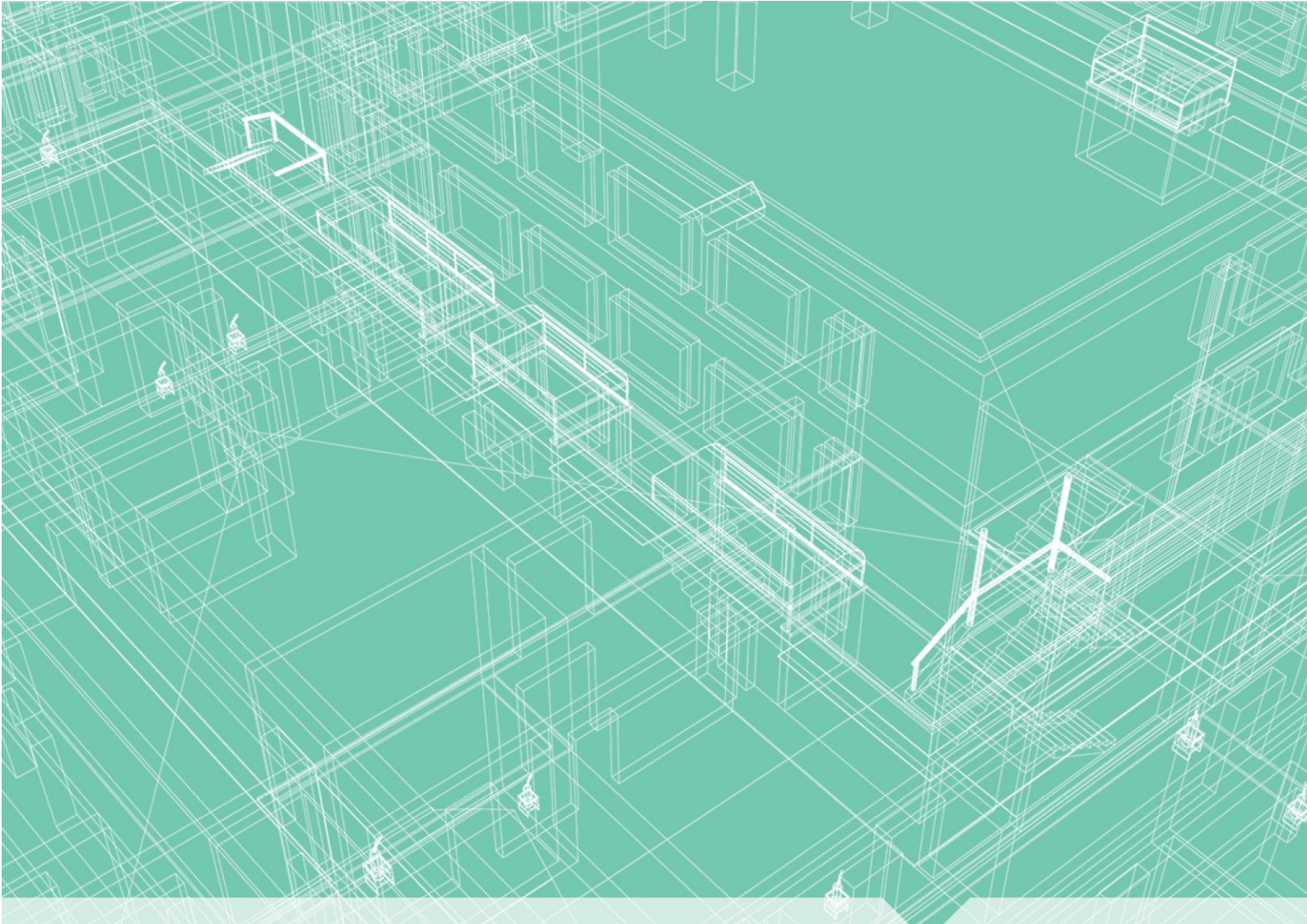
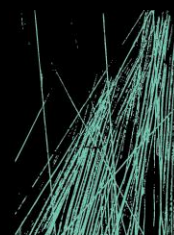




NOISE AND VIBRATION IMPACT ASSESSMENT FOR REF

**HI NSW AMBULANCE INFRASTRUCTURE PROGRAM
CAVES BEACH STATION**



JHA

JHASERVICES.COM

This report is prepared for the nominated recipient only and relates to the specific scope of work and agreement between JHA and the client (the recipient). It is not to be used or relied upon by any third party for any purpose.

DOCUMENT CONTROL SHEET

Project Number	250283
Project Name	HI NSW Ambulance Infrastructure Program – Caves Beach Station
Description	Noise and Vibration Impact Assessment for REF
Key Contact	Lael Lim

Prepared By

Company	JHA
Address	Level 20, 2 Market Street, Sydney NSW 2000
Phone	61-2-9437 1000
Email	@jhaengineers.com.au
Website	www.jhaservices.com
Author	Shahrokh Sepehrirahnama, MAAS
Checked	Jorge Reverter, MAAS
Authorised	Jorge Reverter, MAAS

Revision History

Issued To	Revision and Date						
NSW Health Infrastructure	REV	A					
	DATE	07/10/2025					
DJRD Architects	REV	A					
	DATE	07/10/2025					
Linéaire Projects	REV		B	C			
	DATE		25/02/2026	06/03/2026			

CONTENTS

1	INTRODUCTION	5
2	DESCRIPTION OF THE PROPOSAL	6
2.1	Location / Site Description	6
2.2	Proposed Work	6
2.3	Surrounding Receivers	9
3	SITE MEASUREMENTS	10
3.1	General	10
3.2	Unattended Noise Monitoring	10
3.3	Attended Noise Monitoring	11
4	RELEVANT NOISE STANDARDS AND GUIDELINES	12
4.1	Standards and Guidelines	12
4.2	Regulatory Framework	12
4.3	Lake Macquarie City Council Legislation	13
4.4	NSW EPA Noise Policy for Industry	14
4.4.1	Intrusiveness Criteria	14
4.4.2	Amenity Criteria	14
4.4.3	Project Noise Trigger Levels	15
4.5	Traffic Noise	16
4.5.1	Traffic Noise Generated	16
4.5.2	Sleep Arousal	16
4.6	POEO Noise Regulation Controls	17
4.7	NSW Health Infrastructure ESG	18
4.8	Construction Noise and Vibration	18
4.8.1	Noise Criteria	18
4.8.2	Vibration Criteria	19
5	NOISE EMISSIONS ASSESSMENT	22
5.1	External Mechanical Plant	22
5.2	Vehicle Noise Emissions	24
5.2.1	Ambulance Movements and Roller Door	24
5.2.2	Ambulance Sirens	26
5.2.3	Staff Car Park	26
5.3	Ambulance Wash Bay	27
6	NOISE INTRUSION	29

7	CONSTRUCTION NOISE AND VIBRATION PLANNING	30
7.1	Relevant Standards for Construction Noise and Vibration Criteria	30
7.2	Working Hours	30
7.3	Airborne Noise	30
7.4	Vibration	31
7.5	Mitigation Measures	32
7.5.1	General Control Elements	32
7.5.2	Additional Noise and Vibration Control Measures	33
7.5.3	Construction Traffic Noise	34
8	MANAGEMENT AND COMPLIANCE	35
9	SUMMARY	36
9.1	Summary	36
9.2	Mitigation Measures	37
9.3	Evaluation of Environmental Impacts	38
	APPENDIX A: LONG-TERM NOISE MONITORING DATA	39

1 INTRODUCTION

In June 2022, the Premier, Treasurer, Minister for Health and Minister for Regional Health announced \$1.76 billion over four years to boost frontline emergency care, as part of the NSW Government's 2022-23 Budget. In addition to providing an additional 1,858 extra paramedics, 210 ambulance support staff, 52 nurses and 8 doctors, the budget allocated \$615.5 million for the Ambulance Infrastructure Program (AIP) to deliver 30 new ambulance stations located geographically across Greater Sydney, Newcastle, Wollongong and other infrastructure such as fleet.

JHA Consulting Engineers has been engaged by NSW HI to provide acoustic services for seven proposed new ambulance station for the NSW Ambulance Infrastructure Program (AIP).

The proposed development involves the construction of a new ambulance station, with an ambulance plantroom and ancillary spaces. An acoustic assessment has been undertaken, and it is detailed in this report along with the findings and recommendations.

