



MARSHALL DAY
Acoustics 

THE YARDS BOMADERRY
COMMUNITY HOUSING
NOISE ASSESSMENT

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Project: THE YARDS BOMADERRY COMMUNITY HOUSING

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SUMMARY

Southern Cross Community Housing is proposing to develop a mixed-use development at 25 Moss Vale Road, Bomaderry NSW, known as “The Yards”. Marshall Day Acoustics (MDA) has been engaged by EG Funds Management on behalf of Southern Cross Community Housing to conduct operational and construction noise and vibration assessment of The Yards Bomaderry Community Housing development.

On site commercial activities

Mechanical services designs are not available at this stage and assessment would need to be undertaken once plant selection and layout are finalised. Project specific noise trigger levels are provided in this report for the future design of mechanical services noise controls (if required).

The provided drawings show a number of commercial tenancies to be provided as cold shells for future fitout, potentially including a medical/retail tenancy and a childcare facility as part of the mixed-use building. Noise from these uses is unlikely to require any additional noise controls to address noise breakout to receivers outside the development, which are more than 60 m to the north across Moss Vale Road. However, noise transfer from the commercial uses to residential units within the mixed-use building should be assessed during the design of the building, noting that the commercial / child care operations are likely to be the subject of future Development Applications. The control of such noise is likely to be achievable with commercially feasible noise control solutions.

Noise impacts on the site from existing road traffic noise

The NSW State Environment Planning Policy (Transport and Infrastructure) (SEPP) provides noise criteria which applies to new residential developments adjacent roads with an annual average daily traffic (AADT) volume of more than 20,000 vehicles.

As the traffic volumes on Moss Vale Road are significantly less than 20,000 vehicles per day no assessment of traffic noise impacts on to the development is required.

Noise impacts on existing public roads due to additional traffic generation

The additional traffic flows generated by the development on Moss Vale Road, for both operation and construction phases, are required to comply with the NSW EPA Road Noise Policy. Where additional traffic flow from a development is significantly below the existing traffic flows the net change in noise levels from the road will not change perceptibly. The additional traffic generated by the use is relatively low compared to existing traffic volumes and represents a noise level increase of less than 1.3 dB on Moss Vale Road.

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” and as such no additional mitigation is required.

Construction noise and vibration impacts to external receivers

Limited information is available at this stage regarding proposed construction phasing, equipment, vehicle movements, etc. Assessments have been conducted based on assumptions of construction phasing and equipment made by MDA.

The predicted construction noise is below the highly noise affected management level at all nearby receivers. However, as the noise affected management level is expected to be exceeded at the closest receivers all feasible and reasonable work practices to control noise should be applied. Recommended noise control practices for construction works are set out in this report. All potentially impacted receivers should be informed of the nature of works to be carried out, the expected duration, as well as contact details.

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APPENDIX C CONSTRUCTION NOISE SOURCES

1.0 INTRODUCTION

This Noise Assessment Report is submitted to the Department of Planning, Housing and Infrastructure (DPHI) on behalf of Southern Cross Community Housing (SCCH) in support of a State Significant Development Application (SSDA) (SSD-69257218) for a mixed-use development known as 'The Yards', which will comprise of a mixed-use affordable housing development at 25 Moss Vale Road, Bomaderry (the site).

The proposed development will specifically comprise the following:

- Construction of a master planned community precinct, comprising a mix of land uses across 13 key areas. Specifically, the following is proposed:
 - Non-residential floor uses, including commercial and retail, a childcare centre, and a medical centre.
 - Residential uses that will be provided across a mix of affordable and market housing in the form of a range of different housing sizes and typologies, including attached dwellings, multi dwelling housing, boarding housing and apartments.
 - Communal amenity facilities located throughout the precinct to support the residential development.
- Delivery of the internal road network and off-street carparking.
- Torrens, Community and Strata Title subdivision to support the development.
- Associated landscaping and public domain works.
- Augmentation of, and connection to, existing utilities as required.

For a detailed project description, refer to the Environmental Impact Statement prepared by Beam Planning.

Acoustic terminology used throughout this report is provided in Appendix A.

2.0 RELEVANT SEARS

This report addresses the following relevant Secretary's Environmental Assessment Requirements (SEARs) set out in Table 1.

Table 1: SEARs compliance table

SEARS Request	Location in Report
12. Noise and Vibration Provide a noise and vibration assessment prepared in accordance with the relevant NSW Environment Protection Authority (EPA) guidelines. The assessment must detail construction and operational noise and vibration impacts on nearby sensitive receivers and structures and outline the proposed management and mitigation measures that would be implemented.	Operational noise impact assessment: Section 5.0 and Section 7.0 Construction noise and vibration impact assessment: Section 6.0 and Section 8.0 Construction noise and vibration management plan: Section 9.0

3.0 THE SITE

The site is located at 25 Moss Vale Road, Bomaderry within the Shoalhaven City Local Government Area (LGA). The site comprises three allotments, which are all owned by Southern Cross Community Housing and are legally described as Lot 110 in DP 131219, Lot 1 in DP520502 and Lot 129 in DP3060. The lots have a combined area of 8.5 hectares.

