Lismore Hospital Stage 3C

SEAR 9 Noise Impact Assessment

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1 INTRODUCTION

This report details the noise impact assessment for the proposed Lismore Base Hospital Stage 3C redevelopment project and the potential for noise and vibration impact to surrounding receivers. This report has been prepared to address SSDA 8963 Secretary's Environmental Assessment Requirement 9 which states the following:

> ***9. Noise and Vibration***
>
> *Identify and provide a quantitative assessment of the main noise and vibration generating sources during construction and operation and outline measures to minimise and mitigate the potential noise impacts on surrounding occupiers of land.*
>
> *Relevant Policies and Guidelines:*
>
> *Noise Policy for Industry 2017 (EPA)*
>
> *Interim Construction Noise Guideline (DECC) Assessing Vibration: A Technical Guideline 2006*
>
> *Development Near Rail Corridors and Busy Roads – Interim Guideline (Department of Planning 2008)*

2 SITE DESCRIPTION

Lismore Base Hospital Stage 3C comprises the construction of an additional four floors to the approved North Tower (Levels 7 to 10), which will be fully integrated into the existing floors (Levels 3 to 6) of North Tower, to be constructed as part of Stage 3b of the LBH Redevelopment Project. Internal refurbishments to the existing buildings will also occur.

Stage 3C will include:

- new inpatient wards, including one medical and one surgical ward
- a new intensive care unit and high dependency unit
- additional plant facilities
- education, training, research and hospital administration facilities

The redevelopment will deliver an increase in health services, and enable new models of care to meet the changing needs of the local community.

3 NOISE DESCRIPTORS

Environmental noise constantly varies. Accordingly, it is not possible to accurately determine prevailing environmental noise conditions by measuring a single, instantaneous noise level.

To accurately determine the environmental noise a 15-20 minute measurement interval is utilised. Over this period, noise levels are monitored on a continuous basis and statistical and integrating techniques are used to determine noise description parameters.

In analysing environmental noise, three-principle measurement parameters are used, namely L_{10}, L_{90} and L_{eq}.

The L_{10} and L_{90} measurement parameters are statistical levels that represent the average maximum and average minimum noise levels respectively, over the measurement intervals.

The L_{10} parameter is commonly used to measure noise produced by a particular intrusive noise source since it represents the average of the loudest noise levels produced by the source.

Conversely, the L_{90} level (which is commonly referred to as the background noise level) represents the noise level heard in the quieter periods during a measurement interval. The L_{90} parameter is used to set the allowable noise level for new, potentially intrusive noise sources since the disturbance caused by the new source will depend on how audible it is above the pre-existing noise environment, particularly during quiet periods, as represented by the L_{90} level.

The L_{eq} parameter represents the average noise energy during a measurement period. This parameter is derived by integrating the noise levels measured over the 15 minute period. L_{eq} is important in the assessment of traffic noise impact as it closely corresponds with human perception of a changing noise environment; such is the character of environmental noise.

L_1 levels represent is the loudest 1% noise event during a measurement period.

4 SURVEY OF EXISTING NOISE CONDITIONS

4.1 SURVEY OF BACKGROUND NOISE

Both long term unattended noise logging, and attended noise measurements were conducted to quantify the existing acoustic environmental at the site.

Unattended noise monitoring was conducted over a ten day period between 16 and 23 March 2018 using Acoustic Research Laboratories monitors set on A-weighted fast response mode. The monitors were calibrated before and after the measurements using a Rion Type NC-73 calibrator. No significant drift was recorded. Periods of adverse weather have been omitted when determine the Rating Background Noise Level. Logging data and daily noise level results are presented in appendix 1.

The logger was installed on Little Uralba Street as this location was both secure for monitoring equipment and would provide background noise data representative of the nearest noise receivers.

Figure 1 – Unattended Monitor Location

In addition, a series of attended noise measurements was made between 11:00am to 1:00pm on the 16 March 2018 to further verify that the background noise level measured by the loggers is the same as what is received at the residences. This was done by simultaneous measurement, demonstrating the noise levels at both the logger, and at the residence was the same.

All attended measurements were made using a Norsonic 140 Type 1 sound analyser set on A-weighted fast response mode. Calibration of the meter was checked at the beginning and end of the measurement period, with no significant drift noted.

Measured noise levels are presented below.

Table 1 - – Long Term Noise Logging Data (L_{eq} and Rating Background Noise Level)

Monitor Location	Measured Noise Level - Time of Day		
	Daytime (7am-6pm)	**Evening (6pm-10pm)**	**Night (10pm-7am)**
Little Uralba Street	57dB(A)$L_{eq(Period)}$ 47dB(A)L_{90}	53dB(A)$L_{eq(Period)}$ 46dB(A)L_{90}	52dB(A)$L_{eq(Period)}$ 45dB(A)L_{90}

5 NOISE EMISSION CRITERIA

The following noise controls and guidelines are applicable to the site:

- EPA Noise Policy for Industry.
- EPA Interim Construction Noise Guidelines.

5.1 EPA - NOISE POLICY FOR INDUSTRY (NPfI)

Noise sources covered by this code will include vehicle noise (generated on the site) and mechanical services noise. Both the Intrusiveness and the Project Amenity criteria (as set out below) must be complied with.

5.1.1 NPfI - Intrusiveness Noise Goals

Intrusiveness criteria permit noise generation to be no more than 5dB(A) above existing background noise levels. The criteria are as follows:

Table 2 - - EPA Intrusiveness Criteria

Location	Time of Day	Background noise Level - dB(A)L_{90}	Intrusiveness Noise Objective dB(A)$L_{eq(15min)}$ (Background + 5dB)
Little Uralba Street Residences	Day Time (7am - 6pm)	47	52
	Evening (6pm - 10pm)	46	51
	Night (10pm - 7am)	45	50

5.1.2 NPfI – Project Amenity Goals

Project amenity criteria are determined based on the land use in the area (residential/commercial/industrial). The residential land use is then further categorised into rural, sub-urban and urban areas.