The objectives of this acoustic assessment are:

- Identify the external noise and vibration sources that will potentially affect the proposed development.
- Carry out noise surveys to determine the existing ambient and background noise levels on site.
- Establish the appropriate noise level and vibration criteria in accordance with the relevant standards, guidelines and legislation for the following issues:
 - Noise emissions from mechanical plant from the development to the surrounding receivers.
 - Noise emissions from traffic generated by the proposed development.
 - Noise emissions from the use of the wash bay.
 - Noise intrusion.
- Carry out an acoustic assessment to determine whether the relevant criteria can be achieved and, where applicable, comment on noise control measures required to achieve compliance with the relevant noise level criteria.
- Provide recommendations for Construction Noise and Vibration Planning.

This report provides:

- A statement of compliance with the relevant statutory criteria for the proposed development within the vicinity of the nearest potentially affected receivers.
- Recommendations for noise mitigation measures for the proposed development in order to meet the relevant criteria when compliance is not achieved.
- Recommendations for noise and vibration criteria and best practices during construction phase.

The following documentation has been used for the preparation of this report:

- Architectural drawings of the proposed development prepared by DJRD Architects.
- Noise data collected on site through the use of a noise logger plus a hand-held analyser.

This document and related work have been prepared following JHA Consulting Engineers Quality Management System, which is based on AS/NZS ISO 9001:2015 and ISO 14001:2015 Environmental Management Systems.

This report has been prepared by Shahrokh Sepehrihnama, and Quality Assurance (QA) has been undertaken by Jorge Reverter. Shahrokh and Jorge are both Members of Australian Acoustical Society (MAAS).

2 DESCRIPTION OF THE PROPOSAL

2.1 LOCATION / SITE DESCRIPTION

Caves Beach is a suburb in the Swansea Peninsula under Lake Macquarie City Council, located approximately 30km south of Newcastle and approximately 95km north-east of the Sydney CBD. The proposed Ambulance Station site is located at 2-4 Kayuga Close, and it is bounded by Strathmore to the south and Kayuga Close to the west. There is a commercial building to the south adjacent to the proposed site, and several commercial buildings to the east across Kayuga Close. To the north, there is an Electrical Substation building. Closest residential properties are located to the east of the proposed site. Figure 1 shows the proposed site location.

The proposed development site is legally known as Lot 3 and Lot 4 of DP251324 and currently acquired by HI NSW. Figure 1 shows the proposed site location and its boundary (red solid line).



Figure 1: Aerial view of the location of the site for the proposed development. Site boundary is shown by red solid line.

2.2 PROPOSED WORK

The proposed development involves the construction of an Ambulance Station comprising:

- 8 ambulance bays.
- 8 staff car park and an outdoor washbay.
- Administration area with private offices and training/meeting rooms.
- Amenities and common areas.
- Logistic and services areas.

Figure 2 and Figure 3 show diagrams of the proposed ambulance station site plan and the internal layout.

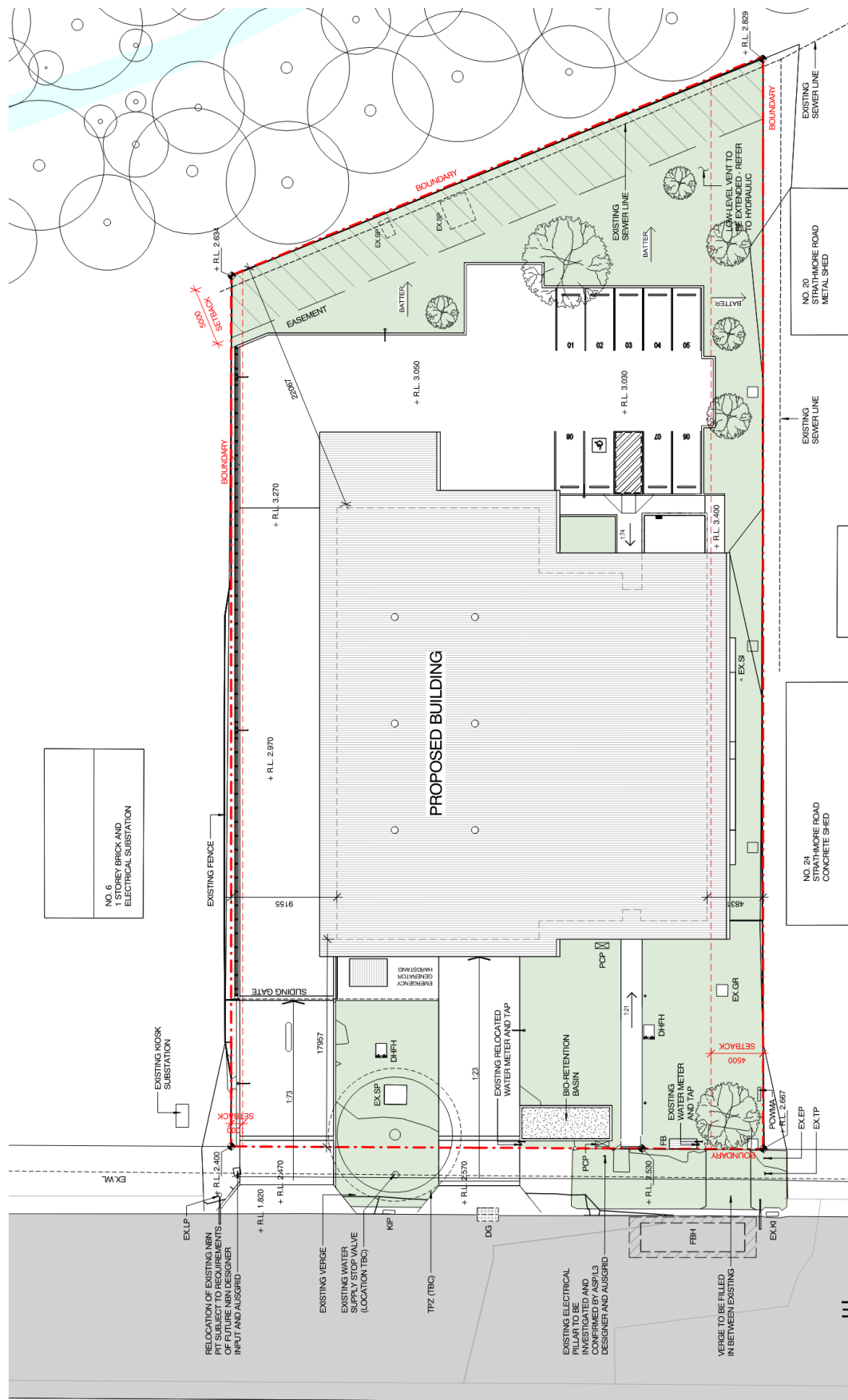


Figure 2: Proposed ambulance station site plan.

2.3 SURROUNDING RECEIVERS

Refer to Figure 4 for the location of the site and surrounding Noise Catchment Areas (NCA). Note that if noise impacts associated with the proposed development are controlled at the nearest noise sensitive receivers, then compliance with the recommended criteria at all noise sensitive receivers will be achieved.



Figure 4: Noise Catchment Areas (NCA) surrounding the site location

The surrounding lots of the proposed site are a mix of residential and commercial / industrial buildings. The residential receivers noise catchment is at the east of the proposed site, with the nearest one approximately 50m away. There are commercial and industrial buildings on the other sides, as shown in Figure 4. And there is a New Hope Church at the south-west side approximately 110m away.

A summary of the nearest sensitive receivers surrounding the site location is shown in Table 1, including the approximate distances between closest lot boundaries.

NCA	Sensitive Receiver	Receiver Type	Distance (m)
1	15 Farrington Close	Residential	50
2	Plains Gully	Passive Recreational	<10
3	6 Kaygua Close	Industry	90
4	26 Strathmore Road	Industry	40
5	29 Strathmore Road	Place of Worship	110
6	25 Strathmore Road	Commercial	75
7	24 Strathmore Road	Commercial	<5

Table 1: Nearest sensitive receivers surrounding the site location plus approximate distances.

3 SITE MEASUREMENTS

3.1 GENERAL

A noise survey was conducted in the location shown in Figure 5 to establish the ambient and background noise levels of the site and surroundings. The noise survey has been carried out in accordance with the method described in the AS/NZS 1055:2018 'Acoustics – Description and measurement of environmental noise'.



Figure 5: Aerial view of the site (red solid line) showing the location of the unattended measurements – L1, and attended measurements – S1, S2.