Formerly, the site was used as a cattle yard, however, as of the issue of this report, it lies vacant. As detailed within the EIS prepared by Beam Planning, the site is subject to a deferred development consent (SF10851) for Torrens Title subdivision and a series of site preparation works, which was approved by Shoalhaven City Council in December 2022. Works on site have commenced in accordance with this consent and are expected to be completed in early-mid 2025.

The site is located approximately 2.2km northwest of Bomaderry Station and 350m west of the A1 Princes Highway. Approximately 5.2km south of the site is the suburb of Nowra, a major commercial centre servicing the south coast suburbs of NSW. A summary of the surrounding development is provided below:

North: The site is bound by Moss Vale Road to the north. Directly across the site is a large area of R5 Large Lot Residential zoned properties. Further north of the site is farmland, which is earmarked for future residential development as part of the Moss Vale Road North Urban Release Area.

East: Immediately east of the site is bushland and Moss Vale Road. To the northeast of Moss Vale Road is detached residential dwellings, a kindergarten and highway retail uses along the Princes Highway. The Bomaderry Town Centre is located approximately 550m southeast of the site and comprises major services and facilities, including a supermarket, high school, aquatic centre, sporting oval and fast-food retailers. This area also contains slightly denser residential uses within low and medium residential zoned land.

South: Immediately south of the site is the Bomaderry Creek nature reserve and Bomaderry Creek Regional Park. Further to the south is the suburb of North Nowra, which extends down to the Shoalhaven River, a perennial river running 327km in a north easterly direction from Braidwood to the Pacific Ocean east of Nowra.

West: The Bomaderry creek riparian corridor runs along the western boundary of the property. Further west of this is the Waymount Farm, a rural property including tourist and visitor accommodation surrounded by Bomaderry Creek. Beyond this is the Moss Vale Road South Urban Release Area, which is a new subdivision currently being developed.

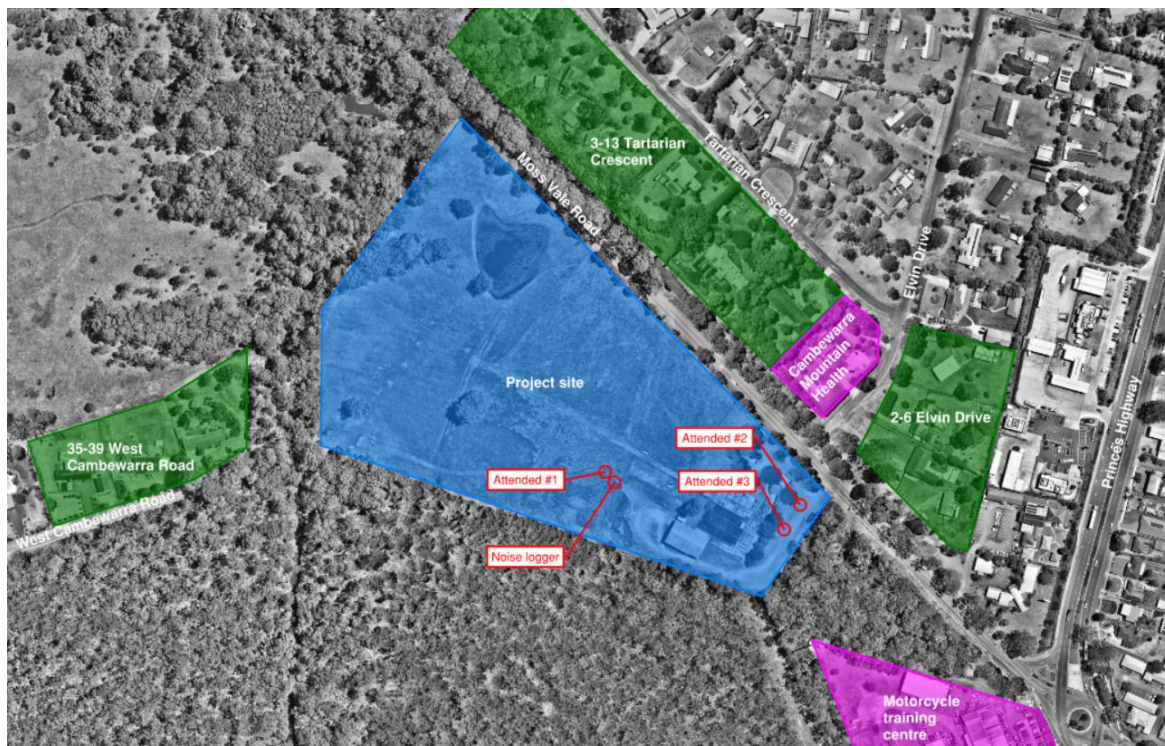
A site aerial is provided in Figure 1.

