

Project: **NORTH SYDNEY PUBLIC SCHOOL SSDA UPGRADE**

Prepared for: **NSW Department of Education
GPO Box 33 Sydney
Sydney NSW 2001**

Attention:

Report No.: **Rp 001 20210481**

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SUMMARY

Marshall Day Acoustics (MDA) has been commissioned by NSW Department of Education to conduct an assessment of noise and vibration relating to the construction and operation of the proposed upgrades to North Sydney Public School located in North Sydney NSW. The assessment of the school has considered the following:

- Planning Secretary's Environmental Assessment Requirements (SEARs) (Application Number: SSD- 118869481) issued 24th December 2020
- *NSW Noise Policy for Industry 2017* (NSW Environment Protection Authority (EPA).
- *Interim Construction Noise Guideline* (Department of Environment and Climate Change, 2009).
- *Assessing Vibration: A Technical Guideline 2006* (Department of Environment and Conservation, 2006).
- *Australian Standard 2363 Acoustics - Measurement of noise from helicopter operations* (AS 2363).

Additional standard and guidelines are referenced, comprising

- *Protection of the Environment Operations Act 1997*, NSW Environment Protection Authority (POEO)
- *Noise Guideline for Local Government*, NSW Environment Protection Authority 2013 (NGLG)
- *Road Noise Policy*, NSW Department of Environment, Climate Change and Water 2011 (RNP)
- *AS 2021:2015 Acoustics - Aircraft Noise Intrusion - Building Siting and Construction*

At the time of the report preparation, Greater Sydney is subject to a COVID 19 lockdown, with limitations to site accessibility. Further, general activities and traffic movements are expected to be significantly lower than for non-lock down period. It has therefore not been possible to carry out the acoustic surveys on site as would typically be carried out as part of a Noise and Vibration assessment.

To carry out a response to the SEARs requirements, in the circumstances of the above, estimates of background noise and prevailing traffic noise intrusion have however been carried out. The background noise levels have been based on RMS and AS 1055 data for different residential area noise classifications. Estimates of traffic noise impacts on the site have been based on predicted noise levels allowing for traffic volumes on Pacific Highway

It may be necessary to carry out on-site noise surveys in accordance with the EPA Noise Policy for Industry (NPfI), following cessation of the COVID19 lock down and resumption of normal traffic flows and school activities. We consider this to be a suitable approach, so as to not impact the delivery of this State Significant project.

A summary of the report responses to the SEARs requirements can be found within the conclusion in section 10

Demolition exaction Construction Noise and Vibration

Noise from demolition, excavation and construction activities have been assessed based on assumed plant equipment likely to be used during the five stages of construction (Site Preparation, Relocation of temporary buildings, Demolition, Bulk Excavation and Construction).

Noise from construction may exceed the "Highly Noise Affected" management goals for some of the surrounding receivers for both "Worst-Case" and "Average" scenarios during the Demolition works. Noise from construction may also exceed the "Highly Noise Affected" management goals for some of the surrounding receivers for only "Worst-Case" scenario during the Bulk Excavation works. However, construction noise is expected to be below the "Highly Noise Affected" management goals for all the surrounding receivers for both "Worst-Case" and "Average" scenarios during the remaining stages of work.

For the most noise affected receivers surrounding the site, noise from the proposed works may exceed the “Noise Affected” goals from the EPA criteria for both “Worst-Case” and “Average” scenarios by up to 29 dB and 22 dB respectively for sensitive residential receivers.

As predicted construction noise levels are expected to be above the “Noise Affected” management goals, MDA has provided a schedule of appropriate noise control recommendations and proposed inclusions for Construction Noise and Vibration Management Plan (CNVMP), to assist in mitigating noise impacts from construction stages. All feasible noise controls and management practises detailed in this report should be adopted as a matter of course. A full, detailed and specific CNVMP must be prepared prior to commencing works on site, once a builder is appointed and detailed construction methodology is known. Recommendations regarding the human responses to vibration levels is provided in this report.

Potential noise impact from construction traffic on public roads is investigated in this report. The impact of the construction traffic on receivers along Pacific Highway or Bay Road is not expected to be significant. However, movements of 6 to 12 trucks per hour through other local roads (i.e. Berry Street and Edward Street) has the potential to increase the existing traffic noise by more than 2 dB. On this basis, alternative routes should be considered. However, if this is the only feasible route, a detailed traffic noise measurements and analysis is required to be carried out at a later stage to assess the potential impact on the residential receivers along the surrounding local roads.

Operational Noise

With respect to operational noise, noise emissions from the following sources have been considered within the limitation of the current lockdown restrictions:

- Public Address System
- School Bell
- Mechanical Services
- Outdoor Activities
- Traffic movements and carpark use
- Use of the hall
- Traffic Noise intrusion to the site
- Aircraft Noise

Public Address, School Bell and Mechanical Services

At this early point in the development of the project design, the specification of the public address system, school bell and mechanical services is not sufficiently progressed such that noise emissions can be evaluated in detail. General comments and derived maximum noise levels have, however, been provided in order to assist the ongoing design and ensure noise emissions from these sources can be properly mitigated.

Noise generated within most areas (Homebases, administrative areas and library, refurbished classrooms in building G) of the internal spaces will be typically low and can be controlled with standard building. Therefore, noise from the school’s internal spaces is generally not assessed in detail in this report, with the exception of the new School Hall.

School Hall

Noise from use of the school hall, during school time and out of hours evening time, has been quantitatively evaluated based on assumed maximum internal sound levels for expected activities, together with estimated external noise criteria. This has informed preliminary performance requirements for building enclosure elements including external walls, roofs, glazing and door systems.

The hall will be naturally ventilated via the northern and eastern awning doors. Based on the anticipated use, standard building envelope construction types (refer minimum acoustic requirements) will generally be

sufficient for typical school uses during normal school hours. The hall will be naturally ventilated via the northern and eastern awning doors. Preliminary assessments indicate that it may be necessary to allow for the eastern doors to be closed during school use, in order to comply with the estimated noise criteria for noise egress.

It will also be possible for the hall to comply with the estimated noise criteria during after hours community use events, however this will require the doors to be closed and acoustically rated. Acoustic ratings are provided in this report for initial guidance.

Outdoor Activities

Outdoor activity noise has been qualitatively assessed based on the subjective assessment guidance described in the Protection of the Environment Operations Act 1997, and the EPA Noise Guideline for Local Government. Noise from general outdoor activities has been clearly established as not qualifying for description as offensive noise, although some restrictions may apply to the use of the COLA area.

The revised playground layout is unlikely to generate adverse acoustic impact to most surrounding residential areas, due to increased setbacks. A moderate noise increase to some residential receptors in Bay Road is possible. On comparison, with the qualitative assessment procedures in the NGLG and the PoEO, noise from the revised playground areas is expected to remain acceptable.

Traffic Noise and Carpark Use

Forecasts of additional traffic generated by the completed development are provided in the transport report prepared by Ason Group. Based on these forecasts we expect additional noise increases associated with the additional traffic to be within acceptable criteria.

The carpark is not subject to revision or increase capacity and, as such is unlikely to generate increased noise levels as a result of its ongoing use.

Traffic Noise intrusion to the site

While acoustic measurements of traffic noise have not yet been carried out, preliminary assessments based on calculated noise data have been carried out. It is currently anticipated that the school precinct is exposed to noise from traffic on Pacific Highway and Bay Road.

- It is expected that acoustic rated construction will be required for elements of the new Homebases, administrative areas and library. These elements include external doors and glazing, roof / ceiling and façade to comply with EFGS noise criteria. The acoustic ratings would however, not be difficult to achieve provided they are adequately specified during detailed design. It would be necessary to allow for external windows and doors to be closed when compliance with the EFGS criteria is required. As it is proposed to air condition these spaces, it should be feasible to ensure that such spaces have an adequate outside air provision.
- It is expected that acoustic rated construction will be required for the external elements of the refurbished GLSs component of building G, in the event that retrospective compliance with the EFGS is required. These elements include external doors and glazing. The acoustic ratings would, however, not be difficult to achieve provided they are adequately specified during detailed design. This would depend on the scope of the refurbishment. Where the refurbishment does not extend to the building envelope, acoustic upgrades may not be feasible. It would be necessary to allow for external windows and doors to be closed when compliance with the EFGS criteria is required. As it is proposed to air condition these spaces, it should be feasible to ensure that such spaces have an adequate outside air provision.
- It is expected that acoustic rated construction will be required for elements of the new Hall. These elements include external glazing, the glazed awning doors, roof / ceiling and lightweight façade in order to comply with EFGS noise criteria. The acoustic ratings would, however, not be difficult to achieve provide they are adequately specified during detailed design. It would be necessary to allow for external windows and doors to be closed when compliance with the EFGS

criteria is required. As it is not proposed to air condition the Hall it may not be feasible to comply with the EFSG internal noise criteria applicable to assembly halls.

- Noise generated by external traffic is expected to be within acceptable criteria at the new COLA and the new play areas.
- Noise from traffic on Bay Road to the southern level 3 outdoor learning area may allow the acceptable criteria for this outdoor space to be exceeded during periods of peak traffic flow on Bay Road. It may be necessary to manage the use of this space for learning activities outside peak periods of traffic flow on Bay Road or provide appropriate screening.

Aircraft Noise

The site lies outside the ANEF 20 Zone associated with the Sydney Airport. As such, the site is defined as “Acceptable” within table 2.1 of AS 2021 and a formal assessment of aircraft noise is not required. This does not mean that there are no aircraft noise impacts, only that the numbers of movements nearby the site and the associated noise is sufficiently low as to be considered as “Acceptable” within AS 2021.

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1.0 INTRODUCTION

Marshall Day Acoustics (MDA) have been commissioned by the NSW Department of Education to conduct an assessment of noise and vibration relating to the construction and operation of proposed upgrades to North Sydney Public School, North Sydney NSW.

It is proposed to upgrade the site, demolishing existing various permanent and temporary buildings and constructing a new 3 level building for administration, Library Homebase rooms and a Hall. The existing library in building G will be internally refurbished and converted to 3 Homebase rooms. The project also will include minor refurbishment of student WCs and canteen.

This assessment is to satisfy the requirements of the Planning Secretary's Environmental Assessment Requirements (SEARs) (Application Number: SSD-11869481) issued 24th December 2020, with respect to Noise and Vibration. These requirements are described in detail in Section 3.0.

The report includes assessments of the following key items:

- General project and site descriptions including nearby noise sensitive receivers
- Derivation of criteria applicable to the Project based on advice provided in the SEARs documentation with additional reference made to other guidance applied outside of the SEARs requirements
- Qualitative assessment of outdoor activities
- Quantitative assessment of noise emissions from the Hall space
- Quantitative assessment of noise generated by vehicle movements and carparking associated with the site
- Quantitative assessment of construction noise with additional comments with respect to construction vibration
- Qualitative assessment of noise from traffic on the proposed site
- Comments regarding noise from mechanical services
- Provision of discussion on school Bell and PA operation
- Provision of measures to mitigate and minimise noise impacts where required

Acoustic advice provided in this report is based on the following documentation:

- SSDA Schematic Design Drawings - prepared by Fulton Trotter Architects (ref. Appendix H)
- Project Description Prepared by GYDE Consulting
- Transport Assessment *Upgrade to North Sydney Public School* P1723r01v01 dated 6/8/2021 prepared by Ason Group

Note: Noise generated within the school's new internal spaces will typically be low and can be controlled with the proposed building construction in this report. Therefore, noise from the school's internal spaces is not assessed in detail in this report, apart from a review of the Hall building.

Technical terms used throughout this report are described in Appendix A.

1.1 Covid 19 Limitation

At the time of the report preparation, Greater Sydney is subject to a COVID 19 lockdown, with a ban on construction activities. Further, general activities and traffic movements are expected to be significantly lower than for non-lock down period.

It has therefore not been possible to carry out acoustic surveys on site as would be typically undertaken for a Noise and Vibration impact assessment.

To carry out an early response to the SEARs requirements preliminary noise estimates have however been carried out based on typical expectations for the local residential environment.

It may be necessary to carry out on-site noise surveys in accordance with the EPA Noise Policy for Industry (NPfI), following cessation of the COVID19 lock down and resumption of normal traffic flows and school activities.

2.0 SITE AND PROJECT DESCRIPTION

2.1 Site Location

The proposed upgrade is to the existing North Sydney Public School site 182 Pacific Highway, North Sydney.

The site is bounded by Pacific Highway to the east, McHatton Street to the north and Bay Road to the south. There is a residential boundary adjacent to the western boundary.

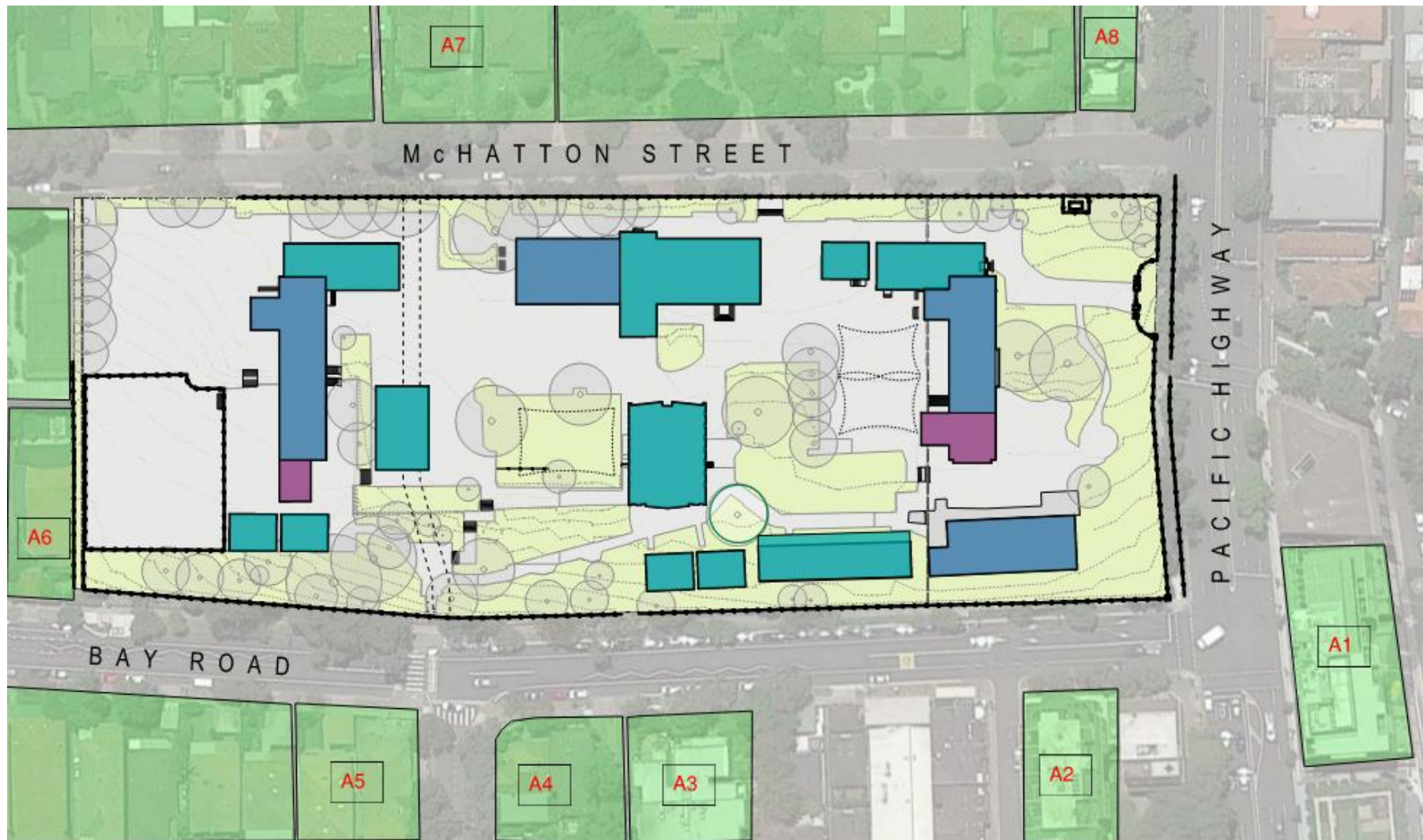
Residential buildings are in close proximity to the site.

The nearest noise sensitive receivers surrounding the proposed site (with reference to the new Building) are listed in Table 1. A site plan is provided in Figure 1 with details in Table 1. The distances shown in the table below at those between the receptor and the closest part of the new Building).

