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Noise Impact Assessment

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1 EXECUTIVE SUMMARY

This assessment presents an analysis of acoustic impacts associated with the proposed Royal Randwick Hotel located within the Royal Randwick Racecourse grounds, Randwick.

This report presents an analysis of acoustic impacts associated with the proposed Royal Randwick Hotel located within the Royal Randwick Racecourse grounds, Randwick.

The report has been to satisfy the relevant acoustic elements of the Director General Requirements including the following sections;

- Item 1 - Environmental Planning Instruments (EPIs)
- Item 2 - Policies, Guidelines and Planning Agreements:
- Item 6 - Environmental and Residential Amenity
- Item 7 - Noise

The proposed development includes a multistorey hotel building consisting of basement parking, podium floors with hotel areas including a lounge, lobby, bar, restaurant & function rooms, pool, outdoor area and 5 multiple levels of hotel rooms above.

Potential noise impacts on the site are primarily:

- Road traffic noise from surrounding roadways, most notably Alison Road, which carries medium to high volumes of traffic flow.

Noise potentially generated by the site will consist primarily of noise from mechanical plant, patrons and activities associated with the podium levels of the development;

The nearest potentially affected noise receivers include:

- Residences to the west of the site facing Doncaster Avenue.
- Residences to the east of the site on Alison road;

All other surrounding areas include either other areas of the Royal Randwick Racecourse or Centennial Park Lands, compliance at the residential receivers above represents compliance at all affected surrounding receivers.

The investigations carried out indicate that the acoustic amenity of existing properties and the future occupants of the proposed development would not be adversely impacted by the proposed development provided appropriate management and engineering control measures are implemented, as indicated below:

- ❖ Internal noise levels will be designed in conjunction with the relevant standards and recommended acoustic treatments to the buildings external façade has been investigated to ensure noise level criteria can be achieved.
- ❖ The recommended acoustic treatments detailed in this report will ensure that internal noise levels within the future hotel associated with events within the Royal Racecourse grounds will be acoustically acceptable for future hotel occupants from activity noise and events within the Royal Randwick Recourse Grounds.
- ❖ Treatment of ventilation equipment associated with the carpark, podium and hotel areas of the development will be required to be treated with silencers, internal lining of ductwork and appropriate enclosures.

A detailed review of all external mechanical plant should be undertaken at construction certificate stage (once plant selections and locations are finalised). Acoustic treatments should be determined in order to control plant noise emissions to the levels set out in this report which has been development in conjunction with the relevant noise criteria as detailed within the Director General Requirements.

- ❖ It is proposed that noise generated from activities associated with the operation of proposed hotel, including the surrounding external areas, restaurant and bar will be assessed similar to the criteria previously developed for noise generated from events within Randwick Racecourse.
- ❖ Manage of noise and vibration associated with the proposed construction activities (including demolition, excavation and construction) which are required as part of the proposed Royal Randwick Hotel Project have been detailed within this assessment. The assessment has been conducted to investigate the potential for construction noise and vibration impact to surrounding receivers within close proximity including residential receivers.

2 INTRODUCTION

This report presents an analysis of acoustic impacts associated with the proposed Royal Randwick Hotel located within the Royal Randwick Racecourse grounds, Randwick.

In this report we will:

- Identify environmental noise sources (primarily traffic noise) which may impact on the site and recommend acoustic treatments to reduce these impacts to acceptable levels.
- Identify potential noise sources generated by the site, and determine noise emission goals for the development to meet Council acoustic requirements to ensure that nearby developments are not adversely impacted.

The noise impact assessment is based on the projects drawings and site location provided to this office.

The report has been to satisfy the relevant acoustic elements of the Director General Requirements including the following sections;

- Item 1 - Environmental Planning Instruments (EPIs)

Address the relevant statutory provisions applying to the site contained in all relevant EP is, including:

- a. Objectives of the EP&A Act 1979;
- b. SEPP (State & Regional Development) 2011;
- c. SEPP 55- Remediation of Land;
- d. SEPP (Infrastructure) 2007;
- e. Randwick Local Environmental Plan 1998 (Consolidation); and
- f. Randwick Draft Local Environmental Plan 2012.

- Item 2 - Policies, Guidelines and Planning Agreements:

Address the relevant planning provisions, goals and strategic planning objectives in the following:

- a. Metropolitan Plan for Sydney 2036;
- b. Royal Randwick Racecourse DCP 2007;
- c. Randwick Development Control Plan- Parking, 1998;
- d. Draft Inner East Subregional Strategy 2007;
- e. Development Near Rail Corridors and Busy Roads- Interim Guideline;
- f. Department of Planning Guidelines for Walking & Cycling 2004;
- g. NSW Government Floodplain Development Manual 2005; and
- h. Final draft Royal Randwick Racecourse Conservation Management Plan, Godden Mackay Logan, December 2006.

- Item 6 - Environmental and Residential Amenity

The EIS shall address:

- a. The degree of intensification and impacts on surrounding residential uses including (but not limited to) solar access, acoustic impacts, visual privacy, security and safety;

- Item 7 - Noise

Identify the main noise generating sources and activities at all stages of construction, and any noise sources during operation. Outline measures to minimise and mitigate the potential noise impacts on surrounding occupiers of land.

Relevant Policies and Guidelines:

- a. NSW Industrial Noise Policy (EPA)
- b. Interim Construction Noise Guideline (DECC).

3 SITE DESCRIPTION / PROPOSED DEVELOPMENT

The proposed development includes a multistorey hotel building consisting of basement parking, podium floors with hotel areas including a lounge, lobby, bar, restaurant & function rooms, pool, outdoor area and 5 multiple levels of hotel rooms above.

Potential noise impacts on the site are primarily:

- Road traffic noise from surrounding roadways, most notably Alison Road, which carries medium to high volumes of traffic flow.