3.2 UNATTENDED NOISE MONITORING

Unattended noise monitoring was carried out from Friday 1st August to Wednesday 13th of August 2025 with a Rion NL-52 noise logger (Serial Number 175549). The noise logger recorded L_{A1} , L_{A10} , L_{Aeq} and L_{A90} noise parameters at 15-minute intervals during the measurement period. The calibration of the noise logger was checked before and after use and no deviations were recorded.

The logger location was secured and considered to be representative of the typical ambient and background noise levels of the surrounding residential receivers. The noise logger microphone was mounted 1.5 meters above the ground, and a windshield was used to protect the microphone. Weather conditions were monitored throughout the duration of the noise survey.

The detailed results of the long-term noise monitoring are presented graphically in Appendix A. As stated in the NSW EPA Noise Policy for Industry (NPfI) 2017, any data likely to be affected by rain, wind or other extraneous noise has been excluded from the calculations (shaded in the Appendix A graphs).

The Rating Background Levels (RBLs) have been established in general accordance with the methodology described in the NSW NPfI – i.e. 10th percentile background noise level (L_{A90}) for each period of each day of the ambient noise level. The median of these levels is then presented as the RBL for each assessment period.

These RBLs are shown in Table 2 together with the ambient noise levels (L_{Aeq}) measured for each period.

Location	Rating Background Levels, dB(A)			L _{Aeq} Ambient Noise Levels, dB(A)		
	Day 7am-6pm	Evening 6pm-10pm	Night 10pm-7am	Day 7am-6pm	Evening 6pm-10pm	Night 10pm-7am
L1	45	43	42	54	51	48

Table 2: Results of unattended noise monitoring.

3.3 ATTENDED NOISE MONITORING

Attended noise monitoring was carried out on 1st August 2025 during daytime to obtain representative third-octave band noise levels of the site. The attended measurements were carried out using an NTI XL-3 hand-held Sound Level Meter (SLM) (Serial Number A3A-00494-D1). The calibration of the SLM was checked before and after each use and no deviations were recorded.

The SLM microphone was mounted 1.5m from the ground on a tripod and a windshield was used to protect the microphone. Weather conditions were calm and dry during the attended noise monitoring. A summary of the results of the attended noise monitoring is shown in Table 3.

Location	Date and Time	Parameter	Sound Pressure Level, dB re 20μPa								
			Overall dB(A)	Octave Band Centre Frequency, Hz							
				63	125	250	500	1k	2k	4k	8k
S1	01/08/2025 12:21pm – 12:36pm	L _{A10,15min}	56	56	53	51	48	48	50	51	40
		L _{Aeq,15min}	58	54	51	49	46	47	51	54	39
		L _{A90,15min}	46	46	44	45	38	39	36	37	22
S2	01/08/2025 12:37pm – 12:52pm	L _{A10,15min}	53	60	60	52	45	44	44	46	35
		L _{Aeq,15min}	52	61	59	52	43	43	43	46	37
		L _{A90,15min}	46	48	56	50	39	39	36	34	22

Table 3: Results of attended noise monitoring.

4 RELEVANT NOISE STANDARDS AND GUIDELINES

4.1 STANDARDS AND GUIDELINES

The following standards and guidelines are considered relevant to the project and have been referenced in developing the project noise level criteria.

- Regulatory Framework:
 - Environmental Planning and Assessment (EP&A) Act 1979.
 - Protection of the Environment Operations (POEO) Act 1997.
- Planning Framework:
 - Lake Macquarie Environment Plan 2014.
 - Lake Macquarie Development Control Plan 2014.
- Operational Noise
 - Protection of the Environment Operations. Noise Controls Regulation (NCR) 2017.
 - NSW EPA Noise Policy for Industry (NPfI) 2017.
 - NSW Department of Environment Climate Change and Water (DECCW) Noise Guide for Local Government (NGLG) 2023.
 - NSW DECCW Road Noise Policy (RNP) 2011.
- External Noise Intrusion
 - NSW Health Infrastructure ‘Engineering Services Guideline’ (ESG), July 2017.
 - NSW Health Infrastructure Functional Brief for Ambulance Stations Rev 0.2 dated August 2024.
- Construction Noise and Vibration
 - NSW DECCW Interim Construction Noise Guideline (ICNG) 2009.
 - NSW DECC Assessing Vibration: A Technical Guideline 2006.
 - NSW Road Maritime Service (RMS) Construction Noise and Vibration Guideline 2016.
 - Australian Standard AS 2436:2010 ‘Acoustics – Guide to Noise Control on Construction, Maintenance & Demolition Sites’.
 - NSW EPA, Draft Construction Noise Guideline 2020.

4.2 REGULATORY FRAMEWORK

The Environmental Planning and Assessment Act 1979 (EP&A Act) provides the regulatory framework for the protection of the environment in NSW. The EP&A Act is relevantly about planning matters and ensuring that “environmental impact” associated with the proposed development is properly considered and reasonable before granting development consent to develop.

The assessment of “environmental impact” relies upon the identification of acceptable noise criteria which may be defined in a Development Control Plan or derived from principles using guidelines like NSW EPA Noise Policy for Industry (NPfI 2017) or Noise Guide for Local Government (NGLG 2023).

The Protection of the Environment Operations (POEO) Act 1997 has the objective of protecting, restoring and enhancing the quality of NSW environment. Abatement of noise pollution is underpinned by the definition of “offensive noise” as follows:

"(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."

4.3 LAKE MACQUARIE CITY COUNCIL LEGISLATION

Relevant Planning Documents of Lake Macquarie City Council have been reviewed for any noise requirement or criteria. The Lake Macquarie Local Environmental Plan (LM-LEP 2014) sets the Land Zoning as shown in Figure 6 as per information extracted from the NSW Planning Portal based on the LM-LEP zoning maps. The proposed site is categorised as General Industrial Zone (E4).



Figure 6: Land Zoning of the site (red outline) and surroundings.

Lake Macquarie Development Control Plan (LM-DCP 2014) has been reviewed for any relevant noise requirements or criteria for the proposed development. There are no specific noise level criteria, but rather sections of the LM-DCP 2014, e.g., Section 4, provide general planning strategies and operation time, i.e., 7am to 6pm from Monday to Saturday, for outdoor noise-generation operations.

4.4 NSW EPA NOISE POLICY FOR INDUSTRY

The NSW NPfl 2017 assesses noise from industrial noise sources - scheduled under the POEO Act. Mechanical noise from the development shall be addressed following the recommendations in the NSW NPfl.

The assessment is carried out based on the existing ambient and background noise levels addressing the following:

- Intrusiveness Criteria, to control intrusive noise into nearby sensitive receivers.
- Amenity Criteria, to maintain the noise level amenity for particular land uses.

These criteria are established for each assessment period (day, evening and night) and the more stringent sets the Project Noise Trigger Levels (PNTLs).

4.4.1 INTRUSIVENESS CRITERIA

The NSW NPfl defines the intrusiveness criteria as follows:

"The intrusiveness of an industrial noise source may generally be considered acceptable if the level of noise from the source (represented by the L_{Aeq} descriptor), measured over a 15 minute period, does not exceed the background noise level by more than 5dB when beyond a minimum threshold."

Based on the intrusiveness criteria definition and the measured background noise levels on site, Table 4 shows the intrusiveness criteria for the noise sensitive receivers.

Indicative Noise Amenity Area	Period	Measured Rating Background Level (L_{A90}), dB(A)	Intrusiveness Criteria, dB(A)
Suburban Residential (R2)	Day	45	50
	Evening	43	48
	Night	42	47

Table 4: Determination of the intrusiveness criterion for residential noise sensitive receivers.

4.4.2 AMENITY CRITERIA

The NSW NPfl states the following to define the amenity criteria:

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

Based on the amenity criteria definition and the land zoning, Table 5 shows the amenity criteria for the noise sensitive receivers.

<i>Indicative Noise Amenity Area</i>	<i>Period</i>	<i>Recommended Amenity Noise Level (L_{Aeq}), dB(A)</i>	<i>Amenity Criterion, dB(A)</i>
<i>Suburban Residential (R2)</i>	Day	55	53 L _{Aeq,15min} (55-5+3)
	Evening	45	43 L _{Aeq,15min} (43-5+3)
	Night	40	38 L _{Aeq,15min} (40-5+3)
<i>Place of Worship</i>	When in use	40 (internal)* 50 (external)	48 L _{Aeq,15min} (50-5+3)
<i>Commercial premises</i>	When in use	65	63 L _{Aeq,15min} (65-5+3)
<i>Industrial premises</i>	When in use	70	68 L _{Aeq,15min} (70-5+3)
<i>Passive Recreational area</i>	When in use	50	48 L _{Aeq,15min} (50-5+3)

Table 5: Determination of the amenity criterion for noise sensitive receivers. Note*: Where reference is made to an internal noise level, an external noise level 10dB above the internal noise levels are applied, which should achieve the internal noise level with a window being adequately opened to provide natural ventilation.

