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1 INTRODUCTION

This report presents an analysis of the acoustic impacts associated with the proposed residential development located at 17-23 Merriwa Street, Gordon.

In this report we will:

- Conduct an external noise impact assessment (primarily traffic noise) and recommend acoustic treatments to ensure that a reasonable level of amenity is achieved for future tenants.

- Identify potential noise sources generated by the site, and determine noise emission goals for the development to meet Ku-ring-gai Councils acoustic requirements and the NSW Industrial Noise Policy to ensure that nearby developments are not adversely impacted.

The following assessment is based on architectural plans provided by Brewster Murray dated November 2013, Sheets DA06-DA24, revision 11.

2 SITE DESCRIPTION

The proposed development consists of two residential flat buildings with 117 units over 6 levels, and once commercial shop within Building B. The surrounding area is generally a mix of commercial and residential buildings. Building A faces Merriwa Street, and Building B faces onto Fitzsimons Lane.

The site is bound by Merriwa Street to the south, Fitzsimons Lane to the north, and adjacent commercial and residential buildings. Approximately 80 metres to the north is Ryde Road. Refer to Figure 1 for the site plan.

The existing environmental noise sources affecting the site are predominantly distant traffic noise from Ryde Road and Pacific Hwy, and local noise from Merriwa Road and Fitzsimons Lane, which typically carry a low volume primarily for occupants in the surrounding region.

Figure 1: Site plan

3 NOISE DESCRIPTORS

Traffic noise constantly varies in level, due to fluctuations in traffic speed, vehicle types, road conditions and traffic densities. Accordingly, it is not possible to accurately determine prevailing traffic noise conditions by measuring a single, instantaneous noise level. To accurately determine the effects of traffic 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. These parameters are used to measure how much annoyance would be caused by a particular noise source.

In the case of 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 interval.

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 measurement 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 traffic noise.

Current practice favours the L_{eq} parameter as a means of measuring traffic noise, whereas the L_{10} parameter has been used in the past and is still incorporated in some codes. For the reasons outlined above, the L_{90} parameter is not used to assess traffic noise intrusion.

4 NOISE INTRUSION ASSESSMENT

As previously detailed, the noise sources that will dominate the acoustic design of the development are as follows:

- Traffic noise from Ryde Road and Pacific Hwy.
- Traffic and general noise from vehicle movements in the surrounding commercial and residential region.

The acoustic design of the development should be such that the relevant Ku-ring-gai Council requirements are complied with.

4.1 TRAFFIC NOISE MEASUREMENTS

Attended noise measurements of external traffic noise were conducted on 14th November 2013 along Ryde Road and Pacific Hwy, during the morning period between 9:30pm to 10:30pm. Measurements were undertaken using a Norsonics Type 118 precision sound level analyser, set to A-weighted fast response. The precision sound level analyser was calibrated before and after the measurements using a Norsonics 1251 precision sound level calibrator. No significant drift was recorded.

Unattended noise measurement were conducted at the rear of the site, along Meriwa Street, between the 7th and 14th of November 2013, using an Acoustic Research Laboratories Pty Ltd noise logger. The logger was programmed to store 15-minute statistical noise levels throughout the monitoring period. The noises monitors were calibrated at the beginning and the end of the measurement using a Rion NC-73 calibrator. No significant drift was detected. All measurements were taken on A-weighted fast response mode. Note that rain affected results have been excluded from the assessment, in accordance with the INP. Refer to Appendix 1 for unattended noise data.

The measurement positions are illustrated in Figure 1.

Table 1 – Traffic Noise Levels

Location	$L_{eq(15minute)}$ dB(A) 24hrs	$L_{eq(15minute)}$ dB(A) 22:00-07:00
Ryde Road (attended measurement)	75	-
Pacific Highway(attended measurement)	74	-
Merriwa Street(un-attended measurement)	56	46

4.2 ACOUSTIC OBJECTIVES

As Ku-ring-gai does not have any specific requirements for traffic noise intrusion, the assessment will be conducted in accordance with Australian/New Zealand Standard AS/NZS 2107:2000 *"Recommended Design Sound Levels and Reverberations Times for Building Interiors"*, for major roads. While the development is not adjacent to the major roads, the roads still place demand acoustically on the development.

The determination of acceptable levels of traffic noise within the residential apartments requires consideration of the activities carried out within the space and the degree to which noise will interfere with those activities. The activity in bedrooms which will most be affected by traffic noise is sleep. Hence a suitable standard should be developed around this criterion. Higher levels of noise will be acceptable in living rooms without interfering with activities that take place.

Table 2 below provides acceptable noise levels for various spaces within the development. The noise criteria are expressed in terms of the L_{eq} descriptor and are based on Australian/New Zealand Standard AS/NZS 2107:2000 *"Recommended Design Sound Levels and Reverberations Times for Building Interiors"*, for residential development near minor roads.

Table 2 - Traffic Noise Criteria for All Spaces inside Development

Internal Space	Time Period	Noise Level dB(A), $L_{Aeq(period)}$
Living Areas	Day	40 (24 hour)
Sleeping Areas	Night	35 (9 Hour, 10pm to 7am)
Retail	Day	50 (24 hour)

4.3 RECOMMENDATIONS

Noise intrusion into the residential units was assessed using the measured external noise levels reported above as the basis. Recommendations have been determined taking into account the orientation of windows, barrier effects (where applicable) of existing buildings, the total area of glazing, facade transmission loss and room sound absorption characteristics.

The recommended treatments are set out in the following sections.

4.3.1 Glazing

Table 3 and 4 below indicates the glazing types that will be required to achieve the recommended internal noise levels.