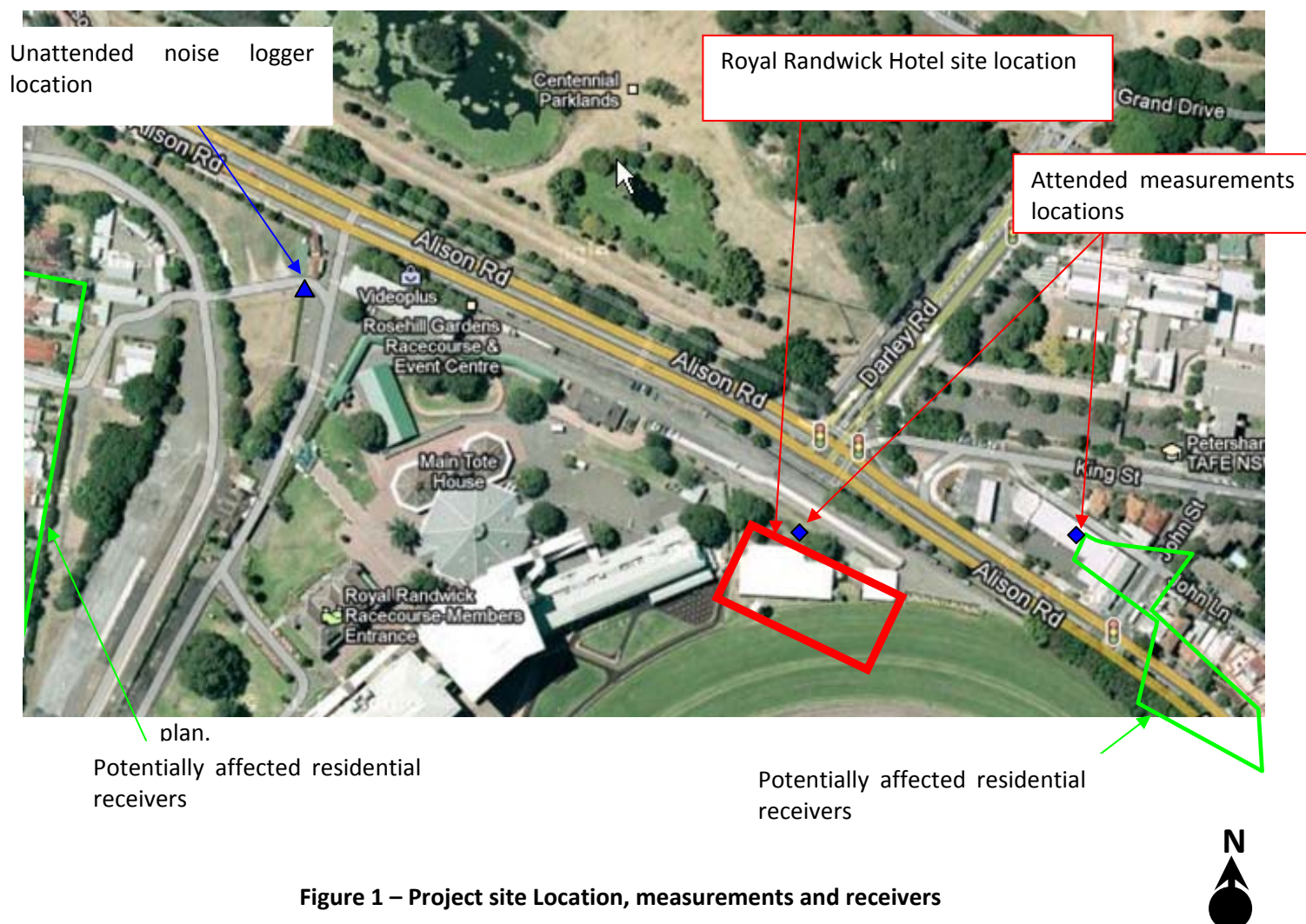
Noise potentially generated by the site will consist primarily of noise from mechanical plant, patrons and activities associated with the podium levels of the development;

The nearest potentially affected noise receivers are:

- Residences to the west of the site facing Doncaster Avenue.
- Residences to the east of the site on Alison road;

All other surrounding areas include either other areas of the Royal Randwick Racecourse or Centennial Park Lands, compliance at the residential receivers above represents compliance at all affected surrounding receivers.

Refer to Figure 1 below, which is an aerial photo of the existing development and the typical floor



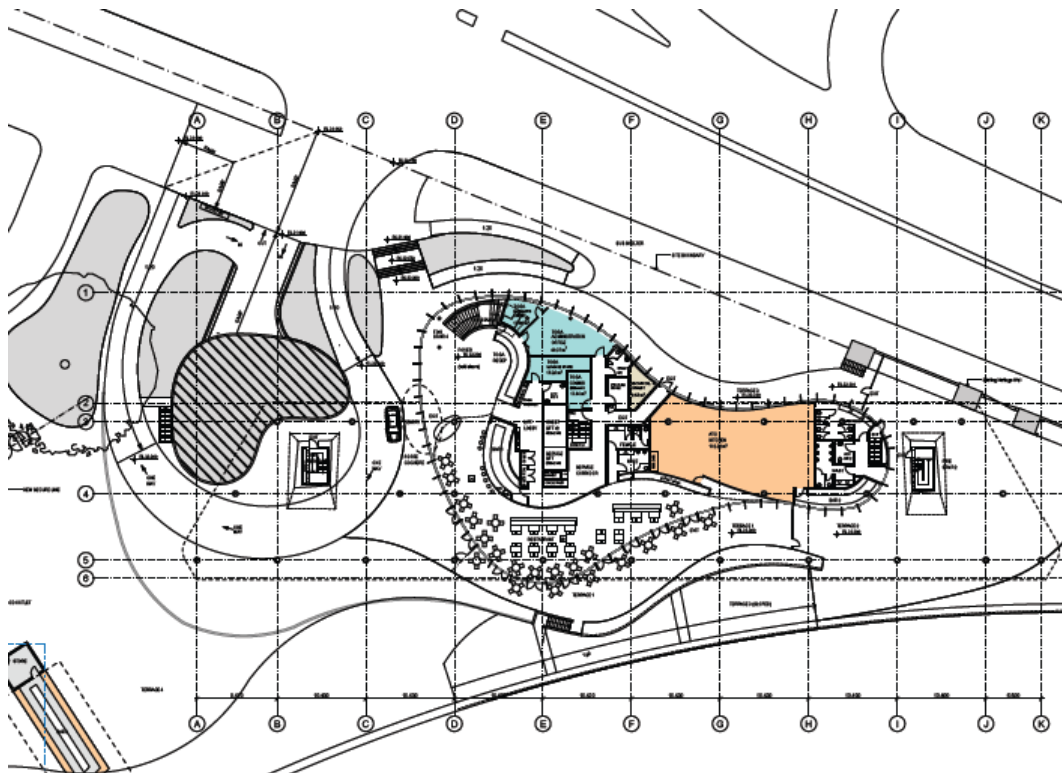


Figure 2- Ground Floor Plan

4 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.