4.4.3 PROJECT NOISE TRIGGER LEVELS

The PNTL are shown in Table 6 and have been obtained in accordance with the requirements of the NSW NPfl. These shall be assessed to the most affected point on or within the noise sensitive receiver boundary.

<i>Indicative Noise Amenity Area</i>	<i>Period</i>	<i>Intrusiveness Criterion</i>	<i>Amenity Criterion</i>
<i>Suburban Residential (R2)</i>	Day	50	53
	Evening	48	43
	Night	47	38
<i>Place of Worship</i>	When in use	---	48
<i>Commercial Premises</i>	When in use	---	63
<i>Industrial Premises</i>	When in use	---	68
<i>Passive Recreational area</i>	When in use	---	48

Table 6: Determination of PNTL (light grey highlight) for noise sensitive receivers.

4.5 TRAFFIC NOISE

4.5.1 TRAFFIC NOISE GENERATED

Road traffic noise impact is assessed in accordance with the NSW DECCW Road Noise Policy (RNP) 2011. The NSW Road Noise Policy (RNP) establishes criteria for traffic noise from:

- Existing roads,
- New road projects,
- Road development projects,
- New traffic generated by developments.

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 should be limited to 2dB above the existing noise levels. An increase of up to 2dB represents a minor impact that is considered barely perceptible to the average person.

4.5.2 SLEEP AROUSAL

The potential of sleep disturbance from short-duration noise events from the proposed development – i.e. ambulance departures – during the night-time period needs to be considered. Sleep disturbance occurs through changes in sleep state and awakenings. For continuous traffic flow, L_{Aeq} appears to be acceptably correlated with sleep disturbance.

However, for intermittent traffic flow, which often occurs at night-time ($L_{AFmax} - L_{Aeq}$) or ($L_{AFmax} - L_{A90}$) are better correlated with sleep disturbance.

NSW EPA NPfI recommends the following criteria:

"Where the subject development night-time noise levels at a residential location exceed:

- $L_{Aeq,15min}$ 40dB(A) or the prevailing RBL plus 5dB, whichever is the greater, and/or
- L_{AFmax} 52dB(A) or the prevailing RBL plus 15dB, whichever is the greater.

A detailed maximum noise level event assessment should be undertaken.

The detailed assessment should cover the maximum noise level, the extent to which the maximum noise level exceeds the rating background noise level, and the number of times this happens during the night-time period."

The detailed assessment should cover the maximum noise level, the extent to which the maximum noise level exceeds the rating background noise level, and the number of times this happens during the night-time period. Some guidance on possible impact is contained in the review of research results in the NSW Road Noise Policy as follows:

- Maximum internal noise levels below 50–55dB(A) are unlikely to cause awakening reactions.
- One or two noise events per night, with maximum internal noise levels of 65–70dB(A), are not likely to affect health and wellbeing significantly.

Other factors that may be important in assessing the extent of impacts on sleep include:

- How often high noise events will occur.
- The distribution of likely events across the night-time period and the existing ambient maximum events in the absence of the subject development.

- Whether there are times of day when there is a clear change in the noise environment (such as during early-morning shoulder periods).
- Current scientific literature available at the time of the assessment regarding the impact of maximum noise level events at night.

Table 7 summarises the noise level criteria for sleep disturbance based on the NSW EPA NPfl recommendations and highlight the criteria to apply.

Sleep Arousal Noise Criteria	
Condition 1	$L_{Aeq,15min} 40dB(A) \parallel RBL + 5 = 47dB(A)$
Condition 2	$L_{AFmax} 52dB(A) \parallel RBL + 15 = 57dB(A)$

Table 7: Sleep Arousal noise criteria.

These values shall be achieved external to the bedroom window of the noise residential sensitive receivers, as opposed to the receiver boundary – which is applied for most other criteria.

4.6 POEO NOISE REGULATION CONTROLS

The POEO Noise Control Regulation 2017 streamlines the handling of common neighbourhood noise problems by providing more specific controls than the general powers provided under the POEO Act. The provisions of the regulation are aimed at residential activities and equipment, rather than those on commercial or industrial premises.

Part 4 deals with common neighbourhood noise problems such as the times of use of air conditioners, heat pump water heaters, pneumatic tools, swimming pool pumps, power tools, building intruder alarms and loud music. This part mainly applies to council enforcement / authorised officers and Police officers, but OEH enforcement / authorised officers also have powers in relation to some provisions.

The regulation applies different methods of control to different neighbourhood noise problems. These controls are:

- Preventing the use of certain articles where they can be heard during noise sensitive periods (e.g. night time).
- Placing limits on how long an article can emit noise (e.g. alarms).
- Prohibiting the use of certain articles where they emit 'offensive noise' (e.g. off-road trail bikes).

Although the clause below refers to residential premises, it is understood that it could be applied as a good practice plus establishing a noise control. Power tools and equipment noise management is described as follows:

"Clause 51 – Use of power tools on residential premises

(a) the person causes or permit a power tool to be used on residential premises in such a manner that it emits noise that can be heard within any room in any other residential premises (that is not a garage, storage area, bathroom, laundry, toilet or pantry) whether or not any door or window to that room is open:

(a) before 8 am or after 8 pm on any Saturday, Sunday or public holiday, or

(b) before 7 am or after 8 pm on any other day."

Therefore, noise from power tools shall be inaudible during the above listed time periods and shall not be 'offensive noise' (as per POEO Act definition) for other time periods.

4.7 NSW HEALTH INFRASTRUCTURE ESG

Section 13 of the NSW Health Infrastructure Engineering Services Guideline provides acoustic design for healthcare buildings considering internal noise levels, reverberation times plus sound insulation performances that should be achieved for the Ambulance Station. Furthermore, NSW Health Infrastructure provided a Functional Brief of Acoustic Services for ambulance stations, which is based on ESG requirements.

Therefore, the criteria and guides outlined in the ESG and HI NSW Functional Brief for ambulance stations shall be adopted for this project, particularly during the design stage.

4.8 CONSTRUCTION NOISE AND VIBRATION

4.8.1 NOISE CRITERIA

The ICNG suggest construction noise management levels that may minimise the likelihood of annoyance being caused to noise sensitive residential receivers depending on the duration of works. The management levels for long-term duration works are as follows:

- Within recommended standard hours.

The $L_{Aeq,15min}$ level measured at the most exposed boundary of any affected residential receiver when the construction site is in operation must not exceed the background noise level by more than 10dB(A). This noise level represents the point above which there may be some community reaction to noise.

However, in the case of a highly noise affected area, the construction noise level ($L_{Aeq,15min}$) at the most exposed boundary of any affected residential receiver when the construction site is in operation should not exceed 75dB(A). This level represents the point above which there may be strong community reaction to noise.

- Outside recommended standard hours.

The $L_{Aeq,15min}$ level measured at the most exposed boundary of any affected residential receiver when the construction site is in operation must not exceed the background level by more than 5dB(A). It is noted that a strong justification is required for works outside the recommended standard hours.

In order to establish the airborne construction noise criteria, noise levels from the unattended noise monitoring have been used for the noise sensitive receivers – refer to Section 3. Table 8 below summarises the airborne construction noise criteria for most the affected noise sensitive receivers surrounding the development site.

Sensitive Receiver		Airborne Construction Noise Criteria, L_{Aeq} dB(A)	
		Within Standard Hours	Outside Standard Hours
Residential	Noise affected / External	RBL + 10	RBL + 5
	Highly noise affected / External	75	N/A

Table 8: ICNG construction airborne noise criteria for noise sensitive receivers surrounding the site.

Table 9 summaries the airborne construction noise criteria for non-residential premises surrounding the development site.

<i>Land Use</i>	<i>Management Level, L_{Aeq} dB(A)</i>
<i>Place of worship</i>	Internal Noise Level 45dB(A)
	External Noise Level 55dB(A)
<i>Commercial (offices, retail outlets)</i>	70dB(A)
<i>Industrial premises</i>	75dB(A)
<i>Passive Recreational area</i>	External Noise Level 60dB(A)

Table 9: ICNG construction airborne noise criteria for non-residential premises.

