Project No: 212142R

Noise Assessment
Proposed Retirement Village
72 Wilsons Road
Mount Hutton, NSW

Prepared for:

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September 2021

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1.0 - INTRODUCTION

This report presents the results, findings and recommendations arising from an acoustic assessment of the proposed operation of a retirement village at 72 Wilsons Road, Mount Hutton, NSW (site outlined indicatively in red on **Figure 1**).

The development, to be known as Oak Tree Wilsons Road, is to include 78 one and two bedroom units constructed over four levels.

Figure 1 – Indicative Site Location (source: Google Earth)

The assessment was requested to accompany a Development Application to Lake Macquarie City Council (LMCC).

This assessment considers the potential for noise from the retirement village to impact on surrounding land uses.

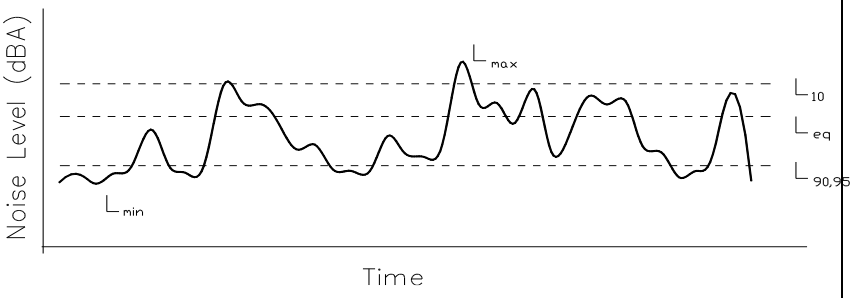
As shown on Figure 1, the retirement village site is located adjacent to the Lake Macquarie Fair shopping centre and Lake Macquarie Tavern. The potential for noise from the operation of the shopping centre (including driveways and car park) and the tavern, as well as traffic noise, to impact on the proposed village is also considered in this assessment.

2.0 - TERMS AND DEFINITIONS

Table 1 contains the definitions of commonly used acoustical terms and is presented as an aid to understanding this report.

TABLE 1
DEFINITION OF ACOUSTICAL TERMS

Term	Definition
dB(A)	The quantitative measure of sound heard by the human ear, measured by the A-Scale Weighting Network of a sound level meter expressed in decibels (dB).
SPL	Sound Pressure Level. The incremental variation of sound pressure above and below atmospheric pressure and expressed in decibels. The human ear responds to pressure fluctuations, resulting in sound being heard.
STL	Sound Transmission Loss. The ability of a partition to attenuate sound, in dB.
Lw	Sound Power Level radiated by a noise source per unit time re 1pW.
Leq	Equivalent Continuous Noise Level - taking into account the fluctuations of noise over time. The time-varying level is computed to give an equivalent dB(A) level that is equal to the energy content and time period (for noise assessments this is typically 15 minutes).
L1	Average Peak Noise Level - the level exceeded for 1% of the monitoring period.
L10	Average Maximum Noise Level - the level exceeded for 10% of the monitoring period.
L90	Average Minimum Noise Level - the level exceeded for 90% of the monitoring period and recognised as the Background Noise Level. In this instance, the L90 percentile level is representative of the noise level generated by the surrounds of the residential area.



3.0 – NOISE CRITERIA

LMCC is responsible for the approval and control of noise emissions from commercial and industrial premises within council boundaries. These approvals are generally based on procedures and criteria detailed in the *Noise Policy for Industry* (NPfI).

The NPfI describes intrusive and amenity criteria applicable to industrial sites. Councils usually refer to the criteria in the NPfI for all proposals which may emit noise to the surrounding area, or be impacted by noise from the surrounding area. These noise criteria depend on the existing background noise level at potentially affected residential receiver areas.

Ambient noise levels have been measured previously on the current project site by other consultants as part of work undertaken on behalf of the Lake Macquarie Tavern. The existing background (L90) and Leq noise levels measured between October 2 and 8, 2019 are shown in **Table 2**.

TABLE 2
MEASURED AMBIENT NOISE LEVELS dB(A)
Site Logger

Period	L90	Leq (15 min)
Day	44	53
Evening	34	48
Night	29	45

3.1 Operational Noise

In setting noise goals for a particular project, the NPfI considers both Amenity and Intrusiveness criteria. The former is set to limit continuing increase in noise from industry, whilst the latter is set to minimise the intrusive impact of a particular noise source.

Amenity criteria are dependent upon the nature of the receiver area and the existing level of industrial noise. The most potentially affected receiver area near the site would be considered “suburban” as per the definitions in the NPfI.

The project amenity criteria (as an Leq (15 min)) for an industrial development are equal to the recommended amenity noise level (from Table 2.2 in the NPfI) minus 2 dB(A) (as detailed in the notes to **Table 3**, below).

