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Construction Noise and Vibration Impact Assessment

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1 INTRODUCTION

A noise and vibration assessment has been carried out for the proposed excavation/construction activities for Stage 2, Epping Park development based on the requirements of NSW DECC "Interim Construction Noise Guideline", German Standard DIN 4150-3 (1999-02): "Structural Vibration – Effects of Vibration on Structures" and DECC "Assessing Vibration: a technical guideline" (DEC,2006).

The assessment outlines the development of controls and safeguards that would be applied to all activity on the site by the excavation & construction contractor. The objective of these controls is to ensure that all work is carried out in a controlled and predictable manner that will minimise emissions and protect the amenity of the sensitive receivers surrounding the site.

Further reviews would be undertaken through the construction period, as required, in response to revised methods and equipment, as well as in response to the monitoring and evaluation of actual impacts. This management plan outlines the procedures that would be adopted by the contractor during the detailed construction planning and execution phases.

2 INTRODUCTION

This report covers an assessment of noise and vibration from construction activities proposed for Epping Park Stage 2 at 61 Mobbs Lane, Epping. The site is indicated in Figure 1.

3 PROJECT DESCRIPTION

The scope of work includes construction of Building 6, Building 9, Building 10 and Building 17. Trucks will enter the site via Mobbs Lane.

The nearest noise receivers are as below:

- Receiver 1 – Ryde TAFE Epping Annex.
- Receiver 2 - The two storey residential properties of Stage 1 bounding the site to the east.
- Receiver 3 - The residential housing under construction to the south of the site across Mobbs Lane.

Detailed site map and receiver location refer to Figure below.

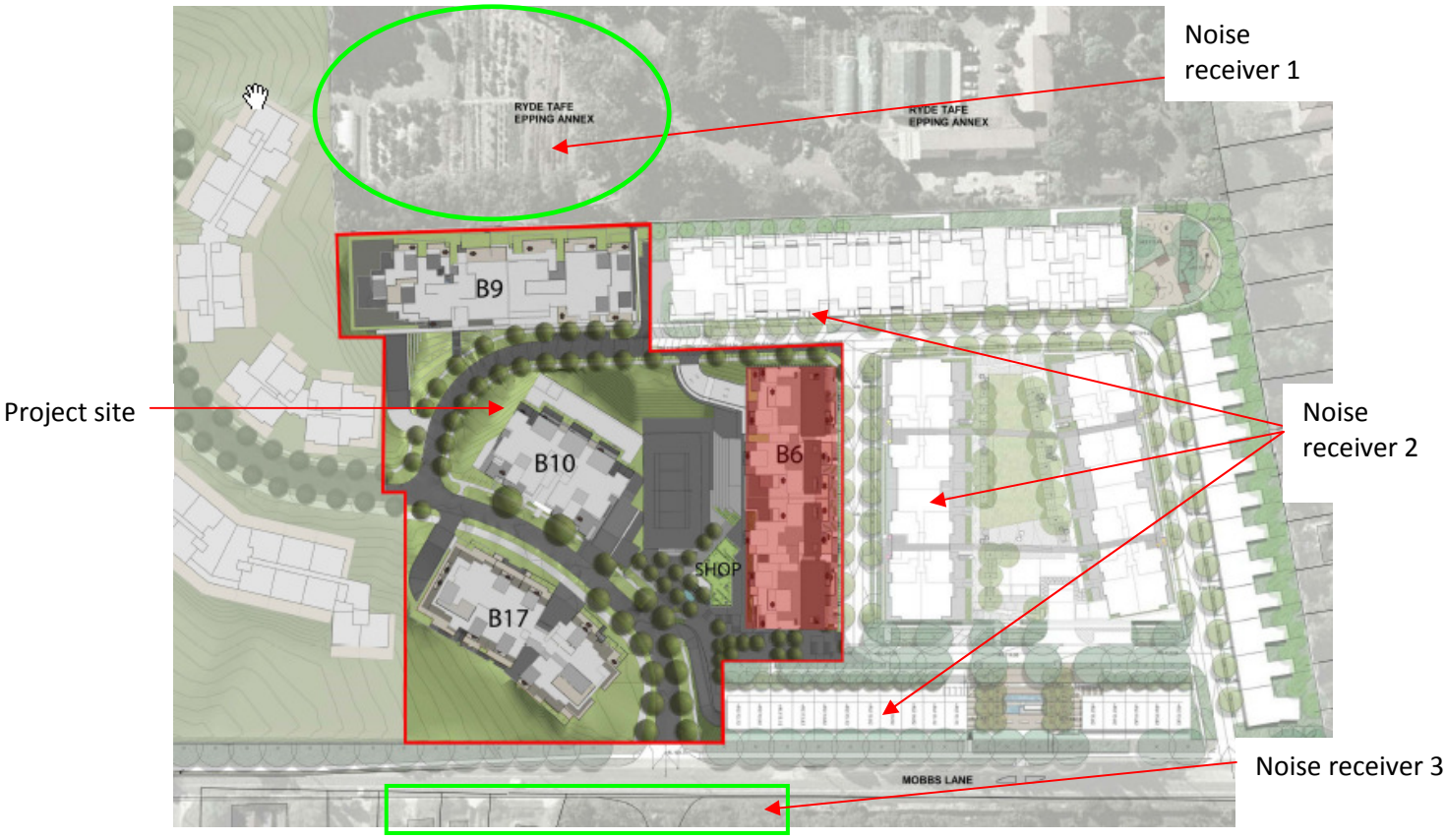


Figure 1 Site Map and Noise Receiver Locations

4 ACTIVITIES TO BE CONDUCTED AND THE ASSOCIATED NOISE SOURCES

Noise impact will be determined from all processes and equipment, which are involved in the activities outlined below by defining the levels of sound, which they generate.

The A-weighted sound power levels for all the component parts of the above-described activities are outlined in the tables below.