5 NOISE IMPACT ASSESSMENT

Significant noise sources in the vicinity of the site are as follows:

- Alison Road located to the north of the proposed hotel which carries medium to high volumes of traffic flow.

Noise impacts have been designed such that internal noise levels will comply with the requirements of the Australian Standard AS2107:2000 *“Recommended Design Sound Levels and Reverberations Times for Building Interiors”*, for major roads and the SEPP 2007 (outlined in the Development near Rail Corridors and Busy Roads – Interim Guideline) as Alison Road is classified as carrying 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).

5.1 ACOUSTIC OBJECTIVES

The determination of an acceptable level of traffic noise within the future hotel spaces requires consideration of the activities carried out within the space and the degree to which noise will interfere with those activities

As sleep is the activity most affected by traffic noise, bedrooms are the most sensitive rooms. Higher levels of noise are acceptable in living areas without interfering with activities such as reading, listening to television, etc. Noise levels in utility spaces such as kitchens, bathrooms, laundries, etc can be higher.

Traffic noise will be assessed to the following criteria:

- Australian/New Zealand Standard AS/NZS 2107:2000 *“Recommended Design Sound Levels and Reverberations Times for Building Interiors”*, for major roads.
- State Environmental Planning Policy 2007

5.2 AUSTRALIAN/NEW ZEALAND STANDARD AS/NZS 2107:2000

The Australian/New Zealand Standard AS/NZS 2107:2000 “*Recommended Design Sound Levels and Reverberations Times for Building Interiors*” for developments near major roads provides recommended maximum noise level criteria for living and sleeping areas. The internal noise level criteria within the standard are expressed in terms of the L_{eq} descriptor and are detailed in the table below.

Table 1 - Traffic Noise Criteria for All Spaces inside Development

Development	Internal Space	Time Period	Noise Level
Residential/Hotel	Living Areas	Day	≤ 45 dB(A), $L_{Aeq(15hrs)}$
	Sleeping Areas	Night	≤ 40 dB(A), $L_{Aeq(9hrs)}$
	Commercial/retail areas	Day Time	50 dB(A)

5.2.1 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,

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 L_{Aeq} 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.”

5.3 RESULTING CRITERIA

Based on the discussion of the relevant criteria discussed above the assessment of environmental noise intrusion into the proposed development has been conducted in accordance with the more stringent criteria specified above as shown in the table below.

Table 2 – Internal Noise Level Criteria

LOCATION	TIME OF DAY	CRITERIA
Bedroom	10:00pm – 7:00am	35 dB(A) $L_{eq(9\text{ hour})}$
Living areas	24 Hours	35 dB(A) $L_{eq(24\text{ hour})}$
Commercial/Retail	24 Hours	45 dB(A) L_{eq}

5.4 UNATTENDED NOISE MONITORING

As part of this investigation, traffic noise from the surrounding perimeter roadway (Alison Road) has been measured. The results of this measurement will be used to determine the treatments required to reduce noise levels to within the project acoustic objectives.

Measurements included attended and unattended noise levels measurements conducted at the locations as detailed in Figure 1 above.

Unattended noise measurements were conducted on site over a period of five days in order to characterise the existing noise environment. The unattended noise measurement results have been presented in Appendix 1.

5.4.1 Time of Measurements

Unattended noise measurements were conducted at the subject site between the period of 14th to 20th March 2012.

5.4.2 Measurement Equipment

Noise measurements were obtained 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 noise monitor was calibrated at the beginning and the end of the measurement period using a Rion NC-73 sound level 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.

5.5 ATTENDED NOISE MEASUREMENTS

Attended noise measurements were also conducted around the project site. Measurements were taken using a Norsonic-140 precision sound level analyser, set to A-weighted fast response. The sound level meter was calibrated before and after the measurements using a RION NC73 precision sound calibrator and no significant drift was recorded. Measurements were taken on 14th March 2012 between 4 to 5 pm and 10pm to 11pm. There were no periods of adverse weather during the measurement.

Attended noise measurements were conducted at a number of locations including King Street and Alison Road such that a representative background noise level for the surrounding residential receivers could be obtained.

5.6 MEASURED NOISE LEVELS

The measured traffic noise levels have been summarised in Table 3 which was determined from the unattended noise measurements presented in Appendix 1.

Table 3 - Measured Traffic Noise Levels dB(A)

Location	Day Time 7am to 10pm	Night Time 10pm-7am
Alison Road – Noise Monitoring	70 dB(A) _{Leq(15hour)}	66 dB(A) _{Leq(9 hour)}
Alison Road – Noise Measurements	71 dB(A) _{Leq(15 min)}	64 dB(A) _{Leq(15 min)}

5.7 ASSESSMENT

Traffic noise intrusion into the proposed development was assessed using the measured external noise levels reported above as a basis.

Calculations were performed taking into account the orientation of windows, the total area of glazing, facade transmission loss and room sound absorption characteristics. In this way the likely interior noise levels can be predicted. Acoustic treatment required to ensure compliance with the assessment criteria are detailed in this section.

Internal noise levels will primarily be as a result of noise transfer through the windows and doors as these are relatively light building elements that offer less resistance to the transmission of sound. Noise transfer through the masonry elements will not be significant and need not be considered further.

The constructions necessary to achieve the noise levels are detailed below. The predicted noise levels have been based on the expected level and spectral characteristics of the external noise, the area of building elements exposed to traffic noise, the absorption characteristics of the rooms and the noise reduction performance of the building elements.

5.8 RECOMMENDATIONS

5.8.1 Glazed Windows and Doors

The following constructions are recommended to comply with the naturally ventilated traffic noise objectives stated in Section 4.3, for both the windows open and windows closed criteria. Aluminium framed/sliding glass doors and windows will be satisfactory provided they meet the following criteria listed below. The recommended construction below are indicative only and conformation of window construction will be provided at the CC submission stage of the project.

Table 4 - Recommended Glazing Constructions

Façade	Level	Room Type	Glazing	Seals
Alison Road Façade	All Levels	Bedroom	10.38mm Laminated	Yes
		Living Areas	10.38mm Laminated	Yes
		Commercial/Retail/Podium	6.38mm Laminated	Yes
East, West and South Facades	All Levels	Bedroom	6.38mm Laminated	Yes
		Living Areas	6.38mm Laminated	Yes
		Commercial/Retail/Podium	6.38mm Laminated	Yes

The proposed glazing thickness will satisfy all acoustic requirements of Section 4. Thicker glazing may be required for structural, safety or other purposes. Where it is required to use thicker glazing than scheduled, this will also be acoustically acceptable. Glazing to all units not listed in the table may be 4mm thick float or 5mm toughened glass for windows and doors, respectively, no acoustic seals required.