For the purpose of this assessment the existing residential dwellings will be considered suburban.

Table 3 -- EPA Project Amenity Criteria

Noise Receiver	Amenity Noise Level – dB(A)$L_{Aeq(15min)}$		
	Daytime	Evening	Night
Existing Residential (Sub-urban)	53	43	38
Commercial (Private Hospital)	63	63	63

5.2 SLEEP AROUSAL ASSESSMENT

Potential sleep arousal impacts should be considered for noise generated after 10pm.

Sleep arousal is a function of both the noise level and the duration of the noise.

As recommended in the NPfI, to assess potential sleep arousal impacts, a two-stage test is carried out:

- Step 1 – Section 2.5 *Maximum noise level event assessment* from the NPfI states the following:

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

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

  a detailed maximum noise level event assessment should be undertaken.

Based on the above the following noise objectives apply:

Table 4 -- Sleep Arousal Criteria (*Maximum*/L_{Max} Noise Events)

Location	Rating Background Level dB(A)L_{90}	Rating Background Level + 15dB(A)	Governing Criteria dB(A)$L_{(Max)}$
Little Uralba Street	45	60	60

- Step 2 - If there are noise events that could exceed the average/maximum criteria detailed in the tables above, then an assessment of sleep arousal impact is required to be carried out taking into account the level and frequency of noise events during the night, existing noise sources, etc. This test takes into account the noise level and number of occurrences of each event with the potential to create a noise disturbance. As is recommended in the explanatory notes of the EPA Industrial Noise Policy, this more detailed sleep arousal test is conducted using the guidelines in the EPA Road Noise Policy. Most relevantly, the Road Noise Policy states:

  For the research on sleep disturbance to date it can be concluded that:

  - *Maximum internal noise levels below 50-55dB(A) are unlikely to awaken people from sleep.*
  - *One to two noise events per night with maximum internal noise levels of 65-70dB(A) are not likely to affect health and wellbeing significantly.*

5.3 CONSTRUCTION NOISE AND VIBRATION IMPACTS

5.3.1 EPA Interim Construction Noise Guidelines

EPA guidelines adopt differing strategies for noise control depending on the predicted noise level at the nearest residences:

- *"Noise affected"/"Noise Management" level*. Where construction noise is predicted to exceed the "noise effected" level at a nearby residence, the proponent should take reasonable/feasible work practices to ensure compliance with the "noise effected level". For residential properties, the "noise effected" level occurs when construction noise exceeds ambient levels by more than:
    - 10dB(A)$L_{eq(15min)}$for work during standard construction hours (7am-6pm Monday to Friday and 8am to 1pm on Saturdays) and
    - 5dB(A)$L_{eq(15min)}$for work outside of standard construction hours.
- "*Highly noise affected level".* Where noise emissions are such that nearby properties are "highly noise effected", noise controls such as respite periods should be considered. For residential properties, the "highly noise effected" level occurs when construction noise exceeds 75dB(A)$L_{eq(15min)}$ at nearby residences.

A summary of noise emission goals for standard hours of construction is presented below.

Table 5 – Construction Noise Emission Goals

Location	**"Noise Affected"/"Noise Management Level" - dB(A)$L_{eq(15min)}$**	**"Highly Noise Affected" Level - dB(A)$L_{eq(15min)}$**
Residences –Little Uralba Street	57 (Standard Construction Hours)	75
Commercial	70	N/A

5.3.2 Construction Vibration

Vibration goals for the amenity of nearby land users are those recommended by the EPA document *Assessing Vibration: A technical guideline.* These levels are presented below:

Table 12 – Construction Vibration Goals

Location	Time	Peak velocity (mm/s)	
		Preferred	Maximum
Continuous Vibration			
Residences	Daytime	0.28	0.56
Hospitals – Office Areas	When in use	0.56	1.1
Hospitals – Theatres	When in use	0.14	0.28
Impulsive Vibration			
Residences	Daytime	8.6	17
Hospitals – Office Areas	When in use	18	36
Hospitals – Theatres	When in use	0.14	0.28

5.4 NSW ROAD NOISE POLICY

The NSW Road Noise Policy states:

> *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'*

6 NOISE EMISSION ASSESSMENT

An assessment of operational noise emissions is presented. Mechanical plant and construction noise have been identified as the two potential sources of noise from the development.

6.1 NOISE FROM MECHANICAL PLANT

An assessment of initial design of primary plant items is presented below.

Primary plant items will include:

- Air handling plant;
- Pumps; and
- Chillers

It is noted that the plant associated with Stage 3C is supplementary plant, and main noise generating items have been installed as per of previous stages (ie diesel generators).

With respect to the above, we note:

- Roof top plant:
    - Major fans (typically with a sound power over 90(A) – such as kitchen exhaust, major toilet exhaust and major relief air fans) will require acoustic treatment if located externally. Whenever possible, for major fans, it is recommended that axial (as opposed to roof mounted fans) are to be used as this will enable acoustic treatment to be incorporated within ductwork running to atmosphere.
    - Rooftop Plant Room: The room is likely to house air handling plant (air handling units, return air fans, exhaust air fans), chillers and pumps. We note:
        - The plant room should not be open on the eastern side (to mitigate noise impacts to residents on Little Uralba Street). If air is to be drawn in from these parts of the façade, it should be drawn in via ducting connected to individual units, as opposed to the plant room being open to atmosphere. This will enable acoustic treatment to the ductwork of the units to be incorporated to ensure noise emitted from the façade to the Somerset Street residences does not exceed EPA requirements. The remainder of any louvres on this façade could then be blanked off using sheet metal.
        - Assuming that the remainder of the plant room remains open to atmosphere, any chiller, and potentially pumps is likely to need to be housed in its own plant area partitioned off from the rest of the plant room to prevent excessive noise emission. This can only be confirmed following final equipment selection and location within the plant room.