Table 1: Noise sensitive receivers selected for assessment

Receiver ID	Location	Receiver Type	Description
A1	225—229 Pacific Highway	Residential	Apartment building across Pacific Highway approx. 83m east from the new Building
A2	174-180 Pacific Highway North Sydney	Residential / Commercial	6 level apartment building commercial ground floor, across Bay Road
A3	12 Bay Road North Sydney	Residential	Apartment building approximately 23 metres from the new Building, across Bay Road
A4	16-18 Bay Road North Sydney	Residential	2 level residential dwelling approximately 23 metres from the new Building, across Bay Road
A5	20-22 Bay Road North Sydney	Residential	Single level residential dwelling approximately 40 metres from the new Building, across Bay Road
A6	11 Bay Road North Sydney	Residential	Single level residential dwelling approximately 90 metres from the new Building, adjacent the southern boundary
	5 McHatton Street North Sydney		
A7	16,18 McHatton Street North Sydney	Residential	6 level apartment building, across Bay Road
A8	188 Pacific Highway	Residential	Single level residential dwelling approximately 100 metres from the new Building, cnr Pacific Hwy and McHatton Street

Figure 1: Existing site and surrounds



2.2 Existing Precinct Development

The current precinct comprises existing buildings as set out in Table 2.

Table 2: Existing buildings on site

Block	Name	Number of Storeys	To be demolished or removed
A	Pacific Building	2	No
B	Hall Building	1	Yes
C	Haven Building	1	Yes
D	McHatton Building	1-2	No
F	River Building	2	No
G	Library Building	2	No
H	Temporary Building	1	Yes

In addition to the above there are 6 small temporary buildings that will be removed from site. Play areas are dispersed through the school precinct, including the central precinct areas, the Pacific Highway frontage and Bay Road frontage. The existing play spaces are shown in Figure 3.

Netball and basketball courts are located at the southwestern corner of the precinct. A paved carpark is located at the north western corner of the precinct, accessible off McHatton Street. The courts and carpark remain unchanged as a result of the proposal. The existing site layout is shown in Figure 2.

Figure 2: Existing North Sydney Public School Precinct

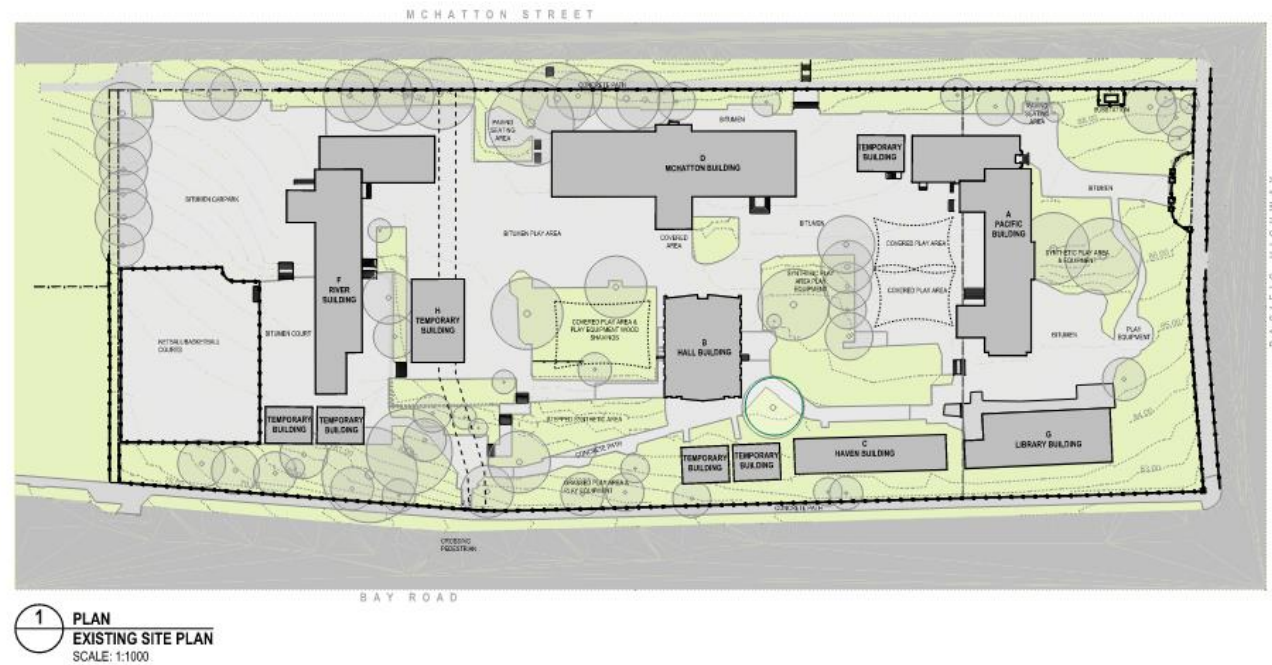
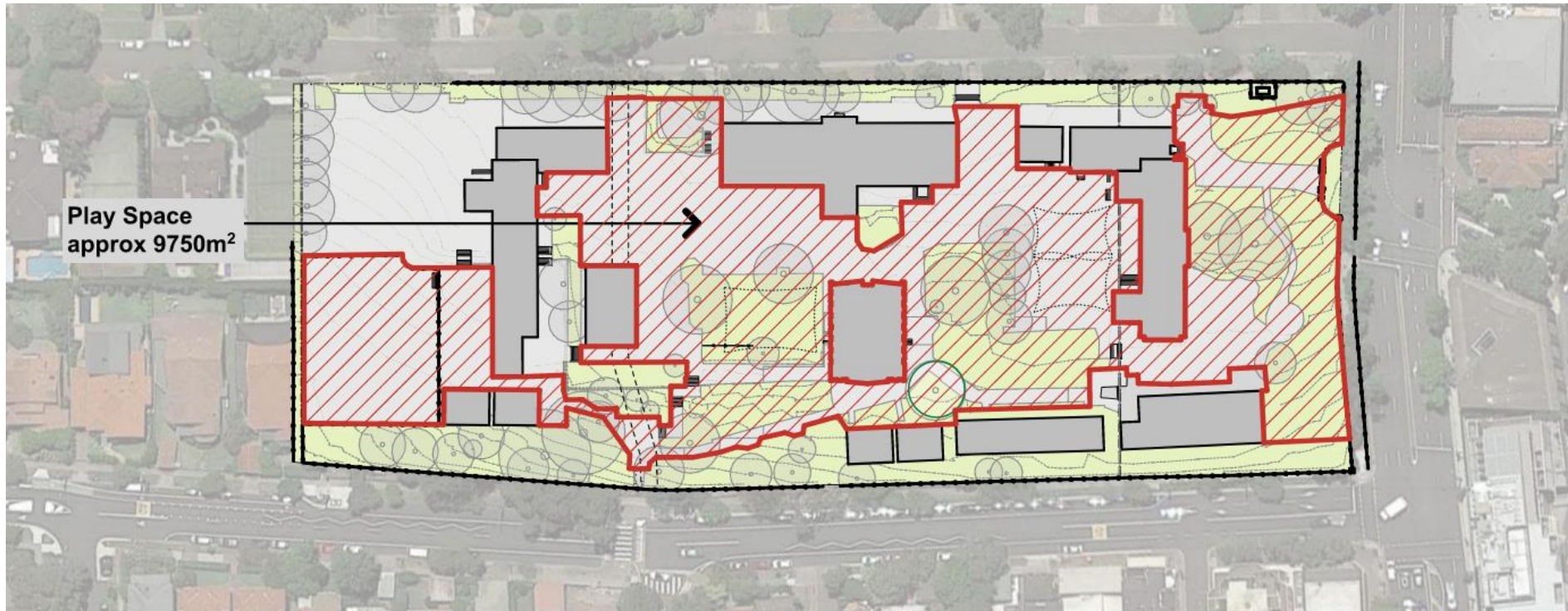


Figure 3: Existing Play spaces



Existing Play Space areas

2.3 Project overview

This SSDA seeks consent for alterations and additions to the existing North Sydney Public School. The proposal entails:

- Demolition of the existing Hall (Building B), Haven Building (building C) and 6 temporary buildings;
- Construction of a three storey building comprising:
 - staff administration rooms;
 - 16 Homebases
 - a new library;
 - Hall;
 - out of school hours care facilities;
 - covered outdoor learning area;
 - bicycle parking and end of trip facilities for staff; and
 - services, amenities and access.
- New entry gate and forecourt from Bay Road;
- Internal refurbishment of building G ground floor from the existing library to 3 homebases;
- Capacity for an increase in student numbers from 869 to 1,012; and
- Associated tree removal, landscaping and excavation.

The proposal maintains:

- The gates and fence of former Crows Nest House including the entrance from Pacific Highway and Bay Road;
- Existing gate along McHatton Street;
- The outdoor play area to the east of Building A;
- Existing covered outdoor learning area adjacent to Building A;
- The basketball courts and staff carpark in the western portion of the site;
- The significant tree planting on all school boundaries;
- Buildings A, D and F noting minor internal refurbishments are being undertaken outside of the SSDA scope of work (exempt development) to improve student amenities and canteen; and
- Building G noting ground floor internal refurbishment is proposed in the SSDA.

2.4 Hours of use

The hours of use and activities for the key school activities are set out in the sections below.

2.4.1 Core School hours and bell times

Table 3: core school hours and bell times

Start	Finish	Activity
8.55am	10.55am	Morning Learning session
10.55am	11.05am	Eating Time
11.05am	11.45am	Lunch play time
11.45am	1.20pm	Middle Learning session
1.20pm	1.40pm	Recess/Afternoon Tea
1.40pm	2.55pm	Afternoon Learning session

2.4.2 Hall Use

Table 4: Hall use times and activities

Start	Finish	Days	Activity	Use
7.30am	9.00am	Mon-Wed	School band	School
9.00am	3.00pm	Monday to Friday	School dance groups, music activities, sport	School
3.00pm	10.00pm	Monday-Friday	Dance groups, Karate, community languages, Choirs, sports groups, Drama for kids	Community
8am	6pm	Saturday and Sunday	Dance groups, Karate, community languages, Choirs, sports groups, Drama for kids, elections	Community

2.4.3 OHSC

Out of Hours School care operates from 7.30 to 6.00pm school days

Morning: one site in Pacific Building, afternoon: 2 sites River and Pacific Buildings

2.5 Proposed built form

SSDA Schematic Drawings for the redevelopment have been prepared by Fulton Trotter Architects 7068WA01 (refer Appendix H). The demolition plan and the ground floor plan from the drawing set is included in Figure 4 and Figure 5. Buildings B and C will be demolished and a new 3 level building will be constructed along the Bay Road frontage. All existing temporary buildings will be removed from site.

Figure 4: Demolition Plan

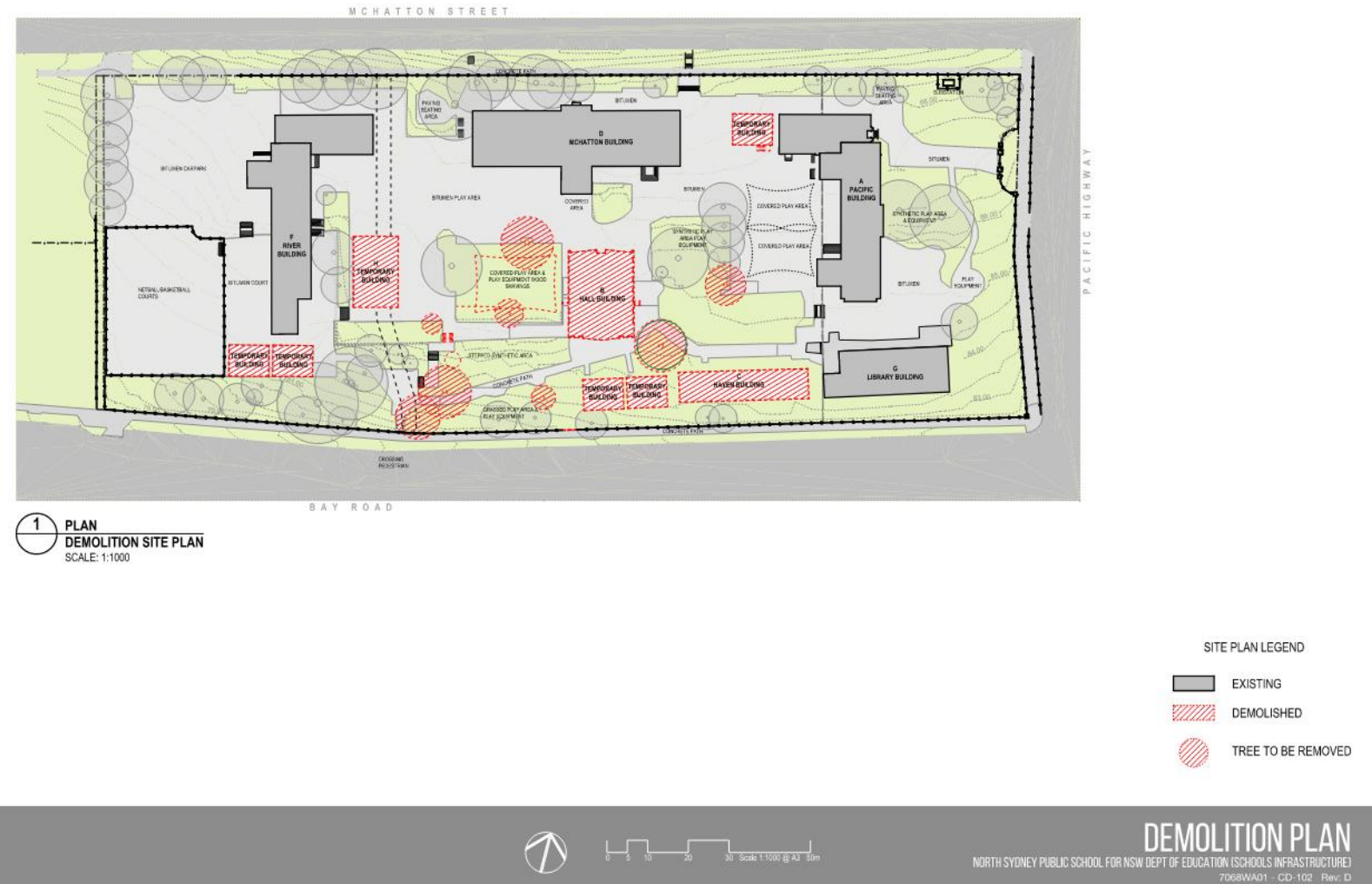
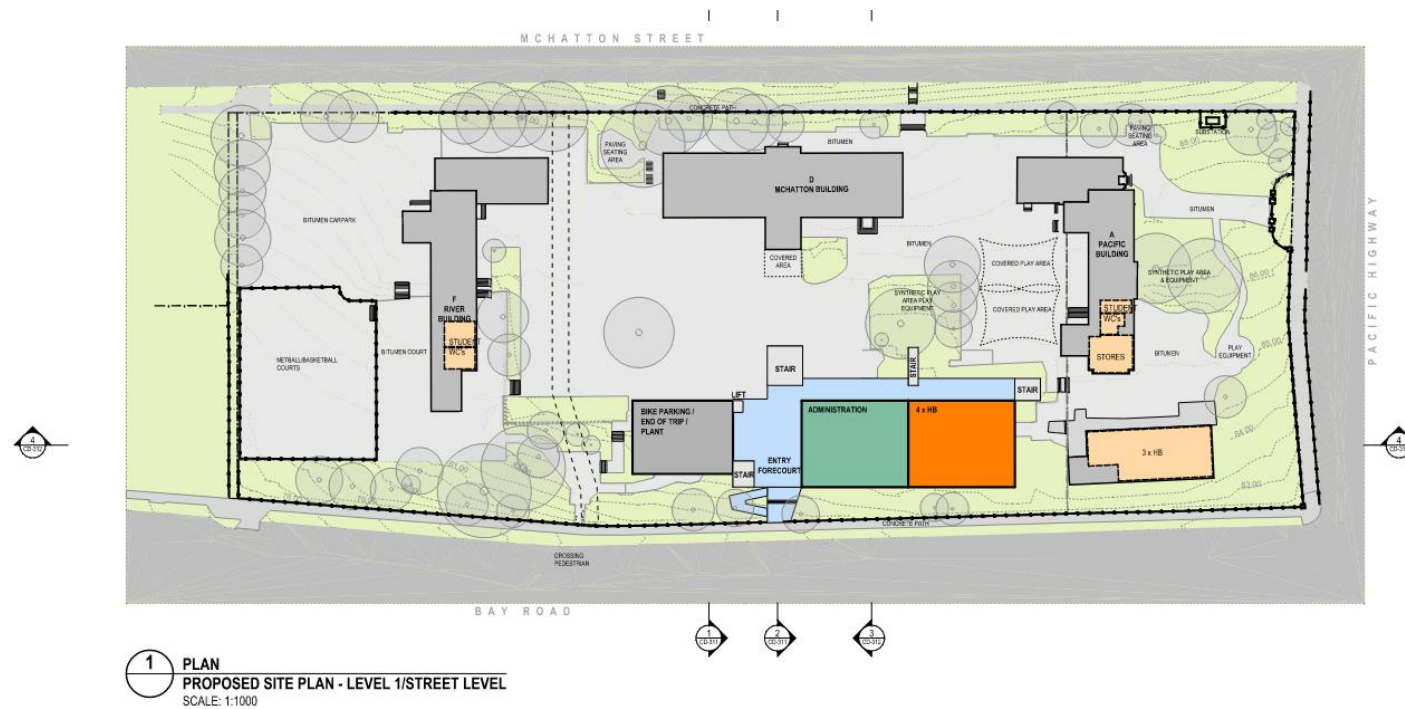


Figure 5: Proposed site plan – level 1 / street level



2.6 Mechanical services

The new Building will be air conditioned in spaces for administrative, library and Homebase use. The new Hall will not be air conditioned and will rely on natural ventilation.