Figure 1: Site aerial (source: Beam Planning)



The nearest noise-sensitive receivers are 3-13 Tartarian Crescent, Cambewarra Mountain Health, and 2-6 Elvin Drive to the northeast of the site across Moss Vale Road, approximately 40 m from the nearest site boundary, and 35-39 West Cambewarra Road to the west of the site across Bomaderry Creek, approximately 40 m from the nearest site boundary. There is also an existing motorcycle training centre to the southeast of the site. The noise-sensitive receivers are shown in Figure 2.

Figure 2: Receiver and measurement locations (source: Nearmap)



4.0 EXISTING NOISE ENVIRONMENT

4.1 Unattended measurements

Unattended noise measurements were conducted in accordance with the NSW EPA's Noise Policy for Industry 2017 (NPfI) to measure the background noise levels representative for the area. A noise monitor was installed on site from Monday 13 May 2024 to Sunday 26 May 2024. The measurement locations are shown on Figure 2, and the results are shown in Table 2. The rating background noise levels (RBL) derived according to NPfI are presented along with the average $L_{Aeq, 15 \text{ min}}$ levels.

Table 2: Rating background noise levels (RBL)

Period	Time	RBL $L_{A90, 15 \text{ min}}$ dB	Average $L_{Aeq, 15 \text{ min}}$ dB
Day	0700 ¹ -1800hrs	40	51
Evening	1800-2200hrs	38	50
Night	2200-0700 ¹ hrs	33	46

¹0800 Sundays and Public Holidays

4.2 Attended measurements

Attended measurements were also conducted on Monday 13 May 2024 at various locations on site. The measurement locations are also shown on Figure 2, and results are given in Table 3. At all three measurement locations ambient noise was dominated by traffic noise on Moss Vale Road. No noise from the motorcycle training centre was audible during either of our visits to site.

Table 3: Attended measurement of existing noise levels

#	Location	L_{Aeq}	L_{A90}	Start time and length	Notes
1	Next to noise logger, approximately 120 m from Moss Vale Rd	48.6	43.2	12:00 15 min	Noise environment dominated by traffic on Moss Vale Rd. Birds, frogs, insects audible.
2	Approximately 30 m from Moss Vale Rd	58.1	43.1	12:29 15 min	Noise environment dominated by traffic on Moss Vale Rd. Activity from nearby shed audible. 97 vehicles passed by on Moss Vale Rd during 15-minute period, including 3 small trucks.
3	Approximately 60 m from Moss Vale Rd	52.5	42.1	12:52 10 min	Noise environment dominated by traffic on Moss Vale Rd. Birds and activity from nearby shed audible. 57 vehicles passed by on Moss Vale Rd during 10-minute period, including 4 small trucks.

5.0 CRITERIA – OPERATIONAL NOISE

5.1 On site commercial activity

In NSW, the EPA *Noise Policy for Industry* (NPfI) is the guideline for assessing noise emissions from industrial facilities regulated under an EPA licence. It is often used for the assessment of non-licensed commercial developments in the absence of council policy or criteria. In the absence of a specific noise policy from Shoalhaven City Council we have used the NPfI to set noise criteria for any future commercial activities that may be incorporated as part of the development. This might include noise from mechanical services on commercial premises or other associated noise generation.

The NPfI sets out a procedure such that 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 the site context.

Compliance with the NPfI requires that total noise from the site not exceed the following limits in Table 4 at the nearby boundaries 1.5 m from ground level. Details on the derivation of the noise limits following NPfI are given in Appendix B.

Table 4: Project Noise trigger level

Receiver	Period	Project trigger level $L_{Aeq, 15min}$, dB
Residential	Day	45
	Evening	43
	Night	38
Commercial	When in use	63

5.2 Noise from increased traffic on surrounding roads

As the development includes some additional traffic to existing roads, relevant acoustic impacts are assessed against the NSW *Road Noise Policy* (RNP). Relevant roads and applicable criteria recommended by the RNP are listed in Table 5.

Noise levels under the RNP are assessed at ground level and criteria are assumed to include façade reflection of 2.5dB.

Table 5: Applicable road traffic noise criteria

Project Road Name	Road Category	Type of Development	Assessment criteria dB	
			Day (0700-2200hrs)	Night (2200-0700hrs)
Moss Vale Road	Arterial road	Existing residences affected by additional traffic on existing freeway/arterial/ sub-arterial roads generated by land use developments	$L_{Aeq(15\text{ hr})}$ 60 (external)	$L_{Aeq(9\text{ hr})}$ 55 (external)
		Relative increase criteria	Existing traffic $L_{Aeq(15\text{ hr})}$ + 12 dB (external)	Existing traffic $L_{Aeq(9\text{ hr})}$ + 12 dB (external)

Importantly, Section 3.4 of 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” and 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 should be limited to 2 dB above that of the corresponding ‘no build option’’. As such, where increases of less than 2dB are predicted for with the proposed development no additional mitigation would typically be applied.