Cumulative assessment of both plant noise with other noise sources is recommended when conducting acoustic design of plant items. Compliance with EPA acoustic criteria (as set out in

Section 5.2) will be achievable, provided that detailed acoustic review of plant items is undertaken once plant is selected, and acoustic treatments similar to those outlined above are adopted.

6.2 CONSTRUCTION IMPACTS

6.2.1 Construction Noise

With respect to general construction noise, the impacts on nearby development will be dependent on the activity in question and where on the site the activity is undertaken. There is no major excavation or piling works associated with Stage 3C. Work close to the eastern boundaries will have greatest potential impact on the residents (on Little Uralba Street).

However, based on analysis of anticipated construction activities:

- During erection of structure, it is the use of hand tools (angle grinders etc for formwork) and concrete pumps which are the loudest typical activity (sound power levels of approximately 105dB(A)$L_{eq(15min)}$). Noise levels exceeding EPA "Noise Management" levels are unlikely to occur.

- Once construction of the building shell is complete, noise from hand tools will be relatively low, as the new building façade will provide considerable noise attenuation. Once the building shell is largely complete, use of hand tools in internal areas is unlikely to exceed EPA recommended levels. Vehicle noise and crane noise will create the greatest possibility of noise disturbance during this phase.

Noise impacts can be minimised using the following:

- Location of static plant (concrete pumps, cranes) as far as practicable away from eastern boundary is recommended.

- Letter box drops or similar to advise residents on Little Uralba Street in the event that there are significant works outside the line of the façade on the east (ie hydraulic mounted hammering)

Through adoption of the above, noise impacts on nearby development can be suitably managed to prevent unreasonable impact.

6.2.2 Construction Vibration

Given the distance between the site and the nearest residential buildings on Little Uralba Street, and given that the development will not require excavation works, it predicted that construction vibration will not exceed EPA guidelines.

Vibration impacts on other buildings within Lismore Hospital will be addressed through internal hospital management.

6.3 NSW ROAD NOISE POLICY

The additional beds associated with the development will have an insignificant impact on traffic noise and is fully compliant with the requirements of the NSW Road Noise Policy which notes that an increase of less than 2dB(A) is a minor impact and would be barely perceptible.

7 RECOMMENDATIONS

We recommend the following acoustic treatments/management controls to ensure compliance with EPA noise emission guidelines.

- A detailed construction noise and vibration management plan should be undertaken following preparation of the construction program. Review of the mitigation techniques outlined in section 6.2 of this report should be done, and implemented where feasible.

- Detailed acoustic review of all plant items should be undertaken following equipment selection and duct layout design. Initial analysis (Section 6.1) indicates that with acoustic treatment, all plant items will be capable of meeting noise emission requirements. However this is likely to require:

    - Noise screening (using either a dedicated noise screen or the building shell)

    - Use of axial fans and induct acoustic lining to major external fans ducted to atmosphere.

    - Further acoustic review of external louvres for any plant room to determine whether acoustic louvres/attenuators or blanking off of those louvres is required, particularly on the eastern edge of the rooftop plant room. This must be conducted once equipment selections are finalised.

8 CONCLUSION

Noise emissions associated with the proposed Lismore Hospital Stage 3C development have been assessed with reference to relevant SEAR 9 and EPA acoustic guidelines.

An analysis of typical operational noise (plant/ equipment) indicates that the site is capable of complying with relevant noise emission criteria.

Construction noise and vibration has been assessed in accordance with EPA Interim Construction Noise Guidelines and treatments to control noise and vibration emissions have been nominated in Section 6.2.

Review indicates that acoustic treatment to major plant items is likely to be required (screens, in-duct attenuation and enclosures, rooftop plant room not open to atmosphere on the eastern facade) however through appropriate treatment, noise emissions are capable of fully complying with EPA requirements.

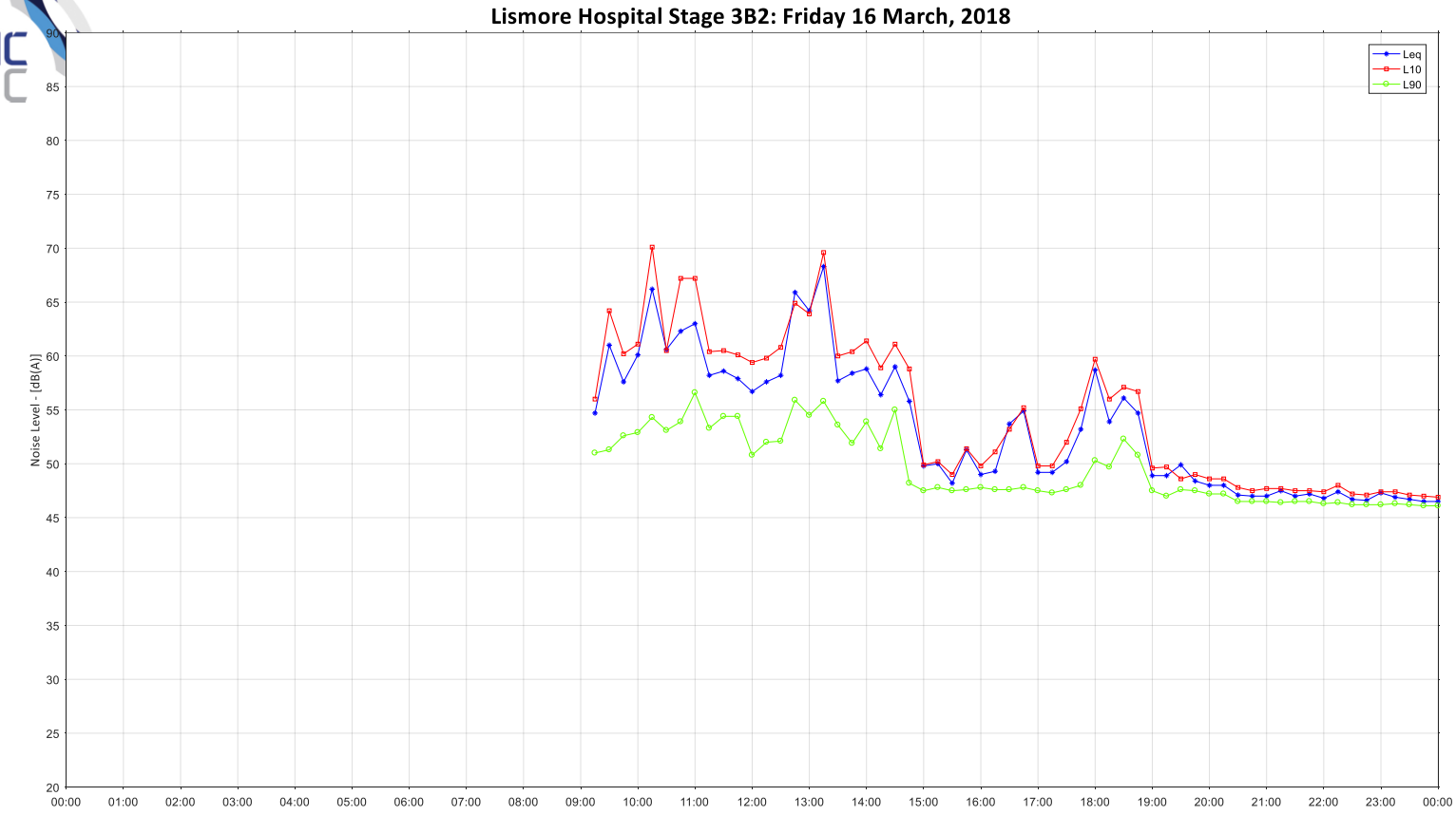
Please contact us if you have any queries.

