5 dB(A) above background noise when measured at any lot boundary.*

### 4.2 State Environmental Planning Policy – (Infrastructure) 2007 (I-SEPP)

As Horace Road is a classified road under the I-SEPP, the requirements of the Policy must be applied to this project. Regarding road noise to the project, the I-SEPP states the following:

#### 102 Impact of road noise or vibration on non-road development

*(1) This clause applies to development for any of the following purposes that is on land in or adjacent to the road corridor for a freeway, a tollway or a transitway or any other road with an annual average daily traffic volume of more than 40,000 vehicles (based on the traffic volume data published on the website of the RTA) and that the consent authority considers is likely to be adversely affected by road noise or vibration:*

- (a) a building for residential use,*
- (b) a place of public worship,*
- (c) a hospital,*
- (d) an educational establishment or child care centre.*

*(2) Before determining a development application for development to which this clause applies, the consent authority must take into consideration any guidelines that are issued by the Director-General for the purposes of this clause and published in the Gazette.*

*(3) If the development is for the purposes of a building for residential use, the consent authority must not grant consent to the development unless it is satisfied that appropriate measures will be taken to ensure that the following  $L_{Aeq}$  levels are not exceeded:*

- (a) in any bedroom in the building—35 dB(A) at any time between 10 pm and 7 am,*
- (b) anywhere else in the building (other than a garage, kitchen, bathroom or hallway)—40 dB(A) at any time.*

*(4) In this clause, freeway, tollway and transitway have the same meanings as they have in the Roads Act 1993.*

While the SEPP sets specific noise criteria for residential premises which are in line with the recommendations provided by Australian Standard AS2107:2016 'Acoustics – Recommended design sound levels and reverberation times for

*building interiors*, it does not set specific target noise levels for the spaces within educational premises but refers to *other guidelines*. As the internal noise requirements of the Educational Facilities Standards & Guidelines (EFSG) Design Guide DG11 are more stringent than those for the equivalent spaces in AS2107, we recommend that these criteria be used to assess compliance with the I-SEPP requirements.

### 4.3 Noise egress design criteria

It is understood that the development proposal may include mechanical ventilation/cooling systems to the new Sports Complex. As such there is potential for some localised items of plant (e.g. toilet extract fans etc.) to be installed as part of the proposal.

Any environmental emissions from the proposed development should be designed to comply with the requirements of the NSW Environment Protection Authority's *Noise Policy for Industry* [NPfI] dated October 2017.

The objective of the NPfI is to ensure noise impacts from the proposed developments are assessed and managed in a consistent and transparent manner. If it is predicted that the development is likely to cause the project noise trigger level to be exceeded at noise-sensitive receivers, management measures need to be considered to seek to reduce the potential noise level.

The project noise trigger level provides an objective for assessing a proposal or site. It is not intended for use as a mandatory requirement. The project noise trigger level is a level that, if exceeded, would indicate a potential noise impact on the community, and so 'trigger' a management response; for example, further investigation of mitigation measures. The project noise trigger level, feasible and reasonable mitigation measures, and consideration of residual noise impacts are used together to assess noise impact and manage the potential noise from a proposal or site.

The project noise trigger level is the lower (that is, the more stringent) value of the project intrusiveness noise level and project amenity noise level. The project intrusiveness noise level aims to protect against significant changes in noise levels, whilst the project amenity noise level seeks to protect against cumulative noise impacts from industry and maintain amenity for particular land uses. Applying the most stringent requirement as the project noise trigger level ensures that intrusive noise is limited, amenity is protected, and that no single development can unacceptably change the noise level of an area.

The NPfI separates the day into three different time periods – daytime, evening and night-time. These time periods are detailed below.

Table 4.1 NPfI time periods

Period	Day of week	Time period
Day	Monday-Saturday	07:00 – 18:00 hours
	Sunday, Public Holiday	08:00 – 18:00 hours
Evening	Monday-Sunday	18:00 – 22:00 hours
Night	Monday-Saturday	22:00 – 07:00 hours
	Sunday, Public Holiday	22:00 – 08:00 hours

It is noted that the dB,  $L_{Aeq}$  noise level is determined over a 15-minute period for the project intrusiveness noise level and over an assessment period (day, evening and night) for the project amenity noise level. This leads to the situation where, because of the different averaging periods, the same numerical value does not necessarily represent the same amount of noise heard by a person for different time periods.

It should be noted that the assessment is based on industrial noise sources, which in this case would relate to mechanical services plant etc. Activity noise from children falls outside of this assessment.



#### **4.3.1 Selection of noise sensitive receivers**

The most affected sensitive receivers to potential noise from the proposed development are the residential properties on Horace Street located approximately 40 m to the west of the site. Should mechanical plant noise emissions meet the requirements at this location then other, more distant, properties will be appropriately protected.