Where reference is made to an internal noise level, an external noise level 10dB above the internal noise levels are applied which should achieve the internal noise level where a window is adequately opened to provide natural ventilation.

The ICNG recommends internal ground-borne noise maximum levels at residences affected by nearby construction activities. Ground-borne noise is noise generated by vibration transmitted through the ground into a structure and can be more noticeable than airborne noise for some sensitive receivers. The ground-borne noise levels presented below from the ICNG are for residential receivers during evening and night-time periods only, as the objective is to protect the amenity and sleep of people when they are at home.

- Evening: $L_{Aeq,15min}$ 40dB(A) (internal)
- Night: $L_{Aeq,15min}$ 35dB(A) (internal)

The internal noise levels are assessed at the centre of the most affected habitable room.

4.8.2 VIBRATION CRITERIA

4.8.2.1 Structural Building Damage

Ground vibration from construction activities can damage surrounding buildings or structures. For occupied buildings, the vibration criteria given in previous section for Human Comfort shall generally form the limiting vibration criteria for the Project.

For unoccupied buildings, or during periods where the buildings are unoccupied, the vibration criteria for building damage suggested by German Standard DIN 4150.3:2016 '*Vibration in Buildings – Effects on Structures*' are to be adopted. Guideline values from DIN 4150.3:2016 are presented in Table 10.

Structural type	Vibration velocity, mm/s (Peak Particle Velocity - PPV)				
	Foundation			Plane of floor uppermost full storey in horizontal direction	Floor slabs, vertical direction
	1Hz to 10Hz	10Hz to 50Hz	50Hz to 100Hz	All frequencies	All frequencies
Type 1: Buildings used for commercial purposes, industrial buildings and buildings of similar design	20	20 to 40	40 to 50	40	20
Type 2: Residential buildings and buildings of similar design and/or occupancy	5	5 to 15	15 to 20	15	20
Type 3: Structures that because of their particular sensitivity to vibration, cannot be classified under Type 1 and 2 and are of great intrinsic value (e.g. heritage buildings)	3	3 to 8	8 to 10	8	20

Table 10: DIN 4150.3:2016 Guideline values of vibration velocity (PPV) for evaluating the effects of short-term vibration.

4.8.2.2 Human Comfort

The Department of Environment, Climate Change and Water (DECCW) developed the document 'Assessing Vibration: A Technical Guideline' in February 2006 to assist in preventing people from exposure to excessive vibration levels within buildings. It is based on the guidelines contained in BS 6472.1:2008 'Guide to evaluation of human exposure to vibration in buildings – Vibration sources other than blasting'.

The guideline does not address vibration induced damage to structures or structure-borne noise effects. Vibration and its associated effects are usually classified as continuous (with magnitudes varying or remaining constant with time), impulsive (such as shocks) or intermittent (with the magnitude of each event being either constant or varying with time). Vibration criteria for continuous and impulsive vibration are presented in Table 11 below, in terms of vibration velocity levels.

Place	Time	r.m.s. velocity, mm/s [dB ref 10 ⁻⁶ mm/s]			
		Continuous Vibration		Impulsive Vibration	
		Preferred	Maximum	Preferred	Maximum
Residences	Day-time	0.20 [106 dB]	0.40 [112 dB]	6.00 [136 dB]	12.00 [142 dB]
	Night-time	0.14 [103 dB]	0.28 [109 dB]	2.00 [126 dB]	4.00 [132 dB]
Offices, schools, educational and worship	When in use	0.40 [112 dB]	0.80 [118 dB]	13.00 [142 dB]	26.00 [148 dB]

Table 11: Continuous and impulsive vibration criteria applicable to the site.

When assessing intermittent vibration comprising a number of events, the Vibration Dose Value (VDV) it is recommended to be used. Table 12 shows the acceptable VDV values for intermittent vibration.

<i>Place</i>	<i>Time</i>	<i>Vibration Dose Values, $m/s^{1.75}$</i>	
		<i>Preferred</i>	<i>Maximum</i>
<i>Residences</i>	Day-time	0.20	0.40
	Night-time	0.13	0.26
<i>Offices, schools, educational and worship</i>	When in use	0.40	0.80

Table 12: Intermittent vibration criteria applicable to the site.

5 NOISE EMISSIONS ASSESSMENT

Noise break-out from the proposed ambulance station has the potential to impact on existing noise sensitive receivers. For the purpose of this noise impact assessment, the noise sources are assumed as follows:

- Noise emissions from mechanical plant from the ambulance station to the surrounding receivers.
- Noise emissions from traffic generated by the proposed development (vehicle noise emission).
- Noise emissions from wash bay.

Each of these noise sources has been considered in the noise impact assessment. The acoustic assessment has considered the following:

- Noise levels have been considered as continuous over assessment time period to provide the worst-case scenario.
- Distance attenuation, building reflections and directivity.
- Lowest measured background noise levels at the nearest noise sensitive receiver have been used to provide a worst-case scenario.

5.1 EXTERNAL MECHANICAL PLANT

Noise from the proposed development mechanical plant should be controlled to ensure external noise emissions are not intrusive and do not impact on the amenity of the sensitive receivers.

The mechanical plant will operate continuously during all day periods. At this stage, a preliminary selection of the external mechanical plant has been provided. A noise assessment at the nearest noise sensitive receivers has been carried out to predict the combined noise level from all the mechanical plants in the worst-case scenario. The nearest noise sensitive receiver is 15 Farrington Close – to the east. The following assumptions have been made in the noise assessment:

- The location of the plant is shown in Figure 7 below. The distance to the nearest receiver is approximately 70m.
- The plantroom is open with partial height blockwork around it. And there are no other solid barriers between the mechanical plantroom and the nearest sensitive noise receiver.
- The assessment is conducted for the nighttime period and mechanical equipment being run at full capacity for the ambulance station operation.
- Primary selection of external condenser units and hydraulic pumps are shown in the Table 13.

<i>Cold Water Pumps</i>	<i>Description</i>	<i>Sound Pressure Level, dB(A) [ref 20μPa]</i>
Vertical discharge Condenser Unit	PURY-P500YNW-A1 (1-off)	65dB(A) @ 1m
Horizontal discharge Condenser Unit	MUZ-AP71VG(D*) (1-off)	59dB(A) @ 1m
CW Booster pump	2-off in duty/standby configuration	70dB(A) @ 1m
Domestic hot water heat pump	1-off 16kW air to water heat pump	59dB(A) @ 3m
Hot water circulating pump	2-off in duty/standby configuration	43dB(A) @ 1m

Table 13: Sound pressure level from mechanical equipment in the plantroom.



Figure 7: Location of external plantroom

The noise assessment of the mechanical plant is summarised in Table 14.

Calculation	Overall A-weighted noise level, in dB(A)
	15 Farrington Close
L_{Aeq} predicted cumulative of external mechanical plants @1m	73
Distance attenuation, dB	-37
Barrier effects, Directivity and reflections, dB	-3
$L_{Aeq,15min}$ noise level at residential receiver	33
Nighttime criteria / Complies?	38 / Yes

Table 14: Noise assessment of external mechanical plant to the nearest noise sensitive receivers.

Based on this assessment of noise impact from the preliminary selection of mechanical equipment, any cumulative noise emission less than 73dB(A) from the mechanical plant at 1m from the plantroom will comply with the noise level criteria at the nearest noise sensitive receivers.

If changes of the mechanical plant are proposed during design stages, noise controls will need to be incorporated with the design of the mechanical plant rooms to ensure that the cumulative noise levels from plant areas to the nearest noise sensitive receivers meets the NSW NPfl noise level criteria – refer to Section 4.4.

Usual design noise controls that may need to be implemented will typically include, but are not limited to:

- Strategic location and selection of plant to ensure the cumulative noise level at the receiver boundaries is met.
- Selection of appropriate quiet plant.
- Acoustic noise control measures to be put in place to minimise noise impacts such as:
 - In-duct attenuation
 - Noise enclosures as required
 - Sound absorptive panels
 - Acoustic louvres as required
 - Noise barriers as required

Acoustic assessment of all mechanical plant shall continue during the detailed design phase of the project in order to confirm any noise control measures.

5.2 VEHICLE NOISE EMISSIONS

An acoustic assessment of the proposed vehicle noise emissions has been undertaken. The potential noise sources associated with the proposed vehicles operations will be:

- Noise generated by vehicles movements, particularly ambulances dispatched for emergencies during night-time.
- Noise generated by ambulance sirens.
- Noise generated by staff vehicles movements.