Specific air conditioning and mechanical ventilation designs are not prepared at this stage. It will however be necessary for plant and equipment to be designed to comply with relevant consent authority noise criteria such as the EPA Noise Policy for Industry

3.0 PLANNING SECRETARY'S ENVIRONMENTAL ASSESSMENT REQUIREMENTS

Key assessment requirements applicable to the Project are detailed in the Planning Secretary's Environmental Assessment Requirements (SEARs) (Application Number: SSD-11869481) issued 24 December 2020. The SEARs provide the following requirements for Noise and Vibration:

10. Noise and Vibration

Provide a noise and vibration impact assessment that:

- *includes a quantitative assessment of the main noise and vibration generating sources during demolition, site preparation, bulk excavation and construction.*
- *details the proposed construction hours and provide details of, and justification for, instances where it is expected that works would be carried out outside standard construction hours.*
- *includes a quantitative assessment of the main sources of operational noise, including consideration of any public-address system, school bell, mechanical services (e.g. air conditioning plant), use of any school hall for concerts etc. (both during and outside school hours) and any out of hours community use of school facilities.*
- *outlines measures to minimise and mitigate the potential noise impacts on nearby sensitive receivers.*
- *considers sources of external noise intrusion in proximity to the site (including, road rail and aviation operations) and identifies building performance requirements for the proposed development to achieve appropriate internal amenity standards.*
- *demonstrates that the assessment has been prepared in accordance with policies and guidelines relevant to the context of the site and the nature of the proposed development.*

Relevant Policies and Guidelines:

- *NSW Noise Policy for Industry 2017 (NSW Environment Protection Authority (EPA)).*
- *Interim Construction Noise Guideline (Department of Environment and Climate Change, 2009).*
- *Assessing Vibration: A Technical Guideline 2006 (Department of Environment and Conservation, 2006).*
- *Development Near Rail Corridors and Busy Roads - Interim Guideline (Department of Planning, 2008).*

3.1 Noise and Vibration Sources

Based on the above, Table 5 shows the expected noise and vibration sources associated with the development of the Project and the documents referred for assessment. Note that vibration has been considered for the construction sources only as no operation sources are expected to give rise to perceptible vibration levels at residential receivers.

Table 5: Project noise and vibration sources and assessment references

Noise/Vibration Source	Assessment Reference
<u>Construction:</u>	
Site Preparation	'Interim Construction Noise Guideline' 'Assessing Vibration: A Technical Guideline'
Relocation of temporary buildings	'Interim Construction Noise Guideline' 'Assessing Vibration: A Technical Guideline'
Demolition	'Interim Construction Noise Guideline' 'Assessing Vibration: A Technical Guideline'
Bulk Excavation	'Interim Construction Noise Guideline' 'Assessing Vibration: A Technical Guideline'
Construction	'Interim Construction Noise Guideline' 'Assessing Vibration: A Technical Guideline'
<u>Operation:</u>	
Public Address System	'NSW EPA Noise Policy for Industry' 'Educational Establishments and Child Care Facilities SEPP 2017'
School Bell	'NSW EPA Noise Policy for Industry' 'Educational Establishments and Child Care Facilities SEPP 2017'
Mechanical Services	'NSW EPA Noise Policy for Industry'
Outdoor Activities	'Noise Guideline for Local Government' 'Protection of the Environment Operations Act'
Aircraft Noise	'AS 2021:2015 Acoustics - Aircraft Noise Intrusion - Building Siting and Construction'
Traffic Noise	'Road Noise Policy'
Carpark noise	'NSW Noise Policy for Industry'

4.0 EXISTING BACKGROUND NOISE LEVELS

In order to assess noise impacts associated with a development proposal it is necessary to establish the existing noise levels at the site, prior to commencement of construction. Most noise criteria such as the EPA Noise Policy for Industry (NPfI) provide noise criteria that are influenced by the existing site noise levels.

At the time of preparation of this report, Greater Sydney is subject to a lockdown as a result of a recent COVID outbreak. Currently, noise surveys on site are not feasible as:

- Construction activity is not permitted, preventing site access
- Traffic and general activity noise is expected to be considerably lower than usual as a result of the lockdown. A survey carried out at this time would result in noise levels that were not typical for the local environment.

The project is however being developed under the Stimulus Package. In order to maintain the benefit of the stimulatory timetable the project must be delivered with the time constraints nominated under the program. While it will not be feasible to carry out the required surveys of existing noise levels in time for these deadlines, estimates have been developed of the existing background noise level to establish likely noise impacts generated by the proposed development. The estimates have been developed considering relevant North Sydney Council DCP criteria and data provided within TfNSW guidelines. These estimates are expected to provide a conservative representation of the likely background noise levels.

It may be necessary to carry out noise monitoring on the site once the lockdown has ceased and traffic activities returned to normal flows.. This would be required to inform façade and building envelope acoustic design.

The report would then require revision, to incorporate the result of the survey, together with relevant updates to the conclusions and recommendations.

The most significant noise source influencing the site and the properties nearby is traffic on Pacific Highway to the east of the school. The large dimensions of the precinct will mean different levels of exposure to traffic noise. The areas nearest Pacific Highway will have the highest background noise levels. These areas would include the eastern school site, apartments 174-180 and 225-229 Pacific Highway and residential dwellings near the corner of Pacific Highway and McHatton Street.

We would expect ambient and background noise to reduce progressively toward the west, with those lowest and at the most distant and west part of the site, Bay Road and McHatton Street.

4.1 North Sydney Development Control Plan 2013

North Sydney DCP 2013 includes generalised noise criteria in Section 3.2.5 *Noise for Non-Residential Development in Residential Zones*. Table B-3.1 of the DCP describes noise limits for residential receptors for both Urban areas and Suburban areas. We have provided the DCP noise criteria in Table 6 below.

Table 6: North Sydney Council noise criteria

Time Period			Max 1 hour noise levels (L _{Aeq} 1hour)	
Day	Week	Time	Urban Area	Suburban Area
Weekday	Day	7am-6pm	60 dBA	55 dBA
	Evening	6pm-10pm	50 dBA	45 dBA
	Night	10pm-7am	45 dBA	40 dBA
Weekend	Day	8am-6pm	60 dBA	55 dBA

Time Period			Max 1 hour noise levels (L _{Aeq} 1hour)	
Day	Week	Time	Urban Area	Suburban Area
	Evening	7pm-10pm	50 dBA	45 dBA
	Night	10pm-8am	45 dBA	40 dBA

In addition to the above the DCP also requires in item P3:

Despite P1 above, the noise emission associated with the operation of non-residential premises must not exceed 5 dBA above the background maximum 1 hour noise level (L_{Aeq} 1 Hour) during the day and evening and not exceeding the background level at night when measured at the boundary of the property.

It is not possible to quantify the additional requirements of the DCP until surveys of existing background noise levels have been carried out. Estimates of the background noise levels are however provided in Section 4.2.

4.2 Estimated Background noise levels

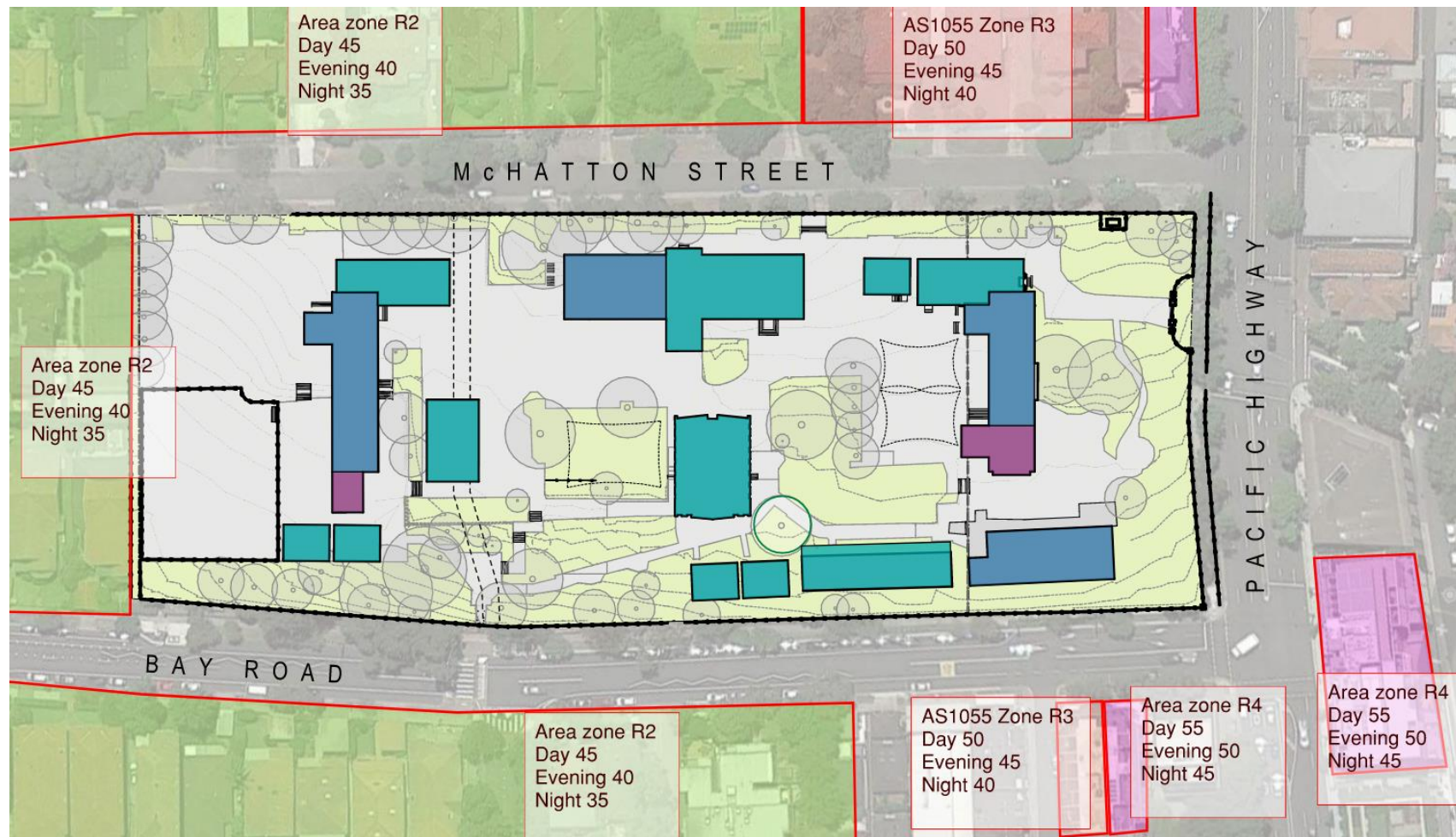
Guidance can be obtained from a spreadsheet prepared by NSW Transport Roads and Maritime Services, which provides typical background noise levels for example locations based on the local environment and proximity to traffic arteries. The spreadsheet groups the example areas into the Noise area categories (R0 to R5) previously defined under AS1055.3-1997. While these categories are no longer defined within the most recent version of AS 1055-2018, the spreadsheet provides useful guides of the expected typical Rating Background Noise Levels (RBL) for different areas.

Based on the descriptions within the spreadsheet and AS 1055.3-1997 we have drawn the following conclusions:

- The west half of the site and the nearby residential properties are most likely to be equivalent to an R2 category zone, due to the distance from Pacific Highway, indicating a likely RBL background noise level of 45, 40, and 35 L_{A90} dB Day, Evening and Night, respectively. The application of the R2 category is shown in Figure 6, similar to a Suburban Area. This should be a conservatively low background noise estimate as the location of the Pacific Highway may result in a prevailing background noise in this area closer to a level experienced in an Urban Area (ie near major transportation sources) particularly during the day and evening times.
- Areas closer to Pacific Highway (but not adjacent) are expected to approximate at R3 category rating, indicating a likely RBL background noise level of 50, 45, and 40 L_{A90} dB Day, Evening and Night, respectively.
- Residential properties and façades fronting Pacific Highway area expected to approximate an R4 category rating, indicating a likely RBL background noise level of 55, 50, and 45 L_{A90} dB Day, Evening, and Night, respectively. Figure 6 describes the estimated background noise levels in this area.
- The estimated background noise shown for the R2 rating areas would be broadly consistent (with the 5 dB exceedance margin) with the DCP maximum noise requirement for suburban areas shown in Table 6. It is possible however that both may be conservatively low and that a greater proportion of this zone may have a background noise more consistent with that for an R3 or Urban rating.

It is stressed that that background noise levels indicated in this report have been estimated in the absence of any measurement data. It may be necessary to carry out noise level surveys to verify the conclusions in this report.

Figure 6: Estimated Rating Background Levels



5.0 CONSTRUCTION NOISE AND VIBRATION

In this section construction noise impact assessments associated with the proposed works are provided. Construction noise and vibration targets have been established and the noise prediction results are based on the assumptions detailed in this report.

Ground-borne noise associated with the expected activities from the transmission of vibration through the ground is expected to be negligible compared to the direct transmission of noise through the air. Therefore, ground-borne construction noise has not been assessed further in this report.

5.1 Construction Hours

It is anticipated that all works will be completed during Standard daytime construction hours. The works during the following periods are anticipated:

Standard hours: Monday to Friday from 7 am to 6 pm, Saturday 8 am to 1 pm. No work on Sundays or public holidays.

5.2 Construction Noise and Vibration Criteria

Noise and vibration criteria applicable to the project site with respect to construction activities have been derived considering the references detailed in Table 5, and are summarised in the following sections.

5.2.1 Construction noise management levels

Noise criteria applicable to the project site with respect to construction activities have been derived considering the 'Interim Construction Noise Guideline' (ICNG) and are summarised in Table 7. These criteria apply to airborne noise emissions related to construction activity during the recommended standard hours only. The full derivation of criteria is provided in Appendix C.

Table 7: 'Interim Construction Noise Guideline' airborne noise criteria

Receiver ID	Receiver Type	Management Level, L_{Aeq} (15 min)	
		Noise Affected	Highly Noise Affected
A1 and A8	Residential	65	75
A2	Residential	60	75
A2	Offices, retail outlets	70 (External noise level)	
A3, A5, A6 and A7	Residential	55	75

The "Noise Affected" level is the point above which there may be some community reaction to noise. The "Highly Noise Affected" level represents the point above which there may be a strong community reaction to noise. Where the "Noise Affected" management level is predicted to be exceeded, the ICNG requires that all feasible and reasonable work practices be employed. Where it is predicted that the "Highly Noise Affected" management level will be exceeded, respite periods may need to be considered.

5.2.2 Construction traffic noise criteria

In accordance with ICNG, potential road traffic noise impact from construction traffic on public roads to and from the subject site should be assessed under the *Environmental Criteria for Road Traffic Noise* (EPA 1999). This policy, however, has been superseded by the *NSW Road Noise Policy* (EPA 2011).

The *NSW Road Noise Policy* (RNP) provides noise level criteria for increased traffic flow as a result of land-use development with the potential to create additional traffic. Table 8 presents the traffic noise criteria applicable to this project.

Table 8: Road Traffic Noise Criteria

Type of Development	Criteria	
	Day 0700-2200hrs	Night 2200-0700hrs
Existing residences affected by additional traffic on existing freeways/arterial/sub-arterial roads generated by land use developments	Leq(1hr) 60 dBA (external)	Leq(1hr) 55 dBA (external)
Existing residences affected by additional traffic on existing local roads generated by land use developments	Leq(1hr) 55 dBA (external)	Leq(1hr) 50 dBA (external)

Source: Table3 EPA – RNP

Additionally, the RNP states that ‘for existing residences and other sensitive land uses affected by additional traffic on existing roads generated by land use developments, any increase in the total traffic noise level as a result of the Development should be limited to 2 dB above that of the noise level without the Development. This limit applies wherever the noise level without the Development is within 2 dB of, or exceeds, the relevant day or night noise assessment criterion.

5.2.3 Human comfort vibration targets

Humans can detect vibration levels which are well below those causing any risk of damage to a building or its contents. Human comfort due to vibration from construction works is assessed under the NSW EPA document *Assessing Vibration – a technical guideline* (AVTG).

The AVTG provides guidance with respect to intermittent, impulsive and continuous vibration sources, which can be generated by construction activities.