Table 1 - Sound Power Levels of the Proposed Equipment

CONSTRUCTION ACTIVITY	EQUIPMENT /PROCESS	SOUND POWER LEVEL - dB(A)
Piling Works	Vibro Piling	110
	CFA Piling	103
Excavation	Screener Machine	110
	30 Ton Excavator	114
	1.6 Ton Bulldozer	114
	19m long Truck	110
Construction	Angle Grinders	114
	Electric Saw	111
	Drilling	94
	Hammering	110
	Concrete Vibrator	100
	Cement Mixing Truck	105
	Concrete Pumps	107

The noise levels presented in the above table are derived from the following sources, namely:

- On-site measurements
- Table D2 of Australian Standard 2436-1981
- Data held by this office from other similar studies.

5 HOURS OF WORK

The proposed working hours are:

- 7:00am to 5:00pm Monday to Fridays
- 8:00am to 5:00pm Saturdays.

No work must be carried out on Sundays or public holidays.

6 NOISE AND VIBRATION OBJECTIVES

6.1 NOISE

6.1.1 To TAFE

Noise emissions to the educational institute to the north of the project site should comply with the recommended internal noise levels provided in Australian/New Zealand Standard 2107:2000 *"Recommended Design Sound Levels and Reverberation Times for Building Interiors"*, as shown in the table below.

Table 2 – AS2107:2000 Recommended Internal Noise Levels

Type of Occupancy	Recommended Internal Noise Level dB(A) L_{Aeq}
Classroom	45

6.1.2 To Residential Noise Receivers

"Interim Construction Noise Guideline". This guideline nominates acceptable levels of noise emissions above the background noise level. For major construction projects within the recommended standard hours the guideline recommends a noise level of 10 dB(A) above the background

Pursuant to this, noise emissions from construction should comply with the DECCW's "Interim Construction Noise Guidelines 2009", which nominates the following noise objectives and hours of construction:

- 7am to 6pm – background + 10 dB(A)$L_{eq(15min)}$

6.1.3 Existing Background Noise Levels

Daytime background noise levels were measured towards the western boundary of the subject site from 7th to 11th October 2010. The background noise monitoring location is detailed in Figure 1 above. Equipment used consisted of an Acoustic Research Laboratories Pty Ltd noise logger. The logger was programmed to store 15-minute statistical noise levels throughout the monitoring period. The equipment was 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. There were no significant periods of adverse weather conditions during the measurement period. The logger data has been included in this report as Appendix 1 below. Noise levels measured at this location will be indicative of background noise levels at nearby residences.

The results of the monitoring are summarised in the following table.

Table 3 - Measured Background Noise

Location	Ratted Day Background Noise Level dB(A) L_{90}
North-western boundary of site	43

6.1.4 Requirements of Guidelines

The applicable guidelines and standards have been summarised in the table below.

Table 4 – Summary of Noise Emission Criteria

Receiver	Time	Noise Criteria
Educational (Classroom)	During construction (7am to 5pm)	45dB(A) Internally (AS2107)
Residential	During construction(7am to 5pm)	53dB(A) $L_{eq(15min)}$ (DECCW Background +10dB)

For the control and regulation of noise from construction sites DECCW "Interim Construction Noise Guideline" nominates the following:

- That all practicable measures be taken on the building site to regulate noise emissions, including the siting of noisy static processes on parts of the site where they can be shielded, selecting less noisy processes, and if required regulating construction hours.
- The undertaking of noise monitoring where non-compliance occurs to assist in the management and control of noise emission from the building site.

Based on these criteria the following procedure will be used to assess noise emissions:

- Predict noise levels produced by typical construction activities at the sensitive receivers.

- Compare predicted noise emissions to noise emission objectives, as presented in Table 4 above.
- If noise levels exceed objectives, investigate and implement all practical and cost effective techniques to limit noise emissions.
- If the noise goal is still exceeded after applying all practical engineering controls to limit noise emissions investigate management and other techniques to mitigate noise emissions.

6.2 VIBRATION CRITERIA

It is proposed to adopt the following vibration guidelines, namely:

- German Standard DIN 4150-3 (1999-02): *"Structural Vibration – Effects of Vibration on Structures"* – which will be used to assess and limit building damage risk.
- British Standard BS 6472 – which will be used to assess the effects of vibration on human comfort.

The criteria and the application of these standards are discussed in separate sections below.

6.2.1 Building Damage

German Standard DIN 4150-3 (1999-02) provides vibration velocity guideline levels for use in evaluating the effects of vibration on structures. The criteria presented in DIN 4150-3 (1999-02) are presented in Table below.

It is noted that the peak velocity is the absolute value of the maximum of any of the three orthogonal component particle velocities as measured at the foundation, and the maximum levels measured in the x- and y-horizontal directions in the plane of the floor of the uppermost storey.

Table 5 - DIN 4150-3 (1999-02) Safe Limits for Building Vibration

TYPE OF STRUCTURE		PEAK PARTICLE VELOCITY (mms^{-1})			
		At Foundation at a Frequency of			Plane of Floor of Uppermost Storey
		< 10Hz	10Hz to 50Hz	50Hz to 100Hz	All Frequencies
1	Buildings used in commercial purposes, industrial buildings and buildings of similar design	20	20 to 40	40 to 50	40
2	Dwellings and buildings of similar design and/or use	5	5 to 15	15 to 20	15
3	Structures that because of their particular sensitivity to vibration, do not correspond to those listed in Lines 1 or 2 and have intrinsic value (e.g. buildings that are under a preservation order)	3	3 to 8	8 to 10	8

6.2.2 Assessing Amenity

On occupied levels of the building, for the type of vibration producing activities proposed, vibration induced within the adjacent buildings is likely to impact amenity well before the damage limits are reached.

The British Standard BS 6472 provides procedures for assessing tactile vibration and regenerated noise within potentially affected buildings. The recommendations of this guideline should be adopted to assess and regulate vibration within the project site.