Table 3 – Glazing Requirements – Building A

Level	Facade	Room Type	Glazing	Acoustic Seals
All Except Top Level (with roof)	East Facade	Living	6.38mm laminated	Yes
		Bedroom	6.38mm laminated	Yes
	North/West Facade	Living Rooms	6.38mm laminated	Yes
		Bedrooms	6.38mm laminated	Yes
	Southern Façade	Bedrooms/Living	4mm float	Yes
Top Level (with roof)	All Facades	Bedrooms/Living	10.38mm laminated	Yes

Table 4 – Glazing Requirements – Building B

Level	Facade	Room Type	Glazing	Acoustic Seals
All Except Top Level (with roof)	North Facade	Commercial	6mm float	Yes
		Living Room	10.38mm laminated	Yes
		Bedrooms	10.38mm laminated	Yes
	East/West Facade	Living Rooms	6.38mm laminated	Yes
		Bedrooms	6.38mm laminated	Yes
	Southern Façade	Bedrooms/Living	6.38mm laminated	Yes
Top Level (with roof)	All Facades	Bedrooms/Living	10.38mm laminated	Yes

The glazing thicknesses recommended are those needed to satisfy acoustic requirements and do not take into account other requirements such as thermal, structural, safety or other considerations. These additional considerations may require the glazing thickness to be increased beyond the acoustic requirement.

In addition to complying with the minimum scheduled glazing thickness, the STC rating of the glazing fitted into openable frames and fixed into the building opening should not be lower than the values listed in Table 5 for all rooms. Where nominated, this will require the use of acoustic seals around the full perimeter of openable frames and the frame will need to be sealed into the building opening using a flexible sealant. Note that mohair seals in windows and doors are not acceptable where acoustic seals are required.

Table 5 - Minimum STC of Glazing

Glazing Assembly	Acoustic Seals	Minimum STC of Installed Window
4mm float	Yes	27
6mm float	Yes	29
6.38mm laminated	Yes	31
10.38mm laminated	Yes	35

4.3.2 External Walls

Noise intrusion through the external masonry walls will be negligible and will not contribute to internal noise levels.

4.3.3 Roof / Ceiling Construction

The recommended roof/ceiling construction is shown in Figure 1 below. Penetrations in all ceilings (such as for light fittings etc.) must be acoustically treated and sealed gap free with a flexible sealant.

The recommended roof/ceiling construction is shown in Figure 2.

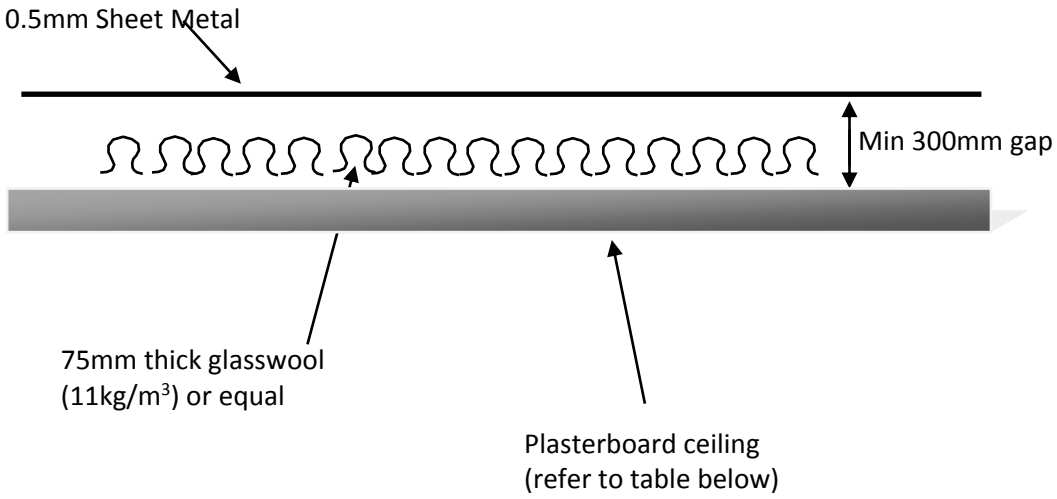


Figure 2 **– Roof / Ceiling Construction**

Table 6 - Ceiling Plasterboards

Room	Ceiling Construction
Living Rooms	1x16mm plasterboard
Bedrooms	1x16mm plasterboard

5 NOISE EMISSION ASSESSMENT

Noise emissions from the site should be assessed to ensure that the amenity of nearby land users is not adversely affected.

The potential noise sources which should be assessed are the noise generated by mechanical plant associated with the new development. The noise should be assessed at the surrounding commercial, industrial and residential receivers.

5.1 BACKGROUND NOISE MONITORING

An unattended noise monitor was installed at the rear of the development between the 7th and 14th of November 2013. This monitor was used to obtain background and ambient noise levels for the site, in order to develop noise emission criteria for the development. Note that rain affected results have been excluded from the assessment, in accordance with the INP.

An Acoustic Research Laboratories noise monitor set to A-weighted fast response was used. The monitor was calibrated at the start and end of the monitoring period using a Rion NC-73 calibrator. No significant drift was noted. Noise logger data is provided in Appendix A.

Table 7 – Measured Background Noise Levels

Location	Background noise level dB(A)L90		
	Daytime (7am-6pm)	Evening (6pm-10pm)	Night time (10pm-7am)
Merriwa Street	42	41	36

5.2 ACOUSTIC OBJECTIVES

As the Ku-ring-gai Council DCP does not set out any specific noise emission criteria, the external noise emission from the project site shall be assessed to the requirements of the Environmental Protection Authority (EPA) Industrial Noise Policy (INP) guidelines. The recommended assessment objectives vary depending on the potentially affected receivers, the time of day, and the type of noise source. The EPA's Industrial Noise Policy has two requirements which both have to be complied with, namely an amenity criterion and an intrusiveness criterion.