Yours faithfully,

Acoustic Logic Consultancy Pty Ltd
Thomas Aubusson MAAS

APPENDIX ONE –

UNATTENDED MONITORING DATA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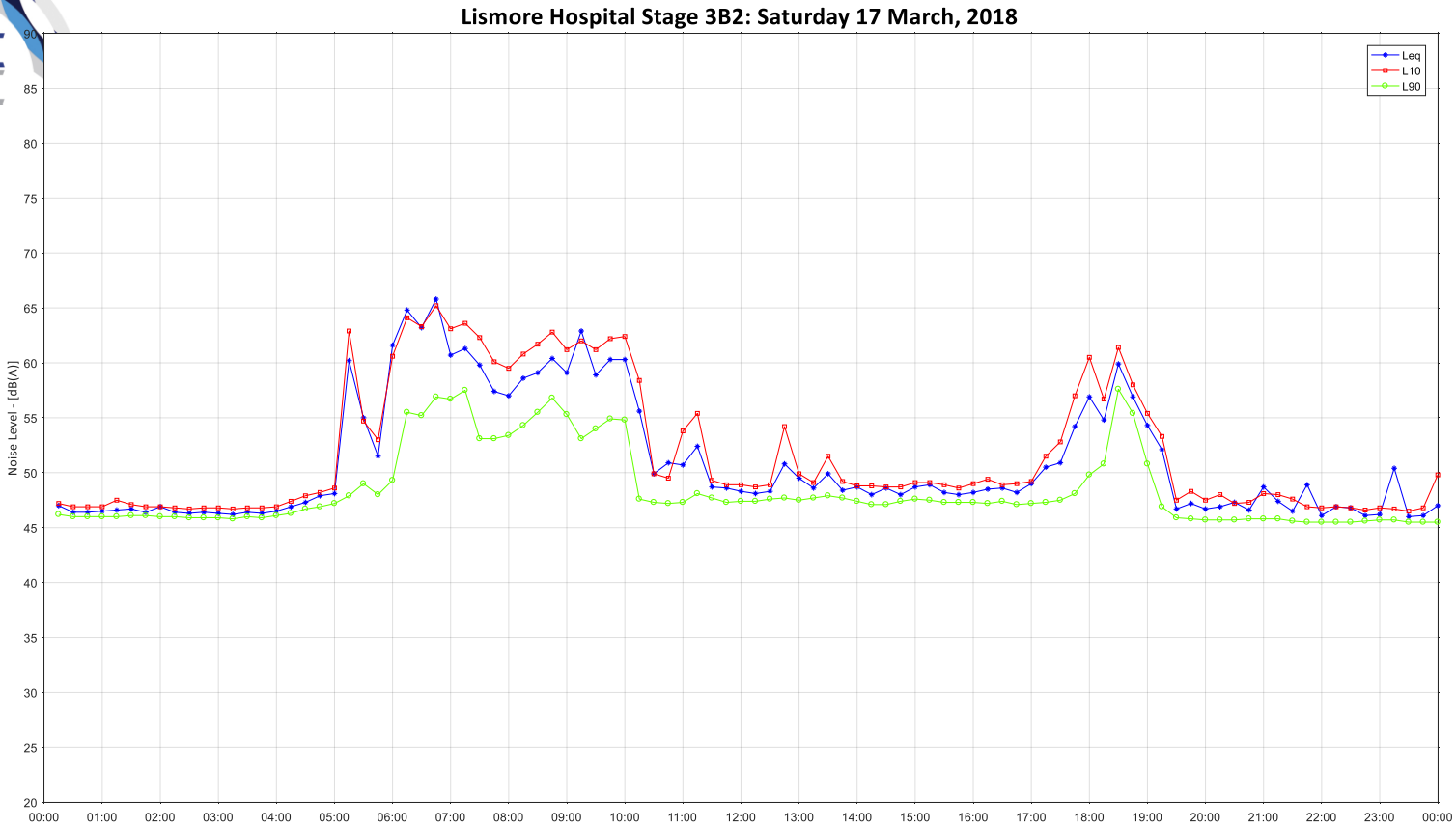