It is recommended that only window systems having test results indicating compliance with the required ratings obtained in a certified laboratory be used where windows with acoustic seals have been recommended.

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 4 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 all these windows are assumed as aluminium awning windows and mohair seals in windows and doors are not acceptable where acoustic seals are required.

Table 5 - Minimum STC of Glazing (with Acoustic Seals)

Glazing Assembly	Minimum STC of Installed Window
10.38mm Laminated	35
6.38mm Laminated	30

5.9 ROOF/CEILING

Any roof of concrete construction will not require upgrading in order to satisfy the project acoustic objectives.

5.10 EXTERNAL WALLS

External walls are of masonry construction and do not require upgrading in order to satisfy the project acoustic objectives.

5.11 ROYAL RANDWICK RACECOURSE NOISE

Noise impact associated with activities and race meetings within the Royal Racecourse grounds, including race meetings, music events and the like have not been included in this assessment. Neither the Australian/New Zealand Standard AS/NZS 2107:2000 "Recommended Design Sound Levels and Reverberations Times for Building Interiors" or the State Environmental Planning Policy (SEPP Infrastructure) 2007 require noise levels from limited events to be acoustically treated to comply with noise levels detailed in this report.

Notwithstanding the above, the recommended acoustic treatments detailed in this report will ensure that internal noise levels within the future hotel associated with events within the Royal Racecourse grounds will be acoustically acceptable for future hotel occupants.

It is also noted that any events conducted within the grounds will be restricted based on local council regulations for such events and will not be conducted after midnight.

6 NOISE EMISSION ASSESSMENT

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

Potential noise sources which should be assessed are:

- Noise generated by mechanical plant.

The nearest potentially affected noise receivers are:

- Residences to the west of the site facing Doncaster Avenue.
- Residences to the east of the site on Alison road;

All other surrounding areas include either other areas of the Royal Randwick Racecourse or Centennial Park Lands, compliance at the residential receivers above represents compliance at all affected surrounding receivers.

Noise emissions noise will be assessed to the following criteria:

- The DECCW's - Industrial Noise Policy

6.1 BACKGROUND NOISE MONITORING

Unattended noise monitoring was conducted between 14th and 20th March 2012 using an Acoustic Research Laboratories monitor set on A-weighted fast response mode. The monitor was calibrated before and after the measurements using a Rion Type NC-73 calibrator. No significant drift was recorded.

Additional attended noise measurements were also conducted around the project site as detailed in Figure 1 of this report. Measurements were taken using a Norsonic-140 precision sound level analyser, set to A-weighted fast response. The sound level meter was calibrated before and after the measurements using a RION NC73 precision sound calibrator and no significant drift was recorded. Measurements were taken on 14th March 2011 between 4 and 5 pm and 10pm to 11pm. There were no periods of adverse weather during the measurement.

The results of background noise level measurements are presented below.

Table 6 – Measured Background

Location	Description	Day Noise Level 7am to 10pm (dB(A))	Evening Noise Level 7am to 10pm (dB(A))	Night Noise Level 10pm to 7am (dB(A))
Royal Randwick Hotel Site	Rating Background Noise Level L _{90,15min}	56	56	37

6.2 NOISE EMISSION GUIDELINES AND ASSESSMENT CRITERIA

Noise emissions from the site should comply with all of the acoustic criteria outlined below.

6.2.1 INDUSTRIAL NOISE POLICY OBJECTIVES/GUIDELINES

The DECCW Industrial Noise Policy provides guidelines for the assessment of noise impacts from industrial and commercial premises. The recommended assessment objectives vary depending on the nearest potentially affected residential receivers, the time of day and the type of noise source. The DECCW Industrial Noise Policy has two requirements that must both be satisfied; that is, an intrusiveness criterion and an amenity criterion.

Criterion for neighbouring commercial/retail/recreation properties are based on set noise level criterion within the Industrial Noise Policy.

If a noise source achieves compliance with the INP guidelines it would generally be accepted the noise source would not cause “offensive noise” as defined in the Protection of the Environment Operations Act (refer below).

6.2.1.1 Intrusiveness Criterion

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

The resulting intrusiveness criteria are presented in the table below based on background noise levels recorded at the site.

Table 7 –DECCW Intrusiveness Noise Emission Objectives

Location	Description	Noise Emission Goal - dB(A) $L_{eq}(15min)$		
		Day	Evening	Night
Royal Randwick Hotel Site	Noise Level $L_{eq,15min}$	61	61	42

6.2.1.2 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 DECCW Industrial Noise Policy sets out acceptable noise levels for various localities. Table 2.1 titled “*Amenity Criteria*” on page 16 of the Policy designates four categories to distinguish different residential areas. They are rural, suburban, urban and urban/industrial interface. The DECCW Industrial Noise Policy also includes recommended noise levels for other land uses such as commercial and industrial premises. The nearest potentially affected residential premises situated immediately to the south of the proposed development site which have been classified as being situated in an sub-urban noise amenity area as defined by the DECCW NSW Industrial Noise Policy.

The following table presents the amenity criteria applicable to the nominated nearest potentially affected receivers. The receiver type utilised against the indicative noise amenity area is defined by the sub-urban criteria.

Table 8 - DECCW Amenity Noise Levels for Nearest Potentially Affected Residential Receivers

Time of Day	Recommended Acceptable Noise Level dB(A) L_{Aeq} (period)
Day (7.00am to 6.00pm)	55
Evening (6.00pm to 10.00pm)	45
Night (10.00pm to 7.00am)	40

The noise emission limit criteria for this project have been determined using the DECCW Industrial Noise Policy and the unattended noise monitoring data.

6.2.2 Assessment Criteria Summary

Table 9 presents a summary of the prevailing assessment criteria applicable to the proposed development at the nearest potentially affected residential receivers.

Table 9 – Project Noise Generation Criteria

Location	Day Time Noise Objective dB(A) L_{eq}	Evening Time Noise Objective dB(A) L_{eq}	Night Time Noise Objective dB(A) L_{eq}
All Surrounding Residential Receivers	55	45	40

6.3 RECOMMENDATIONS

Mechanical plant items are not typically selected at selected at DA stage.

Detailed review of all external mechanical plant should be undertaken at construction certificate stage (once plant selections and locations are finalised). Acoustic treatments should be determined in order to control plant noise emissions to the levels set out in section 5.2 of this report.