5.2.1 Intrusiveness Criterion

The guideline is intended to limit the audibility of noise emissions at residential receivers and requires that noise emissions measured using the L_{eq} descriptor not exceed the background noise level by more than 5dB(A). Where applicable, the intrusive noise level should be penalised (increased) to account for any annoying characteristics such as tonality.

Background noise levels adopted are presented in Section 5.1. Noise emissions from the site should comply with the noise levels presented below when measured at nearby property boundary.

5.2.2 Amenity Criterion

The guideline is intended to limit the absolute noise level from all noise sources to a level that is consistent with the general environment.

The EPA's Industrial noise policy sets out acceptable noise levels for various localities. Table 2.1 on page 16 of the policy indicates 4 categories to distinguish different residential areas. They are rural, suburban, urban and urban/industrial interface. The site is considered to be an urban area.

For the purposes of this condition:

- Day is defined as the period from 7am to 6pm Monday to Saturday and 8am to 6pm Sundays and Public Holidays;
- Evening is defined as the period from 6pm to 10pm.
- Night is defined as the period from 10pm to 7am Monday to Saturday and 10pm to 8am Sunday and public holidays.

5.2.3 Proposed Noise Objectives

Noise emissions to Commercial/Industrial Receivers are to be assessed using only the Industrial Noise Policy "Amenity" criteria. Noise emissions to Residential Receivers are to be assessed using the Industrial Noise Policy Amenity and Intrusiveness criteria. The criteria are listed in table below. The criteria for the development is the project specific levels, which is the more stringent of the intrusiveness and amenity.

Table 8 - Noise Emission Requirements – Surrounding Receivers

Receiver Type	Time of Day	Intrusiveness Noise Objective dB(A)$L_{eq(15min)}$	Amenity Noise Objective dB(A)L_{eq}	Summarised Project Specific Criteria
Residential Receivers	Day	47	60	**47**
	Evening	46	50	**46**
	Night	41	45	**41**
Commercial	When in use	-	65	**65**

Note: The noise levels detailed above in **BOLD** are the projects required criteria.

5.2.4 Plant Noise Emissions

A detailed review of all external mechanical plant has not been undertaken at present due to plant selection not currently being available. A fully detailed assessment of treatments will be conducted once plant selections are finalised.

Acoustic treatments should be determined in order for plant noise emissions to comply with requirements outlined in the EPA's INP as detailed in Sections above. Where required, it is envisaged that acoustic treatments could include acoustic barriers, lined ducting and attenuators on any intake or discharge louvers or openings.

6 CONCLUSION

This report presents our acoustic assessment associated with the proposed residential flat development located at 23 Merriwa Street, Gordon.

Noise intrusion impact from traffic noise onto the future occupants of the development has been assessed in accordance with Ku-ring-gai Council DCP and the relevant Australian Standards. The acoustic treatments in principle necessary to achieve these guidelines have been set out in Section 4.3 of this report.

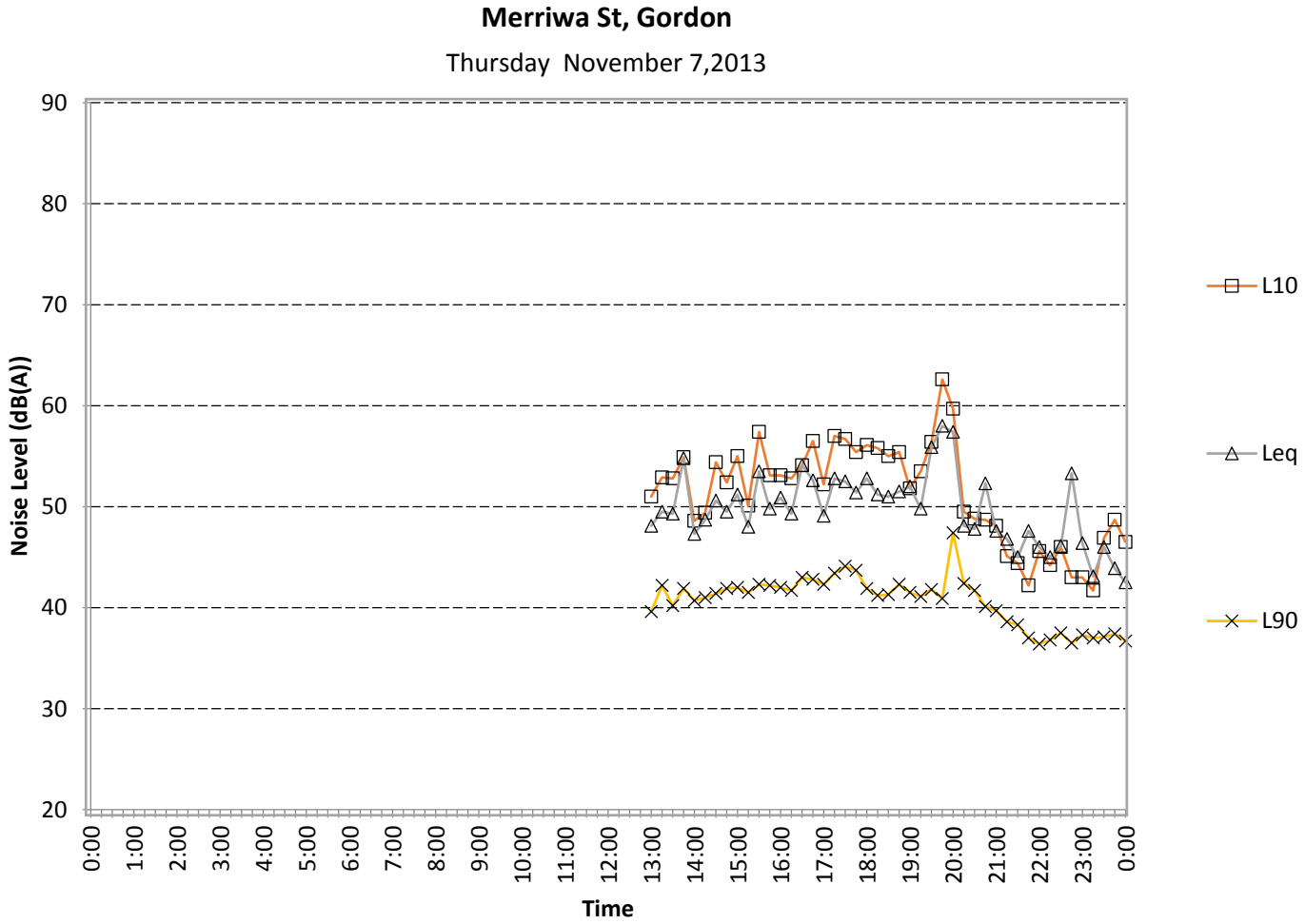
Noise emissions objectives for the site have been determined based on noise logging performed on site, and noise emission guidelines as per the EPA's industrial noise policy, and have been presented in section 5.