6.2.3 Project Specific Vibration Criteria

Damage limits

Project specific vibration limits have been developed based on:

- The recommendations in Table 5.
- The vibration sources producing the highest vibration levels would not generate significant vibration at frequencies of less than 10Hz.

The appropriate vibration limit for the building is **5mm/s PPV for residential building and 3mm/s PPV for heritage structure**.

6.2.4 Amenity Criteria

British Standard BS 6472:1992 “Evaluation of Human Exposure to Vibration in Buildings (1Hz to 80Hz)” includes guidance for the assessment of human response to building vibration.

Human response to vibration has been shown to be biased at particular frequencies, which are related to the orientation of the person. This standard provides curves of equal annoyance for various orientations. These curves are applied as correction filters such that an overall weighted acceleration level is obtained. As the orientation of the resident is unknown or varying the weighting filter used is based on the combined base curve as given in ISO 2631 & Australian Standard 2670 “Evaluation of Human Exposure to Vibration and Shock in Buildings (1 to 80Hz)” which represents the worst case of the X, Y and Z axes. Filtered measurements are made in all three co-ordinate axes and the highest value axis used.

This standard assesses the annoyance of intermittent vibration by using the Vibration Dose Value (VDV). Alternatively the VDV may be estimated by the eVDV which is derived by a simpler calculation using an empirical factor. The VDV or eVDV is calculated for the two periods of the day being the “Daytime” (6am-10pm) and “Night time” (10pm-6am). The overall value is then compared to the levels in Table 7. For this project the aim will be for a low probability of adverse comment.

Table 6 - Vibration Dose Values (m/s1.75) above which various degrees of adverse comment may be expected in residential buildings

Place	Low Probability of adverse comment	Adverse comment possible	Adverse comment probable
Residential buildings 16hr day	0.2 to 0.4	0.4 to 0.8	0.8 to 1.6
Residential buildings 8hr night	0.13	0.26	0.51

7 ASSESSMENT OF POTENTIAL NOISE EMISSIONS

7.1 NOISE EMISSION ASSESSMENT

Noise generated by plant and equipment throughout the duration of the project will be managed to generally comply with the background + 10dB(A) criterion, and where this noise goal may be exceeded noise will be managed in strict compliance with DECCW “Interim Construction Noise Guideline”.

Predictions of the noise levels at the sensitive receivers identified have been made of the construction processes with the potential to produce significant noise.

All predictions were made by taking into account the expected façade reductions, barrier effects (where applicable) distance losses, and using the noise levels tabled above.

7.2 PREDICTION TO NOISE RECEIVERS

7.2.1 Noise Receiver 1- TAFE – North of the Site

The educational institution located to the north of the project site. The noise goal complying with Council guidelines would be 45 dB(A) internally from Monday to Friday at all times.

The predictions indicate that the construction activities will generally comply at this receiver. There will be periods where the noise goal is exceeded; this will be during the use of particularly noisy equipment working close to the receiver side, including the following:

- Excavator, Angle grinder and electric saw working close to the receiver side would exceed the noise goal by up to 7 dB(A).

7.2.2 Noise Receiver 2- Stage 1 of project site – East of the Site

The one and two storey residences located to the east of the project with full view of the project site. The noise goal complying with Council guidelines would be 53 dB(A) at all times.

The predictions indicate that the construction activities will generally comply at this receiver. There will be periods where the noise goal is exceeded; this will be during the use of particularly noisy equipment working close to the receiver side, including the following:

- Excavator, Angle grinder and electric saw working close to the receiver side would exceed the noise goal by up to 20 dB(A).
- Concrete Pump would comply with the noise goal at the eastern most receivers adjacent to the site (with the concrete truck located towards the south-east of the site on Mobbs Lane) with barrier.

7.2.3 Noise Receiver 3 - Residential Housing across Mobbs Lane – South of the Site

The residential townhouse development located to the south of the project. Mobbs Lane is approximately 10m higher in elevation than the receiver, and provides partial screening of this development from the project site. The noise goal complying with Council guidelines would be 53 dB(A) at all times.

The predictions indicate that the excavation and construction activities will generally comply at this receiver. There will be periods where the noise goal is exceeded; this will be during the use of particularly noisy equipment working close to the receiver side, including the following:

- Excavator, Angle grinder and electric saw working close to the receiver side would exceed the noise goal by up to 13 dB(A).
- Concrete Pump would comply with the noise goal at the southern receivers opposite the site on Mobbs Lane (with the concrete truck located towards the south-east of the site on Mobbs Lane).

Noise emissions from the site will generally comply with Council guidelines, however, will intermittently exceed the noise goal for short periods.