The vibration characteristics of many construction activities (e.g. excavation, rock breaking and piling) are generally considered to be intermittent. Continuous vibration sources may include tunnel boring and impulsive vibration sources may include drop piling or blasting.

Continuous and impulsive vibration

Vibration criteria applicable to the site for continuous vibration sources, are summarised in Table 10. Only Daytime criterion is provided as no out of hours construction activities are expected.

Furthermore, vibration criteria for continuous vibration impulsive sources are not shown in Table 10 as such equipment are not expected to be used at this site.

Table 9: Preferred and maximum vibration levels for human disturbance limits - Continues and Impulsive vibration

Vibration type	Location	Assessment period	Preferred values (m/s ²)		Maximum values (m/s ²)	
			z axis	x and y axes	z axis	x and y axes
Continuous vibration	Critical areas	Day	0.005	0.0036	0.010	0.0072
	Residences	Daytime	0.010	0.0071	0.020	0.014

Vibration type	Location	Assessment period	Preferred values (m/s ²)		Maximum values (m/s ²)	
			z axis	x and y axes	z axis	x and y axes
	Offices, schools, educational institutions and places of worship	Day	0.020	0.014	0.040	0.028
	Workshops	Day	0.040	0.029	0.080	0.058

Note: 1- the preferred and maximum values are weighted RMS acceleration values in accordance with NSW EPA document *Assessing Vibration – a technical guideline*.

2- These criteria are only indicative, and there may be a need to assess to other sensitive areas against the relevant criteria.

Intermittent vibration

The vibration characteristics of most construction activities (e.g. excavation, rock breaking and pilling) are considered to be intermittent. Intermittent vibration can be defined as interrupted periods of continuous vibration (e.g. heavy truck passbys or rock breaking) or continuous periods of impulsive vibration (e.g. impact pile driving). Higher vibration levels are allowed for intermittent vibration compared with continuous vibration on the basis that the higher levels occur over a shorter time period. Hence, for intermittent vibration, human disturbance vibration levels are assessed on the basis of the Vibration Dose Value (VDV), based on the level and the duration of the vibration events. Vibration criteria applicable to the site for intermittent vibration sources, are summarised in Table 10. Only Day time criterion is provided as no out of hours construction activities are expected.

Table 10: Preferred and maximum vibration levels for human disturbance limits

Location	Daytime (0600-2200hrs) ¹	
	Preferred Value, VDV	Maximum Value, VDV
Residences	0.2	0.4
Offices, schools, educational institutions and places of worship	0.4	0.8

Note: 1 - Daytime is 7.00 am to 10.00 pm and Night-time is 10.00 pm to 7.00 am.

2 - These criteria are only indicative, and there may be a need to assess to other sensitive areas against the relevant criteria.

5.3 Construction Airborne Noise Prediction Methodology

5.3.1 Assessment scenarios

At this early planning stage, specific details regarding proposed construction processes are not known, with the types of activities, plant and scheduling not yet determined. Based on the proposed construction locations and methodology, the following construction phases were developed to represent the works at various construction sites within the project.

- Site Preparation
- Relocation of temporary buildings
- Demolition
- Bulk Excavation

- Construction

For each construction phase, two scenarios were developed to represent the works potentially having the greatest noise impact on the surrounding receivers. Noise levels for these works in this assessment have been calculated for the following scenarios:

“Typical Average Case” (TA): it is assumed that all the proposed plant items nominated by the client will be working concurrently towards the centre of the relevant construction site for between 25% to 100% of the time over a 15-minute period.

“Typical Worst Case” (TW): it is assumed that two of the noisiest proposed plant items will be working concurrently simultaneously near the boundary of the relevant construction site for between 25 to 100% of the time over a 15-minute period.

Situations, where noise sources would be located towards the centre of the site, are likely to be representative of the longer-term average noise emissions.

5.3.2 Assumed construction plant items and sound power

At this early planning stage, potential plant items have not been formally identified. In order to be able to provide an assessment of the likely construction noise we have provided details of process and plant items that have been adopted for other school SSDA assessments. These assumptions must be reviewed in the detailed design phase when more information is available on the schedule for the works and the equipment to be used. If the plant items to be used differ from those assumed in this report, further assessment of construction noise and vibration will be required. A summary of equipment assumed to be operating and the assumed operating duty (percentage of time operating per 15-minute period) for each phase of construction work, is provided in Appendix C. The relevant sound power data for these plant items is provided in Appendix D.

5.3.3 Modelling assumptions

Noise levels have been calculated at 1.5m above ground level in accordance with the requirements of the ICNG and at various distances from the boundary of the site. Calculated noise levels include the effects of the noise control recommendations specific to each construction phase detailed in this report.

5.4 Noise Control Recommendations

Based on the assumed construction plant items, MDA recommends that the noise control measures detailed in Table 11 are implemented on-site. Predicted construction noise levels in this assessment, include the effect of these recommendations.

Table 11: Noise control recommendations for site

Phase	Equipment/Location	Recommendation
Site preparation	Generator	- Localised noise barriers should be utilised when this equipment is in use.
	Air compressor	- Barriers should be mobile and extend to a height 1 m above the noise source. - Barrier should envelop the work location to ensure no direct line of sight to nearby receivers. - Practical and feasible measures should be taken to allow the noise barrier to be located within 4 m of the noise source.
Relocation of temporary buildings	N/A	

Phase	Equipment/Location	Recommendation
Demolition	Air compressor & lines	- Localised noise barriers should be utilised when this equipment is in use. - Barriers should be mobile and extend to a height 1 m above the noise source. - Barrier should envelop the work location to ensure no direct line of sight to nearby receivers. - Practical and feasible measures should be taken to allow the noise barrier to be located within 4 m of the noise source.
Bulk Excavation	Generator Air compressor & lines	- Localised noise barriers should be utilised when this equipment is in use. - Barriers should be mobile and extend to a height 1 m above the noise source. - Barrier should envelop the work location to ensure no direct line of sight to nearby receivers. - Practical and feasible measures should be taken to allow the noise barrier to be located within 4 m of the noise source.
Construction	Generator Air compressor & lines Concrete saw - road	- Localised noise barriers should be utilised when this equipment is in use. - Barriers should be mobile and extend to a height 1 m above the noise source. - Barrier should envelop the work location to ensure no direct line of sight to nearby receivers. - Practical and feasible measures should be taken to allow the noise barrier to be located within 4 m of the noise source.

The above noise control recommendations are provided in the absence of a detailed construction methodology. A full CNVMP will be required later to be prepared by the builder once appointed and a detailed construction methodology is available.

5.5 Summary of Construction Noise Assessment

Predicted noise levels from construction activities have been calculated and a detailed assessment, including predicted noise levels, is provided in Appendix F.

It is noted that situations, where noise sources would be located towards the centre of the site, are likely to be representative of the longer-term average noise emissions. Within standard hours (Monday – Friday: 0700-1700 hrs, Saturday 0800-1300 hrs) the “Average” noise levels from typical operations at the most noise affected receivers are probable to be;

- Site Preparation activities are calculated to be:
 - o Residential receivers surrounding the site: up to 4 dB above the “Noise Affected” goals and below the “Highly Noise Affected” project-specific management levels.
 - o Commercial receivers surrounding the site: predicted noise levels are expected to be below the Noise Management Levels.
- Relocation of temporary buildings activities are calculated to be:

- o Residential receivers surrounding the site: up to 6 dB above the “Noise Affected” goals and below the “Highly Noise Affected” project-specific management levels.
- o Commercial receivers surrounding the site: predicted noise levels are expected to be below the Noise Management Levels.
- Demolition activities are calculated to be:
 - o Residential receivers surrounding the site: up to 22 dB above the “Noise Affected” goals and up to 2 dB above the “Highly Noise Affected” project-specific management levels.
 - o Commercial receivers surrounding the site: predicted noise levels are expected to be up to 6 dB above the Noise Management Levels.
- Bulk Excavation activities are calculated to be:
 - o Residential receivers surrounding the site: up to 18 dB above the “Noise Affected” goals and below the “Highly Noise Affected” project-specific management levels.
 - o Commercial receivers surrounding the site: predicted noise levels are expected to be up to 2 dB above the Noise Management Levels.
- Construction activities are calculated to be:
 - o Residential receivers surrounding the site: up to 13 dB above the “Noise Affected” goals and below the “Highly Noise Affected” project-specific management levels.
 - o Commercial receivers surrounding the site: predicted noise levels are expected to be below the Noise Management Levels.

Exceedances of “Noise Affected” goals are typical of construction sites in close proximity to residential receivers. Further, since all construction works are restricted to take place only during the daytime, noise impacts will not be experienced during the most sensitive time period i.e. night-time. The ICNG recommends that for situations in which the “Noise Affected” management levels are exceeded all feasible and reasonable work practises should be adopted. Details of feasible and reasonable work practises are provided in Appendix G.

As such, the works at this site will need to be considered during the preparation of the CNVMP such that all feasible and reasonable noise management practices are adopted, including consultation with the community. Inclusions for the construction noise and vibration management plan are proposed in Appendix G.

5.6 Construction Traffic

5.6.1 Construction traffic description

Based on the review of the preliminary construction traffic management plan prepared and provided by Ason Group ‘*Transport Assessment Upgrade to North Sydney Public School P1723r01v01 dated 6/8/2021*’, The following working hours are proposed:

- Monday to Friday: 7.00 AM to 6:00 PM.
- No construction deliveries between 7:30 am to 9:00 am, and between 1:30 pm to 3:00 pm on school days.
- Saturday: 8.00AM to 5.00PM
- Sunday and Public holidays: No planned work.

According to the preliminary traffic report, it is expected that most construction traffic would occur during site establishment, civil and main works. During these stages, the maximum number of trucks accessing the site is estimated to be between 6 to 12 trucks per hour. It is proposed that construction vehicles enter and exit the site via Pacific Highway, Berry Street, Edward Street and Bay Road.

5.6.2 Construction traffic noise assessment

The RNP notes that in assessing feasible and reasonable mitigation measures, an increase of up to 2 dB represents a minor impact that is considered barely perceptible to the average person.

The increase in traffic volume due to the construction works are not expected to increase the current traffic noise on Pacific Highway or Bay Road. Information is not available as to existing traffic movements on Berry Street or Edward Street. We note however, that movements of 6 to 12 trucks per hour through other local roads (i.e. Berry Street and Edward Street) have the potential to increase the existing traffic noise by more than 2 dB. On this basis, alternative routes are suggested to be considered. However, if the intent of the construction contractors is to use the surrounding local roads for truck movements up to 12 truck per hour, a detailed traffic noise measurements and analysis is required to be carried out at a later stage to assess the potential impact on the residential receivers along the surrounding local roads.

5.7 Summary of Construction Vibration Assessment and Recommendations

The AVTG provides guidance with respect to intermittent, impulsive and continuous vibration sources, which can be generated by construction activities. Where vibration intensive activities are proposed close to sensitive receivers, site measurements and alternative equipment or methodologies should be employed. A detailed vibration impacts assessment and recommendations specific to the site as part of the full CNVMP will be required to be prepared at a later date, in the detailed design phase, once a detailed construction methodology is available. Inclusions for the construction noise and vibration management plan are proposed in Appendix G.

5.7.1 Intermittent vibration

The AVTG indicates that intermittent vibration should be assessed in terms of the Vibration Dose Value (VDV). These values for intermittent construction activities are highly specific to site conditions, equipment selections and operational durations. As such, calculation of VDV levels is not typical or practical at planning stage but will need to be considered as part of a later detailed vibration assessment.

The AVTG recommends that best management practises in all cases should be to reduce values as far as practicable, and a comprehensive community consultation program should be developed.

5.7.2 Continuous vibration

Vibration due to some construction operations can be considered continuous depending on the duration and nature of the works. Since the guide values for continuous vibration are independent to exposure duration, indicative safe working distances can be developed and are provided in Table 12.

Table 12: Safe working distances for human comfort (continuous vibration sources), m

Plant Items ¹	Safe Working Distance, (m)
Hydraulic Impact Hammer – Small (300 kg – 5-12 t excavator)	7
Hydraulic Impact Hammer – Medium (900 kg – 12-18 t excavator)	23
Hydraulic Impact Hammer – Large (1,600 kg – 18-34 t excavator)	73
Jackhammer	2

Notes: 1. Based on information published by TfNSW Construction Noise and Vibration Strategy.

2. The values in this table apply to residential receivers.

6.0 OPERATIONAL NOISE EMISSIONS

6.1 Operational Noise Criteria

Noise criteria applicable to the project site with respect to operational activities have been developed considering the references detailed in Table 5 and are summarised in the following sections. The full derivation of criteria is provided in Section 4.2 and in Appendix C.

6.1.1 'Noise Policy for Industry'

Airborne noise criteria applicable to the site derived in accordance with the NPfl are summarised in Table 13. These criteria apply (in accordance with the SEARs) to airborne noise emission related to the PA system, school bell and mechanical services.

Table 13: NPfl Project Noise Trigger Levels

Receiver	Period	Project Noise Trigger Level, $L_{Aeq,15min}$, dB		
		Receiver A3, A4, A5, A6, A7	Receiver A2	Receiver A1, A8
Residential	Day	50	55	58
	Evening	45	48	48
	Night	40	43	43

6.1.2 'Noise Guideline for Local Government'

The NGLG is designed to assist local government officers in assessing noise impacts and associated decision making. In determining whether a source of noise may be offensive, the following checklist is considered:

Q1: Is the noise loud in an absolute sense? Is it loud relative to other noise in the area?

Q2: Does the noise include characteristics that make it particularly irritating?

Q3: Does the noise occur at times when people expect to enjoy peace and quiet?

Q4: Is the noise atypical for the area?

Q5: Does the noise occur often?

Q6: Are a number of people affected by the noise?

Above assessment checklist has been considered in assessing noise from outdoor student activities.

6.1.3 'Protection of the Environment Operations Act 1997'

The PoEO provides a qualitative basis on which to assess impacts from noise sources and outlines assessment considerations designed to establish whether noise can be objectively considered offensive. Offensive noise is defined in the PoEO act as being noise:

(a) that, by reason of its level, nature, character or quality, or the time at which it is made, or any other circumstances:

(i) is harmful to (or is likely to be harmful to) a person who is outside the premises from which it is emitted, or

(ii) interferes unreasonably with (or is likely to interfere unreasonably with) the comfort or repose of a person who is outside the premises from which it is emitted, or

(b) that is of a level, nature, character or quality prescribed by the regulations or that is made at a time, or in other circumstances, prescribed by the regulations.

The PoEO subjective assessment has been considered in evaluating noise from outdoor student activities.

6.1.4 Road Noise Policy

The Road Noise Policy provides a noise criterion for existing residences affected by additional traffic on existing local and arterial roads generated by land-use developments. This is specified as $L_{Aeq(15\text{ hr})}$ 60 dB assessed at the boundary of a residence along arterial roads; and $L_{Aeq(1\text{ hr})}$ 55 dB assessed at the boundary of a residence along local roads.

Additionally, the RNP notes that in assessing feasible and reasonable mitigation measures, an increase of up to 2 dB represents a minor impact that is considered barely perceptible to the average person. An increase of 2 dB equates to an approximate increase in traffic volume in the order of 60%.

6.2 Assessment of Operational Noise Emissions

6.2.1 PA System and School bell

The school bell operates currently operates in accordance with the schedule in Table 14. It is expected that the same schedule will be maintained. Currently the bell operates 5 times per day through a speaker system comprising music for 20 seconds then a bell.

Table 14: School bell times

Start	Finish	Activity
8.55am	10.55am	Morning Learning session
10.55am	11.05am	Eating Time
11.05am	11.45am	Lunch play time
11.45am	1.20pm	Middle Learning session
1.20pm	1.40pm	Recess/Afternoon Tea
1.40pm	2.55pm	Afternoon Learning session

Noise from internal classroom speakers within the new buildings will be well controlled by the building façade (particularly as it will be required to control intruding traffic noise).

Noise emissions from any new speakers located outdoors or within the naturally ventilated hall will need to be reviewed in more detail during the detailed design stages once the specification number and location of the new bells and speakers are known. Noise from new PA or school bell noise sources must be designed such that the criteria shown in Table 13 are achieved when assessed cumulatively with all site-related operational noise emissions.

The following conceptual design recommendations are provided:.

- Speakers should be positioned to minimise noise spill
- Consider the use of directional speaker units
- A distributed system of smaller, lower output speakers rather than a system of fewer, higher output speakers allows better control of noise spill and lower noise levels
- External speaker use should be limited to the provision of short PA announcements and bell functions only and should not be used for playing music, radio or other continuous noise sources.
- Once the new speakers are operational, calibration will be required for the new speakers that are located outdoors or within the naturally ventilated hall, in order that they comply with the required noise criteria.

6.2.2 Noise Emissions from use of the Hall Space

Noise generated within the school's new internal spaces (and refurbished classroom in building G) will typically be low, but with noise within the Hall expected to be potentially higher than in other spaces.