We trust this information is satisfactory. Please contact us should you have any further queries.

Yours faithfully,

Acoustic Logic Consultancy Pty Ltd
Johan Davydov

APPENDIX A – UNATTENDED NOISE DATA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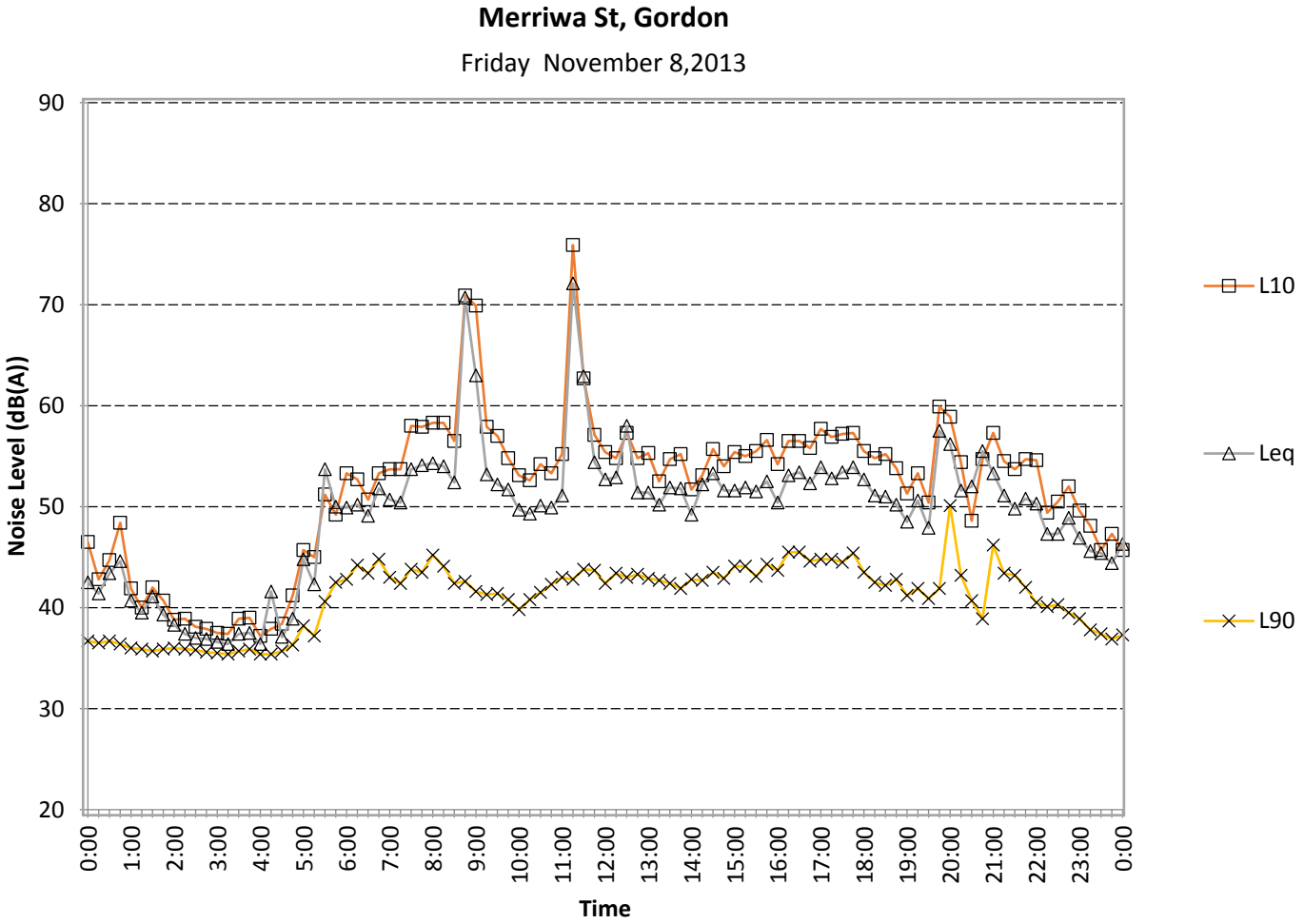
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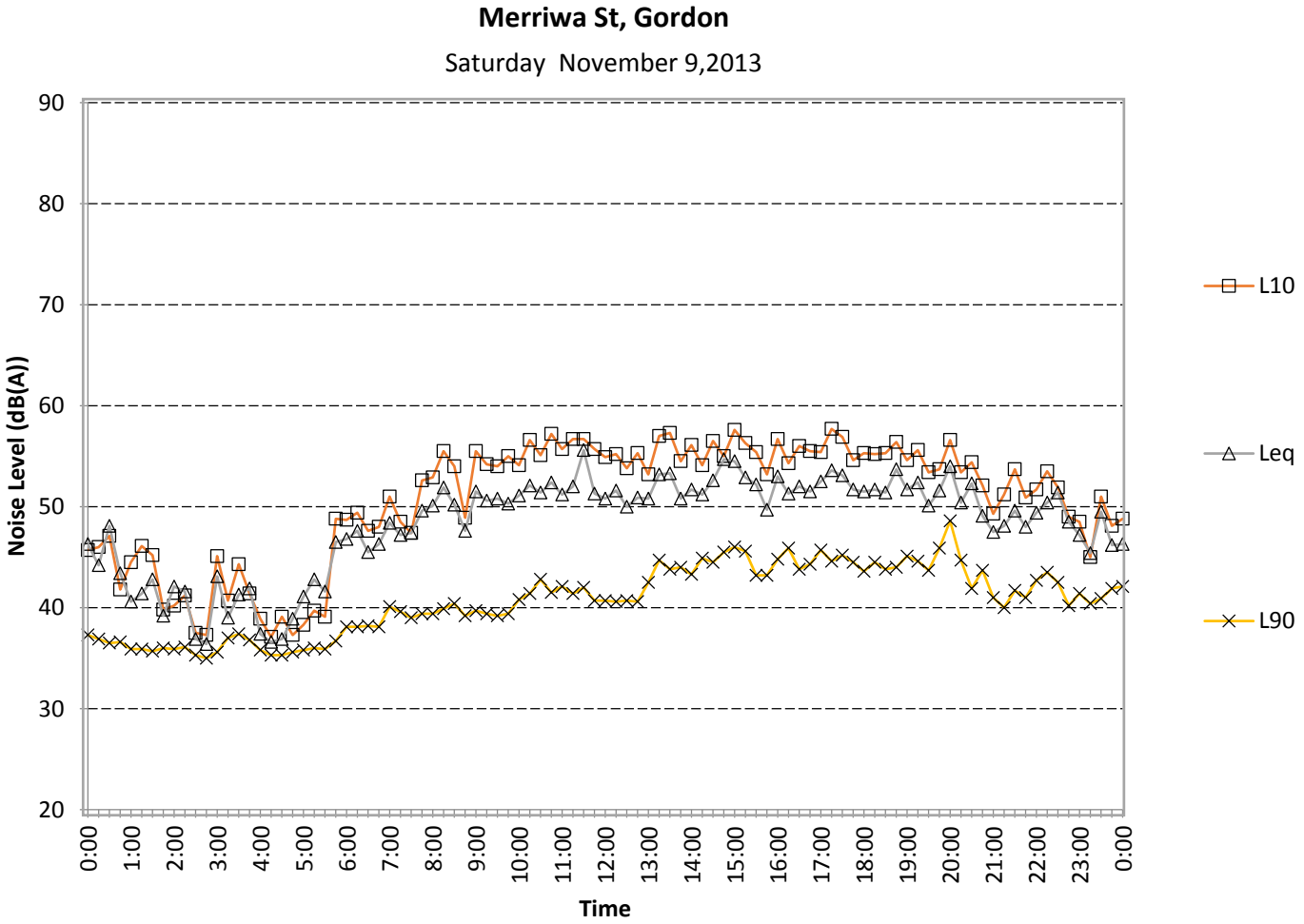