All plant can be satisfactorily attenuated to levels complying with noise emission criteria through appropriate location and (if necessary) standard acoustic treatments such as noise screens, enclosures, in-duct treatments (silencers/lined ducting) or similar.

6.4 ACTIVITY NOISE

Potential noise generation from activities associated with the podium levels of the hotel will be designed such that compliance with the noise level criteria within Section 5.2 of this report is complied with. Details of required acoustic treatments and controls will be provided at the CC submission stage of the project as may include the following;

1. Time restrictions on use of the external pool.
2. Restrictions on the opening of the podium façade facing to the north and east.

7 ACTIVITY NOISE

It is proposed that noise generated from activities associated with the operation of proposed hotel, including the surrounding external areas, restaurant and bar will be assessed similar to the criteria previously developed for noise generated from events within Randwick Racecourse.

The proposed noise limits when measured at surrounding affected residences are similar to those approved for the Future Music Festival 2010 and proposed as part of the upgrade to the Spectator precinct.

The proposed noise level criteria for the hotel operation on days when event are to be held within Randwick Racecourse (both race day and non-race day events on the infield and within the Theatre of the Horse) are:

- LA_{1,15min} 70 dB(A)
- LC_{90,15min} 90 dB(C)

Noise levels are to be measured at the potentially affected residences during event days with the sound level meter set to the 'fast' response setting over any 15 minute period during the operation of the hotel.

8 CONSTRUCTION NOISE AND VIBRATION ASSESSMENT

This section of the report presents a specification for the processes, which will be followed to manage noise and vibration associated with the proposed construction activities (including demolition, excavation and construction) which are required as part of the proposed Royal Randwick Hotel Project. The assessment has been conducted to investigate the potential for construction noise and vibration impact to surrounding receivers within close proximity including residential receivers.

The principal objective of this study is to undertake an evaluation of works to be performed during the operation of the various activities during construction (including demolition and excavation) and develop a management plan to ensure noise and vibration:

1. Is minimised to surrounding residential receivers in compliance with the relevant DECCW and Australian Standards.
2. Does not exceed OH&S standards at surrounding receivers.
3. Is monitored when potentially high noise and vibration generating activities are being used.

This assessment will formulate/present the relevant noise and vibration criteria which construction activities are required to comply with. Additionally effective mitigation measures will be recommended where possible to ensure criteria is achieved and impacts are minimised to surrounding receivers.

The principal issues, which will be addressed in this report, are:

- Identification of the noise and vibration standards which will be applicable to this project.
- Formulation of a strategy for construction activities to comply with the standards identified in the above point.
- Development at demolition and excavation methods which will minimise the impact on surrounding receivers.

8.1 PROJECT OBJECTIVES

The objective of this management plan is to set up a protocol to ensure noise and vibration emissions from the construction works associated with the Royal Randwick Hotel Project comply with applicable standards, recommend required management controls and treatments are adopted where required and detail the required monitoring to ensure standards are met.

8.2 PROJECT DESCRIPTION AND POTENTIALLY EFFECTED PROPERTIES

The proposed Royal Randwick Hotel Project includes the demolition of a portion of the existing building structures and excavation of material including infill and soft sand stone. The expected activities can be expected to include:

1. Demolition of existing buildings.
2. Removal of infill material.
3. Excavation of soft sand stone.
4. Construction of the proposed development Royal Randwick Hotel.

Based on the site location of the Royal Randwick Hotel Project the potentially affect receivers which may be affected include:

1. Surrounding residential receivers on Alison Road and identified in Figure 1 of this report.

8.3 CONSTRUCTION NOISE CRITERIA

It is proposed to utilise Australian Standard AS2436:1981 *“Guide to noise control on construction, maintenance and demolition sites”*, which is the standard commonly applied by Councils for the regulation of construction noise, the New South Wales Construction Noise Guideline developed by The NSW Department of Environment, Climate Change and Water (DECCW) and OH&S requirements are presented in this section of the report.

8.3.1 Australian Standard AS2436:1981 *“Guide to noise control on construction, maintenance and demolition sites”*

The Australian Standard AS2436 states that where all reasonable and available measures have been taken to reduce construction noise, mitigation strategies may be put in place to reduce levels noise levels to within a reasonable and acceptable level.

For the control and regulation of noise from construction sites AS2436:1981 *“Guide to noise control on construction, maintenance and demolition sites”* nominates the following:

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

8.3.2 DECCW Construction Noise Guideline

The Department of Environment, Climate Change and Water in their recognition that previous construction noise criteria used by the former NSW Environmental Protection Authority (EPA) was unworkable, have developed a specific construction noise guideline in the aid of reducing the impact of construction associated noise.

The guideline reflects on feasible and reasonable mitigation strategies, management controls and public liaising in the effort to reach realistic compromises between construction sites and potential noise affected receivers.

8.3.3 DECCW Construction Noise Guideline - Quantitative Assessment Method

The guideline refers to a quantitative assessment method in which construction noise is assessed on a case by case basis with regard to various activities to be conducted on site. This assessment method was developed to smaller scale projects.

Essentially this method of assessment requires that the proponent take into consideration and employ all reasonable and feasible measures to ensure that the impact on noise receivers is minimised. This is generally conducted in the following manner:

- The drafting of a noise management plan outlining all reasonable and feasible mitigation methods for the reduction of noise impact;
- The assessment of high impact equipment such as rock-hammers and piling equipment for lower noise producing methods of construction/excavation;
- The implementation of a complaints handling register and community consultation system;
- Employee (builders, contractors etc) education in effective noise reducing techniques and site etiquette; and
- The operation of plant in a quiet and efficient manner (i.e. turning off machinery when not in use).

This quantitative assessment method has been used for the basis of this report and has been used as the basis for the development of acoustic management and treatments of proposed construction activities.

In addition, the guideline specifies goals which can be used in the effort of minimising noise from construction related activities. These noise goals are presented within the table below.

Table 10 – DECCW Recommended Construction Noise Goals

Governing Body	Receiver Type	External sound level Goal, $L_{eq\ 15\ min}$ dB(A)
DECCW	Residential (also adopted for school receivers)	Background + 10 dB(A) ¹
		75 dB(A) ²

1: Where the predicted or measured L_{Aeq} (15 min) is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to minimise noise. (DECCW CNG, 2008).