The vehicle movements have been noted to be moving slowly / idling when within the Ambulance Station, while acceleration on departure. It has been assumed that worst-case scenario will be during an ambulance departure for a Priority One incident in night-time period.

The nearest noise sensitive receivers to the proposed ambulance exit path are the residential receivers at Farrington Close.

5.2.1 AMBULANCE MOVEMENTS AND ROLLER DOOR

For the noise assessment purpose, departing ambulances noise levels from the Ambulance Station are likely to generate the following noise level range.

Noise Source	Maximum Sound Power Level dB(A), ref 1pW
Ambulance vehicle accelerating	91-96
Roller door noise	70

Table 15: Noise level ranges for ambulance departures from the Ambulance Station.

Besides vehicle movements, noise from the roller door operation has been also considered. The roller door noise data used for this assessment has been obtained from attended measurements and acoustic data provided by a typical roller door. The A-weighted sound power level used is L_{WA} 70dB(A) and based on the opening / closing speed, operation cycle has been assumed approximately 10 seconds.

To minimise roller door noise impact to the nearest noise sensitive receivers, a quiet roller door system is to be selected, and insulators are to be installed on the door fittings to avoid a rigid connection between roller door structure and building elements, reducing structure borne noise emissions. The roller door closing speed is to be controlled such that significant impact noise is not emitted when the roller door leaf comes in contact with the floor.

The noise assessment has considered the following assumptions:

- The Ambulance Station will operate 24 hours a day 7 days per week. Therefore, there will be ambulance movements at any time period.
- One ambulance exit event is estimated to be 30 seconds.
- As a worst-case scenario, one ambulance vehicle exit has been assessed over a 15-minute period.
- Noise levels have been considered as continuous over a 15-minute assessment period to provide the worst-case scenario.
- Ambulance noise levels are based on the highest value of the maximum sound power level range for a worst-case scenario.
- Noise predictions are based on distance attenuation, ground reflection, building reflections / shielding and directivity of the noise source.
- Noise level criteria are based on the lowest measured background noise level in order to provide a worst-case scenario.

The sleep arousal assessment is provided in the following tables.

<i>Calculation</i>	<i>Roller Door</i>	<i>Ambulance Vehicle</i>
L_{Aeq} at 1 m	56	82
Distance attenuation, dB	-40	-42
Duration correction, dB	-12	-15
$L_{Aeq,15min}$ resulting at residential receiver	<10	25
Cumulative $L_{Aeq,15min}$	25	
NPfI Sleep Arousal Night-time / Complies?	47/ Yes	

Table 16: Sleep arousal noise assessment at residential receiver for ambulance departure during night-time. Condition 1.

<i>Calculation</i>	<i>Roller Door</i>	<i>Ambulance Vehicle</i>
L_{Amax} at 1 m	62	88
Distance attenuation, dB	-40	-42
L_{Amax} resulting at residential receiver	22	46
NPfI Sleep Arousal Night-time / Complies?	57 / Yes	57 / Yes

Table 17: Sleep arousal noise assessment at residential receiver for ambulance departure during night-time. Condition 2.

Based on the assessment above, the predicted cumulative $L_{Aeq,15min}$ and $L_{Amax,1m}$ noise level is expected to meet Condition 1 and Condition 2 of the NPfI Sleep Arousal Criteria during the night-time, respectively. Therefore, no sleep arousal events are expected due to ambulance vehicle movements and operation of the roller shutter door.

5.2.2 AMBULANCE SIRENS

Regarding the use of ambulance sirens on site, when ambulances depart to attend incidents, it is not specifically addressed in any relevant noise regulations. When in use, noise levels from ambulance sirens will be audible at the nearest residential receivers.

Events identified as Priority One events (Life Threatening Emergencies), require that warning devices should be used, including warning lights and sirens. The *NSW Ambulance Emergency Driving and Use of Warning Devices Directive PD2023-005* states that:

"...Blue or red flashing lights (and siren where appropriate) should be used when transporting a patient when the highest clinical level paramedic responsible for the patient deems their condition warrants the use of emergency driving procedures during transfer..."

It further states:

"...NSW Ambulance personnel who drive a vehicle under emergency response conditions shall use safety equipment provided by NSW Ambulance for that purpose which includes warning devices: lights and sirens. Lights can be used in isolation without the use of a siren if the driver of the vehicle deems the circumstances are safe to do so and can justify reasonable cause to do so.

The siren should be utilised on the approach to any hazard, in particular:

- *Physical hazards such as junctions, intersections, roundabouts, bends or hill crests.*
- *Those created by the presence, position or movement of other road users*

Deactivation of the siren while driving under emergency response conditions should only be considered if the driver can justify reasonable cause to do so, there is no benefit to be gained from the use of the siren and there is no compromise to the safety of other road users.

The driver's decision to use all warning devices will always be supported by NSW Ambulance should a complaint be received due to noise made when responding to an emergency..."

Based on the above, we understand that ambulance drivers will make a judgement call on whether to use ambulance sirens on a case-by-case basis. We further understand that it is the practice of paramedics to minimise the use of sirens when it will cause a noise disturbance and the sirens are deemed unnecessary.

5.2.3 STAFF CAR PARK

There is provision for 8 staff carparks in the proposed development. Based on this, it is understood that staff movements will only slightly increase the traffic flows to the expected traffic levels in the area. Therefore, it can be stated that there will be no significant increase in road traffic as a result of the development due to the additional staff carparks.

As noted in Section 4.6.2, when considering land use development and the impact on sensitive land uses the NSW Road Noise Policy (RNP) states that an increase up to 2dB in relation to existing noise levels is anticipated to be insignificant.

Therefore, traffic noise associated with the development is expected to meet the NSW RNP recommendations.

Based on Lake Macquarie DCP (LM-DCP 2014) noise and vibration requirements for developments in Industrial Zones, the external wash bay with the pressure washer can be operated from 7am to 6pm from Monday to Saturday. Therefore, based on all above and whenever reasonable, the pressure washer shall only be used during 7am to 6pm from Monday to Friday and 8am to 6pm on Saturdays with noise levels expected to be in compliance with the noise level criteria and not impacting the nearest noise sensitive receivers.

6 NOISE INTRUSION

The noise level within the internal spaces of the proposed development will be a result of the combination of external noise and noise from the building services. Noise generated by building services, particularly the air-conditioning and ventilation systems, needs to be considered to ensure that the internal noise levels for each space of the Ambulance Station meet the ambient noise levels as per NSW Health Infrastructure ESG and Functional Brief for acoustics services.

In order to achieve these internal noise levels for each space, noise control treatments will need to be incorporated into the mechanical systems as required. Table 19 outlines the NSW Health Infrastructure ESG and Functional Brief criteria for continuous internal noise levels.

Area Designation	Continuous Internal Noise Levels L_{Aeq} dB	
	Satisfactory	Maximum
Private Offices	35	40
Multi Person Offices	40	45
Rest Room	35	40
Meeting / Training Room	35	40
Multipurpose room	35	40
Common room	40	45

Table 19: Continuous Internal Noise Levels (L_{Aeq}) as per NSW Health Infrastructure ESG and HI NSW Functional Brief for ambulance stations.

In order to meet the above internal noise levels, JHA has carried out a review of traffic noise impacts and recommends the minimum glazing thickness for the buildings.

The following assumptions have been considered for the traffic noise impacts:

- The average sound Pressure Level L_{eq} of the noisiest 1-hour per day from the unattended noise measurements is used for the internal noise assessment.
- Internal noise levels are predicted based on noise levels incident at the façade of each space, which are based on the above measurements.
- External glazing is the weakest elements of the façade, and solid sections of the façade will provide a sound reduction index of R_w50 .
- Internal noise level of 35dB(A) for the most noise sensitive areas in the ambulance stations is considered for the assessment.

Achieving the proposed internal noise levels, based on the above assumptions, will require the external glazing of the new building to provide a minimum R_w32 sound insulation rating, which can be achieved by any glazing system consisting of 6.38mm laminated glass. Note that this requirement is for acoustic purposes only, and other requirements are to be considered in selection of the appropriate external glazing types.

7 CONSTRUCTION NOISE AND VIBRATION PLANNING

Currently a detailed construction program is not yet full defined. This section of the Construction Noise and Vibration Planning provides general recommendations only and provides applicable criteria together with feasible and reasonable noise and vibration control practices to be observed during the construction of the proposed development.