The intrusiveness criteria are based on the Rating Background Level (RBL) for the time period, plus 5 dB(A). The RBL (L90) is defined as the overall single figure background level representing each assessment period.

Table 3 specifies the project noise trigger levels (criteria) determined for the site.

TABLE 3 NOISE CRITERIA				
Location	Criterion	Day (7am-6pm)	Evening (6pm-10pm)	Night (10pm-7am)
Site	Intrusiveness dB(A),Leq(15-min.)[1]	49	39	35[2]
	Amenity dB(A),Leq(15 min)[2]	53	43	38
	Project noise trigger levels	**49 (15 min.)**	**39 (15 min)**	**35 (15 min)**

1 Rating Background Level (RBL) + 5dB. RBL is the median value of each ABL (Assessment Background Level) over the entire monitoring period. The ABL is a single figure representing the "L_{90} of the $L_{90's}$" for each separate day of the monitoring period.
2. Minimum RBL for night is 30 dB(A) L90 as per NPfl.
3. Project amenity noise level (ANL) is suburban ANL (NPI Table 2.1) minus 5 dB(A) plus 3 dB(A) to convert from a period level to a 15-minute level.

3.2 Licensed Premises

All licensed premises in NSW are governed by the Standard Noise Conditions imposed by ILGA as follows;

"The L10 noise level emitted from the licensed premises shall not exceed the background noise level in any Octave Band Centre Frequency (31.5 Hz - 8 kHz inclusive) by more than 5 dB between 7.00 a.m. and 12.00 midnight at the boundary of any affected residence.

The L10 noise level emitted from the licensed premises shall not exceed the background noise level in any Octave Band Centre Frequency (31.5 Hz - 8 kHz inclusive) between 12.00 midnight and 7.00 a.m. at the boundary of any affected residence.

Notwithstanding compliance with the above, the noise from the licensed premises shall not be audible within any habitable room in any residential premises between the hours of 12:00 midnight and 07:00 a.m."

The ILGA criteria apply to activities within the licensed premises. It is generally considered they are not to be used for the assessment of noise generated by people arriving and departing such premises.

As the hotel operates after midnight, a planning level equal to 5 dB(A) above the measured background noise level for night would be considered appropriate for the assessment of potential noise impacts at the proposed retirement village, as shown in **Table 4**. The octave band spectrum has been adapted from noise measurements made in a typical suburban acoustic environment.

TABLE 4 ILGA CRITERION NOISE LEVELS (as L10)										
		Octave Band Centre Frequency, Hz								
	dB(A)	31.5	63	125	250	500	1k	2k	4k	8k
Night	35	20	21	27	28	29	28	25	23	20

In addition to the above, after midnight, the noise from the hotel should be inaudible inside any residence. Whilst the facades of the proposed development will be closer to the hotel, there is an existing residence on the property and the consideration of potential noise impacts from the hotel presupposes that the hotel is currently operating in compliance with the standard noise conditions (see discussion in **Section 4.2**).

3.3 Road Traffic Noise

There will be residential units that face towards Wilsons Road and parts of the development, therefore, may be potentially impacted by noise emissions from traffic on that road.

New residential developments near busy roads or railway lines must meet the internal noise goals detailed in the Infrastructure SEPP (Department of Planning NSW, 2007). The SEPP (2007) is supported by the Department of Planning guideline "Development near Rail Corridors and Busy Roads – Interim Guideline" (2008) (Noise Guideline) which gives the following criteria in Section 3.5:

- In any bedroom in the building: **35 dB(A) L_{eq}** at any time 10pm – 7am, and

- Anywhere else in the building (other than a garage, kitchen, bathroom or hallway): **40dB(A) L_{eq}** at any time.

These criteria originated from the Rail Infrastructure Corporation (RIC) publication "Consideration of Rail Noise and Vibration in the Planning Process" (2003). In the RIC document it is explicit that the criteria apply with windows and doors closed.

The closest facades of any units are to be a similar distance from the road as the unattended noise logger location. The measured Leq noise levels for day and night times shown in Table 2 indicate that the façade of the closest units to the road will be required to attenuate approximately 13 dB(A) of traffic noise during the day and 8 dB(A) at night. This can be readily achieved using standard stud wall or masonry construction with standard window glazing (nominally 4mm float glass).

There will be no other specific acoustic requirements in relation to traffic noise ingress.

3.4 Generated Road Traffic Noise

Noise generated by road traffic associated with a proposed development is assessed separate to site noise using the Intermittent Traffic Noise guidelines (as generally accepted by Office of Environment and

Heritage). This is due to the non-continuous nature of traffic flow to and from the site.

The NSW Road Noise Policy (RNP) as adopted by the Roads and Maritime Services (RMS) NSW, recommends various criteria for different road developments and uses.

Traffic generated by the current proposal will travel along local roads. An extract Table 3 of the RNP relating to land use developments with the potential to create traffic on local roads is shown in **Table 5**.