2: Where noise is above this level, the proponent should consider very carefully if there is any other feasible and reasonable way to reduce noise to below this level. If no quieter work method is feasible and reasonable, and the works proceed, the proponent should communicate with the impacted residents by clearly explaining the duration and noise level of the works, and by describing any respite periods that will be provided. (DECCW CNG, 2008).

These criteria for resultant noise from construction activities are aimed at maintaining comfort levels within the surrounding residential dwellings. Additionally, noise mitigation techniques as discussed in this report should be used if noise emissions exceed the above criteria. All work is to be carried out in accordance with AS 2436:1981 *“Guide to noise control on construction, maintenance and demolition sites”*.

8.3.4 OH&S guidelines

Regulation 49 of the Occupational Health and Safety Regulation specifies maximum levels of noise which a 'worker' may be exposed to. Acoustic treatment to the work environment or hearing protection is recommended for workers exposed to higher noise levels. These maximum OH&S noise levels are presented in the table below.

Table 11 – OH&S Maximum Noise Level Exposure

	Energy Averaged Over 8 Hour Day	Maximum Noise Level During Day
OH&S maximum noise level exposure	85 dB(A) L_{eq}	140 dB(C) p_{peak}

8.4 CONSTRUCTION VIBRATION CRITERIA

Construction vibration criteria associated with works on the Royal Randwick Hotel Project when measured at the potentially affected receivers should not exceed the following sets of vibration criteria to ensure no architectural or structural damage to surrounding buildings and human comfort is maintained. These standards have been selected as they are widely used in the assessment of vibration associated with construction activities within Australia, namely:

- German Standard DIN 4150-3 (1999-02): *“Structural Vibration – Effects of Vibration on Structures”*; and
- British Standard BS 6472:1992 *“Guide to Evaluation of Human Exposure to Vibration in Buildings (1Hz to 80Hz)”*.

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

8.4.1 German Standard DIN 4150-3 (1999-02)

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 the 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 12 – 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 (eg buildings that are under a preservation order)	3	3 to 8	8 to 10	8

8.4.2 British Standard BS 6472:1992

British Standard BS 6472:1992 develops criteria relating to levels of building vibration that may be expected to give rise to “*adverse comment*”, in the frequency range most applicable to impacts associated with construction, which is 1 to 80Hz. These threshold values are used as criteria for assessing the loss of amenity and are presented below in Table 3.

Table 13 – BS 6472:1992 Criteria to Avoid “Adverse Comment”

Type of Occupancy	Time of Day	Peak Particle Velocity (mms^{-1}) between 1Hz to 80Hz Likely to Cause “Adverse Comment”			
		Continuous Vibration		Intermittent Vibration and Impulsive Vibration Excitation with Several Occurrences per day	
		Vertical	Horizontal	Vertical	Horizontal
Residential	Day	0.3 to 0.6	0.8 to 0.6	8.4 to 12.6	24 to 36
	Night	0.2	0.6	2.8	8
Offices	Day	0.6	1.6	18	51
	Night	0.6	1.6	18	51
Workshops	Day	1.2	3.2	18	51
	Night	1.2	3.2	18	51

The limits indicate that people in buildings are significantly less susceptible to horizontal vibration than to vertical vibration. Furthermore, Section 4.1 of BS 6472 notes that situations can exist where vibration magnitudes above those generally corresponding to minimal “*adverse comment*” levels can be tolerated, particularly for temporary disturbances and infrequent and intermittent events such as those associated with construction projects.

8.5 VIBRATION CRITERIA

Based on the vibration criterion detailed in the sections above the suitable construction vibration criteria to ensure there is no structural or architectural damage to surrounding receivers includes the following:

- Surrounding residential or commercial receivers – 10mm/s

8.6 CONSTRUCTION HOURS

Working hours are subject to planning approval conditions and will be conducted within the approved construction times. Typically the hours of work at sites will be (or as approved on the conditions of consent):

- 7:00am to 6:00pm Monday to Friday
- 8:00am to 5:00pm on Saturdays
- No work on Sundays, Public Holidays.

Works which are proposed to be conducted outside of these hours will be subject to special approval.

As there are no normal construction activities to be conducted during night time hours (without special approval) there is no requirement to conduct an assessment of sleep disturbance.

8.7 CONTROL OF CONSTRUCTION NOISE AND VIBRATION

As a part of the noise management of noise and vibration on each site the following process should be conducted when investigating the impact and construction activities.