5.3 Road traffic impacts on the development from existing roads

The NSW *State Environment Planning Policy (Transport and Infrastructure)* (SEPP) provides noise criteria which applies to new residential developments adjacent roads with an annual average daily traffic (AADT) volume of more than 20,000 vehicles.

Appendix C of *240264.01DB - Traffic and Parking Impact Assessment – August* (the traffic report) prepared by McLaren Traffic Engineering & Road Safety Consultants shows that the highest one-hour peak traffic volume on Moss Vale Road west of Elvin Drive is 549. We do not have daily totals for the road, but using a rule of thumb approximation of daily total being approximately ten times the peak 1-hour levels, a daily volume in the order of 5,500 vehicles per day is assumed. On this basis the total traffic volumes on Moss Vale Road are significantly less than 20,000 vehicles per day required to trigger an assessment under the SEPP. Therefore no assessment of traffic noise impacts on to the development is required.

6.0 CRITERIA - CONSTRUCTION NOISE

In the absence of a published noise policy from the Shoalhaven City Council, construction noise impacts have been assessed in general accordance with the EPA *Interim Construction Noise Guideline* (ICNG).

6.1.1 Residential receivers

The ICNG sets out the noise criteria and management plans for construction activities. Table 2 in section 4.1.1 provides the quantitative noise criteria for nearby residential receivers and is reproduced below.

Table 6: Noise at residence using quantitative assessment (reproduction of Table 2 in Interim Construction Noise Guideline)

Time of day	Management level $L_{Aeq(15\text{ min})}$ *	How to apply
Recommended standard hours:	Noise affected RBL + 10 dB	The noise affected level represents the point above which there may be some community reaction to noise.
Monday to Friday 7 am to 6 pm		Where the predicted or measured $L_{Aeq(15\text{ min})}$ is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level.
Saturday 8 am to 1 pm		
No work on Sundays or public holidays		The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details

Time of day	Management level $L_{Aeq(15\text{ min})}$ *	How to apply
	Highly noise affected 75 dB(A)	<p>The highly noise affected level represents the point above which there may be strong community reaction to noise.</p> <p>Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities can occur, taking into account:</p> <ol style="list-style-type: none"> 1. times identified by the community when they are less sensitive to noise (such as before and after school for works near schools, or mid-morning or mid-afternoon for works near residences) 2. if the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.
Outside recommended standard hours	Noise affected RBL + 5 dB	<p>A strong justification would typically be required for works outside the recommended standard hours.</p> <p>The proponent should apply all feasible and reasonable work practices to meet the noise affected level.</p> <p>Where all feasible and reasonable practices have been applied and noise is more than 5 dB(A) above the noise affected level, the proponent should negotiate with the community.</p> <p>For guidance on negotiating agreements see section 7.2.2 of ICNG.</p>

* Noise levels apply at the property boundary that is most exposed to construction noise, and at a height of 1.5 m above ground level. If the property boundary is more than 30 m from the residence, the location for measuring or predicting noise levels is at the most noise-affected point within 30 m of the residence. Noise levels may be higher at upper floors of the noise affected residence.

6.1.2 Commercial receivers

Section 4.1.3 of the ICNG provides the criteria for commercial and industrial premises. The nearest and most affected commercial premises near the site is the Cambewarra Mountain Health service which provides GP and related services, on the northern side of Moss Vale Road. The ICNG does not provide a specific target for such facilities but does provide an internal target of 45 dB $L_{Aeq(15\text{ min})}$ for 'Hospital Wards and Operating Theatres' which we have adopted. In order to determine an equivalent external noise affected level (for comparison to construction noise predictions) we have assumed an outside to inside sound loss of approximately 20 dB, representing an air-conditioned facility of modern construction. The applicable external trigger level is therefore 65 dB $L_{Aeq(15\text{ min})}$.

6.1.3 Applicable criteria

Based on the above, construction noise criteria have been derived based on the measured site-specific RBL presented in Table 2, and the applicable criteria for the relevant receiver types are provided in Table 7. The construction activities are assumed to only take place during recommended hours. If there is need for the construction activities to take place outside recommended hours, additional justification and assessment would be required. Noise levels apply at the property boundary that is most exposed to construction noise, and at a height of 1.5 m above ground level.

Table 7: Construction noise management levels

Receiver type	Management Level, dB LAeq 15 min	
	Noise Affected	Highly Noise Affected
Residential	50	75
Cambewarra Mountain Health	65	-

6.2 Construction vibration criteria

The ICNG refers assessment of construction vibration to the EPA document *Assessing Vibration: A Technical Guideline (AVTG)*.