The times of use and the activities in the hall is described in Table 15. The expected acoustic design requirements of the building envelope has been informed by the control of noise egress from internal activities, through roof/ceiling structure, glazing and passive ventilation.

Noise emissions from the Hall have been assessed based on the assumed internal reverberant sound levels shown in Table 16 and Table 17. These activities are expected to occur anytime during the Daytime period for school-based activities, or the Evening period weekdays and daytime during the weekends for community-based activities.

Table 15: Hall use times and activities

Start	Finish	Days	Activity	Use
7.30am	9.00am	Mon-Wed	School band	School
9.00am	3.00pm	Monday to Friday	School dance groups, music activities, sport	School
3.00pm	10.00pm	Monday-Friday	Dance groups, Karate, community languages, Choirs, sports groups, Drama for kids	Community
8am	6pm	Saturday and Sunday	Dance groups, Karate, community languages, Choirs, sports groups, Drama for kids, elections	Community

While some music is allowed for in the assumptions for the community use, only moderate amplification is allowed for. Highly amplified music and music with loud low frequency noise levels are not included in the assessment. Music of this type would require a higher level of acoustic treatment.

Table 16: Assumed internal reverberant sound pressure levels, dB

Use	Internal reverberant sound pressure level, $L_{Aeq\ 15\ minutes}$ dB	Comments
General School Hall Use, assemblies and drama (with amplified speech)	75	To occur on a weekly or daily basis
Sports (eg basket ball)	75	To occur on a weekly or daily basis
Community use such as music performance (with amplification)	85	To occur on an occasional basis during community use.

Table 17: Design Spectra - Hall noise levels

	L_{Aeq} dB	Reverberant sound pressure level L_{eq} dB - Octave Band Centre Frequency (Hz)						
		63	125	250	500	1k	2k	4k
General school use	75	86	85	80	73	64	55	48
Community Music Use	85	86	85	80	83	81	78	70

The SSDA design of the Hall is shown within SSDA drawings CD-203, CD-212 and CD-301-CD303. These drawing outlined the following conceptual construction:

- Level 1 and “Wing” area: brick veneer construction
- Main Hall areas: panelised CFC cladding on furring channels and metal stud work and internal lining as required
- Roofing: metal deck

Large, glazed awning type operable doors will be located along the northern and eastern façades. In the interim, a low level of acoustic performance has been assumed for these doors, broadly assuming the doors are not well sealed acoustically when closed.

The Hall will be naturally ventilated, with the assumption by MDA that ventilation will be via these doors.

We have allowed for the metal deck roof to be provided with a solid set plasterboard ceiling, as this will be a requirement for the control of rain noise to the building interior.

Based on noise emissions from the above activities, in addition to other considerations such as rain noise control, the external wall, roof, glazing and door acoustic performance requirements detailed in Table 18 have been derived.

The Hall will be located:

- Approximately 70 metres to the residential properties in McHatton Street, although significantly screened by the heritage McHatton building.
- Approximately 25 metres to the properties across Bay Street.
- Approximately 100 metres to the residential properties immediately to the west of the school although significantly screened by the River building.
- Approximately 110 metres to the residential apartment building at the corner of Bay Street and Pacific Highway.
- Approximately 160 metres to the residential apartment building at 125 Pacific Highway, to the east.

Table 18: Performance assumptions for external building elements, R_w

Building Element/Applicable Block	Performance assumption, R_w
Roof/ceiling	45
External walls	50
Glazing	35
Operable Doors	20 (when closed)

Predicted noise levels at the nearest residential receivers have been calculated and are presented in Table 19. Note that conclusions regarding compliance are indicative as they are based on estimated background noise data only. The comments assume that the Hall would be used for general school activities during daytime hours and community use during the evening hours as defined in Table 16. Use during night-time hours of 10pm to 7am is not assumed and therefore not assessed.

Table 19: Predicted noise levels from School Hall

Receiver/Period	Preliminary NPfI Criteria, L _{Aeq} (15 min), dB	Façade Elements Closed		Façade Elements Open	
		Predicted Level L _{Aeq} (15 min), dB	Estimated likely Compliance?	Predicted Level L _{Aeq} (15 min), dB	Estimated likely Compliance?
Residential A1					
School use Day ¹	58	38	Y	44	Y
Evening ¹	48	42	Y	54	N
Residential A2					
Day ¹	55	39	Y	44	Y
Evening ¹	48	43	Y	54	N
Residential A4					
Day ¹	50	47	Y	53	N
Evening ¹	45	52	N	63	N
Residential A5					
Day ¹	50	32	Y	33	Y
Evening ¹	45	33	Y	39	Y
Residential A6					
Day ¹	50	32	Y	42	Y
Evening ¹	45	41	Y	52	N
Residential A7					
Day ¹	50	43	Y	48	Y
Evening ¹	45	47	N	58	N

¹ Day: 0700-1800hrs, Evening: 1800-2200hrs

While a formal assessment will require the results of background noise survey, our preliminary assessment indicates the following:

- It should be *generally* feasible for the Hall to comply with the anticipated noise criteria during general school usage during the daytime hours when assessed at most boundaries. This allows for the northern and eastern doors open for ventilation
- Preliminary calculations indicate however, that it may be possible for the closer residential properties in Bay Road to be exposed to noise slightly above the criteria during general school activities during the daytime hours. The reason the exceedance is anticipated is the result of noise transmission through the open eastern doors. Compliance is more likely with the eastern doors closed. As a result, depending on the results of the noise level survey, the anticipated

internal noise levels and use, it may be necessary to allow for the eastern doors to be closed in some general school use scenarios.

- Noise emissions during use for community events, particularly during the evening hours, is likely to exceed the noise criteria with the doors open for ventilation. Closing the doors will reduce noise levels although our assessment indicates that some exceedance of the preliminary noise criteria is still possible. Depending on the results of the noise level survey it may be necessary to specify an acoustic rating for the doors to control noise breakout to meet the required noise criteria. Closing doors and any other openings may mean that ventilation would need to be obtained from a mechanical ventilated system.

It will be necessary to specify the hall envelope, during the detailed design stages such that cumulative noise levels at nearby noise sensitive receivers can comply with the derived NPfI criteria .

6.2.3 Mechanical services

The mechanical services design finalised equipment selections have not yet been made. As such, a quantitative assessment of mechanical services noise emissions cannot be conducted. The mechanical services are expected to comprise a fully ducted system with various external plant items likely to give rise to noise emissions from the school.

Any noise emissions related to the Project from external mechanical services items must be designed and selected such that the applicable NPfI noise criteria are achieved at the residential receivers when assessed cumulatively with all other noise emissions from the school as a whole.

Noise control measures that may be required to control noise emissions from external plant could include:

- Noise control barriers
- Selection of low-noise equipment
- Vibration isolation of items
- Attenuators to ducting

It is expected that noise emissions from the plant will be reviewed in detail as part of the ongoing mechanical services design.

6.2.4 Outdoor activities

Noise from children outside engaging in various activities has been assessed. While the precinct includes numerous existing play areas (refer Figure 3), the development would include new and relocated spaces as follows:

- New Covered outdoor learning area to the north of the new Hall
- Relocated play areas, moved from existing area at proposed location for COLA to a new location east of the River Building, adjacent the proposed new Hall building.
- There are existing play areas to the south of the site, adjacent Bay Road. This play space will be consumed by the proposed new building, with these areas replaced by the proposed new play area.

The development would allow the school population to increase from 869 to 1,012 children. In global terms the overall noise level increase as a result of increased student numbers would be minor at around 0.7 dB. A noise increase of this level is unlikely to be noticeable.

Some outdoor play areas will be relocated however with the potential to allow more significant changes in noise levels in local areas. The revisions to the play areas is confined to the western areas of the precinct.

In order to assess these aspects, we have carried out calculated comparisons between the noise expected from the current play areas in the western precinct and the proposed relocated and revised areas.

Information is not available with respect to proposed numbers in each play area or scheduling of outdoor activities. To conduct an assessment of noise impacts, MDA has made assumptions regarding the nature of the outdoor activities and provides comments below.

It should also be noted that no specific quantitative criteria for the assessment of outdoor activities associated with schools are available. NSW EPA indicates consideration of the Noise Guideline for Local Government and the Protection of the Environment Operations Act for the assessment of such sources. These sources provide qualitative guidance for assessment only, however approximate predicted noise levels have been developed to aid in understanding the nature of any noise impacts on nearby receivers. Due to the existing use of the precinct and the various existing play areas, comparisons are made between predicted noise arising from the use of the existing play areas at the western part of the precinct, compared with the new play area and COLA created as part of the new building. The comparison is made by allowing for existing scenario of 40 children in the existing covered play area adjacent the existing Hall, 40 children in the paved play area adjacent building F and 20 children at the existing play areas adjacent Bay Road.

The operational scenario for this assessment has been made by allowing for 40 children in the new, relocated area, and 40 children under the new COLA. As the existing play area adjacent Bay Road would be consumed by the new building, there would be no play activities in this space following completion of the development.

Outdoor Activities Areas

For outdoor recreation activities, it is assumed that up to 40 students may be engaging in active activities within the new play area or the COLA. It is assumed that students will be dispersed over each of these areas. We have also considered expected noise due to teaching activities below the COLA roof, allowing for an educator speaking in a loud voice. The data on which the calculation is based is set out in Table 20 below. The data for 10 children has been corrected in the calculations to allow for the nominal children numbers.

Table 20: outdoor activities noise data

	L _{WA} dB	Sound power level L _{eq} dB - Octave Band Centre Frequency (Hz)						
		63	125	250	500	1k	2k	4k
10 Children	90	94	89	80	80	87	85	77
Educator – raised voice	78	-	60	70	74	76	70	64

Table 21: Calculated noise impacts: existing south western play areas

Receptor Location	Noise source			
	Existing south Playground areas adjacent Bay Road allowing 20 children L _{Aeq}	Existing Covered Play area adjacent Hall, allowing 40 children L _{Aeq}	Existing Play area adjacent building F	Total L _{Aeq}
A4 18 Bay Road	57	55	49	60
A5 20-22 Bay Road	52	52	49	56
A6 11 Bay Road	45	49	Nil (screened by building)	50
A2 Apartments Cnr Bay Road and Hwy	45	48	45	51
A7 16-18 McHatton Street	40	52	55	57

Table 22: Calculated noise impacts: proposed new southwestern play areas (including COLA)

Receptor Location	Noise source			Total L _{Aeq}
	Proposed new Playground areas adjacent Hall allowing 40 children L _{Aeq}	New COLA adjacent Hall, allowing 40 children L _{Aeq}	Existing Play area adjacent building F (unaltered)	
A4 18 Bay Road	47	53	49	55
A5 20-22 Bay Road	53	47	49	55
A6 11 Bay Road	53	43	Nil (screened by building)	53
A2 Apartments Cnr Bay Road and Pacific Hwy	46	47	45	51
A7 16-18 McHatton Street	53	53	55	58

Table 23: Calculated noise impacts: proposed COLA used as a teaching activity

Receptor Location	Noise source
	Single Raised Voice – Teaching L _{Aeq}
A4 18 Bay Road	29
A5 20-22 Bay Road	28
A6 11 Bay Road	26
A7 16-18 McHatton Street	35
A2 Apartments Cnr Bay Road and Pacific Hwy	30

While there are no specific quantitative criteria for the proposed play areas we make the following comments, based on the calculated noise from the relocated play area and the new COLA when used as a play area

- Noise emissions arising from the revised southwest play areas to most residential properties are generally expected to be similar or lower to that existing, as a result of the increased setback.
- Noise emissions arising from the revised southwest play areas to the Bay Road residential areas to the west of the precinct may increase moderately as a result of the reduced set back to the play areas.
- Noise emissions arising from the revised southwest play areas to parts of the McHatton Street residential areas (those visible through a site line between buildings D and F) to the north of the precinct may increase slightly as a result of the reduced set back to the play areas.
- Noise arising from the use of the new COLA for teaching activities is unlikely to generate adverse noise impact.

Guidance on these noise impacts can also be gained by a comparison using the qualitative procedures in the NGLG:

Table: NGLG Subjective Assessment

NGLG Subjective Assessment of Outdoor Activity Noise
Q1: Is the noise loud in an absolute sense? Is it loud relative to other noise in the area? Noise levels from outdoor play activities are predicted to be likely above background noise levels, however, unlikely to be significantly above noise from typical traffic noise along Bay Road when the absolute level is considered. While there is likely to be little traffic on McHatton Street however, the predicted noise increase from playground activities when assessed at this location is minor.
Q2: Does the noise include characteristics that make it particularly irritating? Court judgements about intrusive noise from schools have indicated that noise from student activities may be considered more acceptable and less irritating than the noise of an equivalent level from industrial, commercial or other noise sources
Q3: Does the noise occur at times when people expect to enjoy peace and quiet? Outdoor activities are expected to occur during the Daytime period 0700-1800hrs during which residents are generally expecting to be impacted by community noise sources.
Q4: Is the noise atypical for the area? The proposed site is currently adjacent (and is part of) an existing education precinct which permits the use of land for educational establishments with the relevant consents. Therefore noise from student outdoors is not out of character for the intended land use.
Q5: Does the noise occur often? Noise from students utilising the outdoor areas of the school is expected to occur in varying numbers throughout the day. The worst-case scenario of all students outside simultaneously is likely to occur during lunch times and eating times
Q6: Are a number of people affected by the noise? Noise from the revised play areas is not likely to increase significantly at most of the surrounding residential properties. The number of receivers affected by a possible moderate noise increase is likely to be in the order of 2-3 in McHatton Street. We note that the noise from outdoor activities would only occur during the daytime hours, when it is less likely that residents are sleeping.

With regards to assessment under the PoEO Act, noise from outdoor activities is not considered to be offensive. A summary of our subjective assessment is described in Table 24.

Table 24: PoEO Act Subjective Assessment

PoEO Act Subjective Assessment of Outdoor Activity Noise
(a) that, by reason of its level, nature, character or quality, or the time at which it is made, or any other circumstances: (i) is harmful to (or is likely to be harmful to) a person who is outside the premises from which it is emitted, (ii) interferes unreasonably with (or is likely to interfere unreasonably with) the comfort or repose of a person who is outside the premises from which it is emitted, or Outdoor activities will occur during the Daytime period (0700-1800hrs). Receivers are generally less noise-sensitive during this period due to increase in other noise-generating activities not related to the school, reduced likelihood of residents sleeping, increased likelihood of residents being away from the premises and increase in general activities in the community. (b) that is of a level, nature, character or quality prescribed by the regulations or that is made at a time, or in other circumstances, prescribed by the regulations. The proposed site is currently and is part of an existing education precinct which permits the use of land for educational establishments with the relevant consents. Therefore, noise from student outdoors is not precluded by the regulations.

It is concluded from our assessment, based on the limitation and assumptions noted, that:

The revised playground layout is unlikely to generate adverse acoustic impact to most surrounding residential areas, due to increased setbacks. The existing play area coverage is extensive (refer Figure 3) and the revisions do not add significantly to the overall area.

A moderate increase to some residential Bay Road is possible. However, on comparison with the qualitative assessment in the NGLG and the PoEO, is expected to remain acceptable.

6.2.5 Traffic Movement on Carpark and Public Roads

Ason Group have prepared a transport report *Upgrade to North Sydney Public School Transport Assessment* P1723r01v01 dated 6th August 2021.

The report includes the following peak operational vehicle movements generated by the school for both existing and post completion scenarios as follows:

Table 25: Operational Traffic Movements

Time	Existing Vehicle Trips	Additional projected	Total Projected
AM Peak	374	61	435
PM Peak	122	16	138

The data in section 8.4 the traffic report notes that there are 17 spaces for drop off / pick up (DOPU) total with 8 spaces along McHatton Street and 9 spaces along Bay Road. Assuming conservatively that during the DOPU periods the only traffic on McHatton Street is that generated by the school, the overall increase due to DOPU would be less than 0.7 dBA (AM Peak).

For the Bay Road DOPU area the area is already subject to significant traffic movements (shown in the SCATs data section 4.1.1 of the traffic report to be of the order of 690 VPH AM peak. Allowing approximately 55 % (per the spaces noted in section 8.4 of the traffic report) of the drop off in this area we deduce there would be approximately 34 additional AM peak traffic movements on Bay

Road. Allowing a projected flow along Bay Road would be $690 + 34 = 724$ vph, the estimate increase would be an insignificant 0.2 dBA.

The noise level increase due to the projected additional vehicle movements is therefore expected to be well below the 2 dB allowance within Road Noise Policy guidelines.

In general terms this is consistent with the moderate increase in school population from 869 to 1,102 children.

7.0 ROAD TRAFFIC NOISE INGRESS TO SCHOOL SPACES

This section provides estimates of the likely noise impact on the school precinct due to traffic on Pacific Highway and Bay Road.