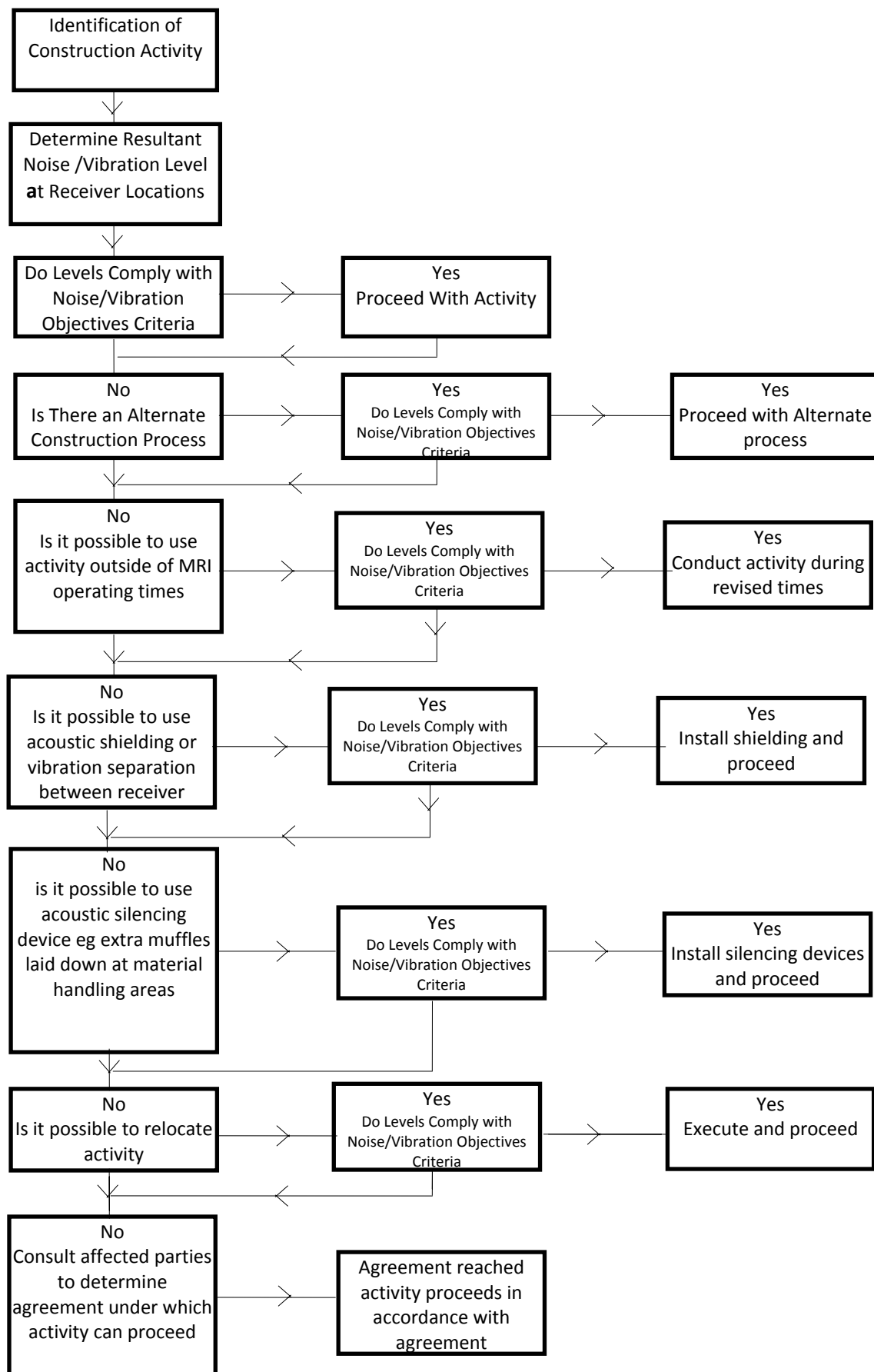


Figure 1 – Process Flowchart

8.8 NOISE AND VIBRATION 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.

8.8.1 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.

8.8.2 Acoustic Barrier

Barriers or screens can be an effective means of reducing noise. Barriers can be located either at the source or receiver.

The placement of barriers at the source is generally only effective for static plant (tower cranes). Equipment which is on the move or working in rough or undulating terrain cannot be effectively attenuated by placing barriers at the source.

Barriers can also be placed between the source and the receiver.

The degree of noise reduction provided by barriers is dependant on the amount by which line of sight can be blocked by the barrier. If the receiver is totally shielded from the noise source reductions of up to 15dB(A) can be effected. Where only partial obstruction of line of sight occurs, noise reductions of 5 to 8dB(A) may be achieved. Where no line of sight is obstructed by the barrier, generally no noise reduction will occur.

As barriers are used to provide shielding and do not act as an enclosure, the material they are constructed from should have a noise reduction performance that is approximately 10dB(A) greater than the maximum reduction provided by the barrier. In this case the use of a material such as 10mm or 15mm thick plywood (radiata plywood) would be acceptable for the barriers.

8.8.3 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.

8.8.4 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).

8.8.5 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.

8.8.6 Establishment of Site Practices

This involves the formulation of work practices to reduce noise generation. A noise plan will be developed for this project outlining work procedures and methods for minimising noise.

8.8.7 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 in Appendix 1. This measure is expected to maintain noise at constant levels, and prevent any increases.

8.8.8 Combination of Methods

In some cases it may be necessary that two or more control measures be implemented to minimise noise.

8.8.9 Saw Cutting

Introduction of a saw cut to manage vibration impacting on surrounding receivers from construction activities.

8.9 NOISE AND VIBRATION MONITORING

Noise and vibration monitoring will be undertaken to determine the effectiveness of measures which are been implemented. The results of monitoring can be used to devise further control measures.

The minimum requirement for noise and vibration monitoring includes the following:

- Noise monitoring at a representative location to the surrounding residential receivers during the demolition, excavation and construction stage to the first level above ground.

8.10 CONSTRUCTION NOISE AND VIBRATION ASSESSMENT

Potential noise and vibration impacts are reviewed below.

8.11 NOISE IMPACTS

Obviously, noise impacts on nearby development will be dependant on the activity and where on the site the activity is undertaken. Excavation works tend to be the loudest typical activity. Work close to the eastern and northern boundaries will have greatest impacts on surrounding residential residents.

The potentially worst case activities are identified and discussed below:

- Excavation and Demolition phase – Primary noise emissions occur during excavation and demolition, with equipment items typically having sound power levels (SWL) of approximately 117dB(A)_{L₁₀(15min)}. Excavators (dozers with bucket, saws or hammers) and piling works are typically the loudest activity during construction. Noise levels of between 60-70 dB(A) at the boundaries of residential receivers on Alison Road may be generated.
- During erection of structure, the use of hand tools (angle grinders, jack hammers etc.) and concrete pumps are the loudest typical activity (sound power levels of approximately 105dB(A)_{L_{eq}(15min)}). Noise levels of between 55-65 dB(A) at the boundaries of residential receivers on at the boundary of residential receiver may be generated.
- Obviously, once construction of the building shell is complete, noise from hand tools will be relatively low, as the new building construction will provide considerable noise attenuation for internal fitout. Once the building shell is largely complete, use of hand tools in internal areas is unlikely to be inaudible at the surrounding receivers.
- Noise levels generated by the construction activities will generally comply with the noise management levels at the boundaries of residential receivers. Some exceedances (depending on type of activity and location) may occur during limited operation of specific equipment. A detailed construction management plan will be required to be provided once a building contractor is appointed as part of the construction approval process.

8.12 VIBRATION IMPACTS

Excavation and demolition are the primary vibration generating activities.

- Vibration impacts on the identified residential receivers are unlikely to exceed the criteria outlined in this report.
- Where practicable, excavation in rock should be done using rock saws as opposed to hammers.
- If piling is required, use of augured or vibro or auger piling should be used rather than impact piling.

8.13 NOISE AND VIBRATION MANAGERMENTS

This section of the report identified the potentially worst case noise and vibration generating activities and presents possible strategies to ensure noise and vibration levels when measured at the worst affected receiver comply with the relevant criteria.

The table below presents the construction activities and discussed the potential management/treatments required to be conducted.