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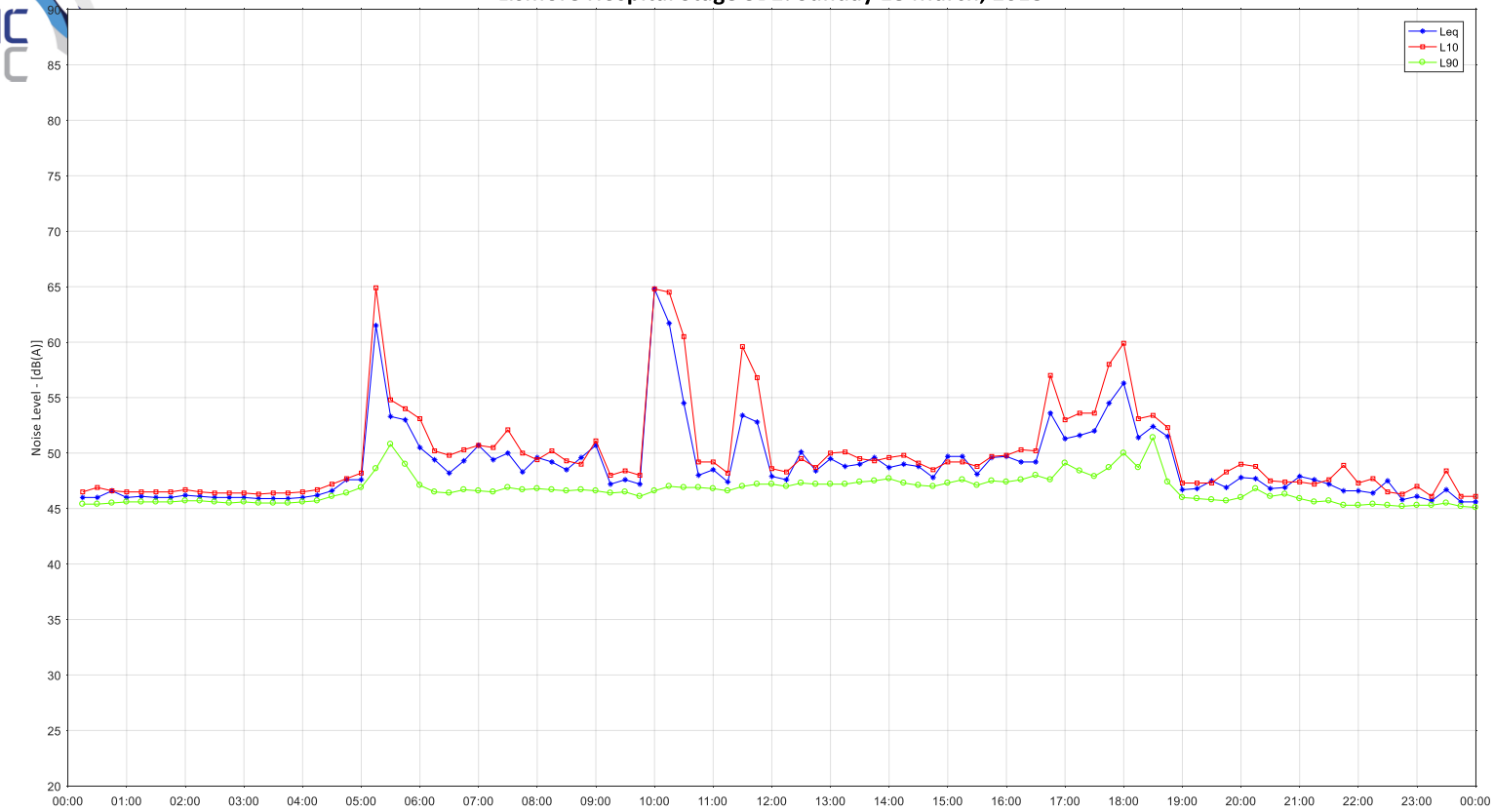
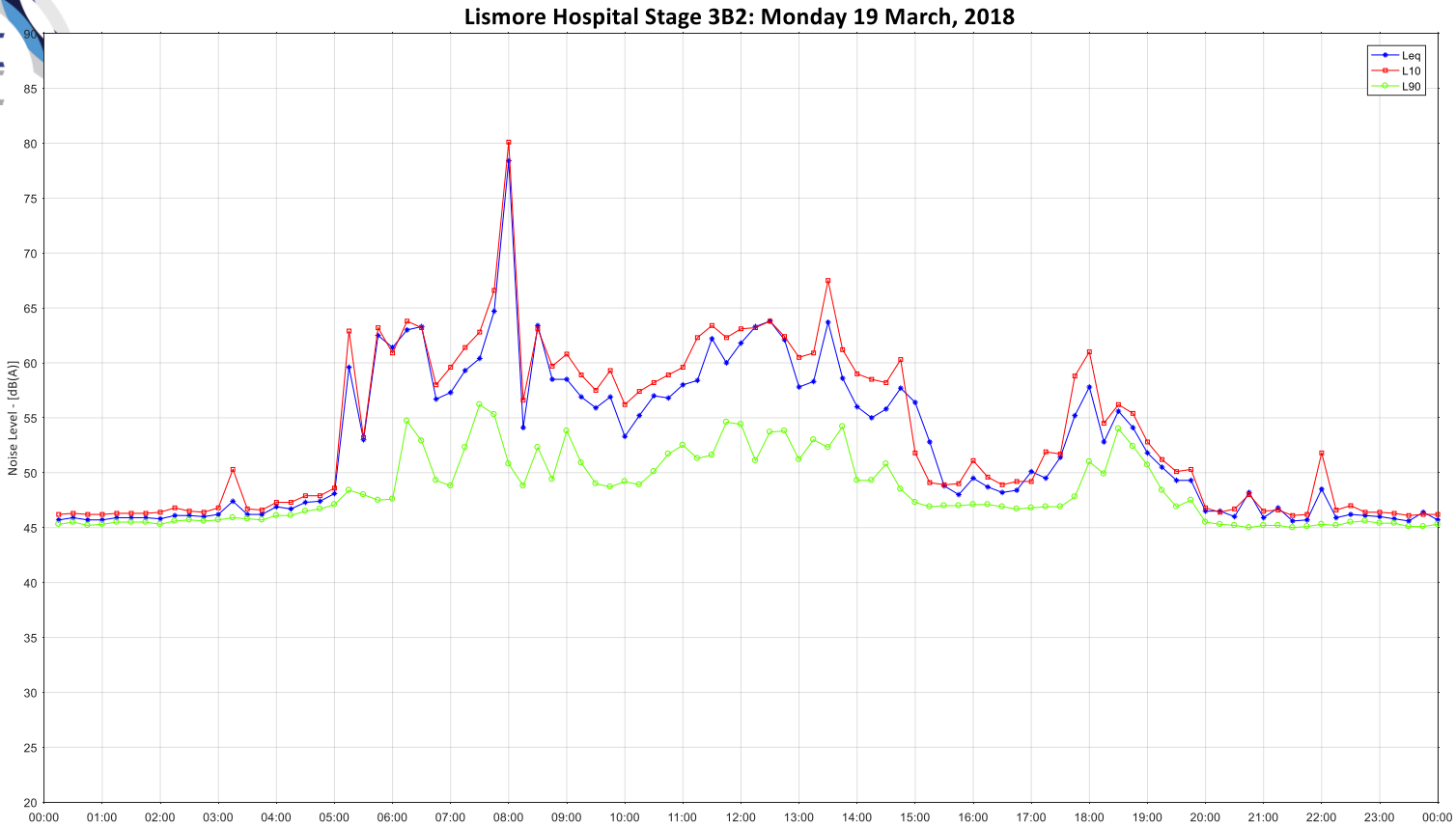
Lismore Hospital Stage 3B2: Sunday 18 March, 2018

