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4-18 Doncaster Avenue, Kensington

Noise Impact Assessment

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1 INTRODUCTION

Acoustic Logic Consultancy have been engaged to undertake an assessment of noise impacts associated with the proposed student accommodation development at 4-18 Doncaster Avenue, Kensington.

This report has been prepared to address the acoustic requirements of the NSW Department of Planning SEAR's requirements for SSD 9649, specifically:

> *4. Amenity*
>
> *5. Noise and Vibration*
>
> *11. Sydney Light Rail Maintenance Facility (Stabling Yard)*

Relevant acoustic criteria to satisfy the requirements of the above have been derived from the following documents;

- Randwick City Council Development Control Plan;
- State Environment Planning Policy (Infrastructure) 2007
- NSW Department of Planning Development Near Rail Corridors and Busy Roads;
- NSW Environment Protection Authority (EPA) Noise Policy for Industry;
- Australian Standard AS2107:2016 – Recommended Design Sound Levels and Reverberation Times for Building Interiors; and
- NSW EPA Interim Construction Noise Guidelines

The assessment has been conducted based on the Architectural drawings provided by *Hayball Architects,* project number 2309, Revision 1, dated 07/12/2018.

2 SITE DESCRIPTION

The proposed student accommodation development comprises of basement level parking, ground floor common/management areas, and three levels of accommodation. Investigation has been carried out by this office in regards to the existing properties and noise impacts surrounding the proposed development, which is detailed below:

- Bounding the site to the east is Doncaster Avenue with is existing multi storey residential development to the west of Doncaster Avenue
- Bounding the site to the east is the recently constructed Sydney Light Rail Maintenance Facility (Stabling Yard). Further this Royal Randwick Racecourse
- North of the site is Allison Road, which carries high volumes of traffic and is nominated as a classified road under SEPP (infrastructure) 2007; and
- South of the site is existing residential development.

The nearest noise receivers around the site are as follows:

- R1: Residential Receiver 1 – Existing residential development to the south of the site along Doncaster Avenue
- R2: Residential Receiver 2 – Existing residential development to the west of the site across Doncaster Avenue.

A site map and measurement locations are detailed in Figure 1.

The following noise sources have been identified and are assessed based on monitoring of a typical race meeting for operational noise, and an average day for road traffic noise to determine the potential for adverse noise impacts on the development:

- Alison Road, a six lane arterial road carrying in excess of 40, 000 vehicles per day;
- Sydney Light Rail Maintenance Facility (Stabling Yard);
- Doncaster Avenue, which carries moderate volumes of traffic;
- Race Day events at Royal Randwick. This covers the possible noise sources from the races, bus, car and taxi movements, public address systems and typical plant and equipment that are present during the events.
- Car park vehicle movements.
- Private events at Royal Randwick. These are events which are unrelated to horse racing such as private parties and functions, UNSW exams, etc.

Figure 1 – Proposed Development Site Map

2.1 EXISTING ACOUSTIC ENVIRONMENT

2.1.1 Noise Descriptors

Environmental 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 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 measurement period. L_{eq} is important in the assessment of noise impact as it closely corresponds with human perception of a changing noise environment.

L_{max} levels represent is the loudest noise event during a measurement period.

2.1.2 Existing Noise Environment

The existing noise environment at the monitor location is dominated by the distant traffic noise on Alison Road. Road traffic noise from Doncaster Avenue was not audible on our site visits and is unlikely to be an issue as all the houses and units along it screen the site.

Ambient noise monitoring has been conducted around the proposed site using an unattended noise monitor. The purpose of the monitoring was to:

- Establish the background noise level in the vicinity i.e. the typical minimum noise level occurring at the potentially affected properties surrounding the development.
- Establish the impact of existing environmental noise sources in the vicinity at the properties potentially most affected by noise emissions.

2.1.3 Unattended Background Noise Measurements

Background noise measurements were obtained over a number of days to characterise the existing noise environment.

2.1.4 Measurement Location

Background Noise Monitor Location: A background noise monitor was installed within the rear of the proposed site location with microphone close to the eastern boundary. The monitoring location is representative of noise receivers surrounding the project site.

2.1.5 Monitoring Period

Background Noise Monitor: the background noise monitoring was conducted between 15th and 19th May, 2014. The results of unattended noise monitoring area included in Appendix 1.

2.1.6 Monitoring Equipment

Ambient noise levels were continuously monitored using an unattended noise monitor. The unattended monitor used continuously measured noise levels and every 15 minutes stored statistical data within memory. The stored data was downloaded at the end of the measurement period. The monitor was set to A-weighted fast response. The monitor was calibrated before and after the measurement using a Rion NC-73 calibrator. No significant drift was recorded. There were no periods of adverse weather conditions during the measurement period.

2.1.7 Rating Background Noise Levels

Result of monitoring are detailed in Appendix 1. Table 1 lists the representative minimum background noise levels. The results are represented for the day, evening and night time periods.

Table 1 – Rating Background Noise Levels at Receivers

Location	Period	Representative Background Noise Level (dB(A) L_{90})
4-12 Doncaster Ave	7am to 6pm (Day)	41
	6pm to 10pm (Evening)	40
	10pm to 7am (Night)	36

2.1.8 Discussion of Monitoring

Monitoring was conducted prior the construction / development of the light rail infrastructure to the east of the site. Since the date of monitoring, it is exceptionally unlikely that background noise levels would have reduced in the area – as such the measured noise levels should be considered appropriate or even a conservative representation of the current noise environment.

Further, ongoing construction works have been occurring during that day, evening and night time period at the light rail stabling yard and surrounding infrastructure. As this activity is temporary (and in close proximity to the site and surrounding residential receivers), any noise measurements that would be proposed to be undertaken during the time of reporting would be adversely impacted.

Additionally, as detailed in Section 4.1.3, based on previously measured background noise levels at the site the project noise trigger levels are governed by amenity requirements for the evening and night time period – these levels are set independently of background noise levels. As such, it is only the daytime period which would be governed by intrusiveness requirements of the INP, and as discussed above the measured noise levels from 2014 should be considered appropriate.

Based on the above, use of background noise monitoring data from May 2014 is reasonable.

3 EXTERNAL NOISE INTRUSION IMPACT

3.1 NOISE INTRUSION CRITERIA

Noise intrusion to the project site has been assessed with reference to the requirements of the following documents;

- NSW Department of Planning SEAR's requirements for SSD 9649
- Randwick City Council Development Control Plan;
- State Environment Planning Policy (Infrastructure) 2007
- NSW Department of Planning Development Near Rail Corridors and Busy Roads; and

3.1.1 NSW Department of Planning SEAR's requirements for SSD 9649

4. Amenity

The EIS shall:

- *Address how the proposal achieves a high level of environmental and residential amenity including consideration of solar access, acoustic impacts, natural ventilation, visual privacy, and noise and vibration emanating from the adjoining light rail holding yard.*

11. Sydney Light Rail Maintenance Facility (Stabling Yard)

The EIS shall undertake the assessment to identify the impacts of the Sydney Light Rail maintenance facility on the proposed development and the impact of the proposed development and the impacts of the proposed development on the Sydney Light Rail maintenance facility. The assessment shall include but not be limited to the following:

- *Noise assessment and associated acoustic treatments for the proposed development*

3.1.2 Randwick City Council Development Control Plan

C2 Medium Density Residential

5.4 Acoustic Privacy

iv) For developments fronting arterial roads, provide noise mitigation measures to ensure an acceptable level of living amenity for the dwelling units is maintained. A noise assessment report prepared by a qualified acoustic consultant must be submitted with suitable noise mitigation solutions. The intention is to achieve an acceptable level of noise exposure in the interior space, without relying on mechanical ventilation.

3.1.3 NSW Department of Planning – State Environmental Planning Policy (SEPP) (INFRASTRUCTURE) 2007

Clause 102 of the NSW SEPP for road traffic noise stipulates

"This clause applies to development for any of the following purposes that is on land in or adjacent to the road corridor for a freeway, a tollway or a transit way or any other road with an annual average daily traffic volume of more than 40,000 vehicles (based on the traffic volume data published on the website of the RTA) and that the consent authority considers is likely to be adversely affected by road noise or vibration:

(a) a building for residential use,

(b) a place of public worship,

(c) a hospital,

(d) an education establishment or child care centre.

If the development is for the purposes of a building for residential use, the consent authority must not grant consent to the development unless it is satisfied that appropriate measures will be taken to ensure that the following LAeq levels are not exceeded:

(a) in any bedroom in the building – 35 dB(A) at any time between 10 pm and 7am,

(b) anywhere else in the building (other than a garage, kitchen, bathroom or hallway) – 40 dB(A) at any time."

Map 16 of the traffic volume maps for Infrastructure SEPP (from the road and maritime services website) classifies the section of Alison Road adjoining the subject site as a carriageway carrying more than 40,000 vehicles per day. Refer to Figure 2 for map and site location.

Figure 2 - Site Location and SEPP (Infrastructure) 2007 Classified Roads

3.1.4 NSW Department of Planning – *Development near Rail Corridors or Busy Roads – Interim Guideline*

Section 3.5 of the NSW Department of Planning's 'Development near Rail Corridors and Busy Roads (Interim Guideline)' states:

"The following provides an overall summary of the assessment procedure to meet the requirements of clauses 87 and 102 of the Infrastructure SEPP. The procedure covers noise at developments for both Road and Rail.

- *If the development is for the purpose of a building for residential use, the consent authority must be satisfied that appropriate measures will be taken to ensure that the following LAeq levels are not exceeded:*
  - *in any bedroom in the building: 35dB(A) at any time 10pm-7am*
  - *anywhere else in the building (other than a garage, kitchen, bathroom or hallway): 40dB(A) at any time."*

3.1.5 Australian Standard AS2107:2016 – *Recommended Design Sound Levels and Reverberation Times for Building Interiors*

Australian Standard AS 2107-2016: Recommended design sound levels and reverberation times for building interiors specifies allowable internal noise levels for internal spaces within residential and commercial buildings. Table 2 presents the sound levels applicable to the proposed redevelopment.

Table 2 – Recommended Design Sound Levels of AS2107:2016

Space /Activity Type	Recommended Maximum Design Sound Level
Residential (near major roads) – Living Areas	45 dB(A)$L_{eq(1hour)}$
Residential (near major roads) – Sleeping Areas (night time)	40 dB(A)$L_{eq(1hour)}$

3.1.6 Summarised External Noise Intrusion Criteria

Summarised internal noise criteria adopted for each internal space is summarised below.

Table 3 – Adopted Internal Noise Levels

Space / Activity Type	Design Internal Noise Level
Residential Living Areas	40 dB(A) $L_{eq\ (15hr)}$ ***For Noise Intrusion from Traffic*** 45 dB(A) $L_{eq(1hr)}$ ***For Noise Intrusion from Other Noise Sources***
Residential Sleeping Areas (night time)	35 dB(A) $L_{eq\ (15hr)}$ ***For Noise Intrusion from Traffic*** 40 dB(A) $L_{eq(1hr)}$ ***For Noise Intrusion from Other Noise Sources***

3.2 NOISE INTRUSION SOURCES SURROUNDING SITE

3.2.1 Traffic Noise Measurements

Traffic noise measurements were performed generally in accordance with the Australian Standard AS 1055 - "Description and measurement of environmental noise - General Procedures".