#### **4.3.2 Project intrusiveness level**

A shorter sampling period over 15-minute is typically used when measuring the level of intrusive noise. This is taken to be a reasonable estimate of the period over which annoyance may occur.

The applicable intrusiveness criteria for the development based on site measurement data<sup>2</sup> are provided in

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<sup>2</sup> Because of the variable nature of background noise levels, the NPfI specifies single number background noise levels for use in setting the intrusiveness noise criterion. The Assessment Background Level [ABL] for each time period is the level exceeded by 90% of the  $L_{A90,15min}$  measurements. The Rating Background Level [RBL] for a particular time period is the median of the ABL values for that time period for each day of the measurement period.

Table 4.2.

Table 4.2 NPfI - Intrusive criteria

Location	Reference monitoring location	Time period	RBL (Measured)	Intrusive criteria RBL + 5 dB
			dBA	dB, $L_{Aeq,15min}$
Nearest residential properties	BG01	Daytime	56	61
		Evening <sup>1</sup>	45	50
		Night-time <sup>1</sup>	28	35 <sup>2</sup>

1) The school activity is not anticipated during these periods.

2) Where the measured RBL noise level during the night-time period is found to be less than 30 dB  $L_{A90}$ , the night-time Intrusive noise criterion is based on the NPfI minimum night-time background noise level of 30 dB  $L_{A90}$ .

### 4.3.3 Project amenity level

The protection of noise amenity applies to noise from all industrial noise sources including noise emitted from the proposed development. Criteria considers the type of receiver, the area classification and the time of day the noise is proposed to occur. The amenity criterion is set so that the  $L_{Aeq}$  noise level from the industrial noise source does not increase the total industrial noise levels at the receiver above the recommended amenity noise level [ANL] for that receiver.

In cases where no other industries are present in the area, the project amenity noise level is set to the ANL for the proposed development.

A summary of the amenity criteria using data from the noise logger is presented in Table 4.3.

Table 4.3 NPfI – Amenity criteria

Location	Classification	Time period	Measured noise level dB $L_{Aeq,15min}$	ANL <sup>1,2</sup> dB $L_{Aeq, period}$	Amenity criteria dB $L_{Aeq,15min}$
Nearest residential properties	Suburban	Daytime	71	55	53 (55-5+3)
		Evening <sup>3</sup>	69	45	43 (45-5+3)
		Night-time <sup>3</sup>	62	40	38 (40-5+3)

1) Acceptable Noise Level for suburban residences, according to Table 2.2 of NSW NPfI, 2017.

2) To standardise the assessment period for the intrusiveness and amenity noise levels, the policy assumes  $L_{Aeq,15min} = L_{Aeq, period} + 3$  dB.

3) We understand that the halls may operate until 11 pm.

### 4.3.4 Applicable project-specific trigger levels

The most stringent of the intrusiveness and the amenity criteria should be set as the project-specific trigger level to be met by the development. Table 4.4 compares the intrusiveness and the amenity criteria and identifies the limiting criterion for each time period.

Table 4.4 NPfI – Project-specific noise trigger levels

Location	Classification	Time period	Intrusive criteria dB $L_{Aeq,15min}$	Amenity criteria dB $L_{Aeq,15min}$	Project -specific trigger level dB $L_{Aeq,15min}$
Nearest residential properties	Suburban	Daytime	61	53	53
		Evening	50	43	43
		Night-time <sup>1</sup>	35	38	35

1) We understand that the halls may operate until 11 pm

#### **4.3.5 Compliance with State Environmental Planning Policy (Educational Establishments and Child Care Facilities) 2017**

Compliance with the established project-specific trigger levels (Table 4.4) will also comply with the Clause 6 of the SEPP Education (Section 4.1).

### **4.4 Noise egress**

#### **4.4.1 Activity noise from the sports halls**

Student activity noise from schools is typically one of the most understandable, and tangible, causes of concern from the occupants of neighbouring premises. Currently there are no specific State criteria for children activity noise from schools and the local DCP does not reference educational facilities other than childcare centres.

The Project site is an existing and established school, covering a large area, and therefore adjacent noise-sensitive dwellings are likely to already be acclimatised to the sounds of general school activity. Notwithstanding this, the extended operation of the courts may result in complaint and we have predicted noise from both Stage 1 and Stage 2 to the nearest noise sensitive receivers, assuming both are operating simultaneously.