As noted in Section 4.0 noise data for the precinct is not available due to the current Sydney lockdown. In order to provide preliminary guidance we have carried out noise estimates based on traffic flow data for Pacific Highway and Bay Road. The traffic flow data is provided in the Ason Group transport report *Upgrade to North Sydney Public School Transport Assessment P1723r01v01* dated 6th August 2021.

These estimates are approximate as detailed current traffic flow data for Pacific Highway is not available and there is no traffic data of any kind available for Bay Road.

It will therefore be necessary to establish measured noise data once traffic resumes to normal levels to clearly establish the noise impacts on the site and provide the necessary acoustic design for building façades.

7.1 Noise Targets

To establish likely noise targets for school receivers the Educational Facilities Standards and Guidelines (EFSG) NSW EPA Road Noise Policy have been considered. School receivers considered for assessment are detailed in Table 26 alongside expected noise targets and reference guidelines.

Table 26: Receiver locations and expected noise targets

Receiver	Recommended noise target dB	Reference Guideline
Internal spaces (school classroom etc.)	$L_{Aeq\ 1\ hr}$ 40	Road Noise Policy
External – Active Use	$L_{Aeq\ 15\ hr}$ 60	Road Noise Policy
External – Passive Use	$L_{Aeq\ 15\ hr}$ 55	Road Noise Policy
Assembly halls up to 250 seats	$L_{Aeq(15\ minute)}$ 35	EFSG
Corridors and Lobbies	$L_{Aeq(15\ minute)}$ 45	EFSG
Duplicating Rooms and Stores	$L_{Aeq(15\ minute)}$ 50	EFSG
Gymnasiums	$L_{Aeq(15\ minute)}$ 40	EFSG
Interview and Counselling Rooms	$L_{Aeq(15\ minute)}$ 35	EFSG
Libraries General Areas	$L_{Aeq(15\ minute)}$ 40	EFSG
Libraries Reading Areas	$L_{Aeq(15\ minute)}$ 35	EFSG
Office Areas	$L_{Aeq(15\ minute)}$ 40	EFSG
Open plan teaching space	$L_{Aeq(15\ minute)}$ 40	EFSG
Professional and administrative offices	$L_{Aeq(15\ minute)}$ 35	EFSG

Receiver	Recommended noise target dB	Reference Guideline
Staff Common rooms	$L_{Aeq}(15 \text{ minute})$ 40	EFSG
Study Rooms	$L_{Aeq}(15 \text{ minute})$ 35	EFSG
Teaching spaces – students who are deaf or hard of hearing	$L_{Aeq}(15 \text{ minute})$ 30	EFSG
Teaching spaces – Primary Schools	$L_{Aeq}(15 \text{ minute})$ 35	EFSG
Toilet/change/showers	$L_{Aeq}(15 \text{ minute})$ 50	EFSG

The NSW EPA Road Noise Policy (RNP) recognises ‘Open space (active use)’ and ‘Open space (passive use)’ as sensitive land uses and sets criteria for these land uses. In this report, both uses of the outdoor activity areas are considered.

7.2 Assessment Results

As a survey of existing noise levels has not been carried out, detailed analysis of the prevailing on site noise levels is not feasible. We note that Pacific Highway is the predominant source of road traffic noise. Bay Road will be a secondary source as it provides a connection between Pacific Highway and Waverton to the west of the school precinct.

In the interim we have carried out an estimate of the noise level across the site using the procedures in the Calculation of Road Traffic Noise (CORTN) based on the supplied traffic flow volumes on Pacific Highway.

As per Section 6.2.3 we have referred to the Ason Group transport report *Upgrade to North Sydney Public School Transport Assessment* P1723r01v01 dated 6th August 2021.

Figure 13 of the transport report provides existing 2021 SCATs traffic volume data for AM and PM school peak periods (8am to 9am and 3pm to 4pm). Adding total flows indicates a total flow past the school site of:

- Pacific Highway 2360 vph (AM peak)
- Bay Road 690 vph (AM peak)

We have allowed for the following traffic parameters in our calculations

- Pacific Highway 60 km/hr 5 % heavy Vehicles (although noting the school zone speed limit of 40 km/hr during relevant AM and PM periods)
- Bay Road 50 km/hr 0 % heavy Vehicles (although noting the school zone speed limit of 40 km/hr during relevant AM and PM periods)

The assessment provides the following estimated L_{Aeq} 1 hour noise levels set out in Table 27. We estimate noise levels on the precinct border with Pacific Highway of the order of 72 $L_{Aeq} (1 \text{ hour})$. We estimate noise levels of 64 $L_{Aeq} (1 \text{ hour})$ at the position of the new building, nearest the Bay Road Boundary.

Table 27: Estimated outdoor noise levels

Location outside:	Estimated $L_{Aeq}(1 \text{ hr})$ dB
Block G new GLA	63 (north)
New Building – West	64 (south)
New Building – Hall	64 (south)

7.2.1 Traffic noise ingress to outdoor activity areas

MDA have carried out estimates of noise levels based on the distance between Bay Road and the proposed outdoor activity area locations. Table 28 shows the calculated traffic noise levels at the proposed outdoor activity areas.

Table 28: Calculated traffic noise levels at outdoor activity areas

Receiver area	Expected noise level $L_{Aeq\ 15hr}$	Recommended noise target
Outdoor activity areas west of hall	<58	$L_{Aeq\ 15\ hr}$ 55 (External – Passive Use) $L_{Aeq\ 15\ hr}$ 60 (External – Active Use)
Level 3 Outdoor learning space east of hall	62	$L_{Aeq\ 15\ hr}$ 55 (External – Passive Use) $L_{Aeq\ 15\ hr}$ 60 (External – Active Use)
COLA	<55	$L_{Aeq\ 15\ hr}$ 55 (External – Passive Use) $L_{Aeq\ 15\ hr}$ 60 (External – Active Use)

While noise measurement data is not available, our estimates of on-site traffic noise levels allow the following conclusions:

- traffic noise levels at the new playground area are expected to within acceptable levels for active use such as playing activities
- traffic noise levels at the new Level 3 outdoor learning area indicate that noise levels during peak traffic periods at these areas may be in excess of acceptable criteria for passive use such as learning activities. Subject to assessment of the noise levels by measurement, it may be necessary to provide screening to these areas or manage outdoor learning activities such that they are carried out outside peak traffic periods.
- traffic noise levels at the new COLA area are expected to within acceptable levels for passive use such as outdoor learning

7.2.2 Traffic noise ingress to internal areas

Based on the estimated noise levels set out in Table 27, calculations have been carried out to determine the acoustic rating likely to be required for the external elements of the new building, in order to achieve the proposed internal noise criteria set out in Table 26. A schedule of indicative acoustic ratings has been prepared for typical space types to demonstrate the likely acoustic requirements. Detailed acoustic design and noise measurements will be required to confirm the type and extent of necessary acoustic ratings for construction. It would be desirable to refine the acoustic ratings based on actual measured noise levels and not based on the peak traffic flows considered in this report. For this reason, it is not intended that these acoustic ratings be mandated by any consent or approval conditions.

Acoustic ratings for the refurbished classrooms for building G are not shown. While acoustic rated elements may also be desirable, the feasibility of providing these would depend on the scope of the refurbishment. Where the refurbishment comprises internal works only, it may not be feasible to provide acoustic upgrades to the building envelope.

Table 29: Calculated Acoustic Ratings for New Building envelope (indicative)

Element	R _w rating	Conceptual Description
External wall East /West/South	55	Precast elements with plasterboard lining
Glazing Level 1/2 Learning Spaces	36	Acoustic Laminated Glass
Glazing Offices Level 1	36	Acoustic Laminated Glass
Library (south)	36	Acoustic Laminated Glass
Glazing Level 3 Learning Space South	36	Acoustic Laminated Glass
Roof / Ceiling Learning Spaces South	45	Metal Deck roof with insulation and suspended multilayer plasterboard ceiling
OSHC office	36	Acoustic Laminated Glass

In order to achieve the required internal noise levels in the new building it would be necessary to allow for most windows (south in particular) to be closed. This would necessitate an alternative means of ventilation such as air conditioning.

For the naturally ventilated Hall, noise levels within the space due to traffic will depend on noise transfer via the large, glazed awning/foldaway doors when open. The doors even when closed are likely to offer only a moderate degree of sound reduction, unless specialist acoustic assemblies are procured. We expect that it will not be feasible to achieve EFSG compliant noise levels within the naturally ventilated Hall. As such, the acoustic rating levels normally necessary for the remaining elements such as the roof and external walls would not be warranted based on the limitations offered by the natural ventilation and awning doors.

Instead, a reduced acoustic rating for the roof / ceiling and external walls its proposed, commensurate with the recommendations in Section 6.2. This however may not provide EFSG compliant internal noise levels.

Table 30: Calculated Nominal Acoustic Ratings for Hall Building envelope (indicative)

Element	R _w rating	Conceptual Description
External wall	50	Light weight or Precast elements with plasterboard lining
Fixed Glazing	35	Acoustic Laminated Glass
Roof / Ceiling	45	Metal Deck roof with insulation and suspended plasterboard ceiling

The estimated noise levels will be subject to revision following the results of noise level surveys on traffic noise levels at various locations

7.3 Noise Mitigation Requirements Summary

The required acoustic controls are expected to comprise:

- Acoustic rated external windows and doors to learning spaces, library and administrative areas.
- Acoustic rated external windows and doors to the refurbished GLs in Building G areas where retrospective compliance with the EFSG is required.

- Acoustic rated ceiling below roof to new Building and Hall typically comprising a solid set unperforated plasterboard ceiling, with necessary acoustic absorptive finishes below the plasterboard
- Acoustic rated windows and awning glass doors to the new Hall

The necessary acoustic ratings would be determined following noise level measurements on site. We understand that the learning spaces, library and administrative areas will be air conditioned and as such we would expect that it would be possible to allow the air conditioning (with fresh air component) to provide an alternative for open windows.

The Hall will not be air conditioned, and as such it may not be feasible to satisfy internal EFSG noise goals with the large awning doors open.

Where alternative ventilation is required, this should be considered during the design of the building. Consideration should be given (by others) to the ventilation requirements of the internal spaces with respect to AS 1668 and the Building Code of Australia.

Any mechanical plant should be designed to comply with internal and external noise limits for mechanical plant noise.

8.0 AIRCRAFT NOISE

The SEARs require an assessment of the impact of external noise sources on the site, including but not limited to, aviation operations.

The site is in distant proximity to the Sydney airport, and subject to occasional noise from distant aircraft.

The relevant planning instrument is the Sydney Airport ANEF 2039. A review of ANEF contours indicates that the North Sydney Public School is located well outside the ANEF 20 contour. Reference to Table 2.1 within AS 2021:2015 *Acoustics-Aircraft noise intrusion – Building siting and construction* notes that:

- A school or university siting is acceptable in a zone of ANEF 20 or less (educational component)

The noting of the development type as 'acceptable', rather than 'conditionally acceptable', indicates further assessment or application of noise controls is not required in accordance with the Standard.

The NSW Department of Education Educational Facilities Standard and Guidelines (EFSG) requires assessment of aircraft noise impacts on the site in certain circumstances as follows:

Aircraft Noise for general learning areas, music, drama, movement studios and hall is to be assessed where the school site lies within Australian Noise Exposure Forecast (ANEF) 25 (or higher) as shown on airport planning instruments. The procedures in AS 2021 are to be followed in the assessment.

As the site is located outside the ANEF 25 (and outside the ANEF 20 contour) zone, an aircraft acoustic assessment would not be required by the EFSG or AS2021.

9.0 INDUSTRIAL NOISE INGRESS TO SCHOOL SPACES

There are no industrial noise sources in proximity to the site which require assessment with regards to noise impacts upon the proposed development.

10.0 CONCLUSIONS

A summary of the assessment requirements within the SEARS requirements for the SSDA design has set out in Table 31 and the response in this report. The table includes references to relevant report sections.

Table 31: Summary of SSDA assessment

SEARS Requirement	Conclusion	Report Reference
<i>includes a quantitative assessment of the main noise and vibration generating sources during demolition, site preparation, bulk excavation and construction.</i>	Assessment have been made based a possible demolition, excavation and construction scenarios and compared them with Noise affected and highly noise affected noise goals with the EPA Interim Construction Noise Guideline. It is predicted that there may be exceedance of the Noise Affected and High Noise affected goals, particularly during demolition and excavation. As a result, a schedule of noise control practises has been included in this report. It will be necessary for the contractor to prepare a detailed Construction Noise and Vibration Management Plan (CNVMP) based on the projected methodologies and plant and equipment selections. It is possible that the proposed construction traffic routing through local roads may lead to noise increases above acceptable criteria, particularly where there is little or no truck movements normally present in those areas.	Section 5 Appendices B,C2,D,E,F,G
<i>details the proposed construction hours and provide details of, and justification for, instances where it is expected that works would be carried out outside standard construction hours.</i>	<u>Standard hours:</u> Monday to Friday from 7 am to 6 pm, Saturday 8 am to 1 pm. No work on Sundays or public holidays.	Section 5
<i>includes a quantitative assessment of the main sources of operational noise, including consideration of any public-address system, school bell, mechanical services (e.g. air conditioning plant), use of any school hall for concerts etc. (both during and outside school hours) and any out of hours community use of school facilities.</i>	Noise from Bells and PA located within the new building or refurbished classrooms in building G is not expected to generate adverse acoustic impact. Any new Bells or Speakers located externally or in the naturally ventilated hall must be installed as per the recommendations in this report. Noise emissions from the hall are expected to be within NPfl criteria during normal week day school use. Community use and use during evening times have the potential to exceed acceptable criteria as a result of doors opened for natural ventilation. This may impose some restriction of use and limitation of internal noise	Section 6.2

SEARS Requirement	Conclusion	Report Reference
<i>outlines measures to minimise and mitigate the potential noise impacts on nearby sensitive receivers.</i>	Conceptual noise control recommendations are provided for the school hall and school bell	
<i>considers sources of external noise intrusion in proximity to the site (including, road rail and aviation operations) and identifies building performance requirements for the proposed development to achieve appropriate internal amenity standards</i>	The site is impacted by noise from vehicles on Pacific Highway and Bay Road. Where it is necessary to comply with EFSG criteria for internal noise, it will be necessary to design the new building, the refurbished classrooms in building G to insulate the internal spaces from these noise sources. As the new building will be air conditioned, it is expected to be feasible to achieve this requirement. The Hall will be naturally ventilated however and as a result it may not be feasible to reduce internal noise to within EFSG criteria. There may be some exceedance of acceptable outdoor noise criteria in the new level 3 outdoor learning space during peak traffic flow periods.	Section 7.0
<i>demonstrates that the assessment has been prepared in accordance with policies and guidelines relevant to the context of the site and the nature of the proposed development.</i>	A schedule of the of the assessment schedule and assessment standard is included in this report. It is noted however that on site noise measurements have not been able to be carried out due to the Greater Sydney lockdown. Estimates of noise levels have been prepared	Section 4.0, 3.1

APPENDIX A GLOSSARY OF TERMINOLOGY

SPL or LP	Sound Pressure Level A logarithmic ratio of a sound pressure measured at distance, relative to the threshold of hearing (20 µPa RMS) and expressed in decibels.
SWL or LW	Sound Power Level A logarithmic ratio of the acoustic power output of a source relative to 10-12 watts and expressed in decibels. Sound power level is calculated from measured sound pressure levels and represents the level of total sound power radiated by a sound source.
dB	Decibel The unit of sound level. Expressed as a logarithmic ratio of sound pressure P relative to a reference pressure of $P_r=20 \mu\text{Pa}$ i.e. $\text{dB} = 20 \times \log(P/P_r)$
dBA	The unit of sound level which has its frequency characteristics modified by a filter (A-weighted) so as to more closely approximate the frequency bias of the human ear.
A-weighting	The process by which noise levels are corrected to account for the non-linear frequency response of the human ear.
L _{Aeq} (t)	The equivalent continuous (time-averaged) A-weighted sound level. This is commonly referred to as the average noise level. The suffix "t" represents the time period to which the noise level relates, e.g. (8 h) would represent a period of 8 hours, (15 min) would represent a period of 15 minutes and (2200-0700) would represent a measurement time between 10 pm and 7 am.
L _{A90} (t)	The A-weighted noise level equalled or exceeded for 90% of the measurement period. This is commonly referred to as the background noise level. The suffix "t" represents the time period to which the noise level relates, e.g. (8 h) would represent a period of 8 hours, (15 min) would represent a period of 15 minutes and (2200-0700) would represent a measurement time between 10 pm and 7 am.
L _{Amax}	The A-weighted maximum noise level. The highest noise level which occurs during the measurement period.
SEL or LAE	Sound Exposure Level The sound level of one second duration which has the same amount of energy as the actual noise event measured. Usually used to measure the sound energy of a particular event, such as a train pass-by or an aircraft flyover
R _w	Weighted Sound Reduction Index A single number rating of the sound insulation performance of a specific building element. R_w is measured in a laboratory. R_w is commonly used by manufacturers to describe the sound insulation performance of building elements such as plasterboard and concrete.