8 NOISE AMELIORATIVE MEASURES

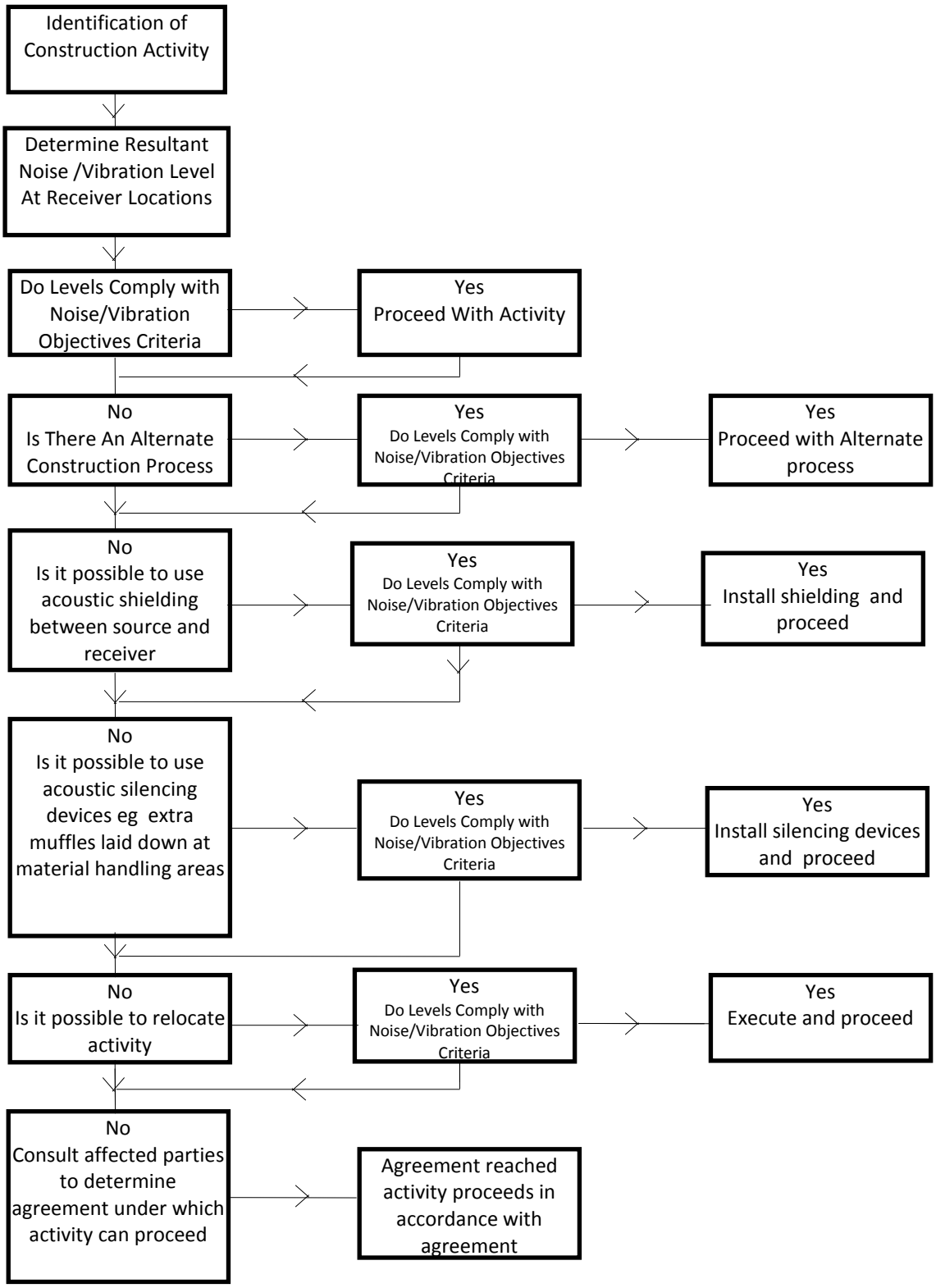
Recommendations are made reduce noise emissions to the noise goals, and to implement to minimise noise emissions where practicable:

- Truck movements should not occur before 7am.

9 CONTROL OF CONSTRUCTION NOISE

As a part of the noise management plan a detailed study has been undertaken of each of the proposed activities which will occur as a part of the construction works on this project. This facilitates the formulation of noise control strategies for this project. The flow chart which follows illustrates the process which will be followed in assessing construction activities.

CONTROL OF NOISE AND VIBRATION



10 NOISE CONTROL METHODS

The determination of appropriate noise control measures will be dependant on the particular activities and construction appliances. This section provides an outline of available methods.

10.1 SELECTION OF ALTERNATE APPLIANCE OR PROCESS

Where a particular activity or construction appliance is found to generate excessive noise levels, it may be possible to select an alternative approach or appliance. For example; the use of a hydraulic hammer on certain areas of the site may potentially generate high levels of noise. By carrying this activity by use of pneumatic hammers, bulldozers ripping and/or milling machines lower levels of noise will result.

10.2 SILENCING DEVICES

Where construction process or appliances are noisy, the use of silencing devices may be possible. These may take the form of engine shrouding, or special industrial silencers fitted to exhausts.

10.3 MATERIAL HANDLING

The installation of rubber matting over material handling areas can reduce the sound of impacts due to material being dropped by up to 20dB(A).

10.4 TREATMENT OF SPECIFIC EQUIPMENT

In certain cases it may be possible to specially treat a piece of equipment to dramatically reduce the sound levels emitted.

10.5 REGULAR NOISE CHECKS OF EQUIPMENT

To determine the requirement for silencing devices on machinery it is proposed to undertake fortnightly noise check. Noise levels of all machines on site will be measured and if they are found to be higher than nominated for that equipment type, items such as mufflers and engine shrouds will be examined to ensure they are in good working order.

A record of these measurements will be kept on a form similar to that shown below.

This measure is expected to maintain noise at constant levels, and prevent any increases.

Meriton Apartments Project Management

STAGE 2, EPPING PARK

Construction Appliance Compliance Certificate

Month .....

Year .....

Plant Item .....

Allowable Noise Level .....

Measured Noise Level .....

Complies Yes ☐ No ☐

Issuing Engineer .....

Sub-Contractor .....

Project Manager .....

11 VIBRATION - ACCEPTABLE SAFETY WORK PRACTICES

The only potentially significant sources of vibration are those associated with driven piling and hammering.

CFA/Bored piling should be undertaken in lieu of impact piles to significantly reduce any vibration impacts upon the adjoining residents. Where complaints are received associated with vibration the complaints procedure listed in appendix will be followed and where required vibration monitoring will be implemented.

To regulate vibration emanating from excavation processes the excavation contractors will need to operate particular machinery at certain distance from affected buildings to comply within the criteria. The following is an estimate of the distances that may be required for the various machinery types.

To regulate vibration emanating from excavation processes the remediation contractor will need to operate particular machinery at certain distances from potentially affected buildings to comply with the criteria.

Based on vibration studies conducted by this office for similar sites, the table below provides recommended safe minimum working distances for the operation of vibration producing machinery.