Whilst the AVTG provides guidelines for the assessment of vibration impacts on people, no direct instruction or guidance is provided for the assessment of impacts on structures. For assessment of vibration effects on structures the German standard DIN4150-3 *Structural vibration – Effects of vibration on structures - 1999* is generally accepted in industry and is used for the purposes of this assessment.

6.2.1 Vibration limits – Effects on people

The ICNG refers the assessment of human comfort vibration to *Section 2.5 Short Term Works* of the AVTG with regard to human perceived impact from construction activities. Based on the characteristics of noise and vibration generated by construction activities and transmission methods, usually noise is the sole determining factor for human comfort and compliance, therefore the vibration impact on human comfort has not been assessed. Whilst Vibration Dose Value (VDV) predictive assessment is not generally considered for Short Term construction works the AVTG suggests feasible and reasonable mitigation measures may need to be applied in response to community response.

6.2.2 Vibration limits – Effects on structures

DIN 4150-3 provides guidelines to use when evaluating the effects of short-term vibration on structures. The guideline vibration limits, as reproduced from the standard, are detailed in Table 8.

Table 8: Vibration limits according to DIN 4150: Peak Particle Velocity (PPV) mm/s

Line	Type of structure	Vibration at the foundation of building, at a frequency of			Vibration in horizontal plane of highest floor, at all frequencies
		1Hz to 10Hz	10Hz to 50Hz	50Hz to 100Hz and above	
I	Buildings used for commercial purposes, industrial buildings, and buildings of similar design	20	20 to 40	40 to 50	40
II	Dwellings and buildings of similar design and/or occupancy	5	5 to 15	15 to 20	15

Line	Type of structure	Vibration at the foundation of building, at a frequency of			Vibration in horizontal plane of highest floor, at all frequencies
		1Hz to 10Hz	10Hz to 50Hz	50Hz to 100Hz and above	
III	Structures that, because of their particular sensitivity to vibration, cannot be classified under lines I and II and are of great intrinsic value (e.g. listed buildings under preservation order)	3	3 to 8	8 to 10	8

Experience has shown that if the guideline values of Table 8 are complied with, damage which reduces the serviceability of the building will not occur. The criterion of 5 mm/s PPV for dwellings is considered appropriate for this assessment.

7.0 OPERATIONAL NOISE ASSESSMENT

At this stage, limited information is available for the assessment of operational noise impact from the site, for example the commercial tenant and associated mechanical services have not been selected. Therefore, this section provides conceptual discussions relating to the operational noise impact.

7.1 Mechanical services noise

The noise from mechanical services on-site will need to comply with the project specific noise trigger levels shown in Table 4. Mechanical services designs are not available at this stage and assessment would need to be undertaken once plant selection and layout are finalised. Based on the location of the site and distance to the nearest receivers, compliance is likely to be achievable with commercially feasible noise control solutions.

7.2 Noise from commercial tenancies

The provided drawings show a number of commercial tenancies including a medical/retail tenancy and a childcare facility as part of the mixed-use building. Noise from these uses is unlikely to require any additional noise controls to address noise breakout to receivers outside the development, which are more than 60 m away across Moss Vale Road. However, noise transfer from the commercial uses to residential units within the mixed-use building should be assessed during the design of the building, noting that the commercial / child care operations are likely to be the subject of future Development Applications. The control of such noise is likely to be achievable with commercially feasible noise control solutions.

7.3 Additional road traffic on external roads

The additional traffic flows generated by the development on Moss Vale Road are required to comply with the criteria detailed in Section 5.2. Where additional traffic flow from a development is significantly below the existing traffic flows the net change in noise levels from the road will not change perceptibly.

Appendix D of *240264.01DB - Traffic and Parking Impact Assessment – August* (the traffic report) prepared by McLaren Traffic Engineering & Road Safety Consultants shows the additional traffic generated by the development in comparison with the existing traffic volumes. During the AM peak the traffic volumes on Moss Vale Road east of the site will increase from 646 vph existing to 865 vph with the development traffic. This represents a noise level increase of 1.3 dB. During the PM peak the traffic volumes on Moss Vale Road east of the site will increase from 660 vph existing to 872 vph with the development traffic. This represents a noise level increase of 1.2 dB.

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” and as such no additional mitigation is required.

8.0 CONSTRUCTION NOISE AND VIBRATION ASSESSMENT

8.1 Construction noise predictions

We have not been provided with a schedule of construction equipment proposed to be used for the project. As such we have made assumptions about the typical loudest plant items to be used, which should be reviewed by the client. An assessment of construction noise and vibration has been conducted considering the construction equipment detailed in Appendix C.

Predicted noise levels presented in Table 9 and Table 10 have been calculated in accordance with the method detailed in Australian Standard 2436:2010, which aligns with British Standard 5228-1:2009. We have calculated impacts based on a ‘typical scenario’, with multiple plant items operating towards the centre of the site, representative of the expected long term average noise levels during construction.