3.2.1.1 Measurement Positions

An attended morning peak hour measurement was used for the assessment. The measurement location was approximately 15m distance from Alison Road as detailed in Figure 1 of this report.

3.2.1.2 Time of Measurements

Attended noise measurements were carried out between 7am and 9am on 16th May 2014.

3.2.1.3 Measurement Equipment

SVAN 958 Four Channels Sound and Vibration Analyser was used for the noise measurements. The analyser was set to fast response and calibrated before and after the measurements using a SVANTEK SV03A calibrator. No significant drift was noted.

3.2.1.4 Measured Noise Levels

The external noise levels from the measurements taken at 15m distance from Alison Road and the results are tabulated below in Table 4.

Table 4 - External Maximum Repeatable Traffic Noise Levels

Location	Measured Traffic Noise Level dB(A) $L_{eq\ (1hr)}$
15m Distance from the Alison Road	68

3.2.2 AJC Morning Horse Training Noise Measurements

As part of this assessment a review of potential noise impacts from actives associated with morning horse training has been undertaken. The assessment has been conducted based on noise level measurements previously undertaken by this office at the site and detailed below.

The Horse training noise from AJC was performed generally in accordance with the Australian Standard AS 1055 - "Description and measurement of environmental noise - General Procedures". This office has been advised that the horse training start from 3am in the morning.

3.2.2.1 Measurement Positions

An unmanned noise monitor was set up at the north western corner of AJC to record the horse training noise levels as detailed in Figure 3 of this report.

3.2.3 Time of Measurements

AJC noise monitoring was undertaken in April 2010, the results of monitoring are included in Appendix 2.

3.2.3.1 Measurement Equipment

Equipment used consisted of an Acoustic Research Laboratories Pty Ltd noise logger. The logger was programmed to store 1-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.

3.2.3.2 Measured Noise Levels

The typical horse training noise measurements taken at the north western corner of AJC are tabulated below in Table 5.

Table 5 - External Maximum Repeatable Noise Levels

Location	Measured Morning Training Noise Levels dB(A)
AJC Noise Monitoring Location	48 dB(A) L_{eq} (1hour) 63 dB(A) L_{Mac}

3.2.4 Discussion of Noise Monitoring

Despite the construction of the light rail stabling yard on part of previous AJC land, activities at the site remain consistent, particularly with regard to early morning use of the track facilities.

Additionally, noise measurements on what is now a light rail facility were of traffic noise, rather than event noise in the locality (as detailed in Section 3.2.5.1). These locations were chosen to measure traffic noise as it is most representative of noise levels from road traffic along Alison Road during peak periods (AJC events).

3.2.5 Randwick Racecourse Event Noise Measurements

The assessment of the operational noise impact is related to the operation of the Royal Randwick race course which is adjacent to the Eastern site boundary. The assessment has been undertaken in conjunction with a noise survey previously conducted by this office of typical noise sources within the race course and detailed in this section of the report.

3.2.5.1 Attended Noise Measurements

This office has previously undertaken a detailed noise survey of the noise sources associated with Royal Randwick Racecourse. Noise measurements were carried out on the typical Race meeting and include a major event including racing and the use of facilities on the site including a marque.

The measurement locations selected are indicated in Figure 3 below.

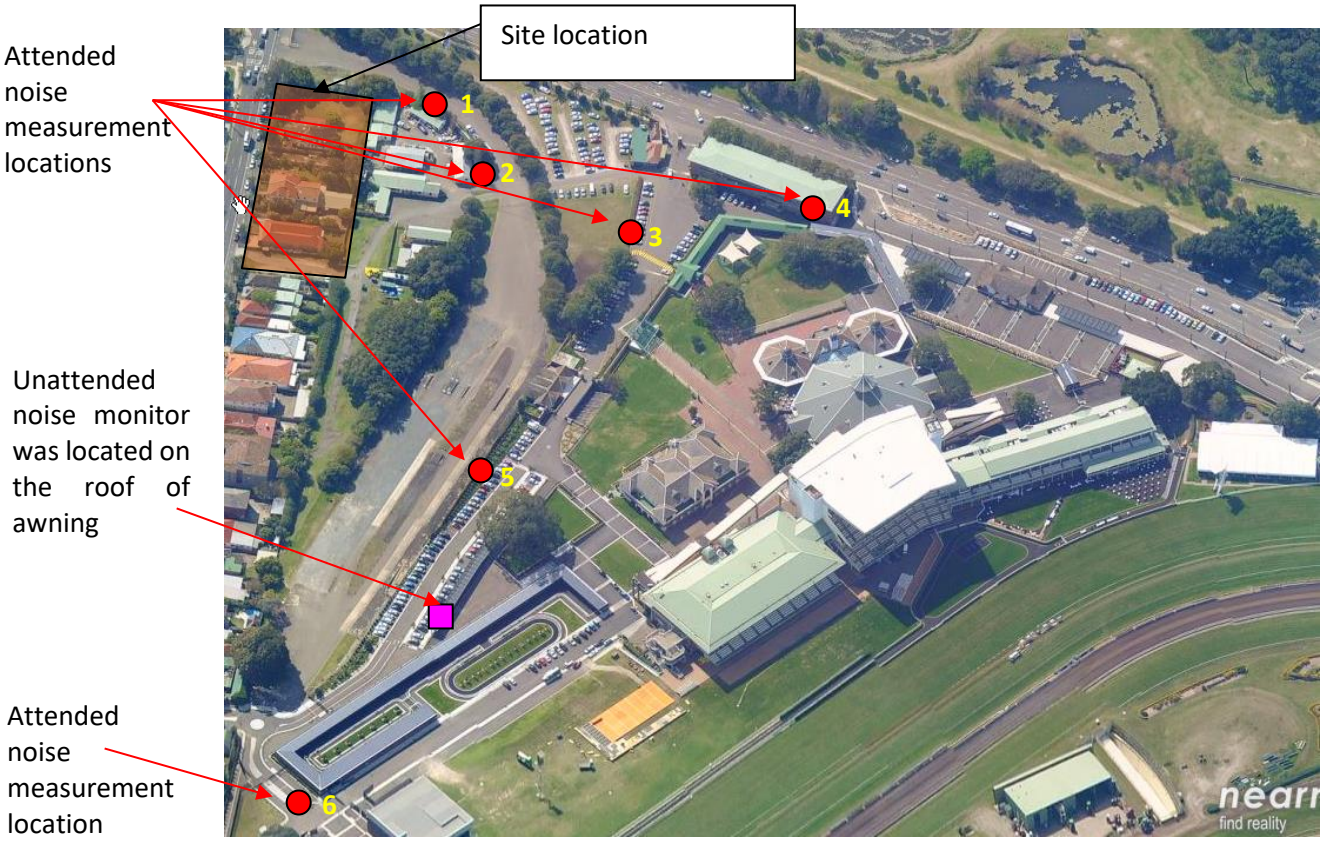


Figure 3 Horse Racing Noise Measurement Locations

- Noise Measurement Location 1 and 2- Peak Hour Traffic Noise Measurements before and during horse racing.
- Noise Measurement Location 3- Peak hour patron's entry noise.
- Noise Measurement Location 4- Peak hour bus movement and patron noise.
- Noise Measurement Location 5- Taxi Bay vehicle movement and patron noise.
- Noise Measurement Location 6- Horse racing and patrons screaming noise.

In summary the selected locations were the nearest accessible spots to take representative measurements. The measured activities included crowd noise in the courtyard at the Super TV screen, the actual race and catering movements. All measurements were taken between taxi movements wherever possible or by pausing the measurement during the taxi pass-bys.

3.2.5.2 Measurement Period

The attended noise measurements were conducted over a busy race weekend event and include all noise sources from the racecourse including racing and associated patron activities including a marque. Noise levels at the site where conducted over a race day event between 11am and 2pm.

3.2.5.3 Measurement Equipment

Attended noise measurement: A Norsonic type SA140 Sound Analyser was used for the noise measurements. The analyser was set to fast response and calibrated before and after the measurements using a Norsonics Sound Calibrator type 1251. No significant drift was noted.

3.2.5.4 Measured Activity Noise Levels

Table 6 lists the measured activity noise levels at the three locations shown in Figure 3.

Table 6 - Measured Activity Noise Levels

Location	Measurement Time	Activity	Noise Level (dB(A) L_{eq})	Noise Level (dB(A) L_{90})	Noise Level (dB(A) L_{max})
1	11:20am-11:35am	Traffic noise from Alison Rd	61	58	74
2	11:00am-11:15am	Traffic noise from Alison Rd	60	56	75
3	1:15pm-1:30pm	Entry patron noise + PA	73	62	83
4	11:40am-11:55am	7 Bus in/out + patron noise	68	64	82
5	12:20pm-12:35pm	Taxi movements and patron noise	54	51	65
6	12:55pm-1:10pm	Horse racing + Patron Noise	54	51	65

3.3 NOISE FROM SYDNEY LIGHT RAIL MAINTENANCE FACILITY (STABLING YARD)

An acoustic assessment of potential noise impact from the future light rail on the future development has conducted and the included the following documents:

- The CBD and South Light Rail approval SSI 6042 dated 4 June 2014, and incorporated documents including 'Additional Information provided to Department of Planning and Environment to support the assessment of the CBD and South East Light Rail Project' ; and
- Policy documents such as Development near Rail Corridors and Busy Roads Interim Guidelines 2008 published by the Department of Planning.

3.3.1 CBD and South Light Rail Approval SSI 6042

The relevant sections of the approval relating to noise emissions at the proposed development has been presented below.

Schedule B, Part C – Operations

Noise and Vibration

Operational Noise and Vibration from Light Rail

C1. The SSI shall be designed and operated with the objective of not exceeding the air-borne and ground borne noise trigger levels as defined in the Rail Infrastructure Noise Guideline (EPA, 2012) and the vibration levels defined in the Assessing Vibration: A Technical Guideline (DEC, 2006).

Operational Noise from Stationary Sources

C2. The Applicant shall ensure that noise emanating from stationary sources complies with the noise limits at the nearest sensitive receivers in accordance with the NSW Industrial Noise Policy or as specified in Table C1 and Table C2. Noise generated from these facilities shall also include associated traffic movements.

However, these limits do not apply if the Applicant has an agreement with the owner/s of the relevant residence to generate higher noise levels, and the Applicant has advised the Department in writing of the terms of this agreement.

Table C1 – Operational Noise Limits for Stabling and Maintenance Facilities at Sensitive Receivers (dBA)

Location	***Day*** $L_{Aeq(15\ min)}$	***Evening*** $L_{Aeq(15\ min)}$	***Night*** $L_{Aeq(15\ min)}$	***Night*** $L_{A1,\ (1\ min)}$
Randwick Stabling Facility	*49*	*49*	*43*	*53*

Table C2 – Operational Noise Limits for Substations at Sensitive Receivers (dBA)

Location	$L_{Aeq(15\ min)}$ ***at All Times***	***Receiver Description***
Randwick Racecourse	*44*	*Residential*

Operational Noise from Rail Traffic

C3. Ground borne noise from rail traffic shall not exceed the following criteria as measured at the nearest residential receiver:

(a) L_{ASmax} 40 dBA between the hours of 6.00pm and 10.00pm; and

(b) L_{ASmax} 35 dBA between the hours of 10.00pm and 7.00am

Note: Ground borne noise level values are only relevant where they are higher than the airborne noise from railways and where the ground-borne noise levels are expected to be, or are, audible within habitable rooms (RING, EPA 2013)

Operational Noise from Ancillary Systems

C5. The Applicant shall ensure that unless they are required for safety reasons, no public address system shall be used as part of the normal operations of the SSI. Any emergency public address system shall be designed to minimise noise spillage from the site. Speakers shall be installed with their pointing axis directed away from residential buildings and sensitive receivers unless other specifies in the Operational Noise and Vibration Management Plan.