As with our assessment of Stage 1 detailed in Cundall report 1019962-RPT-AS-001 Rev B dated 16 November 2018, our noise prediction of the court usage assumes reverberant level of up to 85 dB  $L_{Aeq(15min)}$  (in each facility) through the existing and proposed building envelopes. The noise level due to the operation of both Stage 1 and Stage 2 at the nearest sensitive receiver during the daytime is predicted to be 31 dB  $L_{Aeq}$ , which is 4 dB below the nominated night criteria of 35 dB  $L_{Aeq,15min}$  (refer to Table 4.4). Compliance during the night period will also result in compliance at other times.

#### **4.4.2 Building services noise**

As specific plant items have not been selected at this stage, the project-specific noise trigger levels have been established for consideration during the subsequent design stage. Noise from any mechanical plant associated with the proposed development should be controlled to meet the criteria given in Table 4.4 when assessed at the nearest affected noise-sensitive location.

Typical noise mitigation strategies include selection of low noise outdoor equipment, locating plant to take advantage of shielding from building elements, and the use of plant enclosures or screens if necessary.

#### **4.4.3 Management of other operational activities**

Noise generated by waste collection, services or delivery vehicles is not pacificated from the proposal. However, noise from general operation such as waste collection, services or delivery vehicles should be controlled by management of the collection/delivery times to minimise disturbance to nearby residents. Out of hours (evening and night-time period) activities are not anticipated for the proposed development. Incorporation of Best Management Practice will ensure that impacts to the adjacent receivers, if any, will be reduced during operation.

# 5.0

## Internal acoustic design targets

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## 5.0 Internal acoustic design targets

### 5.1 Design targets

The Educational Facilities Standards & Guidelines (EFSG) Design Guide DG11 provides guidance on the acoustic performance requirements of the various areas and spaces within a school. The design targets provided within this section has been derived from the NSW Department of Education website<sup>3</sup>.

#### 5.1.1 Internal noise level targets

The internal noise level within each space is the combination of any building services and intrusive external noise levels.

Although this is to be a shared use facility, we have based our design criteria on those appropriate to a school, given its location. Recommended design levels for steady-state internal noise and reverberation times within educational buildings are given within EFSG DG11 which are generally in line with the values provided within Australian Standard AS2107:2016.

Table 5.1 outlines internal noise level design targets for typical spaces within the proposed development.

Table 5.1 Summary of recommended room acoustics design targets

Room	Internal noise level (dB, L <sub>Aeq</sub> )
Sports courts	≤ 40
Foyer / Circulation	≤ 45
Multi purpose rooms	≤ 45
Medical rooms (First aid)	≤ 40
Office areas	≤ 40
Reception	≤ 45
Control room	≤ 40
Toilet/change/showers	≤ 50

Compliance with the above noise levels is considered satisfactory for compliance under the I-SEPP.

#### 5.1.2 Rain noise

Rain noise impact is to be assessed only for the following spaces or otherwise directed:

- Office
- Sports Courts
- Reception
- Medical rooms

The design rain intensity level shall use using the one-year annual recurrence, one-hour event for the region as reported by the Bureau of Meteorology.

<sup>3</sup> Department of Education, *Educational Facilities Standards and Guidelines – Design Guide DG11*, <https://efsg.det.nsw.edu.au/design/design/dg11acoustics>, access date 2 August 2018.

The guidance provided within EFSG does not specify internal noise level during rain event. Guidance from Victorian Department of Education and Training (DET) Building Quality Standards Handbook (BQSH) dated May 2017 has been adopted for the design.

The BQSH described the rain noise during a moderate rain event (up to 25 mm/hr rate) as not cause the ambient noise levels to be exceeded by more than 5 dB within learning and speech use areas. Based upon this guidance, the internal design noise level during rain event shall not exceed the nominated internal noise levels of the respective spaces as detailed in Table 5.1 by more than 5 dB.

## 5.2 Acoustic design recommendations

### 5.2.1.1 Existing hall façade

As the new building is to be constructed abutting the Stage 1 hall, the northern wall of the building at ground floor will be the southern wall of the Stage 1 hall. As this interface will contain a number of doors, there are no specific acoustics requirements for this wall.

Consideration should be given to providing acoustic seals to the doors to provide some acoustic separation.

### 5.2.1.2 External noise intrusion

The building façade should be designed such that the maximum ambient noise level criteria detailed in Table 5.2 would be achieved with doors and windows closed. Given the location of the site and based on the measurement data, requirements should be achieved with standard building envelope constructions.