TABLE 5 ROAD TRAFFIC NOISE CRITERIA		
Situation	Recommended Criteria	
	Day - (7am - 10pm)	Night (10pm – 7am)
Existing residences affected by additional traffic on existing local roads generated by land use developments	55 Leq(1hr) External	50 Leq (1 hr) External

3.5 Sleep Disturbance

As car parks at the hotel and shopping centre may be in use during the night, the potential for sleep disturbance from maximum noise level events during the night-time period needs to be considered. The discussion, again, assumes that both premises are operating in compliance with the applicable sleep disturbance criteria.

Sleep disturbance is considered to be both awakenings and disturbance to sleep stages.

The NPI states that a detailed maximum noise level event assessment should be undertaken where the subject development/premises night-time noise levels at a residential location exceed:

- Leq (15 min) 40 dB(A) or the prevailing RBL plus 5 dB, whichever is the greater, and/or
- Lmax 52 dB(A) or the prevailing RBL plus 15 dB, whichever is the greater,

Based on the assumed prevailing night time RBL of 30 dB(A) L90 and, therefore, the trigger level for a detailed assessment is **40 dB(A) Leq (15 min)** and/or **52 dB(A) Lmax**.

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.

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.

Maximum noise level event assessments should be based on the Lmax descriptor on an event basis under 'fast' time response.

The detailed assessment should consider all feasible and reasonable noise mitigation measures with a goal of achieving the above trigger levels.

4.0 - NOISE ASSESSMENT

The subject site and surrounding land uses are shown in **Figure 2**.

Figure 2 - Site layout

4.1 Hotel and Shopping Centre Driveway and Car Parks

There will be residential units with facades facing towards the hotel and shopping centre driveways and car parks. Both the hotel and shopping centre operate during each of the day, evening and night time periods.

The closest of the units will be approximately 15m from the centre of the driveway adjacent to the western site boundary.

An assessment of potential impacts from the use of the driveway can be undertaken using the EPA accepted Intermittent Traffic Noise guidelines due to the non-continuous nature of the traffic flow.

To assess a conservative scenario 15 vehicle movements in a single 15 minute period (i.e. 60 vehicles per hour) during the day, at an average distance of 15m from the boundary, was considered. The vehicles will only move slowly on the site and, for the calculations, were considered to be moving at 10 kph.

Equation 1, below, outlines the mathematical formula used in calculating the Leq,T noise level for intermittent traffic noise.

$$L_{eq},T = L_b + 10\log\left[1 + \frac{ND}{T}\left(\frac{10^{(L\max - Lb)\,/\,10} - 1}{2.3} - \frac{\left(L_{\max} - L_b\right)}{10}\right)\right]$$

Equation 1

Where

L_b is background noise level, dB(A)

L_{MAX} is vehicle noise, dB(A)

T is the time for each group of vehicles (min)

N is number of vehicle trips

D is duration of noise of each vehicle (min)

The results of the assessed scenario are shown in **Table 6**.

TABLE 6
RECEIVED NOISE (Leq (15 min))
DRIVEWAY NOISE

Element	dB(A)
No. of Vehicle movements (per 15 minute)	15
Lw per vehicle @ 10 kph	82
Distance Loss (15m)	-32
Received Noise (Leq 15 min) **per eqn. 1**	44

The results shown in Table 5 show that, under the assessed scenario, the noise from the use of the driveway will be at 44 dB(A) Leq (15 min) during the day.

Similar calculations were undertaken for a night time scenario of 5 x vehicle movements in a 15 minute period. The resultant received noise is 40 dB(A) Leq (15 min).

The noise from the driveway will be at levels that would be readily attenuated through standard facade design.

As per the discussion above in relation to traffic noise, there will, therefore, be no adverse impacts at any receivers due to noise from cars using the driveway.

4.2 Hotel Noise

In relation to noise emissions from the Lake Macquarie Tavern the hotel undertook an acoustic assessment in 2019 (RAPT consulting Rpt. No. 2219215_191025) in relation to an extension to trading hours (after midnight).

That assessment considered noise from activity inside the various parts of the hotel and also from patrons departing the premises and compared these to the relevant ILGA noise conditions.

The results of that assessment lead to conclusions that, based on a worst case scenario, with no acoustic attenuation measures in place, “all noise goals can be achieved for the development at neighbouring residences.” Notwithstanding that the proposed facade will be marginally closer to the hotel than the current receiver location, the

results of the previous assessment are considered applicable to the current development.

4.3 Mechanical Plant

It is assumed that each unit will be individually air conditioned by split systems with the condenser unit mounted on the unit's verandah.

Air conditioner condensers for this sort of application, typically, have an Lw in the range 66 to 70 dB(A). For a condenser with an average Lw of 68 dB(A) Leq, this means that compliance with the most stringent night time criterion will be achieved at a minimum, unshielded, distance of 18m.