Vibration

When an object vibrates, it moves rapidly up and down or from side to side. The magnitude of the sensation when feeling a vibrating object is related to the vibration velocity.

Vibration can occur in any direction. When vibration velocities are described, it can be either the total vibration velocity, which includes all directions, or it can be separated into the vertical direction (up and down vibration), the horizontal transverse direction (side to side) and the horizontal longitudinal direction (front to back).

VDV

Vibration Dose Value

Vibration Dose Value is based on British Standard BS 6472:1992 Guide to Evaluation of Human Exposure to Vibration in Buildings (1Hz to 80Hz) and provides guidelines for the evaluation of whole body exposure to intermittent vibration.

VDV can be used to take into account the weighted measured RMS vibration from many vibration sources including rail vehicles, construction equipment such as jackhammers and industry. VDV takes into account the duration of each event and the number of events per day, either at present or in the foreseeable future and calculates a single value index.

APPENDIX B LOCATION OF CONSTRUCTION PHASES



APPENDIX C PROJECT SPECIFIC CRITERIA

C1 Interim Construction Noise Guideline (ICNG)

The 'Interim Construction Noise Guideline' (ICNG) aims to provide a clear understanding of ways to identify and minimise noise from construction works through applying all 'feasible' and 'reasonable' work practises to control noise impacts. The guideline identifies sensitive land uses and recommends construction hours, provides quantitative and qualitative assessment methods and subsequently advises on appropriate work practises.

For the project site, sensitive receivers and land uses have been identified. It is understood that construction activities on-site will not extend outside of the recommended standard hours detailed in Table D1.

Table D1: ICNG recommended standard hours of work

Work Type	Recommended standard hours of work
Normal Construction	Monday to Friday 0700 to 1800 hrs Saturdays 0800 to 1300 hrs No work on Sundays or public holidays

Based on the recommended standard hours, the guideline provides airborne noise criteria for residential receivers as detailed in Table B2. The "Noise Affected" management level is derived on a Rating Background Level (RBL) + 10 dB basis during Standard hours and RBL + 5 dB during periods Outside Standard hours, with RBL values taken from the measured average background noise levels shown in Table E2. The "Highly Noise Affected" management level is prescriptively set at $L_{Aeq(15\text{ min})}$ 75 dB.

Table D2: Noise Management levels for Residential receivers, dB $L_{Aeq(15\text{ minute})}$

Receiver Type	Noise Management Level, $L_{Aeq(15\text{ min})}$	
	Noise Affected	Highly Noise Affected
R1 and R7	65	
R2	60	75
R3, R4, R5 and R6	55	

Note: 1- NML applies when properties are being used

- 2- Internal noise levels are to be assessed at the centre of the occupied room
- 3- Where internal noise levels cannot be measured, external noise levels may be used. A conservative estimate of the difference between internal and external noise levels is 10 dB for buildings other than residences.
- 4- External noise levels are to be assessed at the most affected point within 50 m of the area boundary
- 5- Assessed at the most affected occupied point of the premises.

The Noise Management Level for commercial receivers (e.g. offices, retail outlets) is not distinguished as either "Noise Affected" or "Highly Noise Affected" but is set as a single Noise Management Level of $L_{Aeq(15\text{ min})}$ 70 dB (external noise level).

Where noise from construction works is above the "Noise Affected" level, all feasible and reasonable work practises should be applied. Where the noise from construction works is above "Highly Affected" management level, restrictions to the hours of construction may be required.

C2 Noise Policy for Industry (NPfI)

In NSW, the NPfI is the guideline used for assessing noise from large industrial premises scheduled by the EPA. However, some Councils also apply the NPfI to the assessment of noise emissions from other developments with noise sources that may be industrial in nature. Whilst the EPA has indicated that the NPfI is inappropriate for the assessment of educational facilities, specifically with regard to noise from children, the NPfI can be used as guidance to inform project-specific criteria that may be developed for a school development from industrial type noise sources such as mechanical plant.

The NPfI sets out a procedure where a noise source can be evaluated against a series of noise assessment levels. In the NPfI, these project-specific noise levels are derived from an analysis of the ambient noise environment and zoning information.

Data on existing noise levels at North Sydney Public School is not available due to the current lockdown. In the interim, estimated noise levels have been derived in Section 4.0 in this report

The estimated background noise levels for this project are summarised in Table D1. In the NPfI, the background noise level is called the Rating Background Level (RBL). As the primary use of the facility will only occur during the Daytime and Evening periods (0700-1800 hrs and 1800-2200 hrs), the Night-time period is not required for assessment and has been omitted.

Table D1: NPfI periods and estimated background noise levels

Period	Time of day	RBL $L_{A90, 15min}$ dB		
		Area R2	Area R3	Area R4
Day	0700-1800 hrs	45	50	55
Evening	1800-2200 hrs	40	45	50
Night	2200-0700 hrs	35	40	45

Intrusiveness noise levels

The intrusiveness noise assessment is applicable to residential receivers and is based on knowledge of the background noise level at the receiver location. The intrusiveness level is the background noise level at the nearest noise-sensitive location plus 5 dB. Therefore, the noise emissions from the premises are considered to be intrusive if the A-weighted source noise level ($L_{Aeq, 15min}$) is greater than the background noise level (L_{A90}) plus 5 dB.

Based upon the background noise data summarised in Table D1, noise limits for Intrusiveness have been calculated in accordance with the NPfI and are presented in Table D2.

Table D2: Derived Intrusiveness noise levels based on estimated data

Period	Intrusiveness Noise Level (RBL + 5 dB), $L_{Aeq, 15 min}$ dB		
	Area R2	Area R3	Area R4
Day	50	55	60
Evening	45	50	55
Night	40	45	50

Amenity noise levels

The project Amenity noise levels are designed to prevent industrial noise continually increasing above an acceptable level. The initial stage in determining the project amenity level is to determine the recommended Amenity noise levels for the appropriate amenity area and time of day.

The NPfl includes various categories for residential area for specific use with the Amenity Criteria . An *Urban* category is considered based on the description with the NPfl as follows

Urban – an area with an acoustical environment that:

- *is dominated by ‘urban hum’ or industrial source noise, where urban hum means the aggregate sound of many unidentifiable, mostly traffic and/or industrial related sound sources*
- *has through-traffic with characteristically heavy and continuous traffic flows during peak periods*
- *is near commercial districts or industrial districts*
- *has any combination of the above*

As both Pacific Highway and Bay Road carry through traffic during the day and evening, an *Urban* category is appropriate.

The receivers would be classified as Urban under the NPfl and the relevant NPfl project Amenity noise levels are detailed in Table D3.

Table D3: Derived project Amenity noise levels

Receiver	Period	Project Amenity Noise Level $L_{Aeq, period}$ dB	Project Amenity Noise Level $L_{Aeq, 15min}$ dB
Residential (Urban)	Day	55	58
	Evening	45	48
	Night	40	43

Source: Table 2.2 NSW Noise Policy for Industry

Determination of Project Noise Trigger Levels

The final process in determining the operational noise limits according to the NPfl is to derive the Project Noise Trigger Levels. The Project Noise Trigger Levels are levels 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 Levels are derived by selecting the more stringent of either the intrusiveness or project amenity noise levels. For residential receivers, each assessment time period is evaluated individually. For non-residential receivers, only the Amenity noise level applies.

Full development of the NPfl criteria can be carried out following the availability of onsite noise data.

APPENDIX D ASSUMED CONSTRUCTION PLANT ITEMS

A summary of equipment and the assumed duty (percentage of operation per 15-minute period) of equipment to be operating simultaneously in a 15-minute period for each construction work, is provided in Table F1.

Table D4: Assumed duration (% of 15-minute) of equipment to be operating simultaneously in a 15-minute period at construction sites

Construction Equipment	Site Preparation		Relocation of Temporary Buildings		Demolition		Bulk Excavation		Construction	
	TW	TA	TW	TA	TW	TA	TW	TA	TW	TA
tracked 35t excavator (35 t)	-	-	-	-	100	75	-	-	-	-
Bogie truck & trailer	-	-	-	-	25	25	50	50	-	-
Generator	-	100	-	-	-	-	-	100	-	100
Air compressor & lines	50	50	-	-	-	75	-	50	-	75
2 x excavators (35 tonne, 27 tonne) with a hydraulic hammer	-	-	-	-	-	-	75	75	-	-
Jack hammer & breaker	-	-	-	-	50	50	-	-	-	-
Concrete saw - road	-	-	-	-	-	25	-	-	-	25
Flatbed truck	-	-	-	-	-	-	-	-	-	25
De-watering plant	-	-	-	-	-	-	-	100	-	-
Concrete pump	-	-	-	-	-	-	-	-	75	75
Brick saw	-	25	-	-	-	-	-	-	-	25
Concrete vibrator	-	-	-	-	-	-	-	-	75	75
Concrete floats	-	-	-	-	-	-	-	-	75	75
Diamond core drill	-	-	-	-	-	-	-	-	-	25
Nail guns	-	-	-	-	-	-	-	-	-	50
Hydraulic bar cutter	-	50	-	25	-	-	-	-	-	-
Concrete truck	-	-	-	-	-	-	-	-	-	25
Electric winch & materials hoist	50	50	-	-	-	-	-	-	-	50

Construction Equipment	Site Preparation		Relocation of Temporary Buildings		Demolition		Bulk Excavation		Construction	
	TW	TA	TW	TA	TW	TA	TW	TA	TW	TA
Mobile Crane	-	-	25	75	-	-	-	-	-	25
3.5t telehandler	-	-	-	-	-	-	-	-	-	25
Cherry picker	-	-	50	50	-	-	-	-	-	25
Hand tools (electric)	-	-	-	75	-	-	-	-	50	25

Note: Assessment Scenarios are described in Section 5.3.1. **TA** = 'Typical Average', **TW** = 'Typical Worst'

APPENDIX E CONSTRUCTION NOISE SOURCES

A variety of excavation and construction equipment will be used for this project. At this early stage, a comprehensive plan of staging and equipment selection is not known. Table C1 provides a schedule of construction equipment that is anticipated to be used on this site and their noise levels as taken from:

- AS2436-2010: *Guide to noise and vibration control on construction, demolition and maintenance sites*
- AS2436-1981: *Guide to noise and vibration control on construction, demolition and maintenance sites*
- BS5228-1-2009: *Code of practice for noise and vibration control on construction and open sites – Part 1: Noise*

Table C1: Construction noise source sound power levels, dB L_{Aeq}

Noise source	A-weighted sound power level, L _{Aeq} dB SWL	Source
Tracked 35t excavator (35 t)	108	BS5228-1-2009
Bogie truck & trailer	107	AS2436-2010
Generator	99	AS2436-2010
Air compressor & lines	101	AS2436-2010
2 x excavators (35 tonne, 27 tonne) with a hydraulic hammer	121*	AS2436 - 1981
12t vibratory roller	108	BS5228-1-2009
Jack hammer & breaker	126*	AS2436-2010
Concrete saw - road	122*	AS2436-2010
Flatbed truck	107	AS2436-2010
De-watering plant	99	BS5228-1-2009
Concrete pump	108	AS2436-2010
Brick saw	107	BS5228-1-2009
Concrete vibrator	103	AS2436-2010
Concrete floats	100	BS5228-1-2009
Diamond core drill	113	BS5228-1-2009
Nail guns	101	BS5228-1-2009
Hydraulic bar cutter	107	BS5228-1-2009
Concrete truck	108	AS2436-2010
Electric winch & materials hoist	96	BS5228-1-2009
Mobile Crane	104	AS2436-2010
3.5t telehandler	98	BS5228-1-2009
Cherry picker	105	AS2436-2010
Hand tools (electric)	102	AS2436-2010

* Includes a +5 dB factor in accordance with recommendations given in Section 4.5 of the ICNG.

APPENDIX F CONSTRUCTION NOISE IMPACT ASSESSMENT

Noise levels during the following phases have been calculated at the nominated receivers:

- Site Preparation
- Relocation of temporary buildings
- Demolition
- Bulk Excavation
- Construction

Noise levels have been predicted under guidance from *AS2436-2010 Guide to noise control on construction, maintenance and demolition sites* and utilising the information provided in *BS 5228-1-2009 Code of practise for noise and vibration control on construction and open sites*.

Levels have been calculated for “Worst-Case” situations where noise sources will either be closest to the noise-sensitive receiver and not screened by existing site structures. Noise levels have also been calculated for the “Average” situation, with noise sources located towards the centre of the site. The latter is likely to be representative of the longer-term noise emissions.

F1 Site Preparation Phase

Table 32 details the predicted noise levels at the nominated receivers’ occupancies during the Site Preparation phase. Noise levels have been calculated at a position within the receiver that is most exposed to noise from associated activities. Calculated noise levels include the effects of the noise control recommendations detailed in Section 5.4.

The calculated levels indicate that noise from Site Preparation activities is expected to be below the “Highly Noise Affected” goals for the “Worst-Case” and “Average” assessment position for all the identified nearby receivers.

Predicted noise levels are expected to be up 4 dB above the “Noise Affected” goals for the “Average” assessment, and up to 10 dB above the “Noise Affected” goals for the “Worst-Case” assessment at some residential receivers.

For commercial receivers surrounding the site, predicted noise levels are expected to be below the Noise Management Levels for commercial receivers during this phase.

During the Site Preparation phase, the use of hydraulic bar cutter has the highest potential to impact on the noise receivers.

F2 Relocation of Temporary Buildings

Table 33 details the predicted noise levels at the nominated receivers’ occupancies during the Relocation of Temporary Buildings phase. Noise levels have been calculated at a position within the receiver that is most exposed to noise from associated activities. Calculated noise levels include the effects of the noise control recommendations detailed in Section 5.4.

The calculated levels indicate that noise from the Relocation of Temporary Buildings activities is expected to be below the “Highly Noise Affected” goals for the “Worst-Case” and “Average” assessment position for all the identified nearby receivers.

Predicted noise levels are expected to be up 6 dB above the “Noise Affected” goals for the “Average” assessment, and up to 9 dB above the “Noise Affected” goals for the “Worst-Case” assessment at some residential receivers.

For commercial receivers surrounding the site, predicted noise levels are expected to be below the Noise Management Levels for commercial receivers during this phase.

During this phase, predicted noise levels are expected to be below Noise Management Levels for commercial receivers.

During the Relocation of Temporary Buildings phase, the use of hand tools has the highest potential to impact on the noise receivers.

F3 Demolition

Table 34 details the predicted noise levels at the nominated receivers' occupancies during the Demolition phase. Noise levels have been calculated at a position within the receiver that is most exposed to noise from associated activities. Calculated noise levels include the effects of the noise control recommendations detailed in Section 5.4.

The calculated levels indicate that noise from Demolition activities is expected to exceed the "Highly Noise Affected" goals for the "Worst-Case" assessment position by up to 11 dB; and "Average" assessment position by up to 2 dB at some residential receivers.

Predicted noise levels are expected to be up to 22 dB above the "Noise Affected" goals for the "Average" assessment, and up to 29 dB above the "Noise Affected" goals for the "Worst-Case" assessment at some residential receivers.

For commercial receivers surrounding the site, predicted noise levels are expected to be up to 6 dB above the Noise Management Levels for the "Average" assessment and up to 16 dB for the "Worst-Case" assessment during this phase.

During the Demolition phase, the use of jack hammer & breaker has the highest potential to impact on the noise receivers.

F4 Bulk Excavation Phase

Table 35 details the predicted noise levels at the nominated receivers' occupancies during the Bulk Excavation Phase. Noise levels have been calculated at a position within the receiver that is most exposed to noise from associated activities. Calculated noise levels include the effects of the noise control recommendations detailed in Section 5.4.

The calculated levels indicate that noise from Bulk Excavation activities is expected to exceed the "Highly Noise Affected" goals for the "Worst-Case" assessment position by up to 7 dB. However, noise levels are predicted to be below the "Highly Noise Affected" goals for the "Average" assessment position for all the identified nearby receivers.

Predicted noise levels are expected to be up to 18 dB above the "Noise Affected" goals for the "Average" assessment, and up to 26 dB above the "Noise Affected" goals for the "Worst-Case" assessment at some residential receivers.

For commercial receivers surrounding the site, predicted noise levels are expected to be up to 2 dB above the Noise Management Levels for the "Average" assessment and up to 12 dB for the "Worst-Case" assessment during this phase.

During the Bulk Excavation phase, the use of excavators has the highest potential to impact on the noise receivers.

F5 Construction Phase

Table 36 details the predicted noise levels at the nominated receivers' occupancies during the Construction Excavation Phase. Noise levels have been calculated at a position within the receiver that is most exposed to

noise from associated activities. Calculated noise levels include the effects of the noise control recommendations detailed in Section 5.4.