Table 5.2 Minimum façade glazing requirement

Façade direction	Calculated facade noise level dB L <sub>Aeq</sub> (1hr)	Internal design criteria dB L <sub>Aeq</sub> (1hr)	dB R <sub>w</sub> rating requirement	Glazing recommendation system option <sup>1</sup>
				Single glazed system
E	55	40	20	6 mm float
S	68	40	35	6.38 mm lam
W	69	40	35	6.38 mm lam

1) Based on current design and glazing areas

Attention should be given to provide the necessary sound insulation performance of the façade and glazing and the selection of suitable ventilation systems. The acoustic performance of glazing systems should not be compromised by the framing system or seals.

The transmission loss performance of the building envelope used in the calculation is presented in Table 3.1.

Table 5.3 Glazing transmission loss specification used in calculation

Octave band Frequency	Transmission loss performance (dB)						
	63	125	250	500	1000	2000	4000
6 mm float glazing	17	20	24	31	35	29	34
6.38mm laminated glazing	14	17	20	24	31	35	33
Brick structure	36	39	35	39	47	55	60
Roof construction	42	44	34	35	37	36	29



### 5.2.2 Roof construction for rain noise

Design rainfall has been obtained from the Bureau of Meteorology Rainfall Intensity-Frequency-Duration (Rainfall IFD). The Rainfall IFD indicate a one-hour even rain fall with 63.2% Annual Exceedance Probability (AEP) of 27.6 mm.

Based on this design level, the following constructions providing a nominal Sound Intensity Level of 40 dB,  $L_{IA}$  are recommended for all lightweight roofs above occupied spaces to minimise the impact of rain noise. This performance will allow compliance of 5 dB above the nominated internal noise levels of the respective spaces detailed in Table 5.1 during the design rainfall:

Either;

- Minimum 0.48 mm thick metal deck roof
- 50 mm thick, minimum 10 kg/m<sup>3</sup> acoustic cavity insulation sandwiched between roof metal and purlins
- Minimum 100 mm airgap (purlin/joist depth), with additional layer of 50 mm thick minimum 10 kg/m<sup>3</sup> acoustic cavity insulation
- 10 mm thick plasterboard, or equivalent
- Selected architectural ceiling finish

Or;

- Minimum 0.48 mm thick metal deck roof
- 50 mm thick, minimum 10 kg/m<sup>3</sup> acoustic cavity insulation sandwiched between roof metal and purlins
- Minimum 150 mm airgap (lightweight suspension system)
- Mineral fibre tile ceiling (NRC  $\geq$  0.6) in grid

The reviewed concept designs appear to indicate a large cavity between the and architectural ceiling of the building. This and any other alternative roofing systems should be assessed during the design stage of the development.

# 6.0

## Construction noise

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## 6.0 Consideration of construction noise

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As the detailed plan of construction has not been established at this stage of the project, an assessment of demolition and construction noise is to be assessed once the information becomes available. It should be noted that all construction works, including demolition, excavation, and building work should comply with the following guideline as a minimum:

- Interim construction noise guideline (NSW Environment Protection Authority, 2009)
- Australian Standard AS 2436-1981 *Guide to Noise Control on Construction, Maintenance and Demolition Sites*
- Local council policies (Ku-ring-gai Council)

It is recommended that a Construction Noise and Vibration Management Plan (CNVMP) be developed at a later stage of the project, prior to the commencement of site works, once a contractor has been appointed and a programme of construction activities confirmed. This section will discuss the preliminary construction programs to identify any potential impacts and provide in principle mitigation options.

### 6.1 Proposed construction

Based on the site plans, the summary of the works are as follows:

- Construction of new Sports Complex; and
- New landscape area.

### 6.2 Construction traffic

Detail of the vehicle traffic due to construction was not available at the time of the assessment. Careful planning of construction program and onsite management is required to minimise noise impact due to delivery and construction vehicle to site and is recommended to be included in the Construction Noise and Vibration Management Plan (CNVMP).

### 6.3 Construction hours

The complying standard hours of construction as per the Ku-ring-gai Council are as follows:

- 07:00 to 17:00 Monday to Friday
- 08:00 to 13:00 Saturday
- No work Sundays or public holidays

Construction outside of the standard hours (out of hours works) are possible with appropriate permit for works requiring special condition. The following work categories might be undertaken outside the recommended standard hours:

- The delivery of oversized plant or structures that police or other authorities determine require special arrangements to transport along public roads
- Emergency work to avoid the loss of life or damage to property, or to prevent environmental harm
- Maintenance and repair of public infrastructure where disruption to essential services and/or considerations of worker safety do not allow work within standard hours

For the following items, the proposal should provide the relevant authority with clear justification for reasons requiring the works to occur outside of standard hours other than convenience, such as to sustain operational integrity of road, rail and utility networks:

- Public infrastructure works that shorten the length of the project and are supported by the affected community
- Works where a proponent demonstrates and justifies a need to operate outside the recommended standard hours.