Table 7 – Minimum Safe Operating Distances to Receivers for Machinery

Machine Type	Residential Receiver	Commercial Receiver
30-Tonne Excavator with Hammer	30m	5m
3-Tonne Excavator with Hammer	5m	2m
CFA/Bored Piling	5m	2m

12 COMMUNITY INTERACTION AND COMPLAINTS HANDLING

12.1 ESTABLISHMENT OF DIRECT COMMUNICATION WITH AFFECTED PARTIES

In order for any construction noise management programme to work effectively, continuous communication is required between all parties, which may be potentially impacted upon, the builder and the regulatory authority. This establishes a dynamic response process which allows for the adjustment of control methods and criteria for the benefit of all parties.

The objective in undertaking a consultation processes is to:

- Inform and educate the groups about the project and the noise controls being implemented;
- Increase understanding of all acoustic issues related to the project and options available;
- Identify group concerns generated by the project, so that they can be addressed; and

- Ensure that concerned individuals or groups are aware of and have access to the Site Complaints Register which will be used to address any construction noise related problems should they arise.

To ensure that this process is effective, regular scheduled meetings will be required for a finite period, until all issues have been addressed and the evidence of successful implementation is embraced by all parties.

An additional step in this process is to produce a newsletter informing nearby residents of upcoming activities that are likely to generate higher noise/vibration levels.

12.2 DEALING WITH COMPLAINTS

Should ongoing complaints of excessive noise or vibration criteria occur immediate measures shall be undertaken to investigate the complaint, the cause of the exceedances and identify the required changes to work practices.

Documentation and training of site staff shall occur to ensure the practices that produced the exceedances are not repeated.

If a noise complaint is received the complaint should be recorded on a Noise Complaint Form. The complaint form should list:

- The name and address of the complainant (if provided);
- The time and date the complaint was received;
- The nature of the complaint and the time and date the noise was heard;
- The name of the employee who received the complaint;
- Actions taken to investigate the complaint, and a summary of the results of the investigation;
- Required remedial action, if required;
- Validation of the remedial action; and
- Setup vibration monitoring system at the location represents the nearest vibration receiver location with alarm device which can inform the project manager on site if the vibration exceedance happened.
- Summary of feedback to the complainant.

A permanent register of complaints should be held.

All complaints received should be fully investigated and reported to management. The complainant should also be notified of the results and actions arising from the investigation.

The investigation of a complaint shall involve where applicable;

- noise measurements at the affected receiver;
- an investigation of the activities occurring at the time of the incident;
- inspection of the activity to determine whether any undue noise is being emitted by equipment; and
- Whether work practices were being carried out either within established guidelines or outside these guidelines.

Where an item of plant is found to be emitting excessive noise, the cause is to be rectified as soon as possible. Where work practices within established guidelines are found to result in excessive

noise being generated then the guidelines should be modified so as to reduce noise emissions to acceptable levels. Where guidelines are not being followed, the additional training and counselling of employees should be carried out.

Measurement or other methods shall validate the results of any corrective actions arising from a complaint where applicable.

13 CONTINGENCY PLANS

Where non-compliances or noise complaints are raised the following methodology will be implemented.

1. Determine the offending plant/equipment/process
2. Locate the plant/equipment/process further away from the affected receiver(s) if possible.
3. Implement additional acoustic treatment in the form of localised barriers, silencers etc where practical.
4. Selecting alternative equipment/processes where practical
5. Setup noise/vibration monitoring devices at locations represent nearest noise receivers and provide noise data for each complain time period. Analysis is required to determine suitable mitigation measures.

Complaints associated with noise /vibration generated by site activities shall be recorded on a Complaint Form. The person(s) responsible for complaint handling and contact details for receiving of complaints shall be established on site prior to construction works commencing. A sign shall be displayed at the site indicating the Site Manager to the general public and their contact telephone number.

14 CONCLUSION

A noise and vibration assessment has been undertaken of the proposed construction activities to identify whether these activities would impact sensitive receivers around the site.

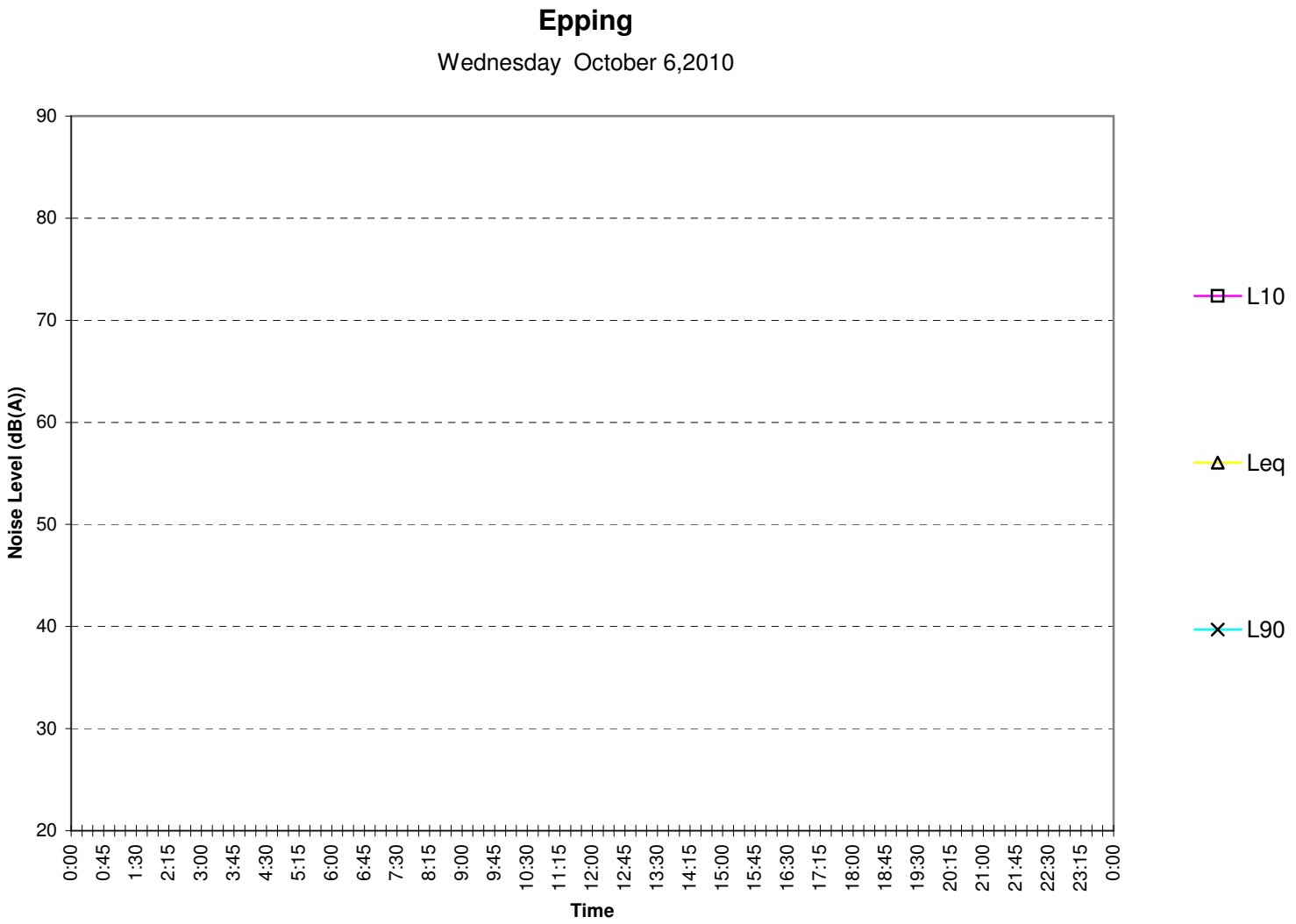
The assessment of construction noise and vibration indicates that management and engineering measures will be needed to limit noise impacts to the residential buildings adjacent to the site based on the requirements of NSW DECC "Interim Construction Noise Guideline", German Standard DIN 4150-3 (1999-02): "Structural Vibration – Effects of Vibration on Structures" and DECC "Assessing Vibration: a technical guideline" (DEC,2006).