This preliminary advice in relation to construction noise and vibration management shall form the basis for the Contractor's Construction Noise and Vibration Management Plan (CNVMP) which shall identify any noise criteria exceedance once construction methods and stages are known.

Any noise from demolition and construction activities to be carried out on site must not result in '*offensive noise*' to any noise sensitive receiver. To this end, the Contractor employed to undertake the demolition and/or construction works is responsible for ensuring that any site noise and, in particular, any complaints shall be monitored, investigated, managed and controlled.

7.1 RELEVANT STANDARDS FOR CONSTRUCTION NOISE AND VIBRATION CRITERIA

Section 4.8 of this report contains the relevant legislation, codes and standards in addition to construction noise and vibration criteria for this project.

7.2 WORKING HOURS

The following construction hours are proposed as follows:

- Monday to Friday: 7am to 6pm.
- Saturday: 8am to 1pm.
- Sundays and Public Holidays: No excavation or construction works.

It is noted that the proposed construction hours are within the recommended EPA hours. Noise control measures are to be implemented during these hours following consultation and engagement with the community.

It is recommended that high noise level works – i.e. piling, excavation, etc – shall be scheduled to not occur during shoulder periods of the recommended standard hours – i.e 7am to 8am and 5pm to 6pm.

A detailed Construction Noise and Vibration Management Plan (CNVMP) shall further assess the noise impact of construction works, and shall include a protocol to minimise any potential noise impacts to identified sensitive receivers, and ensure that appropriate noise control measures are defined and implemented to comply with all relevant noise guidelines.

7.3 AIRBORNE NOISE

These levels are based on the database published by the UK Department for Environmental, Food and Rural Affairs (DEFRA) & Australian Standard AS2436:2010 '*Guide to Noise Control on Construction, Maintenance & Demolition Sites*' for a 15-minute period.

The expected construction noise sources and the predicted noise levels at the nearest residential receiver (i.e. 15 Farrington Close) are shown in the table below as a range from the closest distance to the receiver boundary (approximately 50m) and the middle of the site to the receiver boundary (approximately 85m).

Item	Typical Sound Power Level (dB ref 1pW)	Typical Noise Level $L_{A10,15m}$ at 7m (dB ref 20 μ Pa)	Predicted Noise Level $L_{Aeq,15m}$	Exceedance above 75dB(A)? (Y/N)
			15 Farrington Close	
Angle grinders	104	76	54 – 59	N
Truck (>20 tonne)	108	80	58 – 63	N
Circular saw	115	87	65 – 70	N
Piling rig (bored)	111	83	61 – 66	N
20tn Excavator	107	79	57 – 62	N
40-50tn Mobile crane	111	83	61 – 66	N
Concrete pump	113	85	63 – 68	N
Concrete truck	110	82	60 – 65	N
Drill	94	66	44 – 49	N

Table 20: Predicted airborne noise levels for typical construction plant used during construction works.

Based on the results of the preliminary assessment as shown above, no exceedances above the noise limits for highly noise affected receivers is expected within standard hours. This assessment is based on typical noise levels associated with construction sites and machinery.

Nevertheless, compliance with the relevant construction noise criteria can be achieved through specific noise mitigation measures such as acoustic screening around the site. These noise mitigation measures are to be provided in a detailed Construction Noise and Vibration Management Plan (CNVMP).

7.4 VIBRATION

The Transport for NSW 'Construction Noise and Vibration Guideline (roads)' 2023 provides safe working distances for vibration intensive plant and are quoted for both 'cosmetic' damage (in accordance with BS 7385.2:1993) and human comfort (in accordance with DECCW 'Assessing Vibration: A Technical Guideline'). The recommended safe working distances for a typical construction plant are provided below.

Plant Item	Description	Cosmetic Damage	Human Response
Small Hydraulic Hammer	5-12 tonne	2m	7m
Medium Hydraulic Hammer	12-18 tonne	7m	23m
Large Hydraulic Hammer	18-34 tonne	22m	73m
Vibratory Pile Driver	Sheet piles	2-20m	20m
Pile Boring	<800mm	2m	N/A
Jackhammer	Handheld	1m	Avoid Contact with Structure

Table 21: Recommended minimum working distances for a vibration-intensive plant from sensitive receivers.

For any vibration intensive plant expected to be within proximity of the minimum distances described above, the contractor must engage a qualified engineer to carry out a vibration survey in order to assess any potential risks. The vibration survey and assessment will determine whether the vibration levels might exceed the relevant criteria; then vibration mitigation and management measures will need to be put in place to ensure vibration impacts are minimized as far as practicable.

7.5 MITIGATION MEASURES

In order to meet the noise and vibration requirements of the site, the Contractor will be required to engage a qualified acoustic consultant to assist in the compilation of a Construction Noise and Vibration Management Plan (CNVMP) and undertake noise and vibration monitoring for the duration of the project.

7.5.1 GENERAL CONTROL ELEMENTS

As a general rule, minimising noise and vibration should be applied as universal work practice at any time of day, but especially for any construction works to be undertaken at critical times outside normal daytime/weekday periods.

It is noted that the reduction of noise and vibration at the source and the control of the transmission path between the construction site and the receiver(s) are the preferred options for noise minimisation. Providing treatments at the affected receivers should only be considered as a last resort. Construction noise and vibration shall be managed by implementing the strategies listed below:

- *Plant and equipment.* In terms of both cost and results, controlling noise and vibration at the sources is one of the most effective methods of minimising the impacts from any work site activities. Work practices that will reduce noise and vibration at the source include:
 - Employing quieter techniques for all high noise activities such as rock breaking, concrete sawing, and using power and pneumatic tools.
 - Use quieter plant and equipment based on the optimal power and size to most efficiently perform the required tasks.
 - Selecting plant and equipment with low vibration generation characteristics.
 - Operate plant in a quietest and most effective manner.
 - Where appropriate, limit the operating noise of equipment.
 - Regularly inspecting and maintain plant and equipment to minimise noise and vibration level increases, to ensure that all noise and vibration reduction devices are operating effectively.
- *On site noise management.* Practices that will reduce noise from the site include:
 - Maximising the distance between noise activities and noise sensitive receivers. Strategically locate equipment and plant.
 - Undertaking noisy fabrication work off-site where possible.
 - Avoid the use of reversing beeping alarms or provide for alternative systems, such as broadband reversing alarms
 - Maintaining any pre-existing barriers or walls on a demolition or excavation site as long as possible to provide optimum sound propagation control.
 - Constructing barriers that are part of the project design early in the project to afford mitigation against site noise.
 - Using temporary site building and material stockpiles as noise barriers. These can often be created using site earthworks and may be included as a part of final landscape design.
 - Installing purpose built noise barriers, acoustic sheds and enclosures.

- *Work scheduling.* Scheduling work during periods when people are least affected is an important way of reducing adverse impacts. The following scheduling aspects may reduce impacts:
 - Provide respite periods, including restricting very noisy activities to daytime, restricting the number of nights that after-hours work is conducted near residences, or by determining any specific requirements, particularly those needed for noise sensitive receivers.
 - Scheduling activities to minimise impacts by undertaking all possible work during hours that will least adversely affect sensitive receivers and by avoiding conflicts with other scheduled events.
 - Scheduling work to coincide with non-sensitive periods.
 - Scheduling noisy activities to coincide with high levels of neighbourhood noise so that noise from the activities is partially masked and not as intrusive.
 - Planning deliveries and access to the site to occur quietly and efficiently and organising parking only within designated areas located away from sensitive receivers.
 - Optimising the number of deliveries to the site by amalgamating loads where possible and scheduling arrivals within designated hours.
 - Designating, designing and maintaining access routes to the site to minimise impacts.
 - Including contract conditions that include penalties for non-compliance with reasonable instructions by the principal to minimise noise or arrange suitable scheduling.
- *Consultation, notification and complaints handling.*
 - Provide information to neighbours before and during construction.
 - Maintain good communication between the community and Project staff.
 - Have a documented complaints process and keep register of any complaints.
 - Give complaints a fair hearing and provide for a quick response.
 - Implement all feasible and reasonable measures to address the source of complaint. Implementation of all reasonable and feasible mitigation measures for all works will ensure that any adverse noise impacts to surrounding receivers are minimised when noise goals cannot be met due to safety or space constraints.

7.5.2 ADDITIONAL NOISE AND VIBRATION CONTROL MEASURES

If, during construction, an item of equipment exceeds either the noise criteria at any location or the equipment noise level limits, the following noise control measures, together with construction best practices, shall be considered to minimise the noise impacts on the neighbourhood.