Application for out of hours works permit requires approval by Council. Surrounding residents nearby the project site are to be notified in advance of the out of hours works.

### **6.3.1 Respite periods**

Provision of respite break should be considered for noisy activity (e.g. excavation works). The Council has stated a respite break of 45 minutes between 12:00 pm and 1:00 pm on weekdays and no use of machinery for excavation on Saturdays.

## **6.4 General construction noise and vibration control measures**

Standard good-practice procedures should be adopted on site, including the following:

- Prior to construction, a site-specific Construction Noise and Vibration Management Plan (CNVMP) should be prepared as part of the environmental management plan. The CNVMP should include but not limited to:
  - Identification of nearby residences and other sensitive land uses;
  - Detail of construction criteria - Noise (and vibration, where applicable) Management Levels;
  - Description of approved hours of work and what work will be undertaken;
  - Description of what work practices will be applied to minimise noise;
  - Description of complains handling process.
- Where possible, noise generating equipment should be strategically positioned to take advantage of natural screening from structures to reduce the transmission of noise to sensitive receptors;
- Where practical, undertake the noisiest works during the recommended standard hours;
- Turn off plant that is not being used;
- Fixed plant should be appropriately selected and sited and, where necessary, fitted with appropriate silencers or acoustic enclosures;
- Noisy plant operating simultaneously close together should be avoided to the greatest extent practicable, adjacent to noise affected sensitive receptors;
- All plant and equipment should be maintained in a proper and efficient manner to minimise noise emissions, including the replacement of engine covers, repair of defective silencing equipment, tightening of rattling components and the repair of leakages in air lines;
- All plant and equipment should be operated in the correct manner to minimise noise emissions;
- Noise generating equipment should be orientated away from nearby receivers where feasible to minimise noise impacts;
- Minimise plant and vehicles idling when not in use;
- Keep truck drivers informed of designated vehicle routes, parking locations, acceptable delivery hours or other relevant practices (for example, minimising the use of engine brakes, and no extended periods of engine idling – turn off when not in use);
- No queuing / marshalling of construction vehicles is to occur in any public road, especially along Memorial Avenue and local roads;
- Minimise the reversing movement of vehicles on site;
- Employ broadband reversing alarm for mobile equipment where practicable.

# 7.0

## Conclusion

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## 7.0 Conclusion

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This report presents environmental acoustic input to the DA submission for the proposed development of the St Ives Indoor Sports Complex, St Ives.

Designs for roof constructions have been proposed to mitigate rain noise intrusion.

Assessment of noise generated from activity within the new sports halls, in addition to the existing hall constructed as part of Stage 1 works have been reviewed and assessed. Based upon the currently documented and existing construction, compliance with the nominated environmental noise criteria is predicted.

Internal noise design levels have been established, based on appropriate standards and guidelines. Intrusive noise impact on the development from the surroundings (primarily road traffic noise) has been assessed. Recommendations to achieve the design internal noise levels within the development have been provided within this report.

Environmental noise criteria for noise from the development to nearby noise sensitive receivers have been determined for new mechanical and activity noise associated with the building.

# Appendices

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## Appendix A Acoustic terminology

### ASSESSMENT BACKGROUND LEVEL (ABL)

A single-number figure used to characterise the background noise levels from a single day of a noise survey. ABL is derived from the measured noise levels for the day, evening or night time period of a single day of background measurements. The ABL is calculated to be the tenth percentile of the background  $L_{A90}$  noise levels – i.e. the measured background noise is above the ABL 90% of the time.

### 'A'-WEIGHTED SOUND LEVEL dBA

The unit generally used for measuring environmental, traffic or industrial noise is the A-weighted sound pressure level in decibels, denoted dBA. An A-weighting network can be built into a sound level measuring instrument such that sound levels in dBA can be read directly from a meter. The weighting is based on the frequency response of the human ear and has been found to correlate well with human subjective reactions to various sounds. An increase or decrease of approximately 10 dB corresponds to a subjective doubling or halving of the loudness of a noise. A change of 2 to 3 dB is subjectively barely perceptible.

### DECIBEL

The ratio of sound pressures which we can hear is a ratio of one million to one. For convenience, therefore, a logarithmic measurement scale is used. The resulting parameter is called the 'sound level' (L) and the associated measurement unit is the decibel (dB). As the decibel is a logarithmic ratio, the laws of logarithmic addition and subtraction apply.

### EQUIVALENT CONTINUOUS SOUND LEVEL ( $L_{Aeq,T}$ )

Another index for assessment for overall noise exposure is the equivalent continuous sound level,  $L_{eq}$ . This is a notional steady level, which would, over a given period of time, deliver the same sound energy as the actual time-varying sound over the same period. Hence fluctuating levels can be described in terms of a single figure level.