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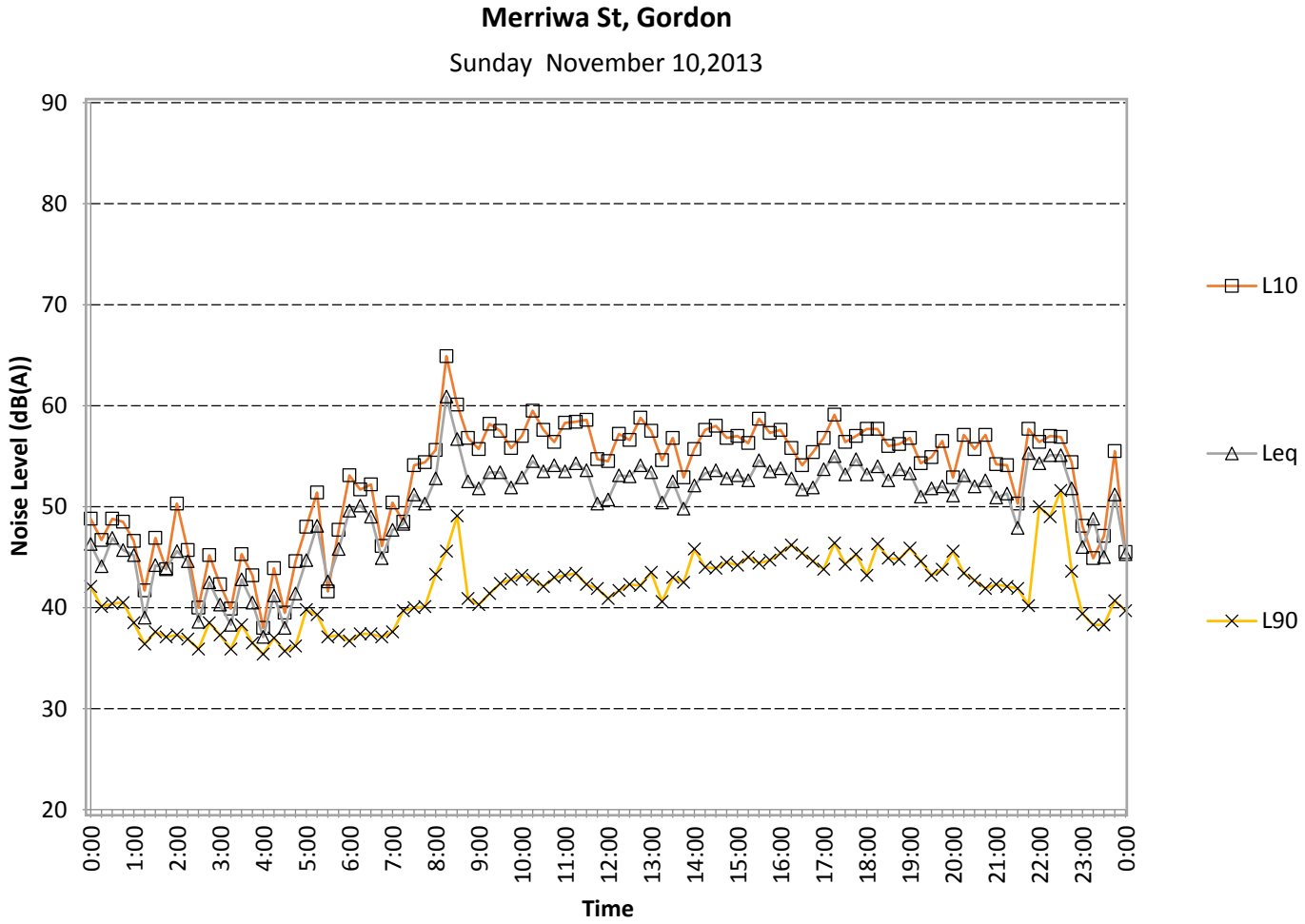
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