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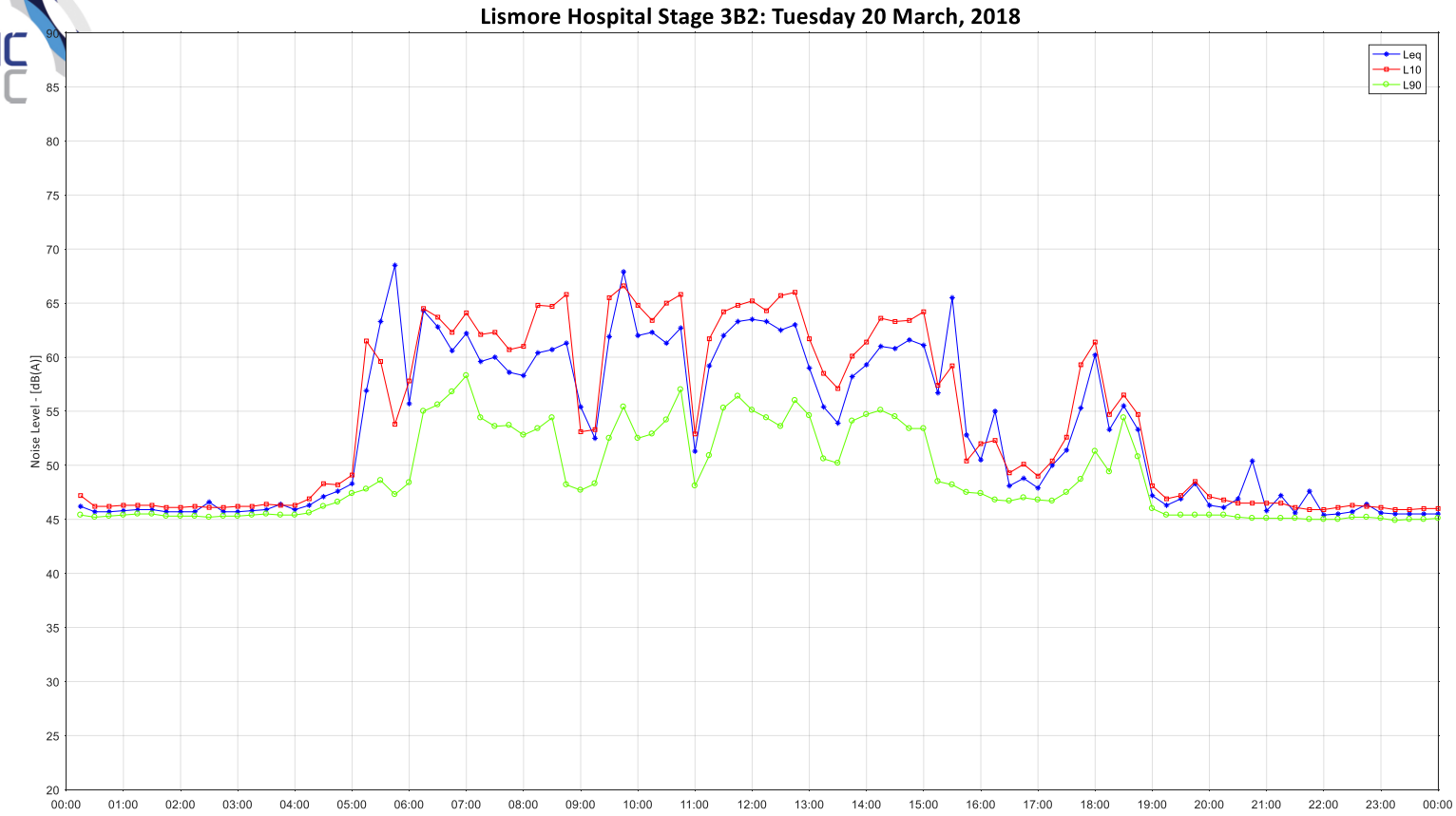
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