In reality, the balcony of each unit will be separated from others by a blade wall, or fence, between verandahs, which will provide additional noise attenuation. The location of the condensers should be chosen to maximise the distance from any adjacent units and to optimise the screening effects of blade walls. With this recommendation in place, it is unlikely that there will be any adverse impacts due to noise emissions from the air conditioning condensers for each unit.

It is very important that vibrating equipment such as a/c condenser units must be mounted such that vibrations cannot transfer to the surrounding structure. This is particularly significant if the condenser is to be mounted against a wall to another unit.

In relation to air conditioner noise at other receivers, the most potentially affected receiver is at 74 Wilsons Road, to the east of the site. Receivers in other directions will be significantly further from any condensers and will also be acoustically shielded from the noise by the building elements of the retirement village.

Condenser units mounted on the balconies will be approximately 1m high. **Table 7** shows a sample calculation of the noise from a condenser on the ground floor of the development, propagated to 74 Wilsons Road at ground level (+1.5m) at a distance of 15m. The calculation assumes a minimum 1.2m high solid balustrade on the balcony which will act an acoustic barrier.

TABLE 7
RECEIVED NOISE (Leq (15 min))
CONDENSER NOISE

Item	dB(A)
Source Lw condenser	68
Distance loss to receiver (15m)	32
Barrier loss (1.2m)	6
SPL @ receiver Leq (15 min)	30
Criterion Leq (15 min) Night	35

The results in Table 7 show that, under the assessed conditions, the noise from a single condenser will be 30 dB(A) at a receiver at 15m from the unit.

There will be a number of verandahs to units that face towards the receiver at 74 Wilsons Road (as shown schematically on **Figure 3**). Those on lower floors may have line of sight to the residential boundary. Units on higher floors will be shielded from the boundary by the barrier effects of the balustrades and also the verandah floors (as well as additional distance to a reception point at ground level on the boundary).

The condensers on each verandah will be at different distances from a single point on the receiver boundary. To look at a worst case a total of six condensers on the lower floors of the building were considered to be operating at the maximum assumed capacity (i.e. 68 dB(A) Leq) for a full 15 minute period (see Figure 3). For the six units this equates to a combined Lw of 76 dB(A) Leq (15 min).

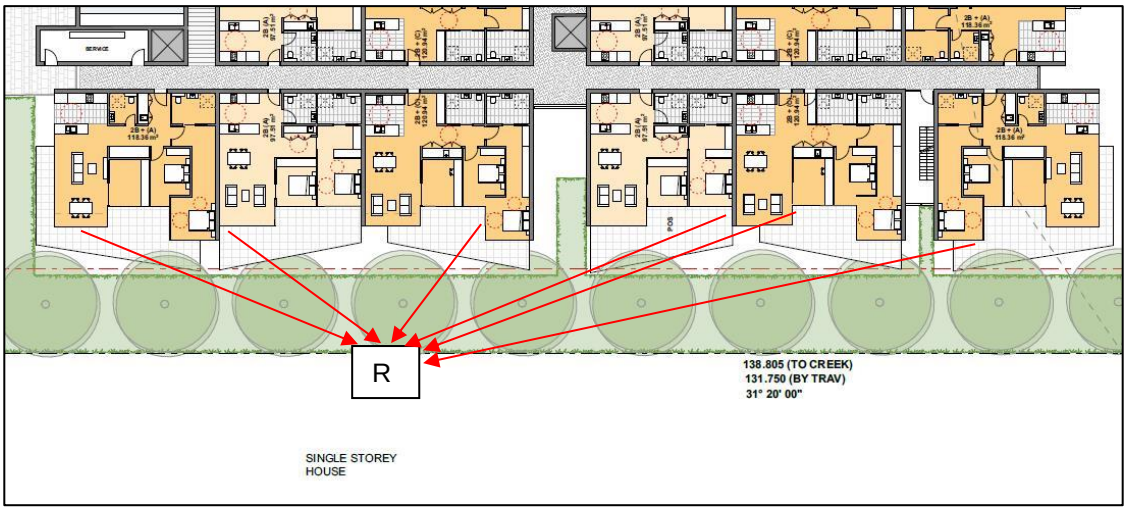


Figure 3 – A/C condenser Noise Sources

Table 8 shows a calculation of the noise from the six condensers propagated to the theoretical reception point "R" at an average distance, from the acoustic centre of the condensers, of 20m.

TABLE 8 RECEIVED NOISE (Leq (15 min)) COMBINED CONDENSER NOISE	
Item	dB(A)
Source Lw condensers (x6)	76
Distance loss to receiver (20m)	34
Barrier loss (1.2m)	6
SPL @ receiver Leq (15 min)	36
Criterion Leq (15 min) Night	35

The results in Table 8 show that, under the assessed conditions, the combined noise from the six condensers will be 36 dB(A) at a reception point on the boundary at an average distance of 20m from the units.