3.3.2 Discussion

The light rail project is required to be designed to comply with the noise and vibration requirements of the NSW Environment Protection Authority's Industrial Noise Policy.

As the subject site's current use is for residential dwellings, the rail facility would need to meet the INP noise emission requirements for residential receivers. Therefore, compliance with their consent conditions means the subject project would not need to be acoustically upgraded to ensure adequate amenity the future residences of the subject development.

Previous experience with similar infrastructure vibration from the light rail infrastructure is not expected to generate magnitudes of vibration which will negatively impact on the proposed development, based on measured vibration from the existing light rail within the Sydney CBD. Notwithstanding this, any adverse vibration generated by the operation of the maintenance facility would need to be addressed by the operators of that facility.

The "*Additional Information provided to Department of Planning and Environment to support the assessment of the CBD and South East Light Rail Project* and the *CBD and South East Light Rail Project Independent Review of Noise/Vibration Assessment Response to Issues Raised"* review conducted by SLR, and included as an appendix to the report, concludes that the impact of light rail on residential receivers within the proximity to the future line will be similar or less than the existing environmental noise levels currently experienced.

The assessment of noise from light rail operation conducted by SLR includes the following:

- *In Randwick, the maximum noise levels from buses on High Street are expected to be similar to maximum noise levels from light rail. While the existing background noise level on High Street is low, the existing L_{Aeq} noise levels are around 9 dB higher than the light rail L_{Aeq} noise goals. The number of light rail services relative to existing bus numbers is unlikely to result in an increase in the number of higher night>time noise events along High Street. Acceptance of the predicted light rail noise impacts of 2 dB to 3 dB above the RING trigger levels along High Street in Randwick is considered reasonable in light of the existing road traffic noise impacts.*

Along Wansey Road, there is a low incidence of existing road traffic noise and consideration of mitigation of light rail noise would be required at any locations where the RING trigger levels are exceeded, noting that no exceedances are anticipated at this location.

- *In Kensington and Kingsford acceptance of light rail noise impacts above the RING trigger levels along Anzac Parade is considered reasonable in light of the existing high road traffic noise impacts, as mitigating light rail noise would not reduce the overall future road traffic noise levels.*

Although this does not specifically detail noise levels for Doncaster Avenue, given that the site would be less impacted given the location of the light rail alignment to the north of Allison Road, it can reasonably be concluded that the future noise levels from the Light Rail will not result in noise levels which are either above existing levels or will be with the acceptable RING Trigger levels.

It is concluded the recommended treatments to the external façade of the building as detailed in this report to address existing noise sources will also result in an suitable acoustic amenity for future residences when the light rail commences operation.

3.4 EVALUATION OF NOISE INTRUSION

External noise intrusion into the proposed development has been assessed using the measured external noise levels reported in above as a basis. The assessment has been conducted based on the Architectural drawings provided by *Hayball Architects,* project number 2309, Revision 1, dated 07/12/2018.

Calculations were undertaken taking into account the orientation of windows, roof area barrier effects (where applicable), the total area of glazing, facade transmission loss and room sound absorption characteristics. In this way the likely interior noise levels can be predicted.

3.4.1 Glazing Constructions

The recommended glazing assemblies are indicated in Table 7. In all cases, the selected glazing type reduces internal noise levels to within the nominated criterion for the various space types. The recommended glazing has been designed to control traffic noise intrusion as well as noise from adjacent noise sources (such as Randwick Racecourse and Sydney Light Rail facilities).

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

The recommended glazing for the proposed development is detailed in Table 7. Glazing to all units not listed in the table may be 4mm thick float glass for windows and doors, no acoustic seals.

Table 7 –Glazing Thickness Required

Level	Façade Location	Space	Glazing Thickness/R_w Rating	Acoustic Seals
All Levels	Northern Façade	Residential Studios	10.38mm Lam/35	Yes
	Eastern Façade		6.38mm Lam/30	Yes
	Southern Façade		6.38mm Lam/30	Yes
	Western Façade		6.38mm Lam/30	Yes

3.4.2 External Wall Construction

External walls are of masonry construction and are acoustically acceptable without any further treatment. In the event any penetrations are required through the external lining of any of the system for other building services, gaps, etc should be acoustically treated/sealed to ensure compliance with acoustic criteria stipulated within this report.

3.4.3 External Roof and Ceiling Construction

Roof is of masonry construction and is acoustically acceptable without any further treatment. In the event any penetrations are required through the external lining of any of the system for other building services, gaps should be acoustically treated/sealed to ensure compliance with acoustic criteria stipulated within this report.

4 NOISE EMISSION ASSESSMENT

4.1 NOISE EMISSION CRITERIA

Noise emissions from the project site has been assessed with reference to the requirements of the following documents;

- NSW Department of Planning SEAR's requirements for SSD 9649
- Randwick City Council Development Control Plan;
- NSW Department of Environment and Heritage, *Environmental Protection Agency document – Noise Policy for Industry (NPI) 2017*.

4.1.1 NSW Department of Planning SEAR's requirements for SSD 9649

4. Amenity

The EIS shall:

- *Demonstrate the impacts of the proposal on the amenity of surrounding development and public domain, including measures to minimise potential overshadowing, noise, visual privacy, wind, daylight and view impacts.*

4.1.2 Randwick City Council Development Control Plan

It is noted that there is no specific numerical criteria for noise emissions from the development detailed in the Randwick City Council DCP. In this regard, the NSW EPA Noise Policy for Industry (2017) will be adopted.

4.1.3 NSW EPA Noise Policy for Industry (NPI) 2017

The EPA NPI has two criteria which both are required to be satisfied, namely Intrusiveness and amenity. The NPI sets out acceptable noise levels for various localities. The policy indicates four categories to assess the appropriate noise level at a site. They are rural, suburban, urban and urban/industrial interface. Under the policy the nearest residential receivers would be assessed against the suburban criteria.

Noise levels are to be assessed at the property boundary or nearby dwelling, or at the balcony or façade of an apartment.

4.1.3.1 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 Table 1. Noise emissions from the site should comply with the noise levels presented below when measured at nearby property boundary.

4.1.3.2 Project 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 NPI sets out acceptable noise levels for various localities. The recommended noise amenity area is based upon factors including the measured background noise levels at the sensitive receiver, land use zoning and the presence of traffic or industrial noise sources around the site. Based on the guidelines in the NPI the surrounding sites have characteristics of Urban and Suburban residential receiver categories. The Noise Policy for Industry 'suburban' categorisation has been adopted as a conservative measure.

The NPI requires project amenity noise levels to be calculated in the following manner;

$$L_{Aeq,15min} = \textit{Recommended Amenity Noise Level} - 5\ dB(A) + 3\ dB(A)$$

The amenity levels appropriate for the receivers surrounding the project site are presented in Table 8.

Table 8 – EPA Amenity Noise Levels

Type of Receiver	Time of day	Recommended Noise Level dB(A)$L_{eq(period)}$	Project Amenity Noise Level dB(A)$L_{eq(period)}$
Residential – Suburban	Day	55	53
	Evening	45	43
	Night	40	38
Commercial premises	When in use	65	63
Industrial premises	When in use	70	68

The NSW EPA Noise Policy for Industry (2017) defines;

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

4.1.4 Sleep Arousal Criteria

The Noise Policy for Industry recommends the following noise limits to mitigate sleeping disturbance:

> *Where the subject development / premises night -time noise levels at a residential location exceed:*
>
> - *$L_{Aeq,15min}$ 40 dB(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 the greater,*
>
> *a detailed maximum noise level even assessment should be undertaken.*

Table 9 - Sleep Arousal Criteria for Residential Receivers

Receiver	Rating Background Noise Level (Night) dB(A)L_{90}	Emergence Level
Residences Surrounding Site Night (10pm – 7am)	36 dB(A) L_{90}	41 dB(A)$L_{eq,\ 15min}$; 52 dB(A)L_{Fmax}

4.2 SUMMARISED NOISE EMISSION CRITERIA (FOR PLANT)

Table 10 – EPA NPI Noise Emission Criteria (Residents Surrounding Project Site)

Time Period	Assessment Background Noise Level dB(A)L_{90}	Project Amenity Criteria dB(A) L_{eq}	Intrusiveness Criteria $L_{eq(15min)}$	NPI Criteria for Sleep Disturbance
Day	41	53	46	N/A
Evening	40	43	45	N/A
Night	36	38	41	41 dB(A)$L_{eq,\ 15min}$; 52 dB(A)L_{Fmax}

Table 11 – EPA NPI Noise Emission Criteria (Non-Residential)

Receiver	Time of Day	Amenity Criteria dB(A) L_{eq}
Commercial	When in use	63
Industrial	When in use	68

4.3 ASSESSMENT OF NOISE EMISSIONS FROM FUTURE MECHANICAL PLANT

Primary mechanical plant and equipment will likely consist of external condenser units (servicing residential and common areas of the development) and ventilation equipment to service basement carpark.

The current proposal has allowed for rooftop plant enclosures to house mechanical plant to service site. Additionally, ventilation fans may be located within the basement area to service the ventilation requirements of the car parking levels.

Detailed plant selection and location has not been undertaken at this stage. Noise emissions can be controlled to satisfactory levels through appropriate plant selection, location and if necessary, standard acoustic treatments such as duct lining, acoustic silencers, screening and enclosures.

Cumulative assessment of all plant noise is recommended when conducting acoustic design of plant items, particularly for assessing emissions at the southern property boundary, due to the proximity of adjacent residential receivers.

Compliance with EPA acoustic criteria (as set out in Section4.2) 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.

5 CONSTRUCTION NOISE AND VIBRATION

5.1 CONSTRUCTION NOISE

Relevant guidelines for noise emissions from construction activities are:

- NSW Environmental Protection Authority (EPA) document – *"Interim Construction Noise Guideline (ICNG) 2009"*; and
- Australian Standard AS2436:2010 – *"Guide to noise and vibration control on construction, demolition and maintenance sites"*.

5.1.1 NSW Environmental Protection Authority (EPA) document – *"Interim Construction Noise Guideline (ICNG) 2009"*

This guideline nominates acceptable levels of noise emissions above the background noise level. For projects within the recommended standard hours the guideline recommends a noise level of 10dB(A) above the background for residential receivers – this level is referred to as the "noise affected level". The noise emission goals for nearby development is as follows:

Table 12 – Noise Emission Goal – Residential Properties

Noise Receiver	Measured Background Noise Levels dB(A)$L_{90(7am-6pm)}$	Noise Affected Level BG + 10dB(A)$L_{eq(15min)}$	Highly Affected Level dB(A)$L_{eq(15min)}$
Residential Receivers (R1 & R2)	41	51	75

Where noise from the construction works is above the "noise affected level", the proponent should apply any feasible and reasonable work practices to minimise noise.