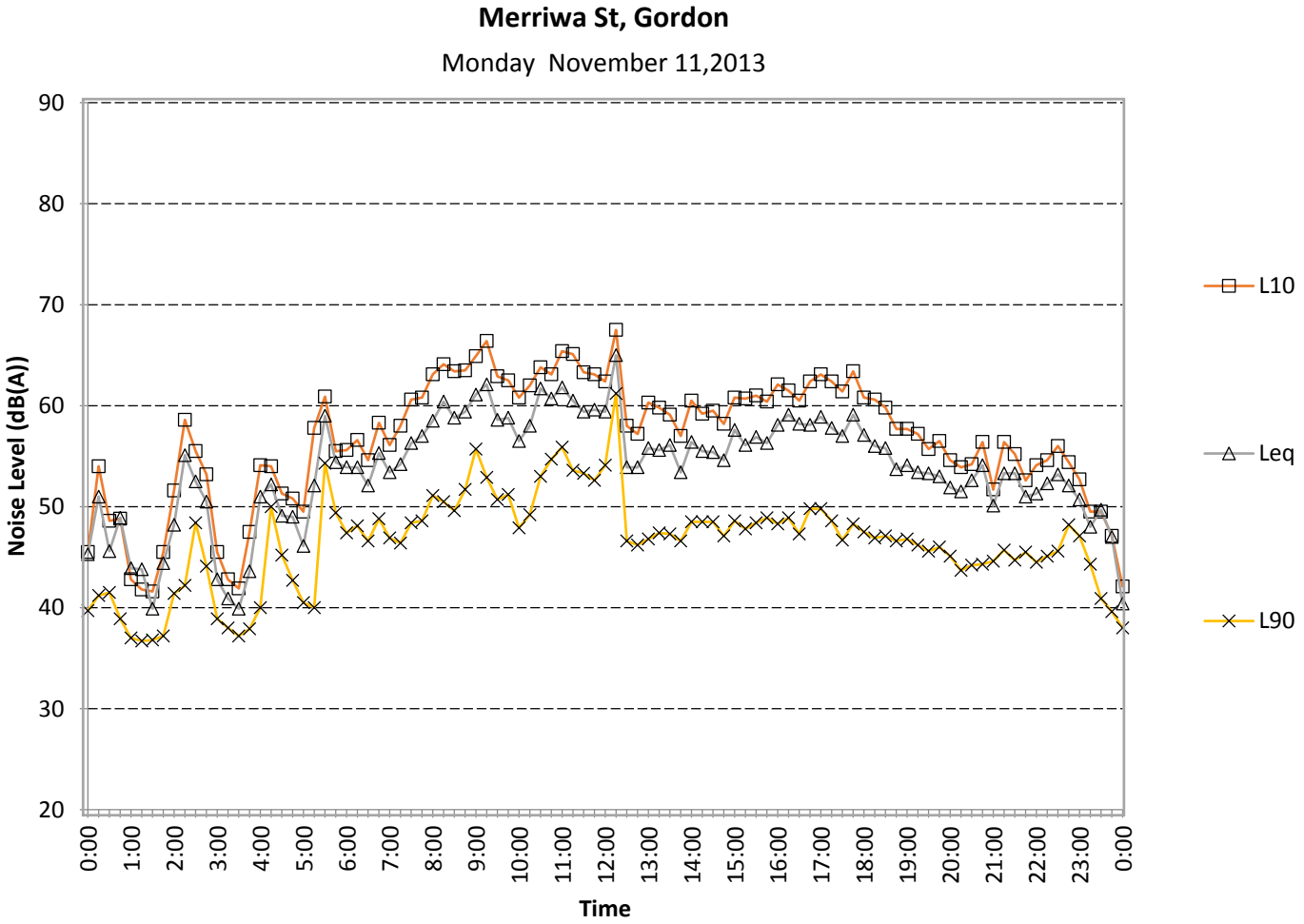
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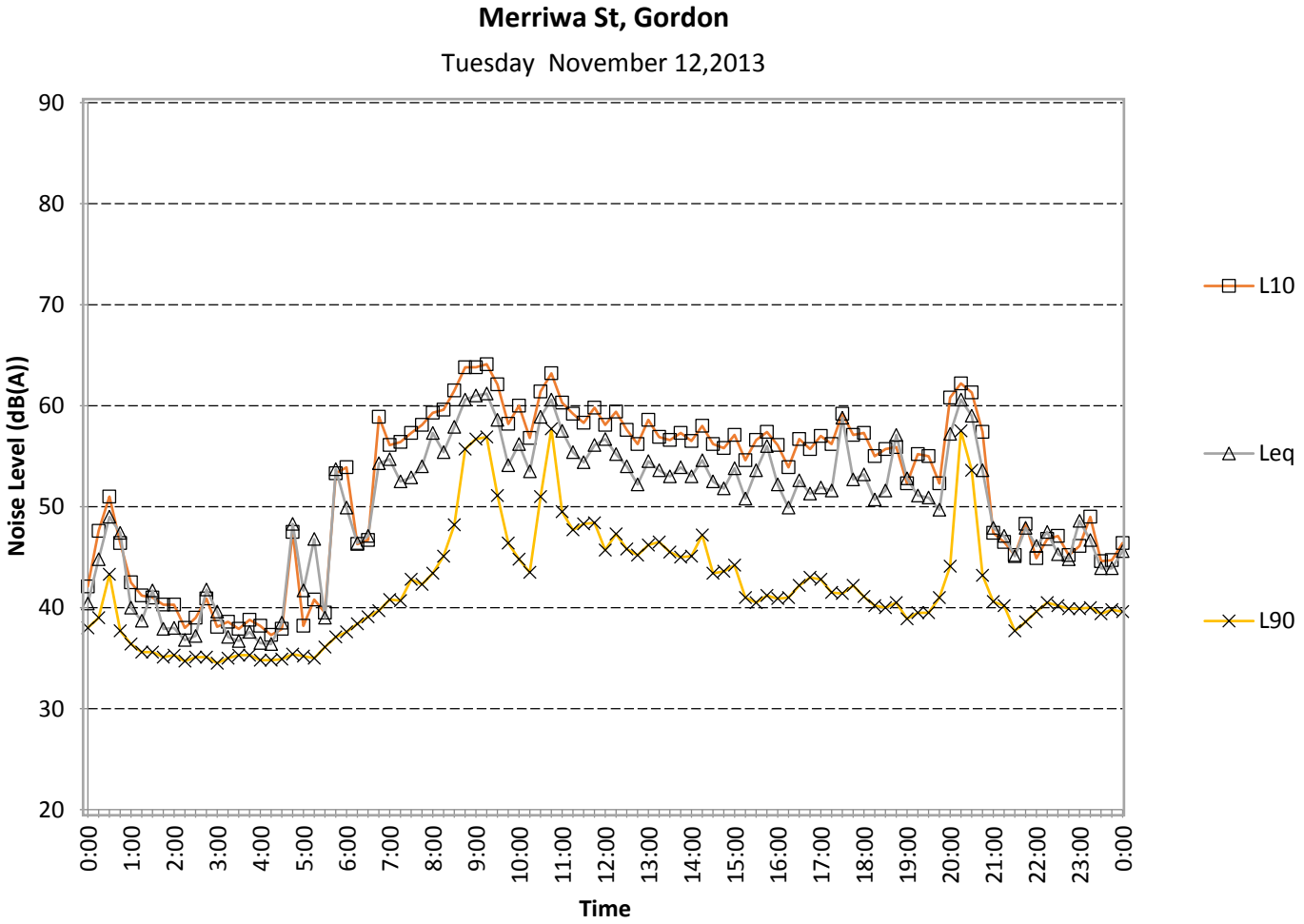
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