Sound power levels assumed for equipment are listed in Appendix C, assumed operating at the given percentage of time, and with soft ground between the site and receivers.

Table 9: Predicted construction noise levels at nearby receivers – Stage 1 – Earthworks and paving

Receiver	Type	Predicted construction noise level, dB L _{Aeq} 15 min	Noise affected management level	Exceedance	Highly noise affected management level	Exceedance
7 Tartarian Crescent	Residential	66	50	16	75	-
39 West Cambewarra Road	Residential	61	50	11	75	-
Cambewarra Mountain Health	Commercial	61	65	-	-	NA

Table 10: Predicted construction noise levels at nearby receivers – Stage 2 – Building construction

Receiver	Type	Predicted construction noise level, dB L _{Aeq} 15 min	Noise affected management level	Exceedance	Highly noise affected management level	Exceedance
7 Tartarian Crescent	Residential	58	50	8	75	-
39 West Cambewarra Road	Residential	54	50	4	75	-
Cambewarra Mountain Health	Commercial	54	65	-	-	NA

For the ‘typical scenario’ none of the receivers are above the highly noise affected management level. Predicted noise levels at the Cambewarra Mountain Health receiver are below the noise affected management level.

However, as the predicted noise levels at some residential receivers are above the Noise Affected Management Level, all feasible and reasonable work practices should be applied in accordance with the ICNG. Recommended construction noise management measures are listed in Section 9.0.

8.2 Individual equipment setback distances

While Section 8.1 assesses a typical scenario of all equipment operating at a typical distance, there may be occasions where individual equipment is closer to a receiver and which may result in a higher noise level at the receiver. The predicted noise levels of the noisiest equipment at various setback distances are given in Table 11, starting at 45 m, representing an item of plant within 10 m of the site boundary, closest to the nearest residential receiver to the north. A setback of 60 m and 65 m represent an item of plant within 10 m of the site boundary, closest to the nearest residential receiver to the south and to Cambewarra Mountain Health, respectively.

Table 11: Predicted noise level of noisiest single equipment at different setback distances

Equipment	Predicted Noise Level, dB L _{Aeq} 15 min		
	45 m	60 m	65 m
Tracked excavator (22 t)	67	64	63
Grader (25 t)	75	72	71
Bulldozer	75	72	71
Vibratory roller (4-6 t)	64	61	60
Asphalt Paver	64	61	60
Concrete truck & pump	64	61	60

From Table 11 no plant items are predicted to exceed the Highly Noise Affected Management Level.

8.3 Construction vibration

The following vibration intensive plant are proposed to be used during construction:

- Excavator
- Vibratory roller

The AVTG provides indicative safe working distances from the vibration intensive plant items applicable for cosmetic damage and structural damage. Safe working distances have been developed to establish a trigger point at which further detailed evaluation e.g. vibration monitoring should be implemented. It should be noted that being located within the safe working distance does not necessarily mean that vibration criteria at a subject receiver is exceeded. Indicative criterion boundaries from the above vibration intensive plant items applicable for cosmetic structural damage are provided in Table 12. The criterion boundary represents the distance from a vibration source within which the cosmetic structural criteria is likely to be exceeded.

Table 12: Recommended minimum working distances, m

Plant Items	Minimum Distance – Cosmetic Damage
Excavator ¹	2
Vibratory Roller (2-4 t) ²	6
Vibratory Roller (4-6 t) ²	12

¹Based on measured data by MDA

²Based on information published in TfNSW document *Construction Noise and Vibration Guideline* in alignment with BS 7385

As all external receivers are located more than 12 m from the site the minimum working distances set out above would not be encroached during the proposed works.

If any additional vibration intensive activity (beyond that assessed in this report) was to be undertaken, a vibration assessment of impacts would need to be carried out against the criteria set out in DIN 4150-3. The frequency dependant vibration criteria in Peak Particle Velocity (PPV) are set out in Table 13 for reference.

Table 13: DIN 4150-3 Vibration guidelines for Heritage Buildings PPV (mm/s)

Vibration at the foundation at a frequency of			Vibration at the horizontal plane of the
1 Hz to 10 Hz	10 Hz to 50 Hz	50 Hz to 100 Hz	

			highest floor at all frequencies
3	3 – 8	8 – 10	8

8.4 Construction traffic noise

The additional traffic on Moss Vale Road from construction vehicle movements, including heavy vehicles, is required to comply with the criteria detailed in Section 5.2. Construction traffic predictions are not available at the time of this assessment. Where additional traffic flow from a development is significantly below the existing traffic flows the net change in noise levels from the road will not change perceptibly. On the assumption that the existing traffic volumes on Moss Vale Road are in the order of of 5,500 vehicles per day (see Section 5.3), and the additional traffic generated by construction traffic is less than 250 vehicle movements a day the increase in traffic noise from Moss Vale Road would be less than 1 dB. As this is a less than 2 dB increase the EPA Road Noise Policy would require no additional mitigation to be applied.