If noise emissions are likely to exceed 75dB(A) $L_{eq(15min)}$, the receiver is deemed to be "highly noise affected". Introduction of management controls such as scheduling of noisy periods, or respite periods is recommended.

5.1.2 Australian Standard 2436-1981 "Guide to Noise Control on Construction Maintenance and Demolition Site"

Where the NML's established using the with ICNG cannot be achieved, noise emissions are to be managed in accordance with principles in AS2436:

- That reasonable suitable noise management levels is established (i.e. – adopt DECC/Council guidelines).
- 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.

5.2 CONSTRUCTION VIBRATION

Vibration caused by construction should be limited to:

- For structural damage vibration, German Standard DIN 4150-3 *Structural Vibration: Effects of Vibration on Structures; and*

- For human exposure to vibration (amenity), the evaluation criteria presented in the British Standard BS 6472:1992 *Guide to Evaluate Human Exposure to Vibration in Buildings (1Hz to 80Hz)* for low probability of adverse comment

The criteria and the application of this standard are discussed in separate sections below.

5.2.1 Structure Borne Vibrations

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 13.

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 13 – 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

5.2.2 Assessing Amenity

Department of Environment and Conservation NSW "Assessing Vibration: A Technical Guideline" (Feb 2006) is based on the guidelines contained in BS 6472:1992. This guideline 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 construction site.

Table 14 – EPA Recommended Vibration Criteria

		RMS acceleration (m/s^2)		RMS velocity (mm/s)		Peak velocity (mm/s)	
Place	**Time**	**Preferred**	**Maximum**	**Preferred**	**Maximum**	**Preferred**	**Maximum**
Continuous Vibration							
Residences	**Daytime**	0.01	0.02	0.2	0.4	0.28	0.56
Impulsive Vibration							
Residences	**Daytime**	0.3	0.6	6.0	12.0	8.6	17.0

5.3 NOISE IMPACTS FROM CONSTRUCTION

Noise levels from typically noisy construction activities have been predicted to nearby sensitive receivers. The predicted noise levels during excavation and construction will be dependent on:

- The activity undertaken;
- The distance between the work site and the receiver. For many of the work areas, the distance between the noise source and the receiver will vary depending on which end of the site the work is undertaken. For this reason, the predicted noise levels will be presented as a range.

Predicted noise levels are presented below. Predictions take into account noise reduction as a result of distance. The A-weighted sound power levels for all the component parts of the above-described activities are outlined in the table below.

Table 15 – Sound Power Levels (SWL) of the Typical Construction Equipment

Equipment / Process	Sound Power Level dB(A)
Rock Hammering	120
Excavator (in clay / soil)	110
Bored Piling Rig	110
Concrete Pump	110
Crane (Electric)	95
Trucks	100
Powered Hand Tools	95-100

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

- On-site measurements;
- Table A1 of Australian Standard 2436-2010;
- Data held by this office from other similar studies.

5.3.1 Construction Hours

Standard construction hours as detailed in the NSW EPA *Interim Construction Noise Guideline* are as follows;

- Monday to Friday: 7am – 6pm
- Saturday: 8am – 1pm
- Sundays and Public Holidays: No work

Works may be considered outside of standard hours where the following is provided;

- A strong justification would typically be required for works outside the recommended standard hours.
- The proponent should apply all feasible and reasonable work practices to meet the noise affected level.
- Where all feasible and reasonable practices have been applied and noise is more than 5 dB(A) above the noise affected level, the proponent should negotiate with the community

5.3.2 Predicted Noise Levels

The following table presents the predicted noise levels from construction activities.

Table 16 – Predicted Construction Noise Level

Work Item	Receiver	Predicted Noise Level dB(A)$L_{eq,\ 15min}$	Noise Management Levels	Comments
Excavation	Receiver 1 (Residences Bounding Site to the South)	58 - 86	51dB(A) $L_{eq(15\ minute)}$ (Noise Affected Level) 75dB(A)$L_{eq(15\ minute)}$ (Highly Noise Affected Level)	A further detailed assessment is recommended to be undertaken at CC stage once further detailed knowledge of proposed construction methodologies are known.
	Receiver 2 (Residences to the East)	57 – 84		
Construction	Receiver 1 (Residences Bounding Site to the South)	48 - 75		
	Receiver 2 (Residences to the East)	47 – 74		

The predicted noise levels exceed the noise management level (BG +10) when close to each receiver.

Noise management for the excavation and construction of project site is required (particularly when operating very noisy plant such as hammering in rock). Management measures and would include, for example, acoustic barriers, respite hours, noise monitoring, contingency plan, etc.

Details shall be determined at Construction Certificate stage (once a construction program and work methods have been determined) to ensure that the noise impacts to residential receivers around is minimised to the extent required by the ICNG.

5.3.3 Vibration Impacts

Primary vibration generating activities are bulk excavation (if in rock) and demolition. It is recommended that vibration monitoring be undertaken at the southern residential boundary during the demolition and excavation stage of the construction period to ensure that vibration levels do not exceed the requirements detailed in Section 5.2

6 CONCLUSION

Acoustic Logic Consultancy have undertaken an assessment of noise impacts associated with the proposed student accommodation development at 4-18 Doncaster Avenue, Kensington. Assessment has been undertaken with reference to the relevant NSW Department of Planning SEAR's requirements, NSW Department of Planning guidelines with respect to traffic noise and NSW EPA guidelines with respect to noise emissions from the project site.

An analysis of noise intrusion to the development indicates that the site can be appropriately designed to achieve relevant internal noise requirements. Minimum façade acoustic ratings are provided in the report to address noise intrusion from the surrounding industrial, rail and traffic noise sources.

A preliminary assessment of noise emissions with respect to mechanical plant has been undertaken. This indicates that with appropriate plant selection and treatment noise emissions are capable of achieving the requirements of the NSW EPA Noise Policy for Industry and emissions would therefore not adversely impact surrounding receivers.

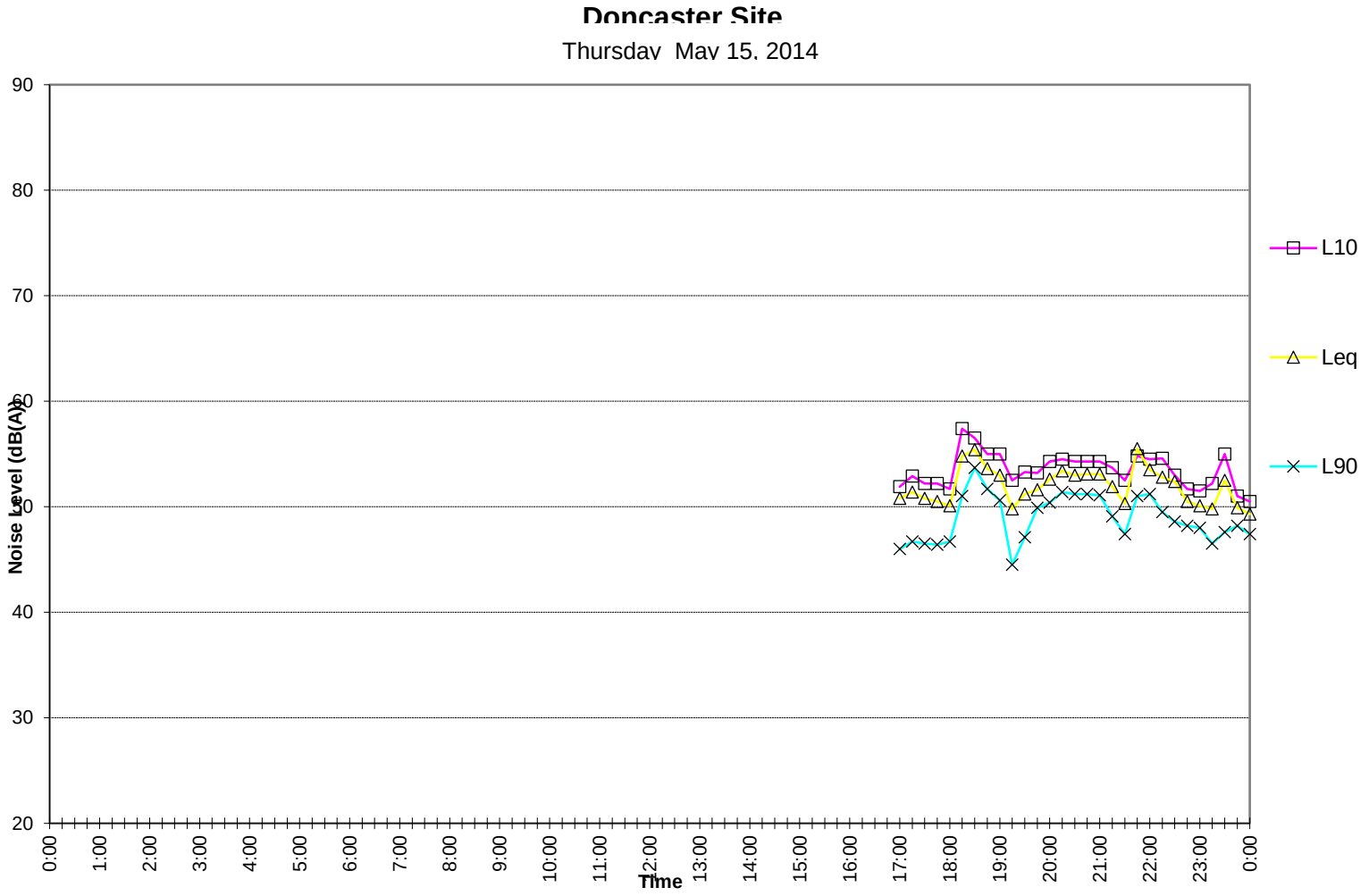
A preliminary review of construction noise and vibration impacts from the site indicates that due to the proximity of sensitive receivers, management of activities and emissions would need to be undertaken. A detailed assessment of construction noise impact and the development of a project construction noise and vibration management plan is recommended prior commencement of construction. The purpose of the assessment and plan is to assess emissions form the actual construction methodologies selected and then determine and document appropriate mitigation and management measures that will be adopted to address any residual impacts in accordance with the ICNG methodology.