Minimal vibration impacts are expected. Notwithstanding this, safeguards to ensure no adverse impacts at the residential buildings have been recommended in this report.

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

Yours faithfully,

Acoustic Logic Consultancy Pty Ltd
George Wei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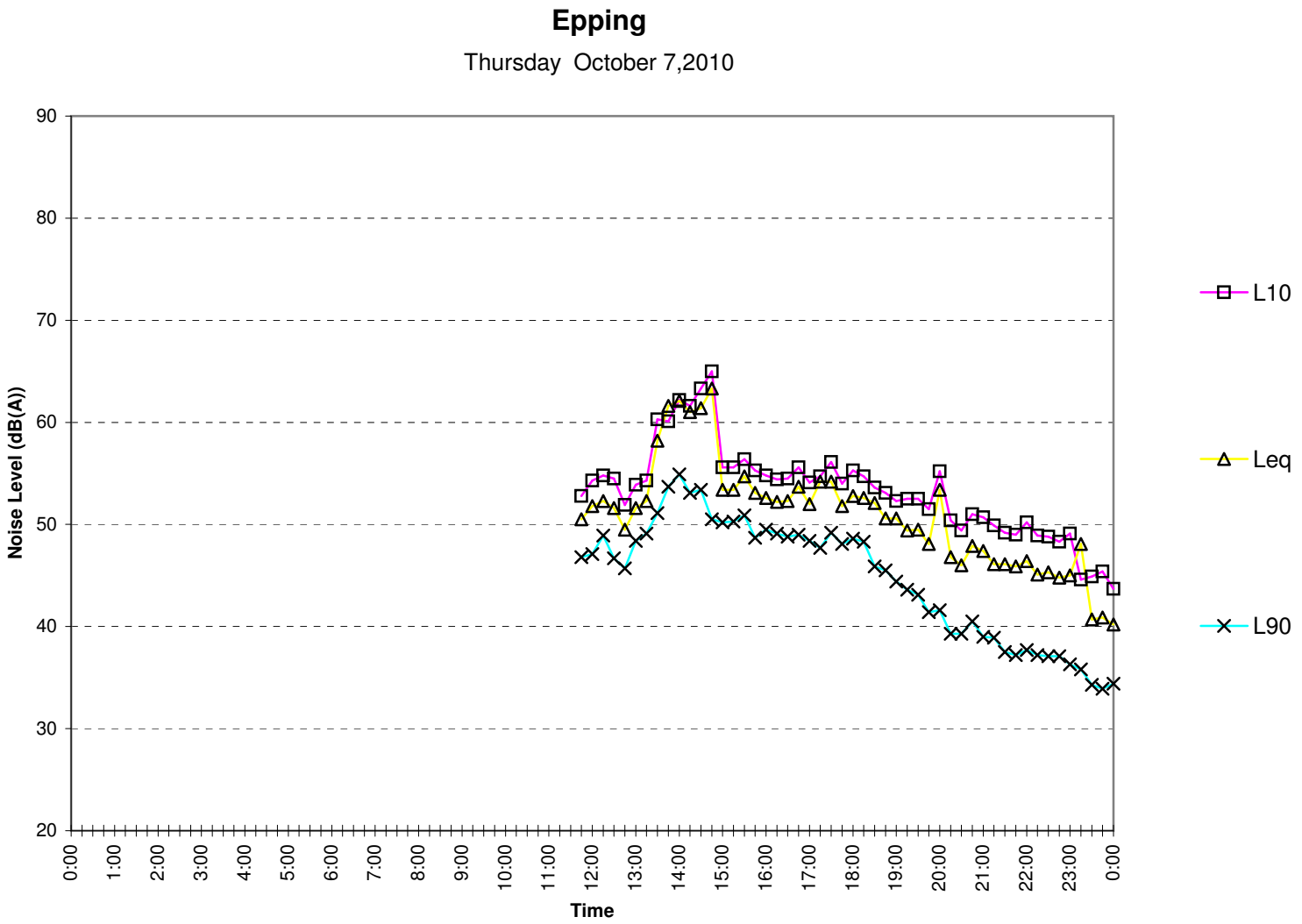
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Noise Level (dB(A))
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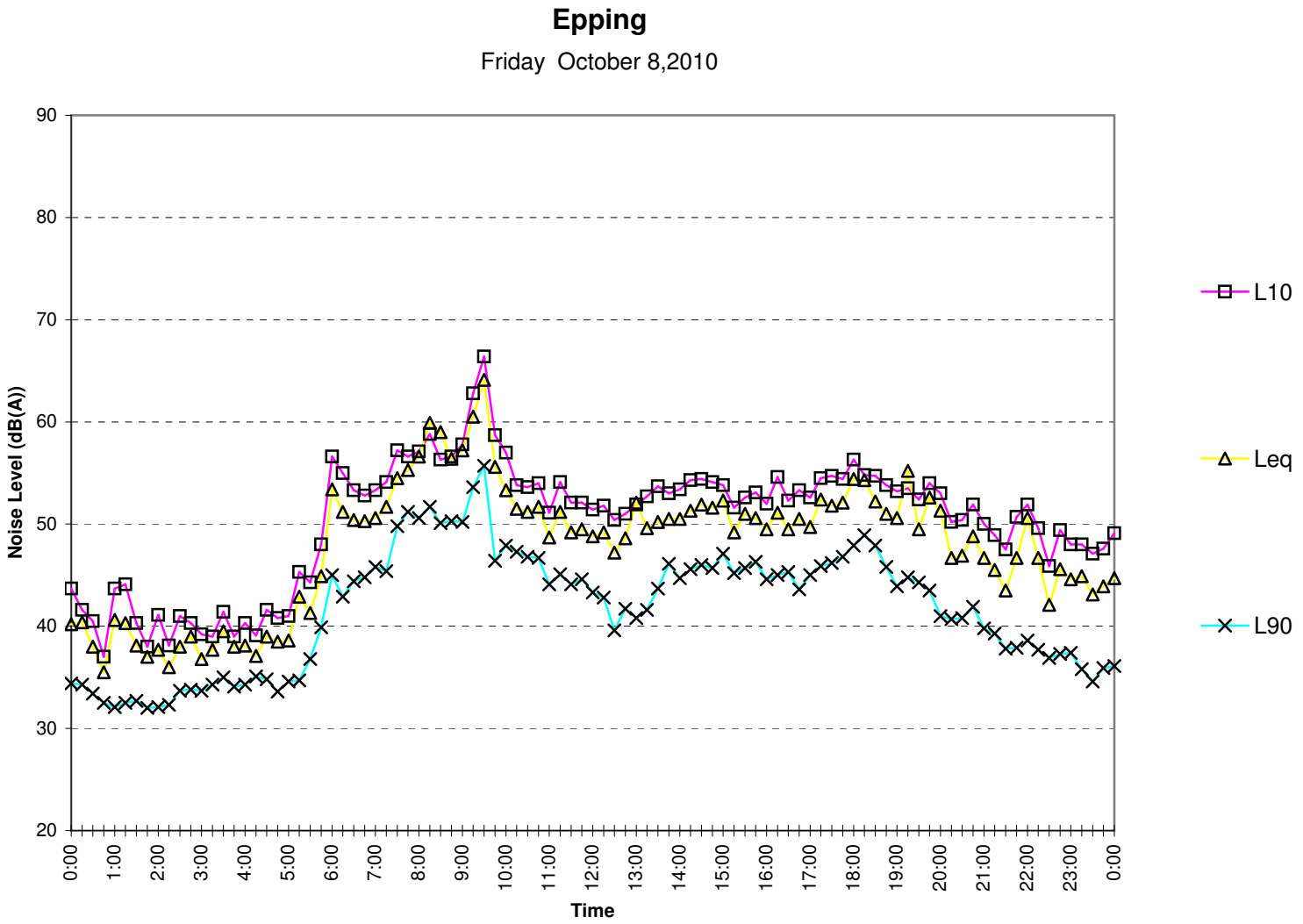
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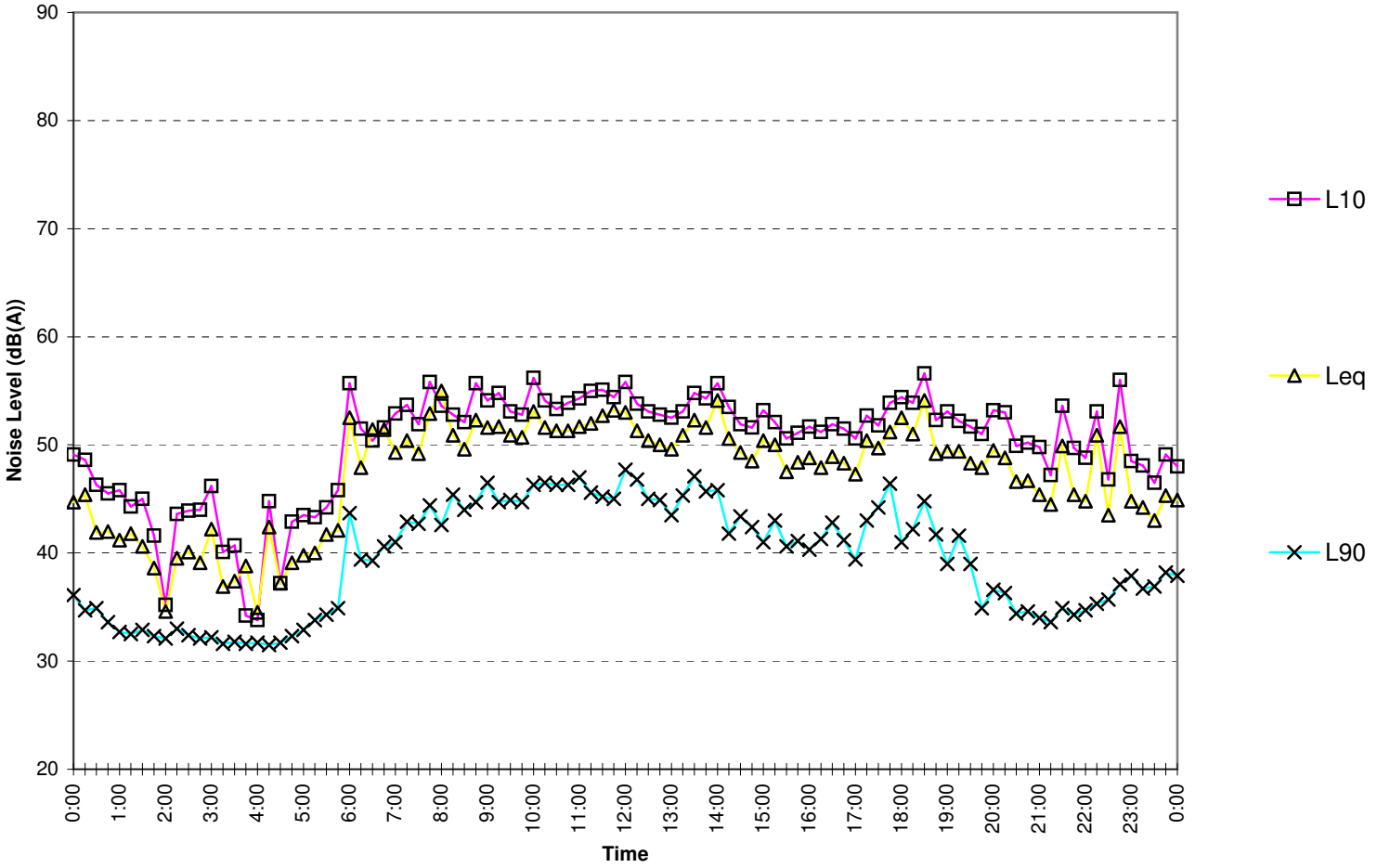
Epping