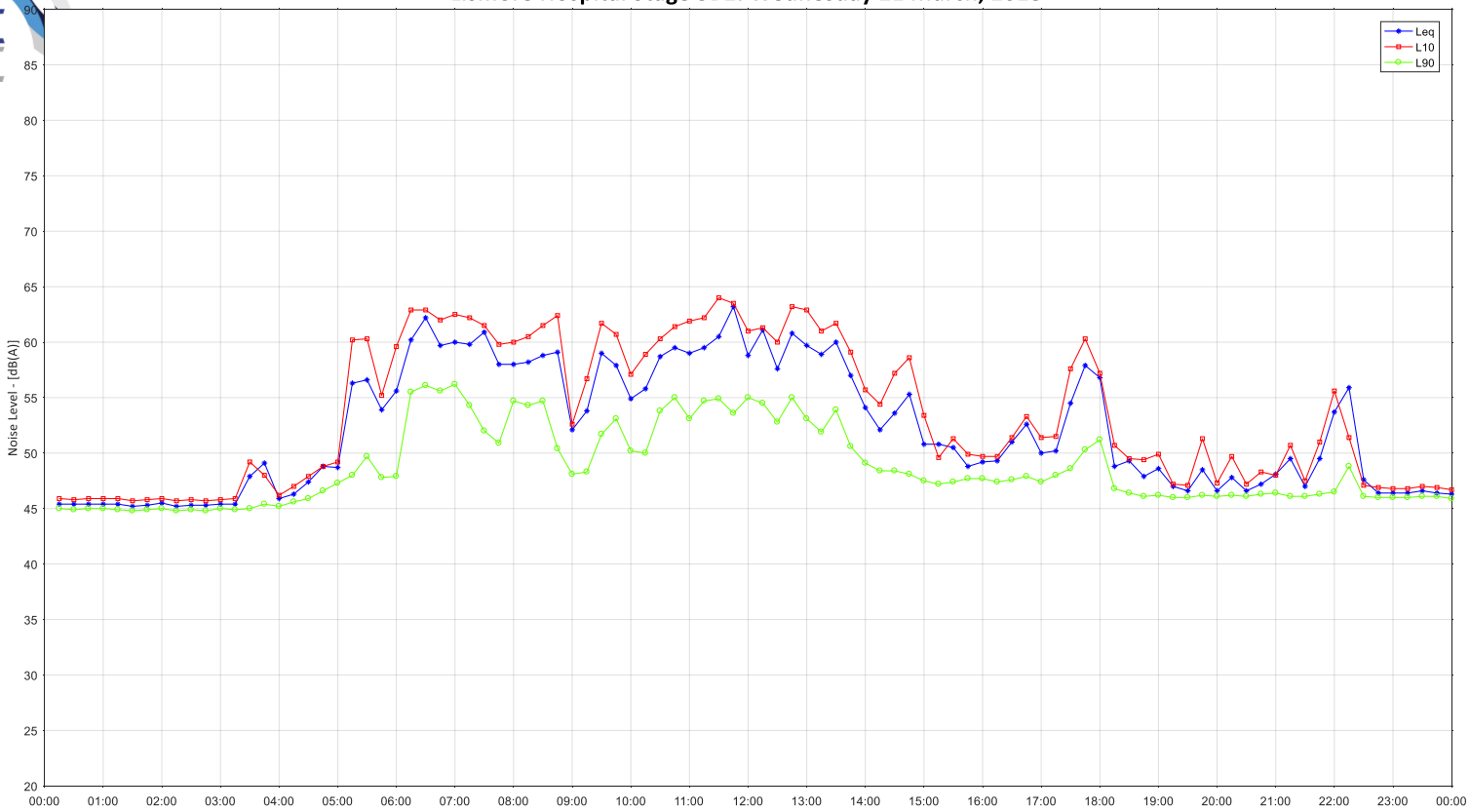
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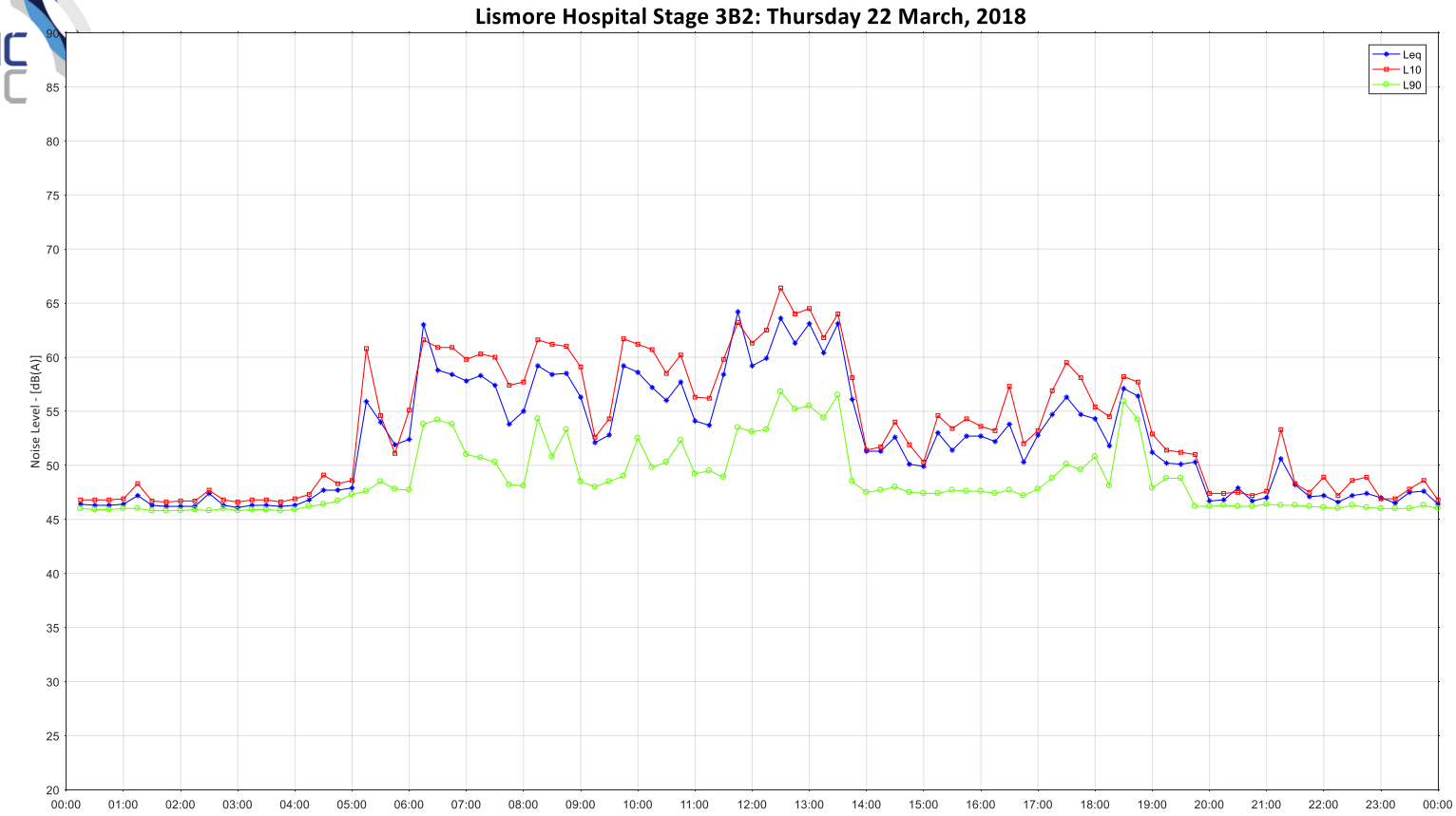