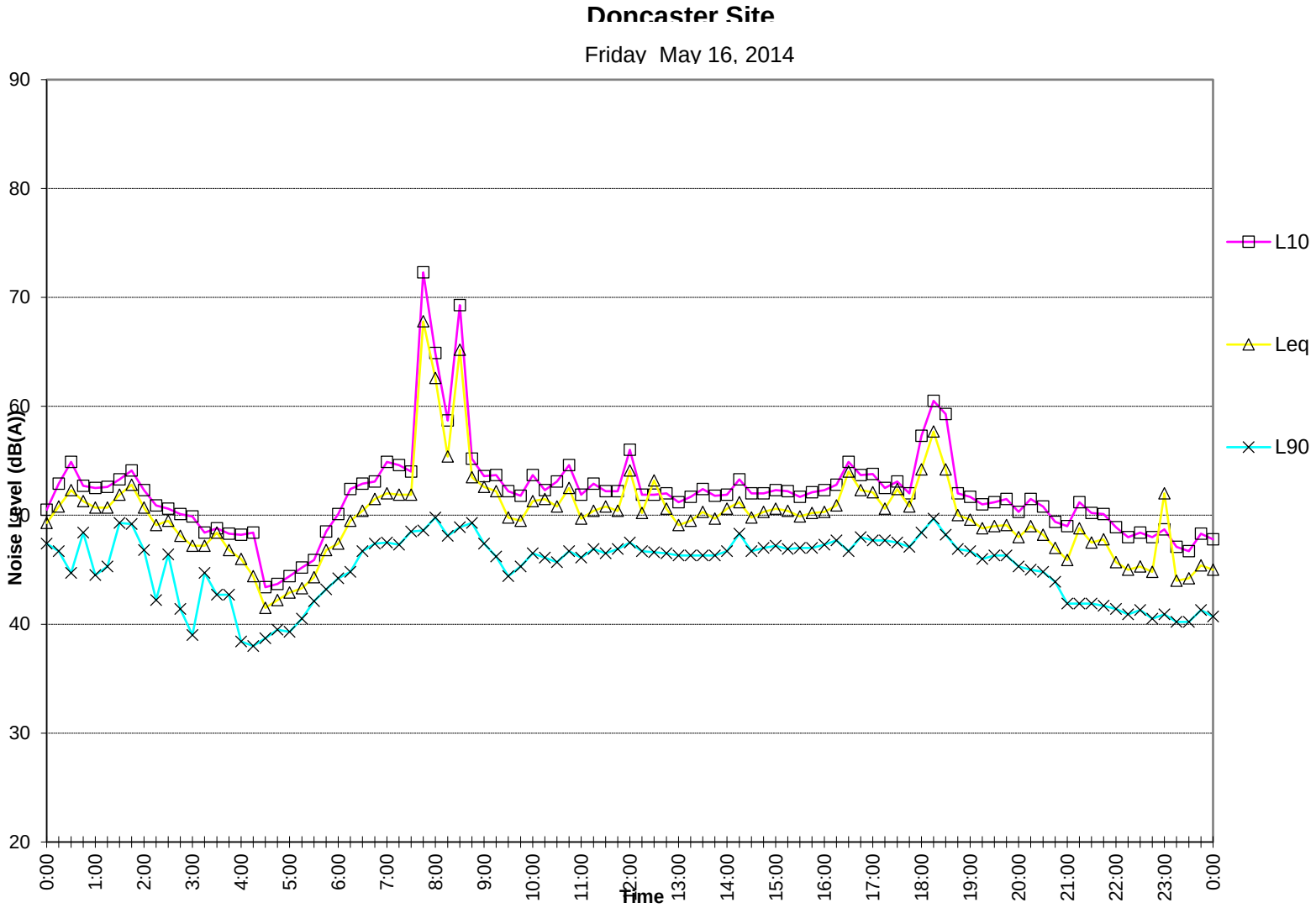
We trust this information is satisfactory. Please contact us should you have any further queries.

Yours faithfully,

Acoustic Logic Consultancy Pty Ltd
Alex Washer

APPENDIX ONE – UNATTENDED NOISE MONITORING – DONCASTER AVENUE


Doncaster Site
Thursday May 15, 2014
Noise Level (dB(A))
90
80
70
60
50
40
30
20
0:00
1:00
2:00
3:00
4:00
5:00
6:00
7:00
8:00
9:00
10:00
11:00
12:00
13:00
14:00
15:00
16:00
17:00
18:00
19:00
20:00
21:00
22:00
23:00
0:00
Time
L10
Leq
L90


Doncaster Site
Friday, May 16, 2014
Noise Level (dB(A))
90
80
70
60
50
40
30
20
0:00
1:00
2:00
3:00
4:00
5:00
6:00
7:00
8:00
9:00
10:00
11:00
12:00
13:00
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15:00
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23:00
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Time
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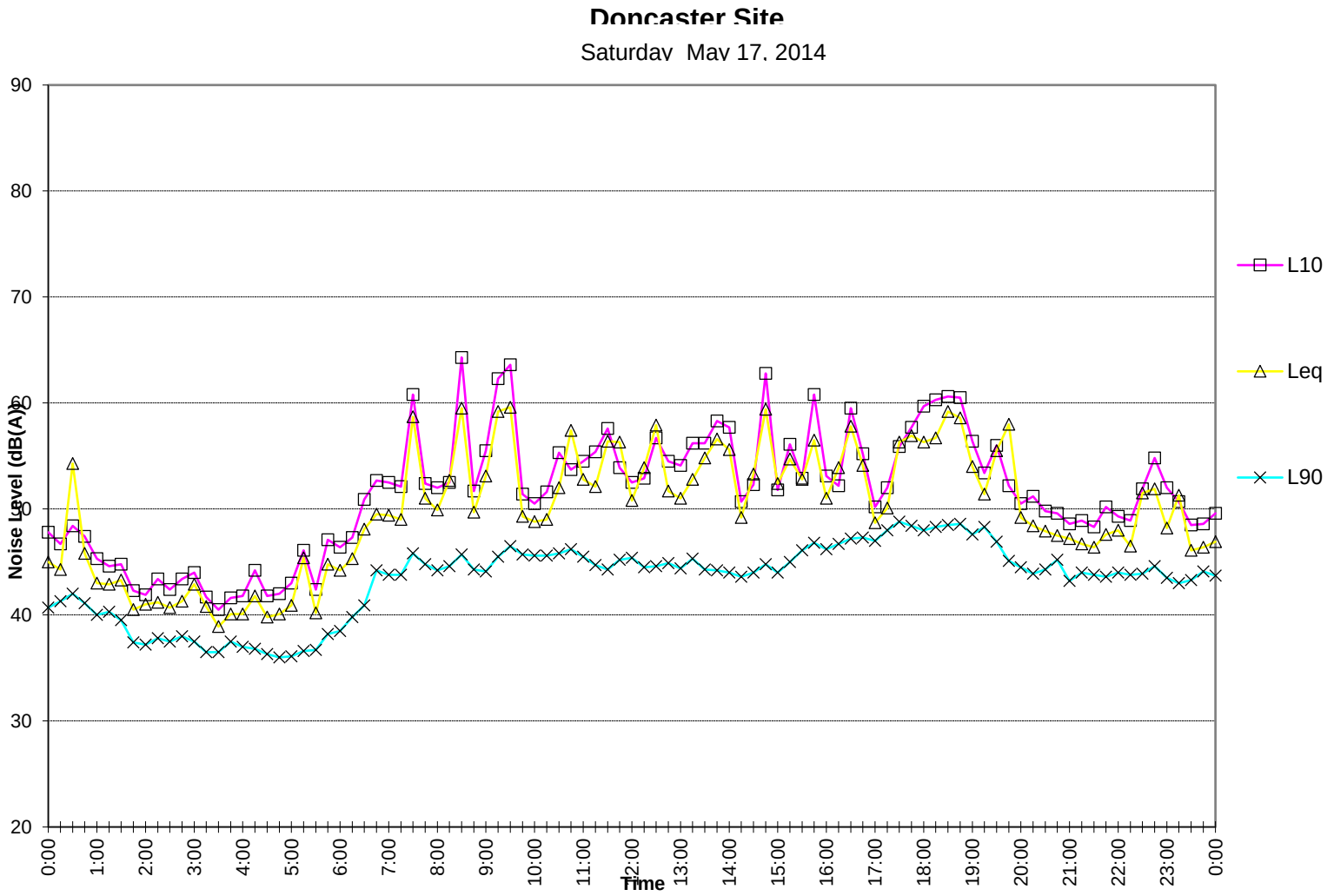
Leq
L90


Doncaster Site
Saturday May 17, 2014
Noise Level (dB(A))
90
80
70
60
50
40
30
20
0:00
1:00
2:00
3:00
4:00
5:00
6:00
7:00
8:00
9:00
10:00
11:00
12:00
13:00
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15:00
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22:00
23:00
0:00
Time
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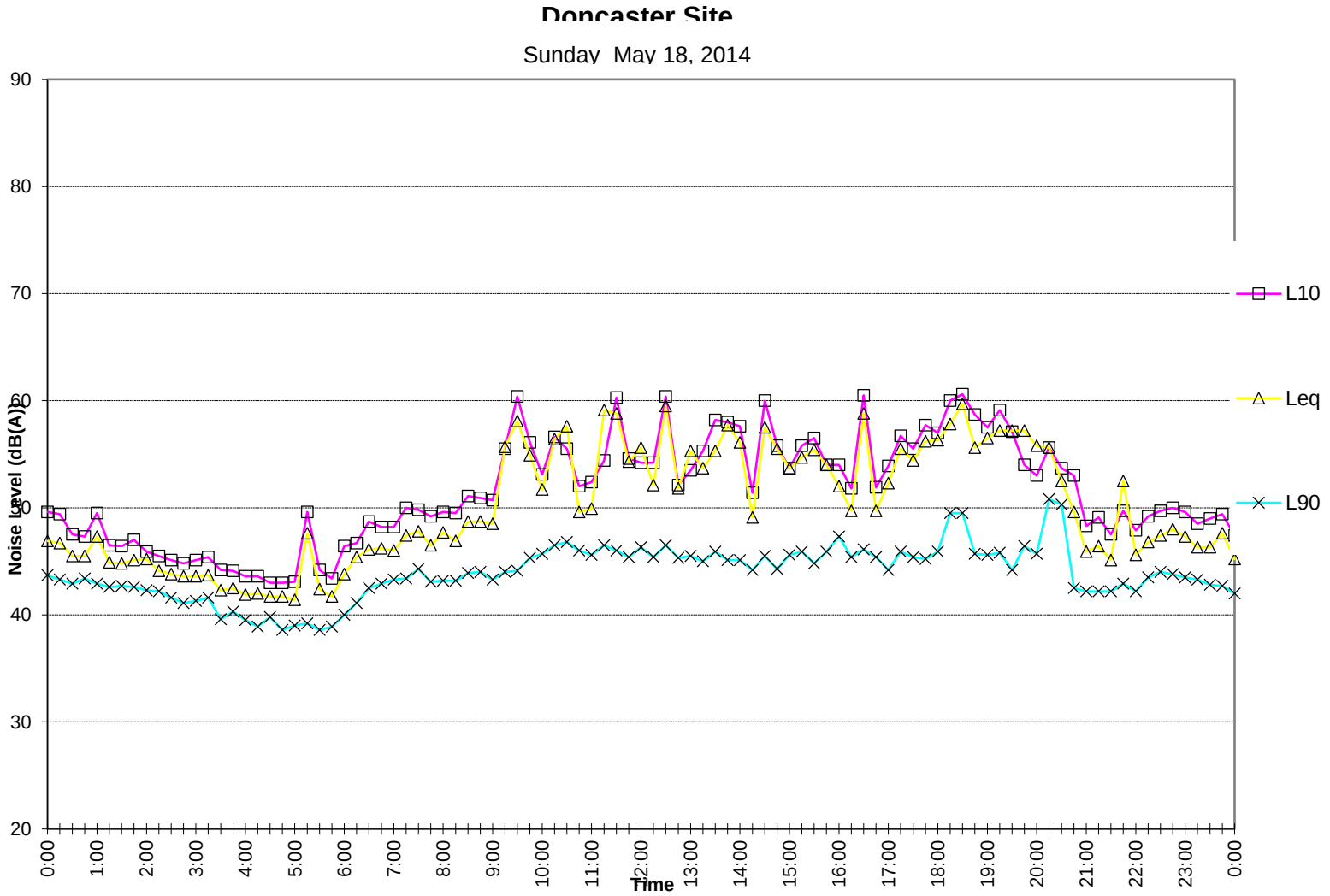
L90