### FREQUENCY

The rate of repetition of a sound wave. The subjective equivalent in music is pitch. The unit of frequency is the Hertz (Hz), which is identical to cycles per second. A thousand hertz is often denoted kilohertz (kHz), eg 2 kHz = 2000 Hz. Human hearing ranges from approximately 20 Hz to 20 kHz. The most commonly used frequency bands are octave bands, in which the mid frequency of each band is twice that of the band below it. For design purposes, the octave bands between 63 Hz to 8 kHz are generally used.

For more detailed analysis, each octave band may be split into three one-third octave bands or, in some cases, narrower frequency bands.

### RATING BACKGROUND LEVEL (RBL)

A single-number figure used to characterise the background noise levels from a complete noise survey.

The RBL for a day, evening or night time period for the overall survey is calculated from the individual Assessment Background Levels (ABL) for each day of the measurement period, and is numerically equal to the median (middle value) of the ABL values for the days in the noise survey.

### SOUND POWER AND SOUND PRESSURE

The sound power level ( $L_w$ ) of a source is a measure of the total acoustic power radiated by a source.

The sound pressure level ( $L_p$ ) varies as a function of distance from a source. However, the sound power level is an intrinsic characteristic of a source (analogous to its mass), which is not affected by the environment within which the source is located.

## STATISTICAL NOISE LEVELS

For levels of noise that vary widely with time, for example road traffic noise, it is necessary to employ an index that allows for this variation. 'A'-weighted statistical noise levels are denoted  $L_{A10}$ , dB  $L_{A90}$  etc. The reference time period (T) is normally included, e.g. dB  $L_{A10, 5min}$  or dB  $L_{A90, 8hr}$ .

### $L_{A90, T}$

Refers to the sound pressure level measured in dBA, exceeded for 90% of the time interval (T) – i.e. measured noise levels were greater than this value for 90% of the time interval. This is also often referred to the background noise level.

### $L_{A10, T}$

Refers to the sound pressure level measured in dBA, exceeded for 10% of the time interval (T). This is often referred to as the average maximum noise level and is frequently used to describe traffic noise.

### $L_{A1, T}$

Refers to the sound pressure level measured in dBA, exceeded for 1% of the time interval (T). This is often used to represent the maximum noise level from a period of measurement.

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## Information Paper

<b>Project:</b>	St Ives HS Stage 2 & 3	<b>Project No.</b>	1026651
<b>Subject:</b>	Response to Council RFIs	<b>Doc No.</b>	CAN-AS-001
<b>Author:</b>	Patrick Carpenter	<b>Date:</b>	23 November 2021
<b>Attention:</b>	Katherine Madden	<b>Revision:</b>	C

Cundall has previously issued an acoustics report (1026-651-RPT-AS-001 dated 10 June 2021, "our report") as part of the Development Application for the project.

The Ku Ring Gai Council have raised a number of RFIs in relation to the acoustic performance of the proposed facility. This document addresses them individually below:

### Noise – Operational hours

The Council's RFI is as follows:

*To address night-time noise impacts it is recommended the use of the facilities not be permitted after 10pm on any night and the operational hours are reduced even further on Sunday and weekday nights where there is a reasonable expectation within the community of less activity and quiet enjoyment of their premises and surrounds.*

*To minimise potential noise impacts for surrounding residents the following hours are recommended as the operational hours for community purposes:*

#### School days

- Monday to Thursday - after the end of school until 8.00pm.
- Friday - after the end of school until 9.00pm.

*All players, spectators, officials and café staff must depart the facility within 30 mins of the end of approved operational hours.*

#### Non-school days

- Monday - Thursday - 8.00am - 8.00pm
- Friday - Saturday - 8.00am - 9.00pm
- Sunday - 8.00am - 4.00pm
- Public holidays - Closed

*All players, spectators, officials and café staff must depart the facility within 30 mins of the end of approved operational hours.*

### Response:

We understand that it is preferred to allow the facility to operate until 11 pm. Provided patron noise is controlled as part of the operational management plan, mechanical services are appropriately treated acoustically and the ventilation strategy is able to accommodate the required closing of windows after 6 pm, there is no reason acoustically that the venue may not operate until 11 pm.

Our responses to the following items will further clarify the reasons for our opinion.