9.0 CONSTRUCTION NOISE AND VIBRATION MANAGEMENT

9.1 Community consultation and negotiation

It is recommended that the following practices relating to community consultation be adopted:

- All potentially impacted residents should be informed, reasonably ahead of time, of the nature of works to be carried out, the expected noise levels from noisier activities and their duration, and the measures being taken to minimise noise from the construction.
- Effective channels of communication must be established between the contractor/developer, Local Authority and affected receivers.
- A site representative responsible for all matters relating to noise should be appointed and contact details of this representative should be readily available. A site information board should be installed in front of the construction site with the name and contact details for the site representative.

9.2 Scheduling of activities and providing respite periods

- Scheduling high noise-generating activities to be undertaken when background noise, including local road traffic, is high to provide masking to construction noise.
- All building, demolition and site work, including site deliveries are restricted to Monday to Saturday 7.00am to 5.00pm and not any time on Sunday & public holidays as per standard ICNG Work Hours.

9.3 Management work practices

- Planning deliveries and access to the site to occur quietly and efficiently. Truck drivers must be kept informed of designated entry and egress points, parking locations and acceptable delivery hours. Vehicle movements outside standard construction hours should be avoided where possible.
- Scheduling vehicle deliveries so that there are no trucks waiting in side streets and ensuring that all delivery vehicles are switched off during loading and unloading activities where close to residences.

9.4 Construction noise control measures

It is envisaged that a variety of practicable noise control measures may be employed:

- Using any available land form and temporary site structures and material stockpiles as noise barriers
- Reducing the line-of sight from noise source to receiver through erection of barriers as necessary around static, high noise items such and preferentially locating at positions on-site that use existing land form screening (if applicable) as shielding.
- Where practicable, installing broadband noise reversing alarms as an alternative to common 'beeper' alarms for on-site vehicles and vehicles that regularly visit the construction site.
- Siting of noisy plant as far away from sensitive properties as permitted by site constraints.

9.5 Complaint handling procedure

- The site representative responsible for matters relating to noise will be responsible for handling complaints and will need to be readily accessible to give complaints a fair hearing should they arise.
- All feasible and reasonable measures will need to be applied to address the source of complaint.
- A register of all complaints will need to be maintained documenting the nature of complaints and the procedures applied to resolve the complaint. All complaints should be responded to and a record kept of actions taken to address the issues. All complaints should be followed up after the implementation of any controls to identify whether the complaint has been adequately resolved.

APPENDIX A GLOSSARY OF TERMINOLOGY

Background sound	The sound that is continuously present in a room or outdoor location. Often expressed as the A-weighted sound level exceeded for 90 % of a given time period i.e. L_{A90} .
Frequency	Sound occurs over a range of frequencies, extending from the very low (e.g. thunder) to the very high (e.g. mosquito buzz). Measured in units of Hertz (Hz). Humans typically hear sounds between 20 Hz and 20 kHz. High frequency acuity naturally reduces with age most adults can hear up to 15 kHz.
Hertz (Hz)	The unit of frequency, named after Gustav Hertz (1887-1975). One hertz is one pressure cycle of sound per second. One thousand hertz – 1000 cycles per second – is a kilohertz (kHz).
Noise	A subjective term used to describe sound that is unwanted by, or distracting to, the receiver.
Octave band	The interval between one frequency and its double. Sound is divided into octave bands for analysis. The typical octave band centre frequencies are 63 Hz, 125 Hz, 250 Hz, 500 Hz, 1 kHz, 2 kHz and 4 kHz.
A-weighting	A set of frequency-dependent sound level adjustments that are used to better represent how humans hear sounds. Humans are less sensitive to low and very high frequency sounds. Sound levels using an “A” frequency weighting are expressed as dB L_A . Alternative ways of expressing A-weighted decibels are dBA or dB(A).
dB	Decibel. The unit of sound level.
L_{A90}	The A-weighted sound level exceeded for 90 % of the measurement period, measured in dB. Commonly referred to as the background noise level.
L_{Aeq}	The equivalent continuous A-weighted sound level. Commonly referred to as the average sound level and is measured in dB.
L_p	Sound pressure level. The sound level measured at distance from a source. Distinctly different from sound power level (L_w)
L_w	Sound Power Level. The calculated level of total sound power radiated by a sound source. Usually A-weighted i.e. L_{WA} .

APPENDIX B ENVIRONMENTAL NOISE GUIDELINES

In NSW, the NPfl is the guideline for assessing noise emissions from industrial facilities regulated under an EPA licence. The NPfl sets out a procedure where an industrial facility can be assessed against a series of noise levels. Project specific noise levels are derived from an analysis of the ambient noise environment and zoning information.