Doncaster Site
Sunday, May 18, 2014
Noise Level (dB(A))
90
80
70
60
50
40
30
20
0:00
1:00
2:00
3:00
4:00
5:00
6:00
7:00
8:00
9:00
10:00
11:00
12:00
13:00
14:00
15:00
16:00
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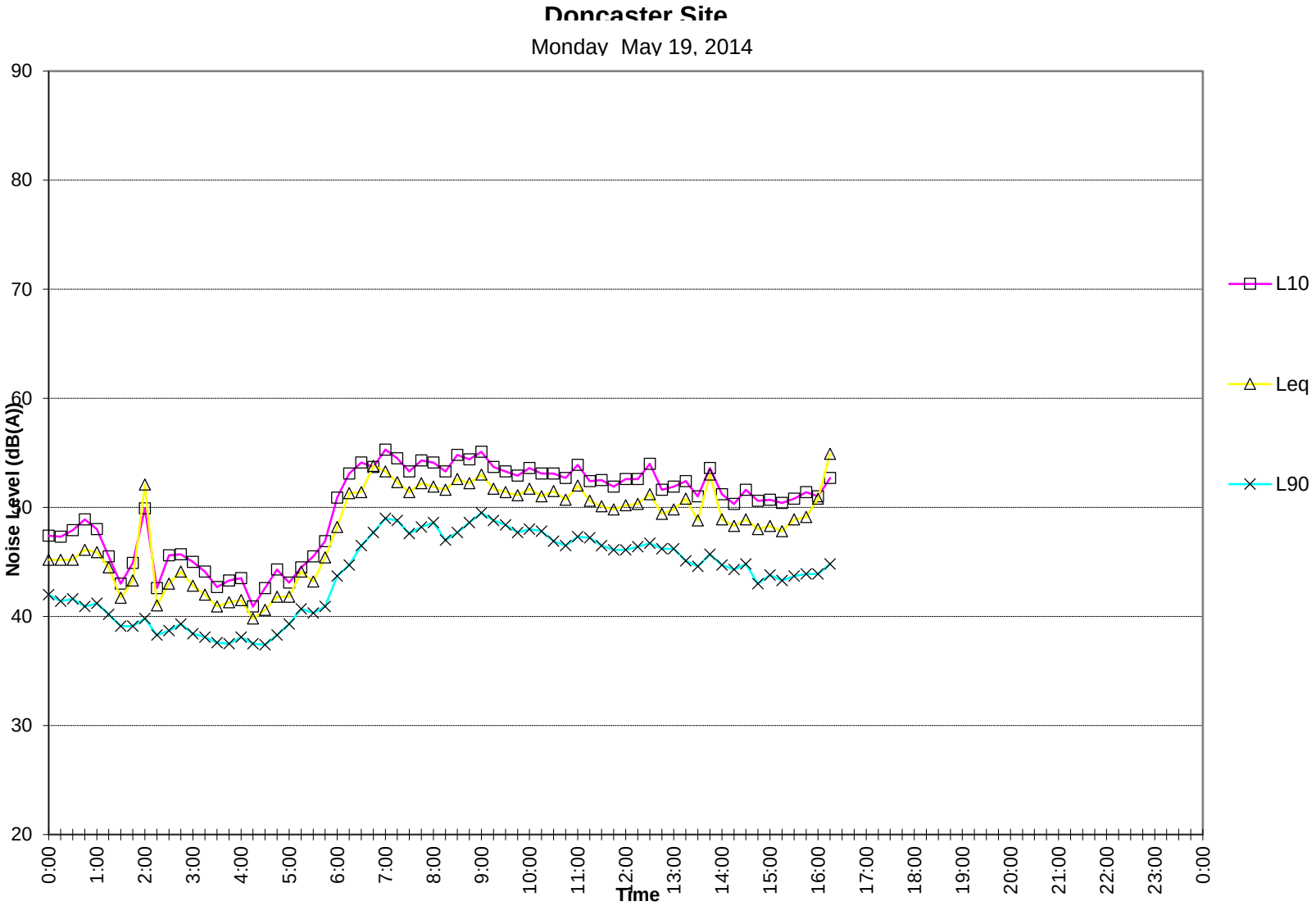
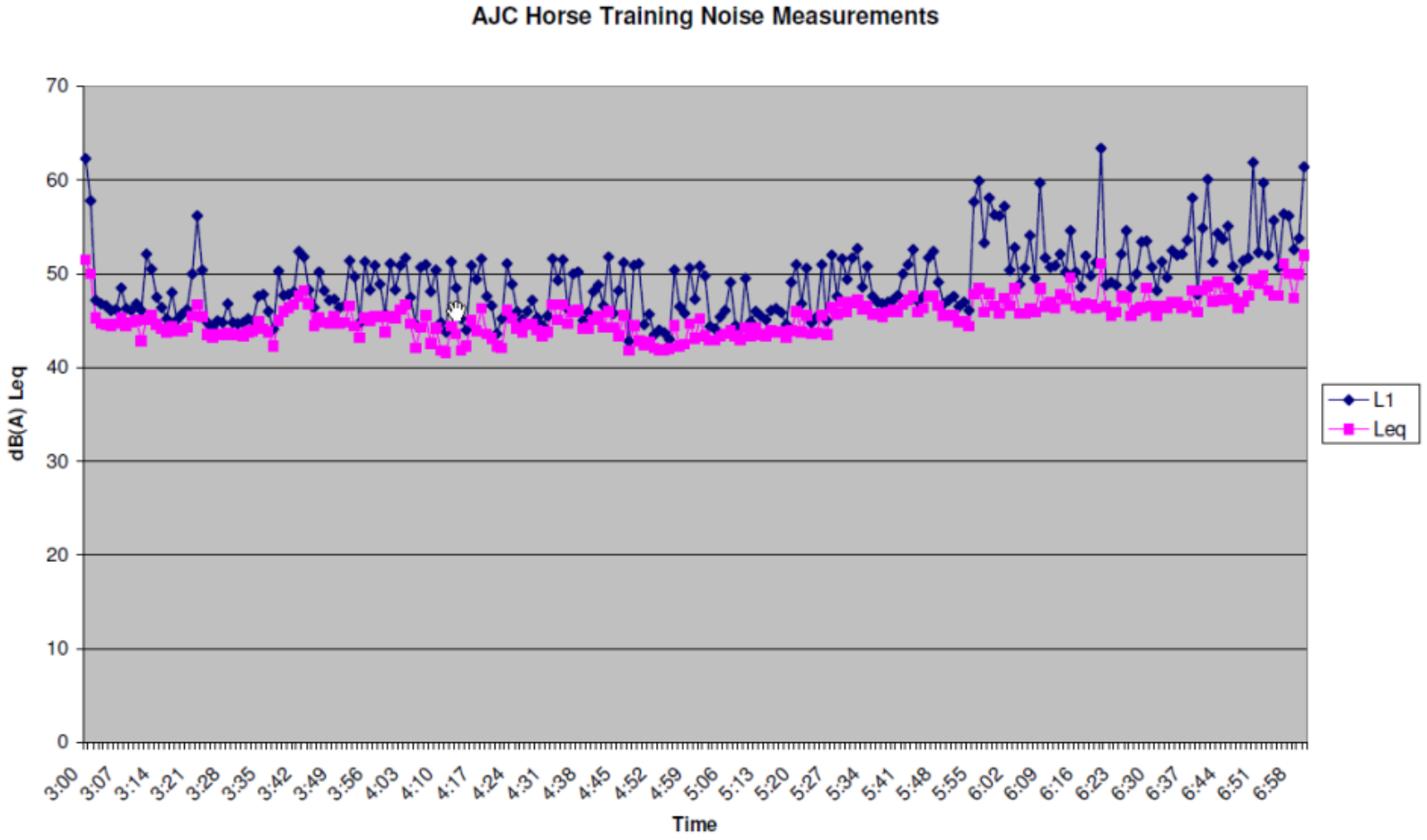
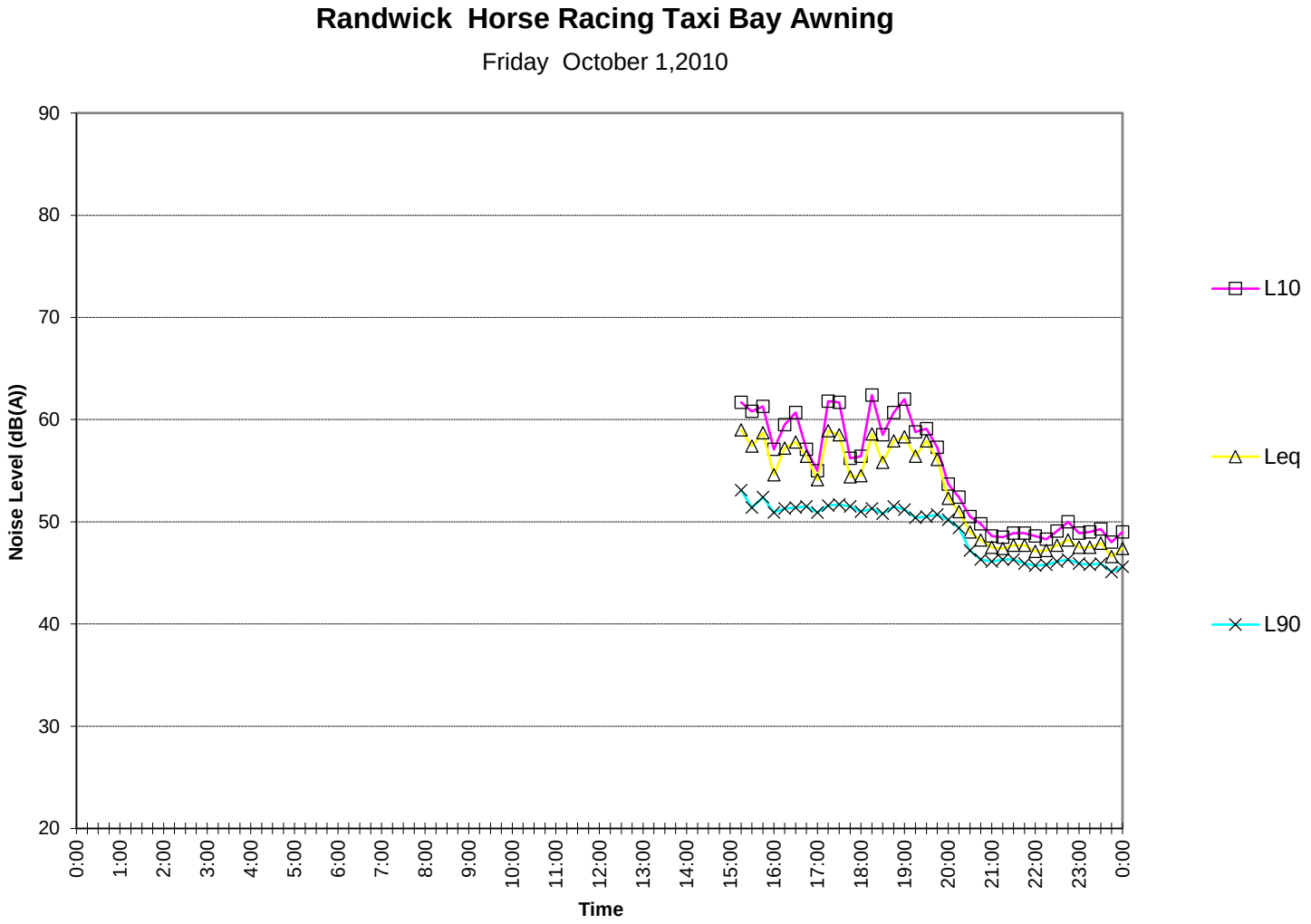
20:00
21:00
22:00
23:00
0:00
Time
L10
Leq
L90