Saturday October 9,2010



Epping

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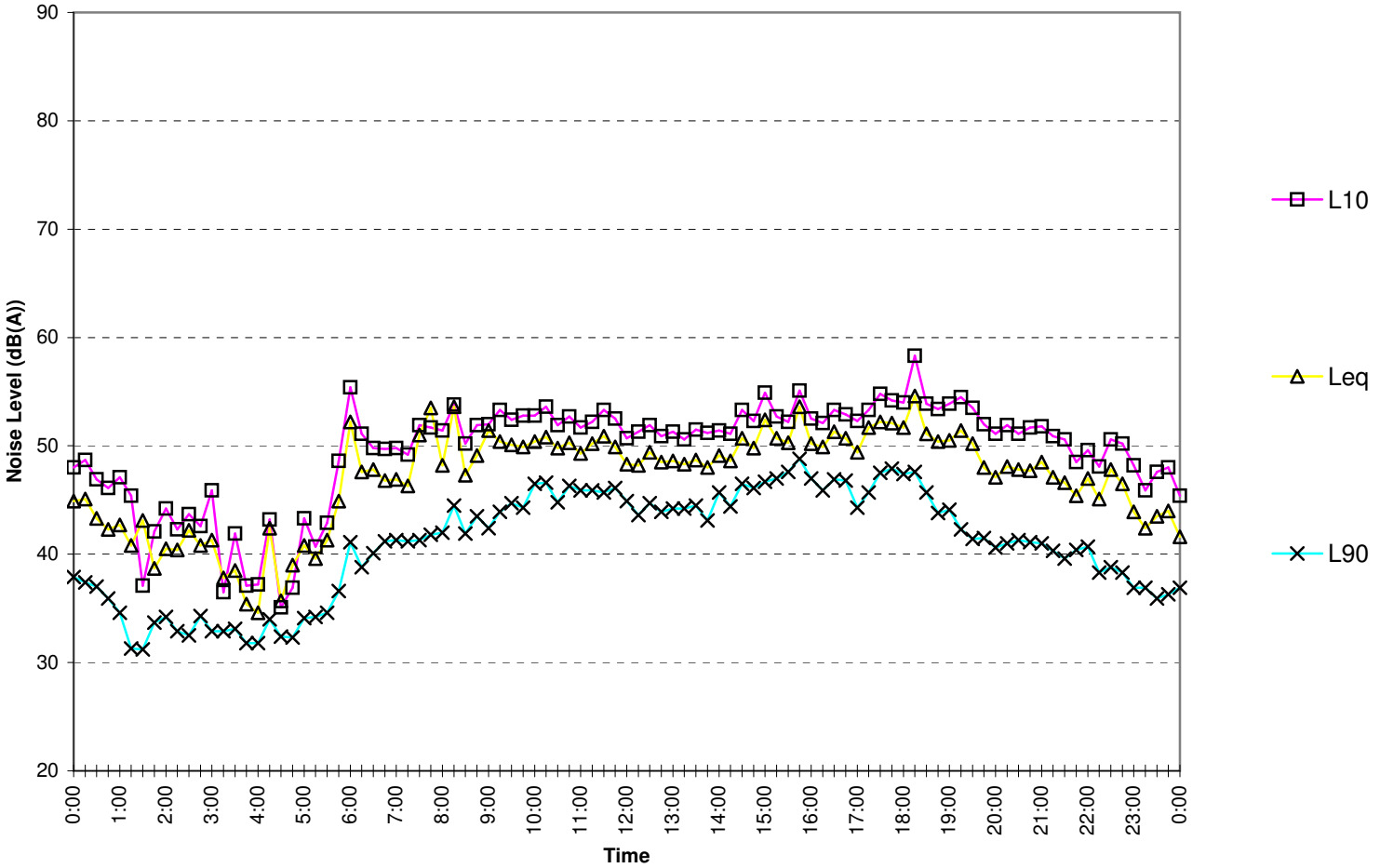

Epping

Monday October 11,2010