Under the assessed conditions, therefore, the most stringent night time noise criterion may be exceeded by 1 dB(A) Leq (15 min). The NPfI describes that where the predicted noise exceeds the project noise trigger level by ≤ 2 dB(A), the residual noise is regarded as negligible and "the exceedances would not be discernible by the average listener and therefore would not warrant receiver-based treatments or controls."

It should also be noted that the calculation in Table 8 assumes full line of sight from each of the condensers to the reception point. In reality there will be some acoustic shielding afforded by the various elements of the retirement village building, thus providing a degree of conservatism to the results.

4.4 Sleep Disturbance

Units facing towards the hotel and shopping centre may be subjected to maximum noise events due to noise from cars on the driveway or in car parks or from patrons leaving the hotel at night (between 10pm and 7am).

The maximum noise levels for a loud car, a car door being slammed or patrons yelling when leaving a hotel have a range of between 95 to 102 dB(A) Lmax (from the Spectrum Acoustics technical database).

Table 9 shows the calculation of potential sleep disturbance impacts at the closest facade of the units facing the driveway due to the loudest of the noises at a distance of 20m.

TABLE 9
RECEIVED NOISE (Lmax)
SLEEP DISTURBANCE IMPACTS

Source	Noise Level
Loud car in driveway	102
Distance loss to Receiver (20m)	34
Received noise	**68**
Screening criterion	52

The results in Table 9 show that the worst case predicted Lmax noise may exceed the screening criterion for the site. In such circumstances a more detailed assessment should be undertaken as detailed in **Section 3.5**.

The Lmax events are unlikely to occur often and are unlikely to occur every night.

Guidance on assessing the potential for noise impacts from vehicles can be gained from Appendix B of the (now superseded) publication *"Environmental Criteria for Road Traffic Noise"* (ECRTN). This document outlines the results of research into the possible causes and effects of sleep disturbance as a result of traffic noise and concludes that;

- *"Maximum internal noise levels (i.e. inside a residence) below 50 – 55 dB(A) are unlikely to cause awakening reactions, and*

- *One or two noise events per night, with maximum internal noise levels of 65 – 70 dB(A) are not likely to affect health and wellbeing significantly."*

The RTA's *"Environmental Noise Management Manual"* indicates that the facade of a typical dwelling, with the windows open, will attenuate approximately 10 dB(A) of traffic noise. A light framed house, with the windows closed, will attenuate up to 20 dB(A).

Based on the discussion above, an external noise level of 68 dB(A) (at a bedroom window) corresponds to 58 dB(A) internal with windows open and 48 dB(A) internal with windows closed.

It is, therefore, considered unlikely that an external noise level of up to 68 dB(A) Lmax will not create any adverse sleep disturbance reactions as a result of the loudest noise from cars using the driveway.

4.5 Generated Traffic Noise

Due to the non-continuous nature of traffic flow to and from the site the OEH accepted Intermittent Traffic Noise guidelines, as detailed in Equation 1 (Section 4.1).

Typical vehicle noise levels were sourced from Spectrum Acoustics library of technical data, while background noise levels are those taken from the unattended logger data. The Lmax vehicle noise levels used in equation 1 are the maximum predicted noise levels produced at the facade of a residence by vehicles entering and departing the site.

Traffic coming to, or leaving, the site and travelling on nearby roads is assessed separate to site noise and is subject to the road traffic criteria described earlier in this report.

Typically, vehicles will come and go from a car park at a retirement village at varying rates, with no particularly peak times. The approach in this assessment has been to determine the maximum number of vehicle movements that could be generated by the development to maintain compliance with the relevant criterion.

Impacts have been calculated to a theoretical receiver located 10 m from the centre of traffic flow on local roads, with results shown in **Table 10**. An average sound power level of 96 dB(A) has been used in the calculations to represent a mix of vehicles travelling at various speeds.

TABLE 10 TRAFFIC NOISE – NEARBY ROADS	
Typical Maximum Sound Power, dB(A)	96
Distance Loss to Receiver, (10 m)	28
Received Noise dB(A)	70
Traffic Volume, (cars/hr)	650
Time each vehicle audible at 60 kph (mins)	<0.1
Background Noise Level dB(A)	30
Calculated Traffic Noise, dB(A)(Leq 9 hr)	55
Criteria (Night) dB(A) (Leq 9 hr)	55

The results in Table 10 show that, under the assessed conditions, there may be up to 650 vehicle movements generated (in one direction) by the development at night before the criterion is exceeded. Similar calculation show that there may be more than 3000 vehicle movements during the day before the criterion is exceeded.

Neither of these scenarios will occur and, therefore, there will be no adverse traffic noise impacts as result of the development.

5.0 – CONCLUSION

An acoustic assessment has been undertaken for a proposed retirement village at 72 Wilsons Road, Mount Hutton, NSW. The assessment has been prepared to accompany a development application to Lake Macquarie City Council.