## Acoustic – Building services noise

The Council's RFI is as follows:

*Building services noise – the facility is proposed to have air conditioning units, exhaust for the kitchen, toilets and garbage room and rainwater tanks. The operation of this equipment individually and in combination could potentially create noise impacts for surrounding residents if is not positioned or screened in a manner to attenuate the noise. Although the specific selection of equipment may not have been undertaken, the acoustic report should have identified all of these potential noise sources and clarified if the proposed locations e.g. café and garbage room exhaust discharge points are suitable or better relocated to other positions around the building and/or if any screening or other mitigation measures are likely to be required. Note: it appears air conditioning condensers may be located within the basement which is desirable.*

### Response:

It is not possible to predict the extent of building services which may be required for a development until such time as the operational requirements of the facility is fully understood as the location, type and number of items of mechanical plant required cannot normally be fully appreciated at this stage of the project. At the time of writing our report for the Development Application, this information was not available.

Our review of Northrop Consulting Engineers' mechanical services layouts dated August 2020 indicates that:

- Ducted building services equipment (fans, heat exchange units etc.) have sufficient lengths of ductwork to allow for acoustic treatment if required
- AC condenser units are located in the car park at the side of the development furthest from noise sensitive receivers
- Roof ventilation selections appear to be low noise type

A detailed assessment of noise from these units will be required during the design stages of the project to ensure compliance with the noise criteria detailed in our report, but we can see no reason to delay the project on the basis of noise from mechanical services.

## Acoustic – Vehicle noise

The Council's RFI is as follows:

*Vehicle noise – the acoustic assessment has identified lower background noise levels in the evening and night however it does not identify or comment on potential noise impacts to residents from the movement of vehicles to or from the carpark in the evening or night particularly if use after 10pm is approved.*

### Response:

Traffic modelling indicates that noise from vehicle movements and sporting activity will peak at different times, so we have not considered the impact from each concurrently, refer to Figure 1.

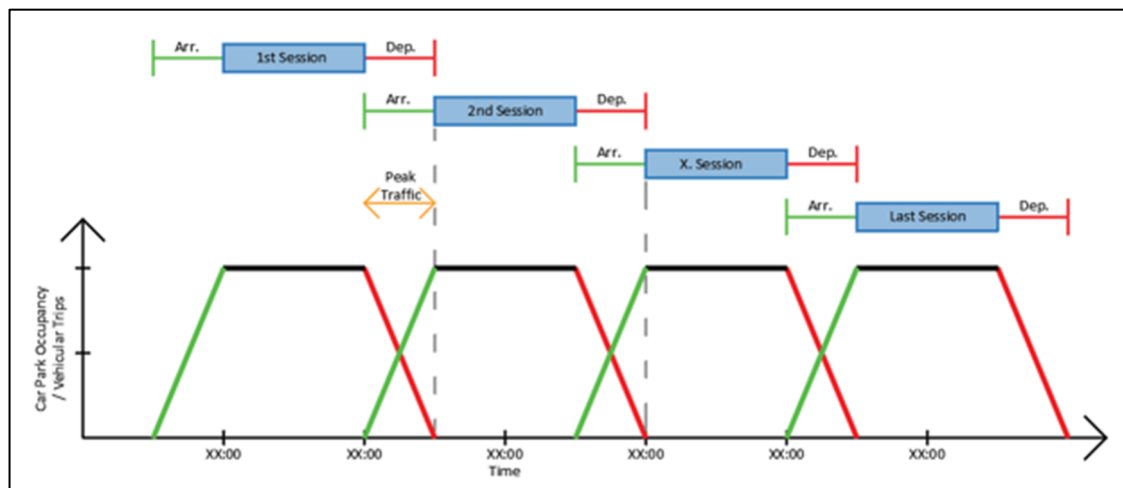


Figure 1 Provided traffic flow data

We have developed an acoustic model using SoundPlan proprietary software to predict noise due to the increase activity of traffic to the proposed gym carpark.

## Peak traffic noise

We have been provided with information that states up to 219 vehicles may enter or leave the site within the hour. The predicted noise level at the boundary of the most affected residential receiver from this level of traffic utilising the access road to the car park is detailed below.

Table 1 Predicted carpark traffic noise, 1 hour

Nearest affect resident	Noise level dB $L_{Aeq}$
53 Horace Street	45

An excerpt from our report of the determined NSW Noise Policy for Industry (NPfI) project trigger levels is provided below.

Table 2 NPfI – Project-specific noise trigger levels

Location	Classification	Time period	Intrusive criteria dB $L_{Aeq,15min}$	Amenity criteria dB $L_{Aeq,15min}$	Project -specific trigger level dB $L_{Aeq,15min}$
Nearest residential properties	Suburban	Daytime	61	53	53
		Evening	50	43	43
		Night-time (10-11 pm)	47	38	38

We have modelled traffic noise from vehicles entering and leaving the facility based upon the maximum predicted during the day and evening periods, and a reduced number during the night period (between 10 and 11 pm), as advised by the operator of the venue.