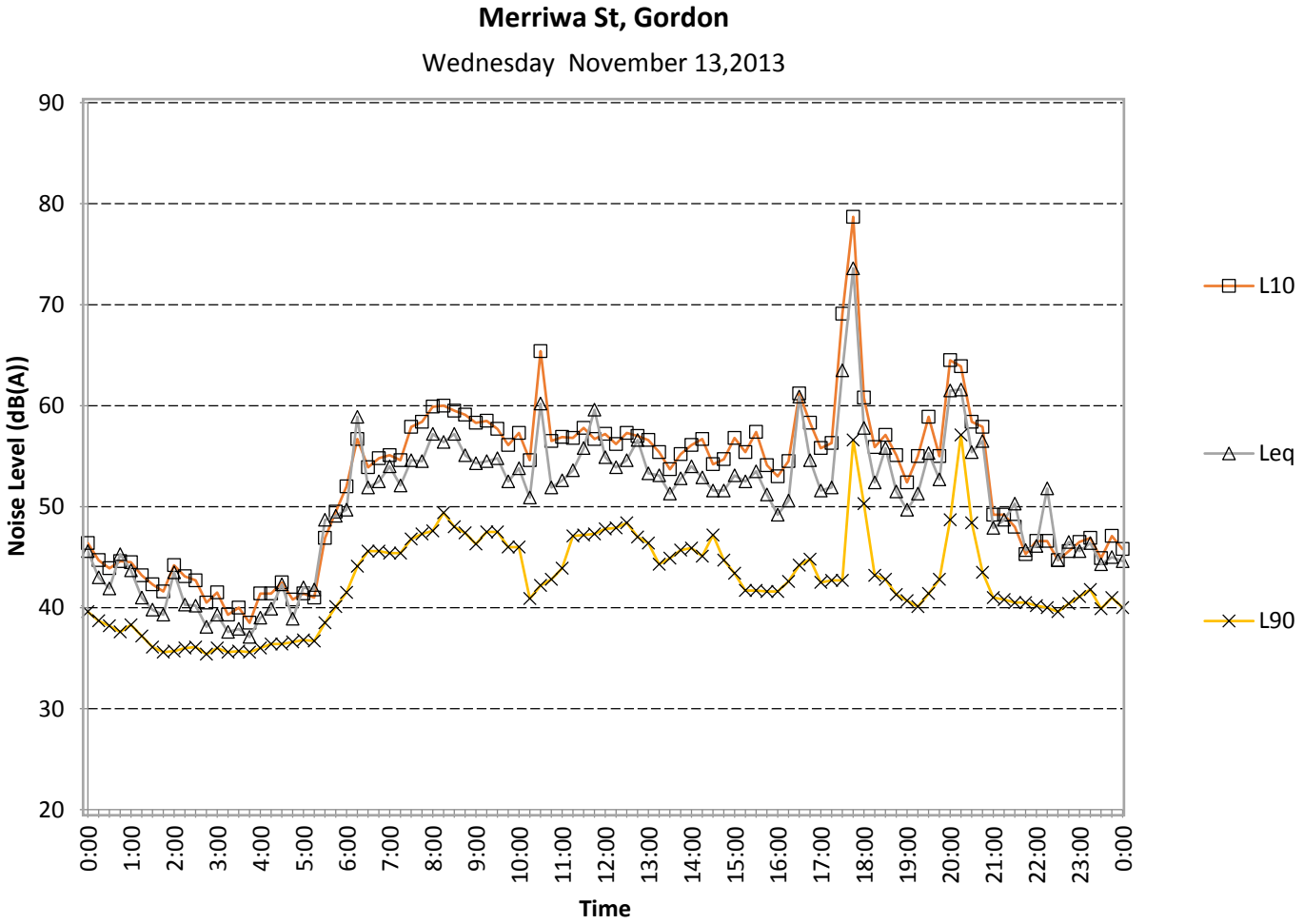
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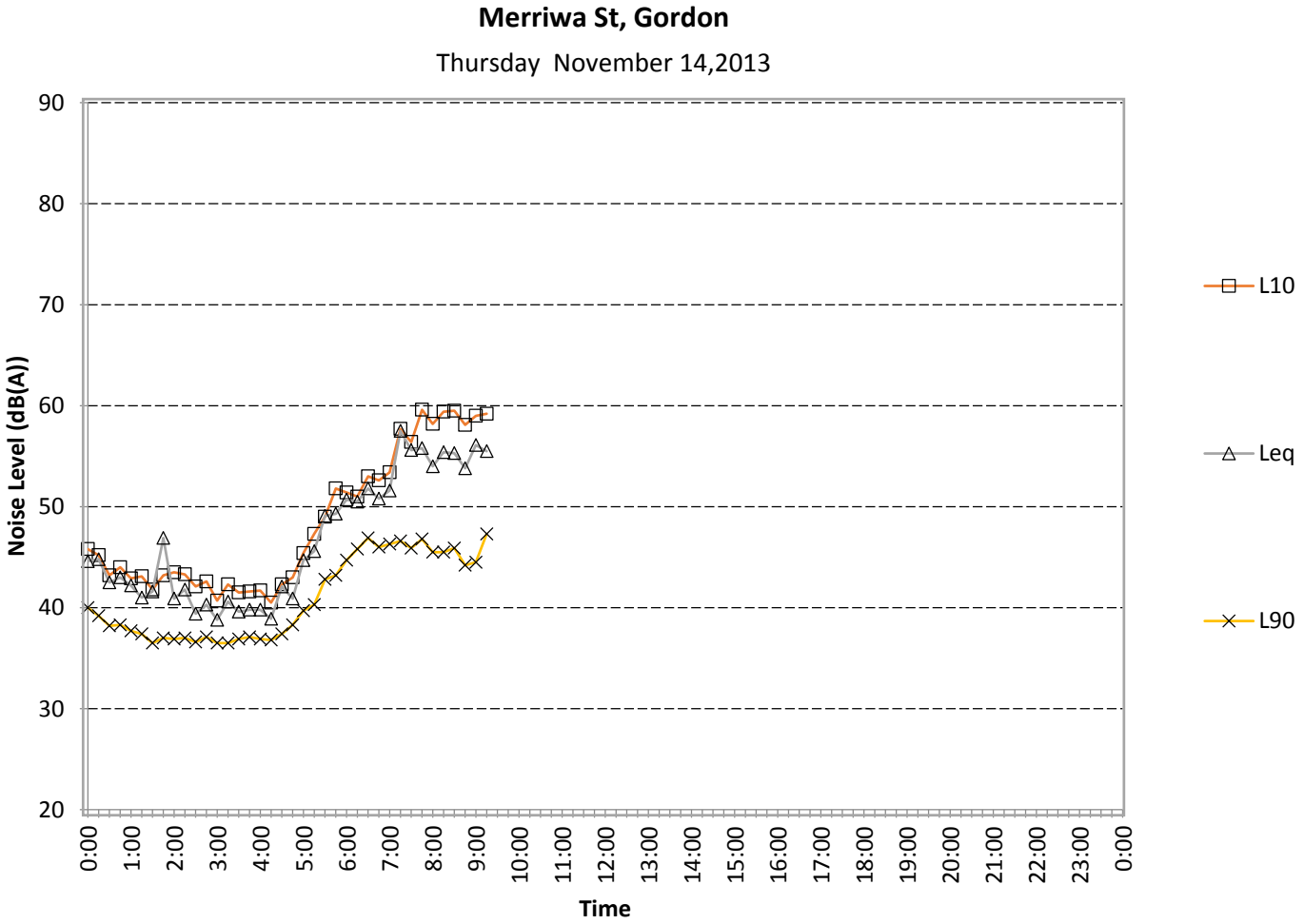
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