Potential noise impacts on and from the proposal have been assessed against the relevant State guidelines and policies. The assessment has shown that there will be no adverse impacts on or from the proposal, subject to recommendations given in this report, and that it could operate in compliance with noise limits as may be set by Council should the proposal be approved.

A.0 – ADDENDUM

This addendum is written to address points raised by LMCC in response to the original acoustic assessment presented in the main body of this report

The specific request for further information from LMCC is shown below:

Acoustic report – "*The Acoustic Report prepared by Spectrum Acoustics assumes the tavern to be operating in compliance with the standard noise condition which raises concerns on the predicted noise levels. A noise monitoring (programme) should be undertaken to establish the existing acoustic environment. Further, the impact of noise from the plant/equipment associated with the proposed commercial spaces has not been considered in the assessment. Please provide a revised acoustic report addressing these matters. Any noise mitigation measures resulting from this assessment should be included in the proposal."*

Tavern Noise

The LMCC request doesn't suggest any noise assessment criteria, nor does it give any quantification of the stated "concerns on the predicted noise levels". That is, there is an implication that the Tavern may not be operating in compliance with the standard noise conditions, but no indication of what level of exceedance may be considered acceptable.

To quantify the existing acoustic environment, a noise monitoring programme was undertaken at various locations in the vicinity of the Lake Macquarie Tavern on Friday 14 January, 2022.

At the time of the monitoring weather conditions were mild and clear with light breeze. Noise emission levels were measured with a Brüel & Kjær Type 2260 Precision Sound Analyser. This instrument has Type 1 characteristics as defined in AS1259-1982 "Sound Level Meters". Calibration of the instrument was confirmed with a Brüel & Kjær Type 4231 Sound Level Calibrator Prior to and at the completion of measurements. Bruel & Kjaer "*Evaluator*" analysis software was used to quantify the contributions of the entertainment noise from the hotel and other significant noise sources to the overall.

All noise emissions from the Tavern were measured (and observations made) at a number of occasions at locations at the boundary of the property at 72 Wilsons Road. It was not possible to make any noise measurements inside the venue.

The noise measurements were made over a period between 8.30pm and 11.30pm at a time when there was a performer with amplified

accompaniment playing at the Tavern. The entertainment was set up next to the front door of the Tavern.

The most representative noise measurement locations and their relationship to the proposed development are shown in **Figure A1**.