Table 3 Predicted vehicle noise levels dB  $L_{Aeq}$

Time period (number of vehicles)	Criteria dB $L_{Aeq}$	Predicted traffic noise level, dB $L_{Aeq}$	Exceedance of trigger level, dB $L_{Aeq}$
Day (219)	53	45	0
Evening (219)	43	45	+2
Night (90)	38	40	+2

Noise levels during the day are predicted to comply with the NPfI noise trigger level. Although the evening and night periods are predicted to exceed project trigger levels by 2 dB, the NPfI states that the significance of an excess of up to 2 dB is considered negligible.

In addition to the above, we have also predicted overall noise levels from vehicle traffic on Horace street using the available traffic data provided by TAR Technologies (June 2018).

Table 4 provides a comparison of results from traffic noise between 2018 traffic volume and with the addition of the proposed increase due to the development of the gym.

Table 4 Predicted noise levels dB L<sub>Aeq</sub>

	2018 traffic noise level, dB L <sub>Aeq</sub>	Noise level including proposed increase in vehicles	Predicted noise level increase, dB
Weekday PM Peak	63	64	+1
Saturday Midday	64	65	+1

Overall traffic noise levels are predicted to increase by 1 dB during Weekday PM Peak and Saturday Midday hours.

As with our comparison with the NPfI noise criteria, an increase of 1-2 dB is considered negligible and is unlikely to be appreciable by the vast majority of the population.

## Acoustic – Doors and windows

The Council's RFI is as follows:

*Doors and windows – the acoustic assessment has identified that the doors and windows to the halls will need to be kept closed to achieve the internal noise design criteria of 40dB L<sub>Aeq</sub>(1hr). Other documents submitted with this proposal including the operational plan of management indicate that the windows and doors will be open during the day and plans indicate the windows will be automated operable windows. This needs to be clarified further as the acoustic report indicates that having the windows/doors open could result in non-compliance with the internal noise criteria. Additionally, open doors and windows is likely to create external noise impacts for residents and this aspect has not been adequately considered or assessed in the acoustic report.*

### Response:

The operation of windows and doors should be formalised during the design stage of the project to ensure that external noise intrusion and noise from the facility does not exceed the nominated acoustic criteria detailed in our report.

We have based our predictions on an internal noise level of up to 85 dB L<sub>Aeq</sub> during sporting events, which is typical for the noise from athletes and referees (including whistles).

With windows and doors to the facility closed and mechanical ventilation paths acoustically treated, compliance with the nominated environmental noise criteria is anticipated.

As natural ventilation forms part of the operational strategy of the facility, additional acoustic treatment may be required to ventilation paths.

We understand that the hybrid ventilation strategy for the project allows for up to 36% openable windows on each façade. With all 36% open, we predict an exceedance of 2 dB at the nearest residence during the day period, which is within the 1-2 dB tolerance considered acceptable under the NPfI.

During evening and night-time periods all windows must be closed to achieve compliance with the NPfI criteria at residences to the east and west of the site. Ventilation will be achieved at these times via mechanical ventilation which will be assessed further during the detailed design stage of the project.

Roof cowls are to be acoustically treated using internally lined ductwork, the extent of which can be defined once final selections are made. At this stage, a single internally lined bend is proposed.

Mechanical systems can be reviewed during the design stage where drawings, specification and schedules are provided. Night purge must be completed when the sports halls are not in use.



## Acoustic – Open outdoor area

The Council's RFI is as follows:

*Open outdoor area – there is an open outdoor area identified on the plans adjoining the lounge area of the café. Assessment of the noise impacts for use of this area particularly in the evening or night was not included in the acoustic report. To address noise concerns a condition could be applied restricting use of this area after 6pm and that all doors to the area be closed and locked.*

### Response:

We understand that up to 16 patrons are to be accommodated in the outdoor area of the café. We have based our modelling on voices of 30% of people speaking at one time as not all people will be speaking simultaneously. Noise from patrons has been predicted in accordance with the methodology of the Hayne<sup>1</sup> paper. Although the paper refers to Restaurant dining, similar noise levels are likely to occur for cafés. Sound power,  $L_w$  of patrons is as follows:

- 78 dB  $L_{Aeq}$
- 98 dB  $L_{Amax}$

Based on the above, the noise level from patrons at the café is predicted to be < 20 dB  $L_{Aeq}$  at the nearest residence, which complies with the nominated NPfI criteria.

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<sup>1</sup>Hayne et al 2011, 'Prediction of noise from small to medium sized crowds', in *Acoustics 2011: Breaking New Ground, Proceedings of the Annual Conference of the Australian Acoustical Society, AAS Queensland Division 2011, Gold Coast, paper number 133.*