Doncaster Site
Monday, May 19, 2014
Noise Level (dB(A))
90
80
70
60
50
40
30
20
0:00
1:00
2:00
3:00
4:00
5:00
6:00
7:00
8:00
9:00
10:00
11:00
12:00
13:00
14:00
15:00
16:00
17:00
18:00
19:00
20:00
21:00
22:00
23:00
0:00
Time
L10
Leq
L90

APPENDIX TWO – UNATTENDED MORNING HORSE TRAINING NOISE MEASUREMENTS


AJC Horse Training Noise Measurements
dB(A) Leq
70
60
50
40
30
20
10
0
3:00
3:07
3:14
3:21
3:28
3:35
3:42
3:49
3:56
4:03
4:10
4:17
4:24
4:31
4:38
4:45
4:52
4:59
5:06
5:13
5:20
5:27
5:34
5:41
5:48
5:55
6:02
6:09
6:16
6:23
6:30
6:37
6:44
6:51
6:58
Time
L1
Leq

APPENDIX THREE – UNATTENDED HORSE RACING EVENT NOISE MEASUREMENT


Randwick Horse Racing Taxi Bay Awning
Friday October 1,2010
Noise Level (dB(A))
90
80
70
60
50
40
30
20
0:00
1:00
2:00
3:00
4:00
5:00
6:00
7:00
8:00
9:00
10:00
11:00
12:00
13:00
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15:00
16:00
17:00
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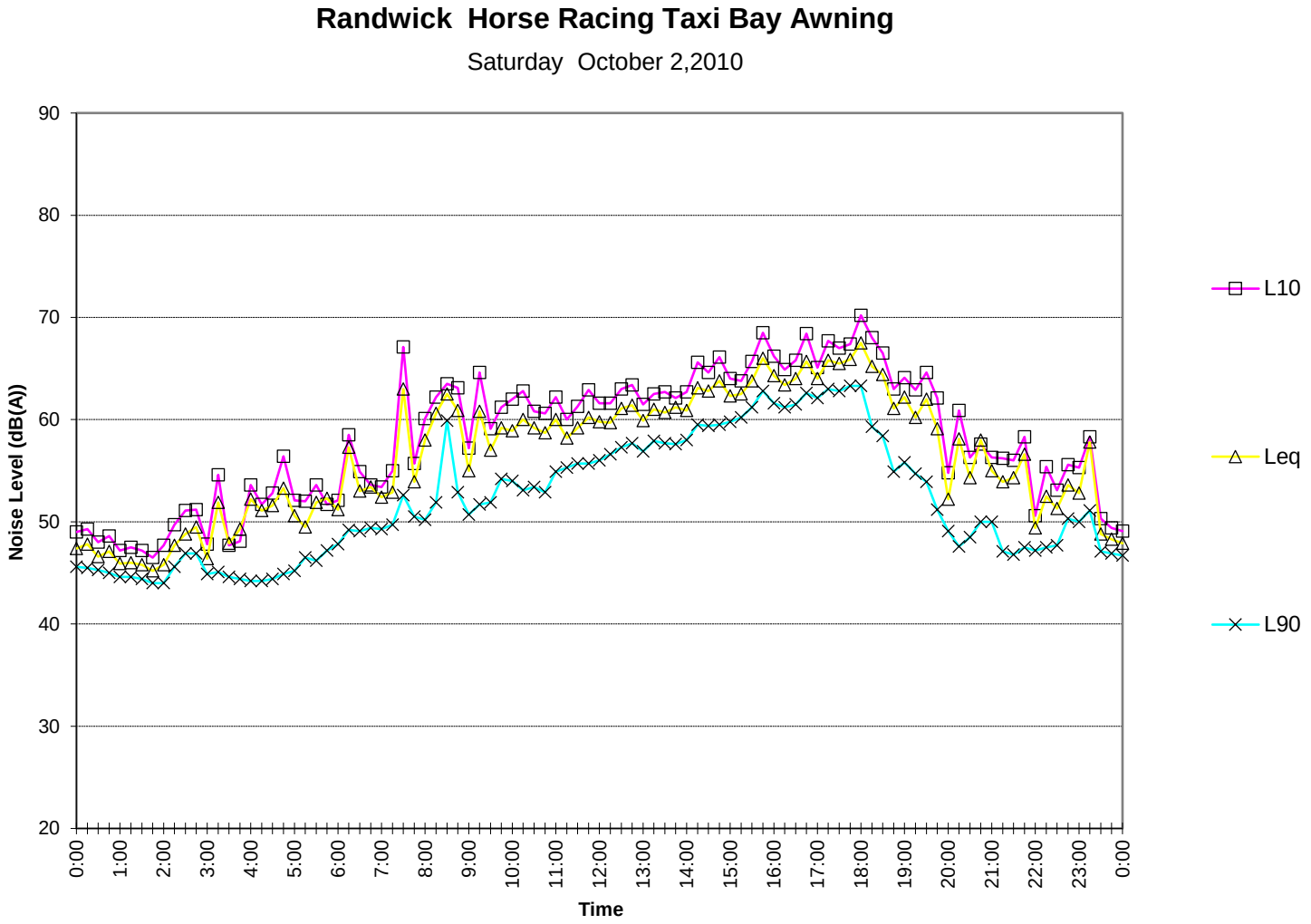
19:00
20:00
21:00
22:00
23:00
0:00
Time
L10
Leq
L90


Randwick Horse Racing Taxi Bay Awning
Saturday October 2,2010
Noise Level (dB(A))
90
80
70
60
50
40
30
20
0:00
1:00
2:00
3:00
4:00
5:00
6:00
7:00
8:00
9:00
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11:00
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15:00
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23:00
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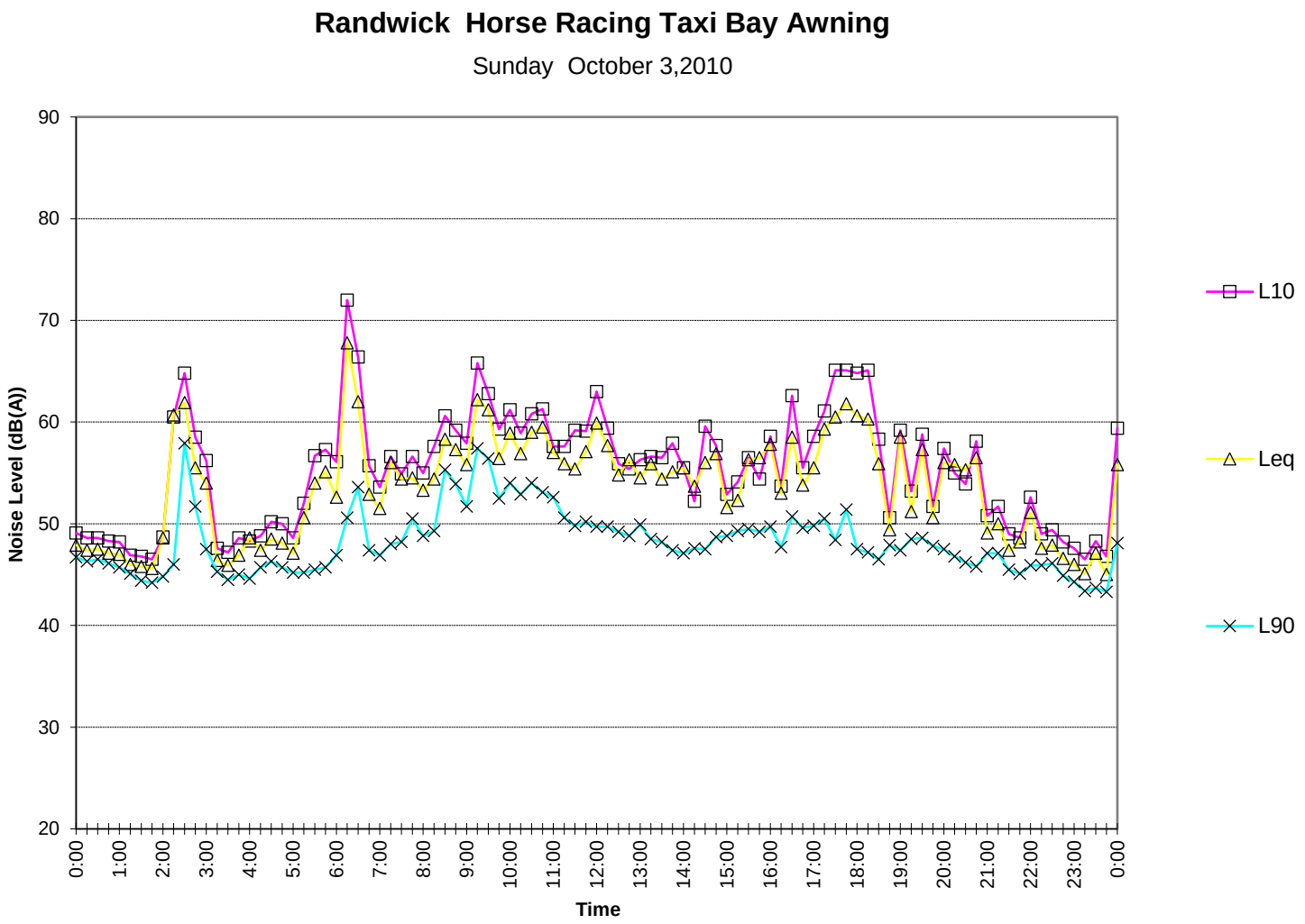
Time
L10
Leq
L90