The calculated levels indicate that noise from Construction activities is expected to be below the “Highly Noise Affected” goals for the “Worst-Case” and “Average” assessment position for all the identified nearby receivers.

Predicted noise levels are expected to be up to 13 dB above the “Noise Affected” goals for the “Average” assessment, and up to 15 dB above the “Noise Affected” goals for the “Worst-Case” assessment at some residential receivers.

For commercial receivers surrounding the site, predicted noise levels are expected to be below the Noise Management Levels for the “Average” assessment and up to 1 dB for the “Worst-Case” assessment during this phase.

During the Construction phase, the use of excavators has the highest potential to impact on the noise receivers.

Table 32: Predicted noise levels during Site Preparation works

Receiver	Period	Assessment	Calculated noise level ² , dB L _{Aeq, 15min} ³	“Noise Affected”		“Highly Noise Affected”	
				Management level, dB L _{Aeq, 15min}	Exceedance, dB	Management level, dB L _{Aeq, 15mins}	Exceedance, dB
A1	Within	Worst-case	59	65	--	75	--
	guideline hours ²	Average	55		--		--
A2	Within	Worst-case	67	60	7	75	--
	guideline hours ²	Average	56		--		--
A3	Within	Worst-case	65	55	10	75	--
	guideline hours ²	Average	59		4		--
A5	Within	Worst-case	65	55	10	75	--
	guideline hours ²	Average	56		1		--
A6	Within	Worst-case	63	55	8	75	--
	guideline hours ²	Average	56		1		--
A7	Within	Worst-case	64	55	9	75	--
	guideline hours ²	Average	58		3		--
A8	Within	Worst-case	61	65	--	75	--
	guideline hours ²	Average	55		--		--

¹ Monday – Friday: 0700-1700hrs, Saturday 0800-1300hrs

² Calculations included the recommended noise controls detailed in Section 5.2

³ Unless noted otherwise, noise level calculated at 1.5m above ground level at the property boundary most exposed to construction noise in accordance with the requirements of the ICNG. Noise levels at upper floors without shielding are likely to be higher.

Table 33: Predicted noise levels during Relocation of Temporary Buildings works

Receiver	Period	Assessment	Calculated noise level ² , dB L _{Aeq, 15min} ³	“Noise Affected”		“Highly Noise Affected”	
				Management level, dB L _{Aeq, 15min}	Exceedance, dB	Management level, dB L _{Aeq, 15mins}	Exceedance, dB
A1	Within guideline hours ²	Worst-case	56	65	--	75	--
		Average	57		--		--
A2	Within guideline hours ²	Worst-case	60	60	--	75	--
		Average	59		--		--
A3	Within guideline hours ²	Worst-case	64	55	9	75	--
		Average	61		6		--
A5	Within guideline hours ²	Worst-case	62	55	7	75	--
		Average	59		4		--
A6	Within guideline hours ²	Worst-case	61	55	6	75	--
		Average	58		3		--
A7	Within guideline hours ²	Worst-case	58	55	3	75	--
		Average	60		5		--
A8	Within guideline hours ²	Worst-case	59	65	--	75	--
		Average	57		--		--

¹ Monday – Friday: 0700-1700hrs, Saturday 0800-1300hrs

² Calculations included the recommended noise controls detailed in Section 5.2

³ Unless noted otherwise, noise level calculated at 1.5m above ground level at the property boundary most exposed to construction noise in accordance with the requirements of the ICNG. Noise levels at upper floors without shielding are likely to be higher.

Table 34: Predicted noise levels during Demolition works

Receiver	Period	Assessment	Calculated noise level ² , dB L _{Aeq, 15min} ³	“Noise Affected”		“Highly Noise Affected”	
				Management level, dB L _{Aeq, 15min}	Exceedance, dB	Management level, dB L _{Aeq, 15mins}	Exceedance, dB
A1	Within	Worst-case	78		13		3
	guideline hours ²	Average	73	65	8	75	--
A2	Within	Worst-case	86		26		11
	guideline hours ²	Average	76	60	16	75	1
A3	Within	Worst-case	84		29		9
	guideline hours ²	Average	77	55	22	75	2
A5	Within	Worst-case	77		22		2
	guideline hours ²	Average	75	55	20	75	--
A6	Within	Worst-case	76		21		1
	guideline hours ²	Average	73	55	18	75	--
A7	Within	Worst-case	78		23		3
	guideline hours ²	Average	75	55	20	75	--
A8	Within	Worst-case	76		11		1
	guideline hours ²	Average	74	65	9	75	--

¹ Monday – Friday: 0700-1700hrs, Saturday 0800-1300hrs

² Calculations included the recommended noise controls detailed in Section 5.2

³ Unless noted otherwise, noise level calculated at 1.5m above ground level at the property boundary most exposed to construction noise in accordance with the requirements of the ICNG. Noise levels at upper floors without shielding are likely to be higher.

Table 35: Predicted noise levels during Bulk Excavation Phase works

Receiver	Period	Assessment	Calculated noise level ² , dB L _{Aeq, 15min} ³	“Noise Affected”		“Highly Noise Affected”	
				Management level, dB L _{Aeq, 15min}	Exceedance, dB	Management level, dB L _{Aeq, 15mins}	Exceedance, dB
A1	Within	Worst-case	74	65	9	75	--
	guideline hours ²	Average	69		4		--
A2	Within	Worst-case	82	60	22	75	7
	guideline hours ²	Average	72		12		--
A3	Within	Worst-case	81	55	26	75	6
	guideline hours ²	Average	73		18		--
A5	Within	Worst-case	74	55	19	75	--
	guideline hours ²	Average	71		16		--
A6	Within	Worst-case	73	55	18	75	--
	guideline hours ²	Average	69		14		--
A7	Within	Worst-case	75	55	20	75	--
	guideline hours ²	Average	71		16		--
A8	Within	Worst-case	73	65	8	75	--
	guideline hours ²	Average	70		5		--

¹ Monday – Friday: 0700-1700hrs, Saturday 0800-1300hrs

² Calculations included the recommended noise controls detailed in Section 5.2

³ Unless noted otherwise, noise level calculated at 1.5m above ground level at the property boundary most exposed to construction noise in accordance with the requirements of the ICNG. Noise levels at upper floors without shielding are likely to be higher.

Table 36: Predicted noise levels during Construction works

Receiver	Period	Assessment	Calculated noise level ² , dB L _{Aeq, 15min} ³	“Noise Affected”		“Highly Noise Affected”	
				Management level, dB L _{Aeq, 15min}	Exceedance, dB	Management level, dB L _{Aeq, 15mins}	Exceedance, dB
A1	Within	Worst-case	64	65	--	75	--
	guideline hours ²	Average	64		--		--
A2	Within	Worst-case	71	60	11	75	--
	guideline hours ²	Average	66		6		--
A3	Within	Worst-case	70	55	15	75	--
	guideline hours ²	Average	68		13		--
A5	Within	Worst-case	65	55	10	75	--
	guideline hours ²	Average	66		11		--
A6	Within	Worst-case	63	55	8	75	--
	guideline hours ²	Average	65		10		--
A7	Within	Worst-case	65	55	10	75	--
	guideline hours ²	Average	66		11		--
A8	Within	Worst-case	63	65	--	75	--
	guideline hours ²	Average	65		--		--

¹ Monday – Friday: 0700-1700hrs, Saturday 0800-1300hrs

² Calculations included the recommended noise controls detailed in Section 5.2

³ Unless noted otherwise, noise level calculated at 1.5m above ground level at the property boundary most exposed to construction noise in accordance with the requirements of the ICNG. Noise levels at upper floors without shielding are likely to be higher.

APPENDIX G PROPOSED INCLUSIONS FOR CONSTRUCTION NOISE AND VIBRATION MANAGEMENT PLAN

Prior to the commencement of construction, once a contractor is appointed and proposed construction methodologies and plant and equipment are finalised, a Construction Noise and Vibration Management Plan (CNVMP) will need to be prepared. The CNVMP is a documented plan that should assist the construction team in managing and mitigating noise impacts as well communicating effectively with impacted stakeholders. Whilst the details of the CNVMP are outside of the scope of this document the following is provided for the consideration of those preparing the plan.

Many complaints about construction noise are due to preventable activities during construction periods. The following should be considered for adoption on site:

- Regularly train workers and contractors (such as at toolbox talks) to use equipment in ways to minimise noise
- All staff will participate in an induction training session, during regular site meetings and/or 'toolbox' training sessions prior to the start of construction works, with attention given to the construction vibration matters e.g. activities with the potential to generate high levels of noise and vibration, mitigation and management procedures.
- Ensure site managers periodically check the site and nearby residences and other sensitive land uses for noise problems so that solutions can be quickly applied
- Include in tenders, employment contracts, subcontractor agreements and work method statements clauses that require minimisation of noise and compliance with directions from management to minimise noise
- Avoid the use of radios or stereos outdoors where neighbours can be affected
- Avoid the overuse of public address systems
- Avoid shouting and minimise talking loudly and slamming vehicle doors
- 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)
- Develop a one-page summary of approval or consent conditions that relate to relevant work practices and pin it to a noticeboard so that all site operators can quickly reference noise information
- Workers may at times need to discuss or negotiate practices with their managers

G1 Consultation and negotiation

The community is more likely to be understanding and accepting of noise if the information provided is frank, does not attempt to understate the likely noise level, and if commitments are firmly adhered to.

Notification Before and During Construction

- Provide, reasonably ahead of time, information such as total building time, what works are expected to be noisy, their duration, what is being done to minimise noise and when respite periods will occur. For works outside standard hours, inform affected residents and other sensitive land use occupants between five and 14 days before commencement.
- Provide information to neighbours before and during construction through media such as letterbox drops, meetings or individual contact. In some areas, the proponent will need to provide notification in languages other than English. A website could also be established for the project to provide information

- Use a site information board at the front of the site with the name of the organisation responsible for the site and their contact details, hours of operation and regular information updates. This signage should be clearly visible from the outside and include after-hours emergency contact details
- Maintain good communication between the community and the project staff
- Appoint a community liaison officer where required
- For larger projects consider a regular newsletter with site news, significant project events and timing of different activities
- Provide a contact phone number for enquiries during the works
- Facilitate contact with people to ensure that everyone can see that the site manager understands potential issues, that a planned approach is in place and that there is an ongoing commitment to minimise noise

Complaints Handling

- Provide a readily accessible contact point, for example, through a 24-hour toll-free information and complaints line
- Give complaints a fair hearing
- Have a documented complaints process, including an escalation procedure so that if a complainant is not satisfied there is a clear path to follow
- Call back as soon as possible to keep people informed of action to be taken to address noise problems. Call back at Night-time only if requested by the complainant to avoid further disturbance
- Provide a quick response to complaints, with complaint handling staff having both a good knowledge of the project and ready access to information
- Implement all feasible and reasonable measures to address the source of the complaint
- Keep a register of any complaints, including details of the complaint such as date, time, the person receiving the complaint, complainant's contact number, the person referred to, description of the complaint, work area (for larger projects), time of verbal response and timeframe for written response where appropriate

G2 Plant and equipment

In terms of both cost and results, controlling noise at the source is one of the most effective methods of minimising the noise impacts from any construction activities.

Use quieter and less vibration generating methods

- Examine and implement, where feasible and reasonable, alternatives to rock-breaking work methods, such as hydraulic splitters for rock and concrete, hydraulic jaw crushers, chemical rock and concrete splitting, and controlled blasting such as penetrating cone fracture. The suitability of alternative methods should be considered on a case-by-case basis
- Use alternatives to diesel and petrol engines and pneumatic units, such as hydraulic or electric controlled units where feasible and reasonable. Where there is no electricity supply, use an electrical generator located away from residences

Use quieter and less vibration generating equipment

- Examine different types of machines that perform the same function and compare the noise level data to select the least noisy machine. For example, rubber-wheeled tractors can be less noisy than steel tracked tractors

- Noise labels are required by NSW legislation for pavement breakers, mobile compressors, chainsaws and mobile garbage compactors. These noise labels can be used to assist in selecting a less noisy plant
- Pneumatic equipment is traditionally a problem – select super silenced compressors, silenced jackhammers and damped bits where possible
- When renting, select quieter items of plant and equipment where feasible and reasonable
- When purchasing, select, where feasible and reasonable, the most effective mufflers, enclosures and low-noise tool bits and blades. Always seek the manufacturer's advice before making modifications to plant to reduce noise
- Operate plant in a quiet and efficient manner
- Reduce throttle setting and turn off equipment when not being used.
- Examine and implement, where feasible and reasonable, the option of reducing noise from metal chutes and bins by placing damping material in the bin

Maintain equipment

- Regularly inspect and maintain equipment to ensure it is in good working order. Also, check the condition of mufflers
- Equipment must not be operated until it is maintained or repaired, where maintenance or repair would address the annoying character of noise identified
- For machines with enclosures, check that doors and door seals are in good working order and that the doors close properly against the seals
- Return any hired equipment that is causing noise that is not typical for the equipment – the increased noise may indicate the need for repair
- Ensure air lines on pneumatic equipment do not leak

G3 On-site

Barriers and acoustic sheds are most suited to longer-term fixed works, as in these cases the associated cost is typically outweighed by the overall time savings.

Location of plant

- Place as much distance as possible between the plant or equipment and residences and other sensitive land uses
- Restrict areas in which mobile plant can operate so that it is away from residences and other sensitive land uses at particular times
- Locate site vehicle entrances away from residences and other sensitive land uses
- Carry out noisy fabrication work at another site (for example, within enclosed factory premises) and then transport to site

Alternatives to reversing alarms

- Avoid the use of reversing alarms by designing site layout to avoid reversing, such as by including drive-through for parking and deliveries
- Install where feasible and reasonable less annoying alternatives to the typical 'beeper' alarms taking into account the requirements of the Occupational Health and Safety legislation; examples are smart alarms that adjust their volume depending on the ambient level of noise and multifrequency alarms that emit noise over a wide range of frequencies

- In all circumstances, the requirements of the relevant Occupational Health and Safety legislation must be complied with. For information on replacing audible warning alarms on a mobile plant with less annoying alternatives.

Maximise shielding

- Reuse existing structures rather than demolish and reconstruct
- Use temporary site buildings and materials stockpiles as noise barriers
- Schedule construction of any permanent walls so that they can be used as early as possible as noise barriers
- Use natural landform as a noise barrier – place fixed equipment in cuttings, or behind earth berms
- Note large reflecting surfaces on and off-site that might increase noise levels and avoid placing noise-producing equipment in locations where reflected noise will increase noise exposure or reduce the effectiveness of mitigation measures

G4 Work scheduling

Scheduling noisy work during periods when people are least affected is an important way of reducing noise impact.

Provide respite periods

- Consult with affected education facilities to ensure that noise-generating construction works in the vicinity of affected education buildings are not scheduled to occur during examination periods, unless other arrangements (such as relocation to an alternative location) acceptable to the affected parties can be made.
- Where night work near residences cannot be feasibly or reasonably avoided, restrict the number of nights per week and/or the number of nights per calendar month that the works are undertaken, in consultation with residents who will be most affected.

Schedule activities to minimise noise impacts

- Organise work to be undertaken during the recommended standard hours where possible
- When works outside the recommended standard hours are planned, avoid scheduling on Sundays or public holidays
- Schedule work when neighbours are not present (for example, commercial neighbours, colleges and schools may not be present outside business hours or on weekends)
- Schedule noisy activities around times of high background noise (local road traffic or when other local noise sources are active) where possible to provide masking or to reduce the amount that the construction noise intrudes above the background.
- Schedule vibration intensive activities during Day period where possible.
- Consult with affected neighbours about scheduling activities to minimise noise and vibration impacts

Organise deliveries and access

- Nominate an off-site truck parking area, away from residences, for trucks arriving prior to gates opening
- Optimise the number of vehicle trips to and from the site – movements can be organised to amalgamate loads rather than using a number of vehicles with smaller loads
- Designate access routes to the site, through consultation with potentially noise-affected residences and other sensitive land uses and make drivers aware of nominated vehicle routes

- Provide on-site parking for staff and on-site truck waiting areas away from residences and other sensitive land uses. Truck waiting areas may require bunding or walls to minimise noise
- Schedule deliveries to nominated hours only

G5 Transmission path

Physical methods to reduce the transmission of noise between the construction works and residences or other sensitive land uses are generally suited to works where there is longer-term exposure to the noise.

- Reduce the line-of-sight noise transmission to residences or other sensitive land uses using temporary barriers
- Temporary noise barriers can be constructed from hoarding (plywood boards, panels of steel sheeting or compressed fibre cement board) with no gaps between the panels at the site boundary. Stockpiles, shipping containers and site office transportables can be effective barriers
- Erect temporary noise barriers before work commences to reduce noise from works as soon as possible
- Consult with most affected neighbours about how effective the proposed noise mitigation measures will be in addressing their concerns

APPENDIX H ARCHITECTURAL DOCUMENTATION

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