The measured ambient noise levels for this project are summarised in Table 14 below. In the NPfl, the background noise level is called the Rating Background Level (RBL).

Table 14: NPfl Time Periods and Measured Background Noise Levels

Period	Time of day	Rating Background Level, $L_{A90, 15min}$ dB	Equivalent Continuous Noise Level, $L_{Aeq, 15min}$ dB
Day	0700*-1800hrs	40	51
Evening	1800-2200hrs	38	50
Night	2200-0700*hrs	33	46

*0800 Sundays and Public Holidays

An NPfl assessment requires the derivation of two Project Noise Trigger Levels, one is derived from an Intrusiveness assessment and another from an Amenity assessment.

B1 Intrusive Noise Level

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 5dB. Therefore, the noise emissions from the premises are considered to be intrusive if the A-weighted source noise level ($L_{Aeq(15 min)}$) is greater than the background noise level (L_{A90}) plus 5dB.

Based upon the data for summarised in Table 14 the Intrusiveness Noise Levels have been calculated in accordance with the NPfl and are presented in Table 15 below.

Table 15: Derived Intrusiveness Noise level

Period	Rating Background Level, $L_{A90, 15min}$ dB	Intrusiveness Noise Level (RBL + 5 dB), $L_{Aeq, 15 min}$ dB
Day	40	45
Evening	38	43
Night	33	38

B2 Amenity Noise Levels

Project amenity noise trigger levels are designed to prevent industrial noise continually increasing above an acceptable level over time with expansion of infrastructure and development. The initial stage in determining the Amenity level is to correct the acceptable noise levels set for the appropriate amenity area with the baseline noise monitoring.

A review of the noise levels measured indicates that the residential noise environment is typical of a Suburban area. Modification is undertaken to account for the standardisation of the assessment time periods to recommended amenity noise levels (as detailed in Section 2.2 of the NPfl) as well as to account for other potential commercial noise sources in the area (as detailed in Section 2.4 of the NPfl). Resultant levels and the relevant modifications are presented within Table 16.

Table 16: Derived Amenity noise level

Receiver	Period	Recommended Amenity Noise Level $L_{Aeq(Period)}$, dB	Modified Amenity Noise Level $L_{Aeq, 15 min}$, dB
Residential (Suburban)	Day	55	53 (55 – 5 + 3)
	Evening	45	43 (45 – 5 + 3)
	Night	40	38 (40 – 5 + 3)
Commercial	When in use	65	63 (65 – 5 + 3)

Source: Table 2.2 NSW *Noise Policy for Industry*

B3 Project Noise Trigger Levels

The final process in determining the operational noise limits for the development 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 Amenity noise levels. The Project Noise Trigger Levels applicable to the Subject site are shown in Table 17.

Table 17: Project Noise trigger level

Receiver	Period	Project trigger level $L_{Aeq, 15min}$, dB
Residential	Day	45
	Evening	43
	Night	38
Commercial	When in use	63

B4 Maximum noise level events

Section 2.5 of the NPfI also includes screening criteria for the assessment of sleep disturbance potential for maximum noise level events L_{AFmax} , during the night-time hours of 10pm to 7am (8.00am Sundays and Public Holidays) only. The preliminary screening test is:

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

The prevailing RBL for night period is 33 dB, hence the screening criteria of $L_{Aeq(15 min)}$ 40 dB and/or L_{AFmax} 52 dB is applicable.

APPENDIX C CONSTRUCTION NOISE SOURCES

We have not been provided with a schedule of construction equipment proposed to be used for the project. As such we have made assumptions regarding the typical loudest plant items to be used, which should be reviewed by the client.

Table 18 provides a schedule of construction equipment assumed for use on this site including references for the associated noise levels used for assessment, as sourced from the following standards:

- AS 2436-2010: *Guide to noise and vibration control on construction, demolition and maintenance sites*
- BS 5228-1-2009: *Code of practice for noise and vibration control on construction and open sites – Part 1: Noise*

Table 18: Assumed construction equipment, sound power level, and percentage of operation in a simultaneous 15-minute period

Construction equipment	Sound power level (SWL) dB L_{WA}	Stage 1 – Earthworks and paving	Stage 2 – Building construction
Tracked excavator (22 t)	106	100%	
Grader (25 t)	114	100%	
Roller	101	100%	
Bulldozer	114	100%	
Vibratory roller (4-6 t)	103	100%	
Asphalt Paver	103	100%	
Concrete truck & pump	103	100%	100%
Dump Truck	102	50%	50%
Generator	93	100%	100%
Air compressor	93	100%	100%
De-watering plant (water pumps)	93	100%	100%
Electric winch & materials hoist	96		100%
Concrete saw or core drill	113		25%
Mobile crane	95		100%
Concrete vibrator	97		100%
Concrete floats	100		100%
Nail gun	101		25%
Hydraulic bar cutter	107		25%