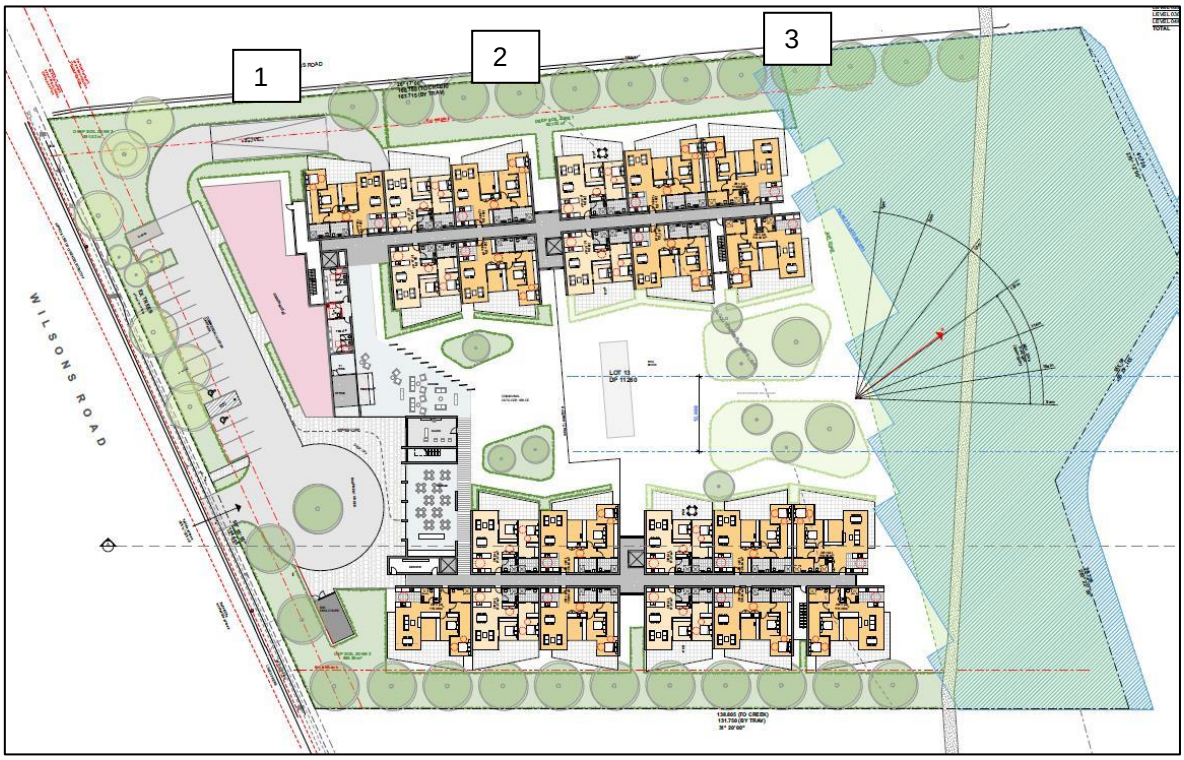


Figure A1 – Noise Monitoring Locations

Measurement location 1 is on the site boundary at a point that is in line with the front of the hotel. At this location the noise from the Tavern was from entertainment and from patrons leaving the premises.

Measurement location 2 is on the site boundary in line with the rear of the Tavern. At this location the noise from the Tavern was mainly from patrons in the premises (outdoor gaming area?) with some contribution from entertainment.

Measurement location 3 is on the site boundary in line with the rear of the proposed development. At this location the noise from the Tavern was mainly from entertainment.

The noise from entertainment was audible at each of the measurement locations.

It was not the objective of the current noise monitoring to assess whether the entertainment noise coming from the Tavern was in compliance with the standard noise conditions at all receivers. It was noted, however,

that the entertainment noise was clearly audible at the boundary of nearby residences and, in the author's experience, the noise was most likely exceeding the Taverns noise conditions.

Table A1 presents a summary of the results of the worst case Lmax levels from the entertainment noise at each of the noise measurement locations. The Lmax noise from other sources are described in the text.

TABLE A1 –
Entertainment Noise - Lmax

Measurement No.	Total	Octave Band Centre Frequency, Hz								
	dB(A)	32	63	125	250	500	1k	2k	4k	8k
Location 1	55	17	**40**	**44**	50	52	47	43	37	28
Location 2	48	16	**38**	**41**	37	42	42	36	30	17
Location 3	47	15	**39**	**38**	37	35	40	36	33	23

There are no specific noise criteria designed to assess the potential impacts from noise of this nature. The NPfI and ILGA criteria don't contain any relevant specific internal noise criteria for residential developments.

As a guide, the noise levels have been considered against an L1 (1 min) (or Lmax) sleep disturbance criterion. This would normally be applicable to night time noise emissions (e.g., entertainment noise or from patrons leaving the Tavern after 10pm).

The council request doesn't mention specific times of the day or noise sources but as the intent of the Lmax criterion is to minimise the potential for loud noises to wake people from sleep, it is considered that, acoustically, this is, typically, the most sensitive time.

The sleep disturbance screening criterion is detailed in **Section 4.4** in the main body of this report at 52 dB(A) Lmax. Further notes relating to the sleep disturbance criterion are reproduced partially below;

- *"Maximum internal noise levels (i.e. inside a residence) below 50 – 55 dB(A) are unlikely to cause awakening reactions, and*

- *One or two noise events per night, with maximum internal noise levels of 65 – 70 dB(A) are not likely to affect health and wellbeing significantly."*

At Location 1 the worst case Lmax noise was from patrons leaving the tavern. This was measured at 66 dB(A) Lmax from the raised speech of patrons standing at the front of the hotel, in the bottle shop drive through, whilst waiting for transport. The noise from music also ranged

up to 55 dB(A) Lmax, when the Tavern doors were open. Noise from cars passing on Wilsons Road generally ranged to up to 60 dB(A)Lmax.

At Location 2 the Lmax noise from the Tavern ranged up to 48 dB(A). This was from music noise, which had occasional peaks lasting for several seconds. It is assumed that this most likely corresponded to times when the doors from the main body of the hotel to the outdoor gaming area were open. At other times the Lmax noise was in the low 40's dB(A) and was from either music noise or from the raised speech of patrons (in the gaming area). The Lmax noise from passing vehicles on Wilsons Road was up to 53 dB(A) and regularly between 45 and 50 dB(A).

At Location 3 the Lmax noise from the Tavern ranged up to 47 dB(A). This was from music noise, which had occasional peaks lasting for several seconds, most likely corresponding to times when the doors from the main body of the hotel to the outdoor gaming area were open. At this location the raised speech of patrons was audible but generally at around 40 dB(A) Lmax or lower. The Lmax noise from passing vehicles on Wilsons Road was up to 50 dB(A).

The results of the noise monitoring show that, on the night of the measurements, the Lmax noise from the Tavern was at levels that were generally lower than the sleep disturbance screening criterion.

The loudest of the noise from the raised speech of patrons leaving the Tavern was 66 dB(A) at Location 1. As detailed in the main body of this report the facade of the proposed residences, with windows open, will attenuate approximately 10 dB of broad band noise. The patron noise would, therefore, equate to an internal level of approximately 56 dB(A) Lmax which is unlikely to cause sleep disturbance.