Randwick Horse Racing Taxi Bay Awning
Sunday October 3,2010
Noise Level (dB(A))
90
80
70
60
50
40
30
20
0:00
1:00
2:00
3:00
4:00
5:00
6:00
7:00
8:00
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15:00
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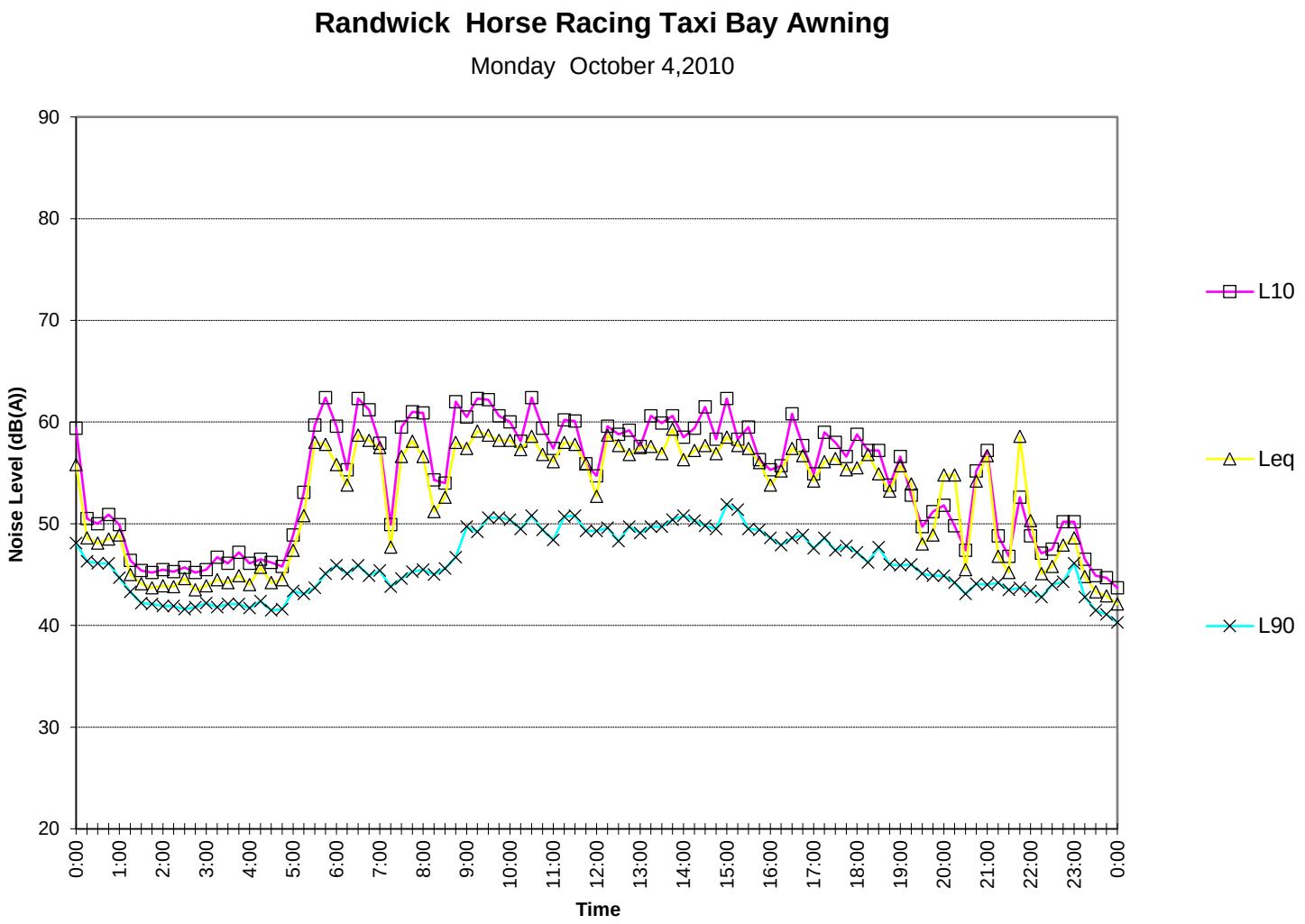
Leq
L90


Randwick Horse Racing Taxi Bay Awning
Monday October 4,2010
Noise Level (dB(A))
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80
70
60
50
40
30
20
0:00
1:00
2:00
3:00
4:00
5:00
6:00
7:00
8:00
9:00
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Time
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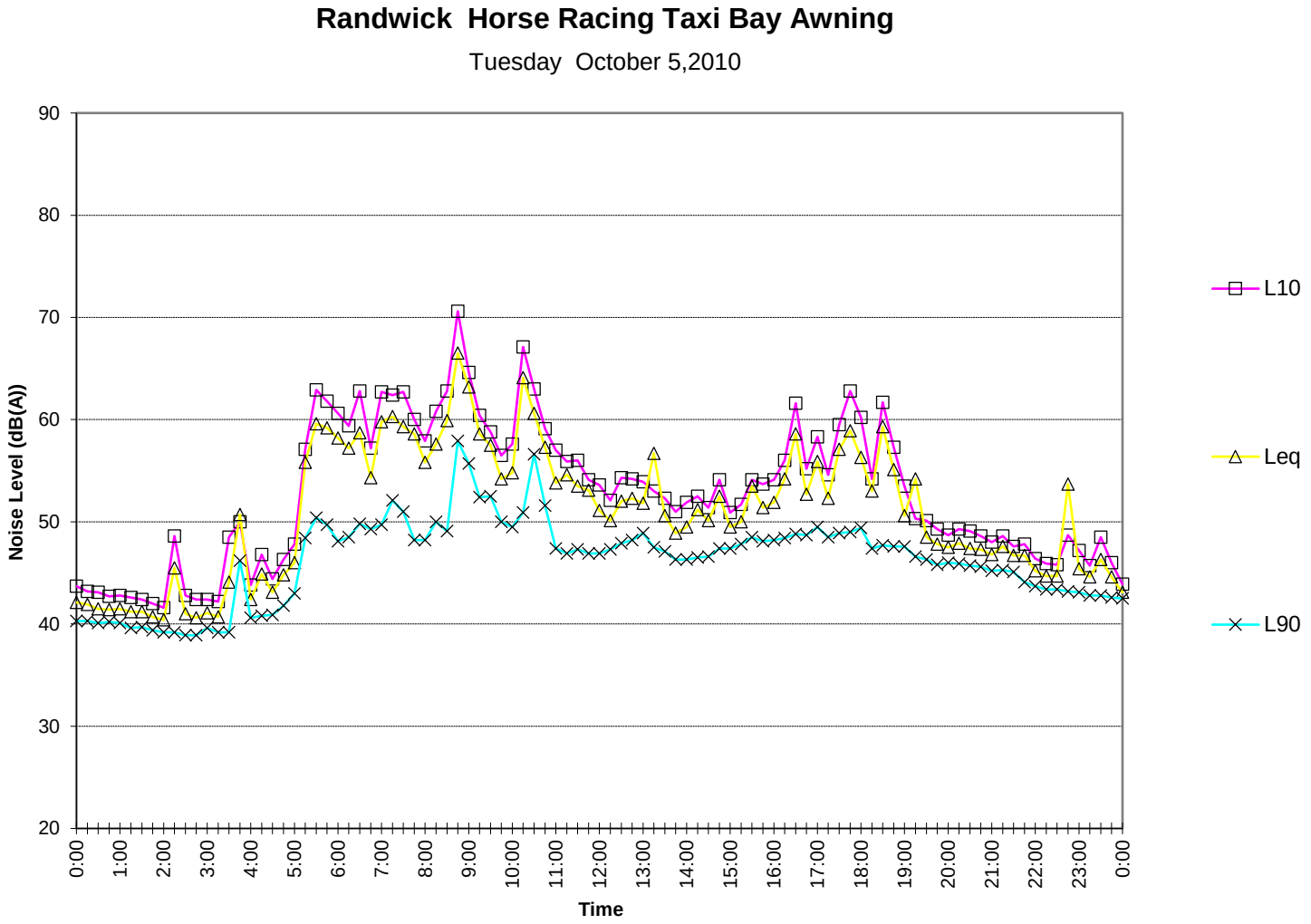
Leq
L90


Randwick Horse Racing Taxi Bay Awning
Tuesday October 5,2010
Noise Level (dB(A))
90
80
70
60
50
40
30
20
0:00
1:00
2:00
3:00
4:00
5:00
6:00
7:00
8:00
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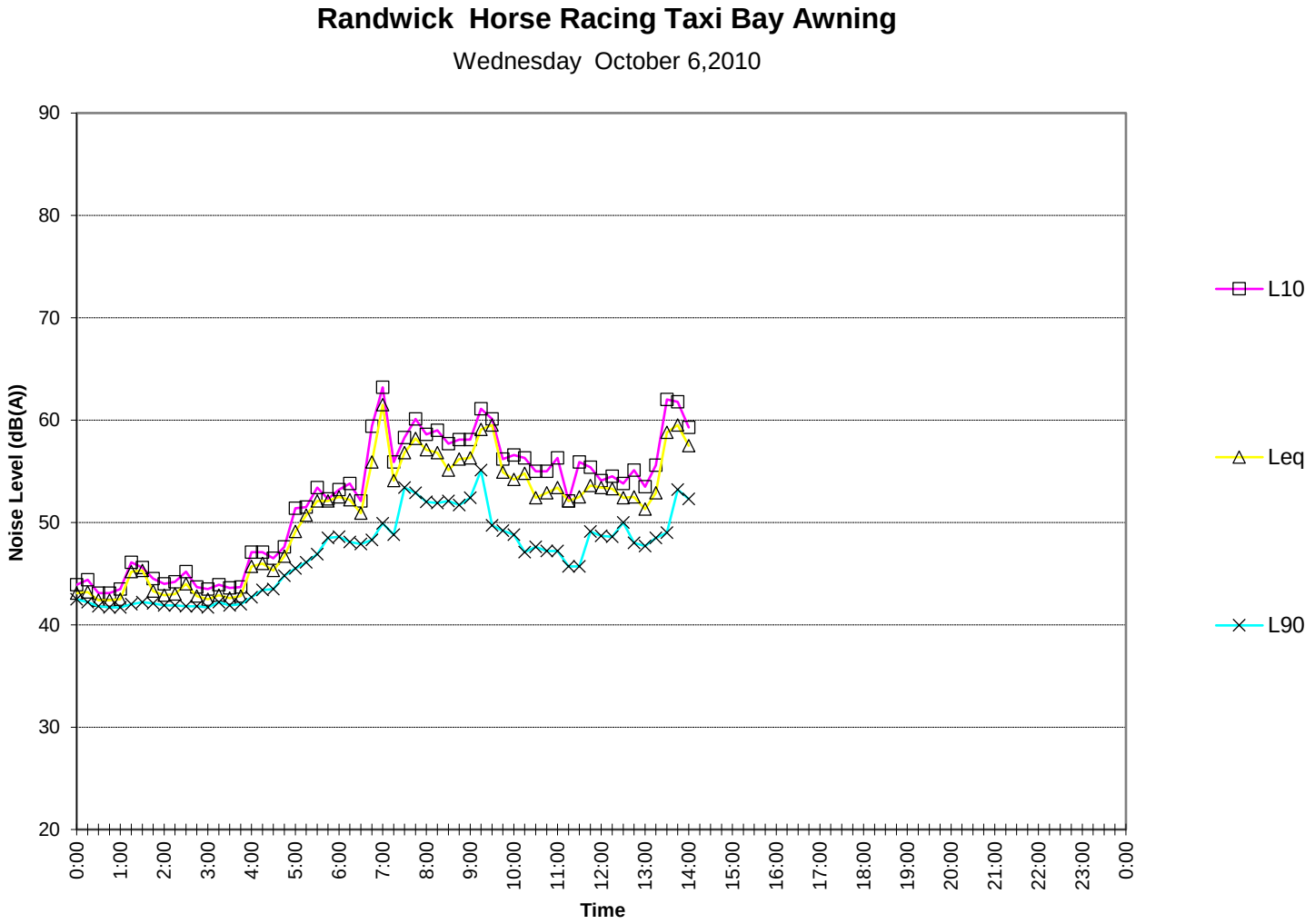
Leq
L90


Randwick Horse Racing Taxi Bay Awning
Wednesday October 6,2010
Noise Level (dB(A))
90
80
70
60
50
40
30
20
0:00
1:00
2:00
3:00
4:00
5:00
6:00
7:00
8:00
9:00
10:00
11:00
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Time
L10
Leq
L90