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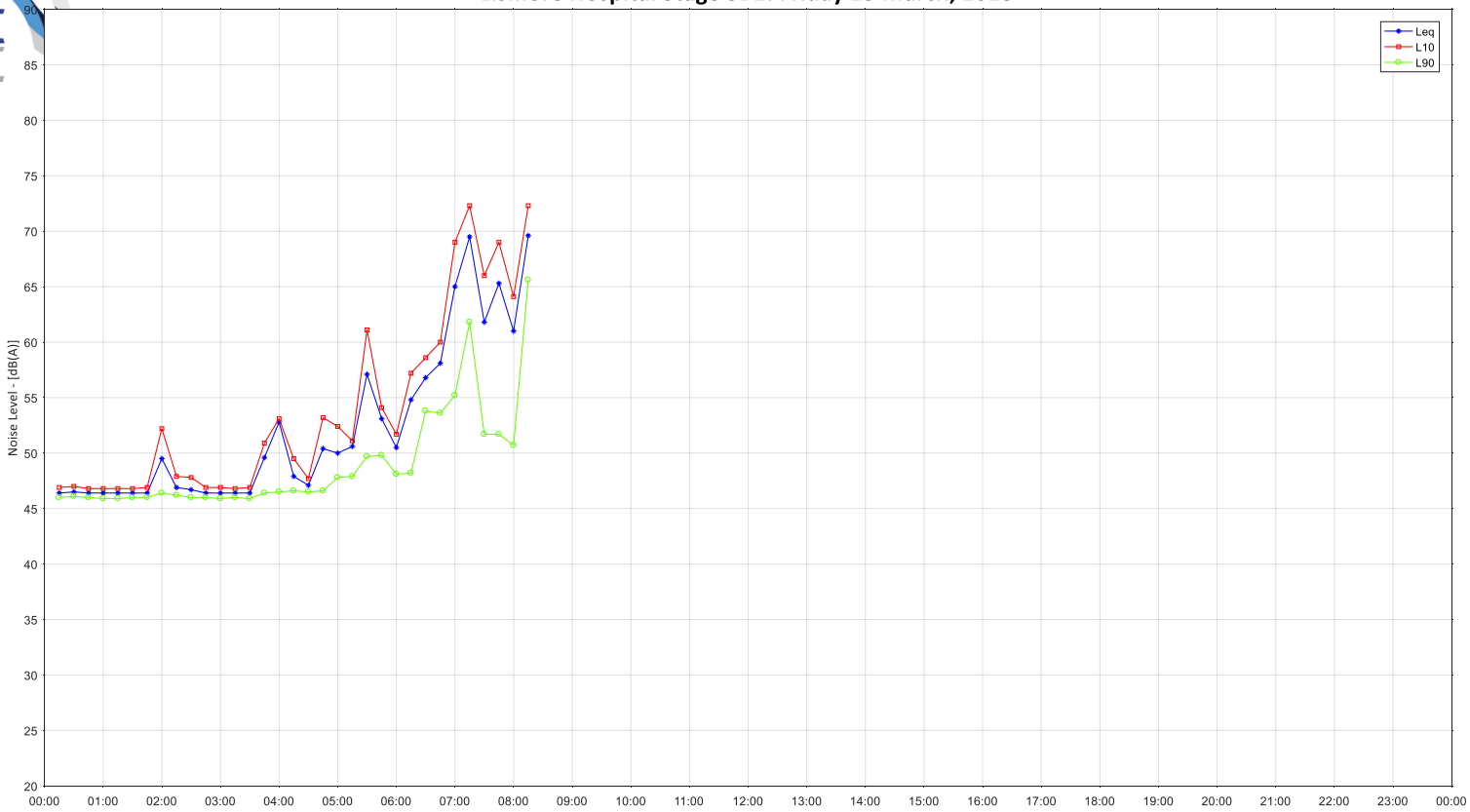
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