At Locations 2 and 3 the noise from patrons leaving the hotel was significantly attenuated by the acoustic screening effects of the structure of the building. Internal noise level at these locations would be lower than the screening criterion and would be unlikely to cause sleep disturbance.

The Lmax noise from entertainment and patrons inside the Tavern is marginally higher than the screening criterion at Location 1 and below that criterion at Locations 2 and 3 (noting that the noise emissions from the Tavern may not be in compliance with the standard noise conditions imposed by ILGA).

Entertainment noise, typically, contains a significant low frequency (bass) component at its source and this bass noise is more acoustically pervasive than mid to high frequency noise.

The results presented in Table A1 highlight the low frequency component of the measured Lmax noise in bold. This was readily audible during the monitoring.

Low frequency noise from entertainment is often a source of annoyance for some people.

Upgrading the windows of the bedroom to include thicker glazing and more acoustically solid frames would result in lower internal noise levels when compared to the sound transmission properties of standard glazing.

The following tables contain sample calculations of the maximum internal noise level with various glazing types fitted (as shown in the tables). The calculations are based on an Lmax of 66 dB(A) adjusted from the spectrum from the measurement shown for Location1 in Table A1. The sound transmission loss (STL) data for windows is typically only published for the octave bands in the frequency range from 125Hz to 4kHz. The STL for other octave bands has been extrapolated from this.

Table A2 shows that calculation of maximum internal noise levels for windows fitted with 6.38mm laminated glass (based on published STL data). The windows are considered to be closed.

TABLE A2
INTERNAL NOISE as dB(A) Lmax
6.38mm laminated glass

	TOTAL	Octave Band Centre Frequency, Hz							
Propagation Elements	dB(A)	63	125	250	500	1k	2k	4k	8k
External Noise	66	51	55	61	63	58	54	48	39
STL 6.38mm laminated glass		19	22	26	30	35	34	38	40
Internal Noise	39	32	33	35	33	23	20	10	<0

Table A3 shows that calculation of maximum internal noise levels for windows fitted with 6.5mm “Hush” glass (based on published STL data from Viridian). The windows are considered to be closed.

TABLE A3
INTERNAL NOISE as dB(A) Lmax
6.5mm Hush Glass

	TOTAL	Octave Band Centre Frequency, Hz							
Propagation Elements	dB(A)	63	125	250	500	1k	2k	4k	8k
External Noise	66	51	55	61	63	58	54	48	39
STL 6.5mm Hush Glass		20	23	28	32	37	39	38	40
Internal Noise	38	31	32	33	31	21	15	10	<0

Table A4 shows that calculation of maximum internal noise levels for windows fitted with 8.5mm “Hush” glass (based on published STL data from Viridian). The windows are considered to be closed.

TABLE A4 INTERNAL NOISE as dB(A) Lmax 8.5mm Hush Glass									
	TOTAL	Octave Band Centre Frequency, Hz							
Propagation Elements	dB(A)	63	125	250	500	1k	2k	4k	8k
External Noise	66	51	55	61	63	58	54	48	39
STL 8.5mm Hush Glass		22	25	30	33	39	40	44	46
Internal Noise	36	29	30	31	30	19	14	4	<0

The results in the tables above show that there is a general decrease in the internal noise levels within the bedrooms with an increase in the thickness and acoustic integrity of the glazing. Maximum internal noise levels of 36 to 39 dB(A) are considered unlikely to cause sleep disturbance.

It must be noted that the glazing thickness is indicative only, and other options may be considered provided the minimum RW and STL of any proposed windows is confirmed by the glazing supplier prior to installation.

Published sound insulation performance in terms of Rw ratings relate to partitions tested in ideal laboratory conditions or opinions based on such measurements and suppliers must be able to ensure compliance with the detailed Rw ratings when windows are installed.

Windows should be in solid frames neatly fitted to the parent wall with any gaps sealed to full thickness with a flexible sealant prior to fitting of architraves.

Attention to detail during the construction is very important in achieving an adequate acoustic integrity for any window system.

The discussion above would be applicable only to those bedroom windows with line of sight to the Tavern.

Plant Noise

The proponent has indicated that the commercial tenancies are most likely to be occupied by a doctor's surgery or some kind of allied health professional.

There may be a café in the tenancy adjacent to the residential building entry, but it will be stipulated on the lease that this to be a non-cooking space. There will, therefore, be no need for kitchen exhausts etc.

The only mechanical plant associated with the commercial spaces may be air conditioning condensers which would be mounted at ground level. These would only operate during the day time.

There is ample space at the northern or western side of the spaces, or internally in the building, to accommodate the condenser sin locations that will not create any noise impacts.

It is recommended that the type and location of any air conditioning plant be approved by an acoustic consultant prior to operation.