- Schedule noisy activities to occur outside of the most sensitive times of the day for each nominated receiver.
- Consider implementing equipment-specific screening or other noise control measures recommended in Appendix C of AS 2436:2010.
- Limit the number of trucks on site at the commencement of site activities to the minimum required by the loading facilities on site.
- When loading trucks, adopt best practice noise management strategies to avoid materials being dropped from height into dump trucks.
- Avoid unnecessary idling of trucks and equipment.
- Ensure that any miscellaneous equipment (extraction fans, hand tools, etc) not specifically identified in the CNVMP incorporates silencing/shielding equipment, as required, to meet the noise criteria.

7.5.3 CONSTRUCTION TRAFFIC NOISE

Noise emissions due to construction vehicle traffic (particularly heavy vehicles) will need to be assessed and management to ensure the amenity of the surrounding receivers are not overtly affected.

Management of heavy vehicle to and from the site should be scheduled to occur outside the busiest traffic periods but also to avoid noise-sensitive times. Truck engine or heavy braking or accelerating should be avoided, as well as and excessive idling, particularly in residential streets.

Construction vehicle routes, parking and sub-contractor / driver behaviour should be observed and monitored to ensure considerate behaviour is maintained.

A Construction Traffic Management Plan will need to address the minimisation of construction traffic noise.

8 MANAGEMENT AND COMPLIANCE

Limiting noise nuisance from a premise generally requires management on an ongoing basis. Strategies for the proposed development should consider the following:

- Whenever possible, the pressure washer and other power tools shall be operated between 7am to 8pm during Monday and Friday and between 8am to 8pm on Saturdays, Sundays and Public Holidays.
- Use of ambulance sirens within the Ambulance Station lot and surroundings shall be minimised whenever possible, as intended in the "Good-Neighbour practice" of NSW Ambulance to minimise the noise impact of sirens on the noise sensitive receivers near the ambulance stations.
- To minimise impact on the surrounding amenity, Waste Collection movements are recommended to occur during the day-time.

9 SUMMARY

9.1 SUMMARY

A noise assessment has been carried out for the proposed development of an Ambulance Station at 2-4 Kayuga Close, Caves Beach, NSW. This report forms part of the documentation package to be submitted to NSW Health Infrastructure as part of the REF application.

This report establishes relevant noise level criteria, details the acoustic assessment and provides comments and recommendations for the proposed development.

The noise assessment has adopted methodology from relevant guidelines, standards and legislation to assess noise impact. The noise impacts have been predicted at the nearest noise sensitive receiver boundaries, taking in account distance attenuation, building reflections and directivity.

External Mechanical Plant: A preliminary assessment of the mechanical plant noise emission has been conducted. Based on this assessment, any cumulative noise emission less than 73dB(A) from the mechanical plant at 1m from the plantroom will comply with the noise level criteria at the nearest noise sensitive receivers. The acoustic assessment of all mechanical plant shall continue during the detailed design phase of the project in order to confirm any required noise control measures.

Vehicle Noise Emissions and Roller door: Existing ambient and background noise levels will not be significantly increased by vehicle movements from the staff cars of the Ambulance Station as there will be only 8 staff carpark spaces.

Based on the sleep arousal assessment, the predicted cumulative $L_{Aeq,15min}$ and $L_{Amax,1m}$ noise levels are expected to meet Condition 1 and Condition 2 of the NPfl Sleep Arousal Criteria during the night-time, respectively. Therefore, no sleep arousal events are expected due to ambulance vehicle movements and operation of the roller shutter door.

For noise from ambulance sirens, it is recommended that their operation within the development and surroundings shall be addressed in the Management Plan and minimised whenever possible. The noise impact due to vehicle movements associated with the Ambulance Station staff are anticipated to meet the noise criteria. This extends to traffic noise impact due to traffic generated by the proposed development. This is expected to be achieved by implementing and exercising the "Good-Neighbour practice" of NSW Ambulance, which is to avoid avoiding the use of sirens as much as possible near stations, to minimise the impact siren noise on noise sensitive receivers, e.g., residential properties, educational buildings, etc.

Wash Bay: Based on the assessment result, it is recommended to restrict pressure washer operations to day-time period, whenever possible. As required by the NSW POEO NCR 2017, noise from all power tools, including the pressure washer, shall not be audible within any habitable room in any residential premises outside the proposed hours. The recommended operation time period based on requirements of NSW POEO NCR 2017 and LM-DCP 2014 shall only be from 7am to 6pm from Monday to Friday and 8am to 6pm on Saturdays. Therefore, whenever reasonable, the pressure washer shall only be used during these hours with noise levels expected to be in compliance with the noise level criteria and not impacting the nearest noise sensitive receivers.

Noise Intrusion: Noise break-in from external sources has been assessed for the external glazing of the new ambulance building. A minimum sound insulation performance of R_w32 for the external glazing is recommended.

Construction: A preliminary construction noise assessment has been carried out. Based on the results, the noise associated with the normal construction works is expected to meet the noise limits in accordance with the ICNG Guideline. Nevertheless, compliance with the relevant construction noise criteria can be achieved through specific noise mitigation measures – to be provided in a detailed Construction Noise and Vibration Management Plan (CNVMP) prepared by a qualified acoustic consultant prior to Construction Certificate.

The information presented in this report shall be reviewed if any modifications to the features of the development specified in this report occur, including and not restricted to selection of mechanical plant, modifications to the building and introduction of any additional noise sources.

Based on the information presented in this report, it can be stated that relevant objectives will be satisfied and therefore, approval is recommended to be granted.

9.2 MITIGATION MEASURES

Aspect	Mitigation Measure Name	Mitigation Measure	Timing
Compliance	Mechanical Services Noise Emissions	At this stage, preliminary mechanical plant selections have been made. Based on noise emission assessments, the noise emission from the external mechanical plant will comply with the noise level criteria at the nearest noise sensitive receivers – see Section 5.1. Any changes in the external mechanical plant requires an assessment to confirm any noise control measures required to achieve the relevant noise criteria at the nearest noise sensitive receivers	During design – prior to commencement of any works
Compliance	Roller door	To minimise roller door noise impact to the nearest noise sensitive receivers, a quiet roller door system is to be selected with a sound power level lower than $L_{w70dB(A)}$ and insulators are to be installed on the door fittings to avoid a rigid connection between roller door structure and building elements, reducing structure borne noise emissions.	During design – prior to commencement of any works
Compliance	Pressure washer and other power tools	As required by the NSW POEO NCR 2017, noise from all power tools, including the pressure washer, shall not be audible within any habitable room in any residential premises outside the proposed hours. Based on the above and LM-DCP 2014 requirements, the recommended operation time period is only between 7am and 6pm Monday to Friday, and between 8am and 6pm on Saturdays. Therefore, whenever reasonable, the pressure washer shall only be used during these hours with noise levels expected to be in compliance with the noise level criteria and not impacting the nearest noise sensitive receivers.	During operation – as part of Operation Noise Management
Compliance	Noise Intrusion	The predicted noise level within the internal spaces of the ambulance stations will comply with the internal noise level criteria, provided that the external glazing provides a minimum sound insulation rating of R_w32 , which typically can be achieved using 6.38mm laminated glass.	During design – prior to commencement of any works

<i>Aspect</i>	<i>Mitigation Measure Name</i>	<i>Mitigation Measure</i>	<i>Timing</i>
Construction	Construction Noise and Vibration Plan (CNVMP)	Currently a detailed construction program is not yet fully defined. This report has provided general Construction Noise and Vibration Planning recommendations only, applicable criteria plus feasible and reasonable noise and vibration control practices to be observed during the construction of the proposed activity. The preliminary advice in relation to construction noise and vibration management shall form the basis for the Contractor's Construction Noise and Vibration Management Plan (CNVMP) which shall identify any noise criteria exceedance once construction methods and stages are known.	Prior to commencement of any works

9.3 EVALUATION OF ENVIRONMENTAL IMPACTS

An assessment of the environmental impacts of the Caves Beach Ambulance Station has been conducted. Based on the information presented in this report, the extent and nature of potential impacts are low and will not have a significant impact on the locality, community and/or the environment. Potential impact can be appropriately mitigated or managed through the recommended mitigation measures to ensure that there is minimal impact on the locality, community and/or the environment.

APPENDIX A: LONG-TERM NOISE MONITORING DATA