Table 14 – Recommended Noise and vibration Controls

EQUIPMENT /PROCESS	Receiver	Discussion
Hydraulic Hammering	Surrounding residential receivers	Hammering to be conducted during approved construction hours. All equipment to be kept in good working order.
	Ripping	Ripping of material should be maximised where possible.
Drill pilling equipment	Surrounding residential receivers	No acoustic controls required for impacts to surrounding residential receivers.
Concrete Saw Cutting	Surrounding residential receivers	No acoustic controls required for impacts to surrounding residential receivers.
Excavators – Including all excavators up to and including 35 tons	Surrounding residential receivers	No acoustic controls required for impacts to surrounding residential receivers.
Truck (including the loading of materials into trucks)	Surrounding residential receivers	No acoustic controls required
Bobcat	Surrounding residential receivers	No acoustic controls required
General Construction including - Angle Grinders, Electric Saw, Drilling, Hammering etc	Surrounding residential receivers	No acoustic controls required for impacts to surrounding residential receivers.
Concrete Pumps	Surrounding residential receivers	No acoustic controls required for impacts to surrounding residential receivers.

8.14 COMMUNITY INTERACTION AND COMPLAINTS HANDLING

In order for any construction noise management programme to work effectively, continuous communication is required between all parties, which may be potentially impacted upon including the builder and neighbours. 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 Complaints Register which will be used to address any construction noise related problems should they arise.

To ensure that this process is effective, regular information regarding the proposed works and period when they will be required to be conducted should be provide to neighbouring receivers (including residences), until all issues have been addressed and the evidence of successful implementation is embraced by all parties.

8.15 DEALING WITH COMPLAINTS

Should ongoing complaints of excessive noise or vibration criteria occur measures shall be undertaken to investigate the complaint, the cause of the exceedances and identify the required changes to work practices. In the case of exceedances of the vibration limits all work potentially producing vibration shall cease until the exceedance is investigated.

The effectiveness of any changes shall be verified before continuing. 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 location 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;
- 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.

8.16 CONTINGENCY PLANS

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

- Determine the offending plant/equipment/process
- Locate the plant/equipment/process further away from the affected receiver(s) if possible.
- Implement additional acoustic treatment in the form of localised barriers, silencers, vibration separation etc where practical.
- Selecting alternative equipment/processes where possible

Complaints associated with noise and vibration generated by site activities shall be recorded on a Noise 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.

9 CONCLUSION

Potential noise impacts from a proposed Royal Randwick Hotel development have been assessed and presented in this report.

Noise impacts from nearby sources (primarily traffic noise from Alison Road) on future hotel occupants have been assessed in accordance with relevant planning controls. The acoustic treatments necessary to achieve these guidelines have been set out in section 4.

Noise emissions objectives have been determined based on on-site noise logging and noise emission guidelines typically adopted by DECCW and have been presented in Section 5.

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

Yours faithfully,

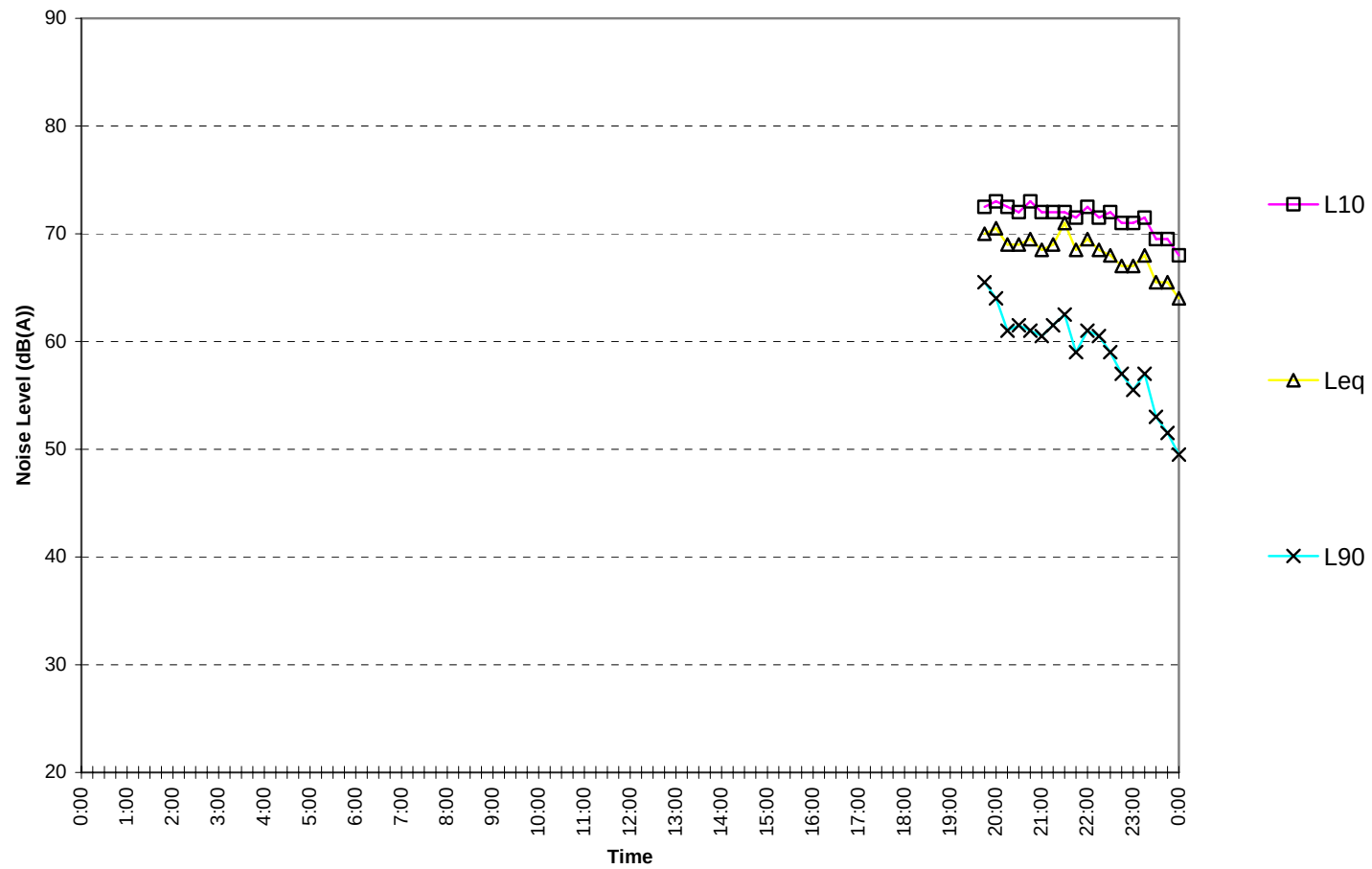
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Acoustic Logic Consultancy Pty Ltd
Ben White

APPENDIX A – Noise Logging Results

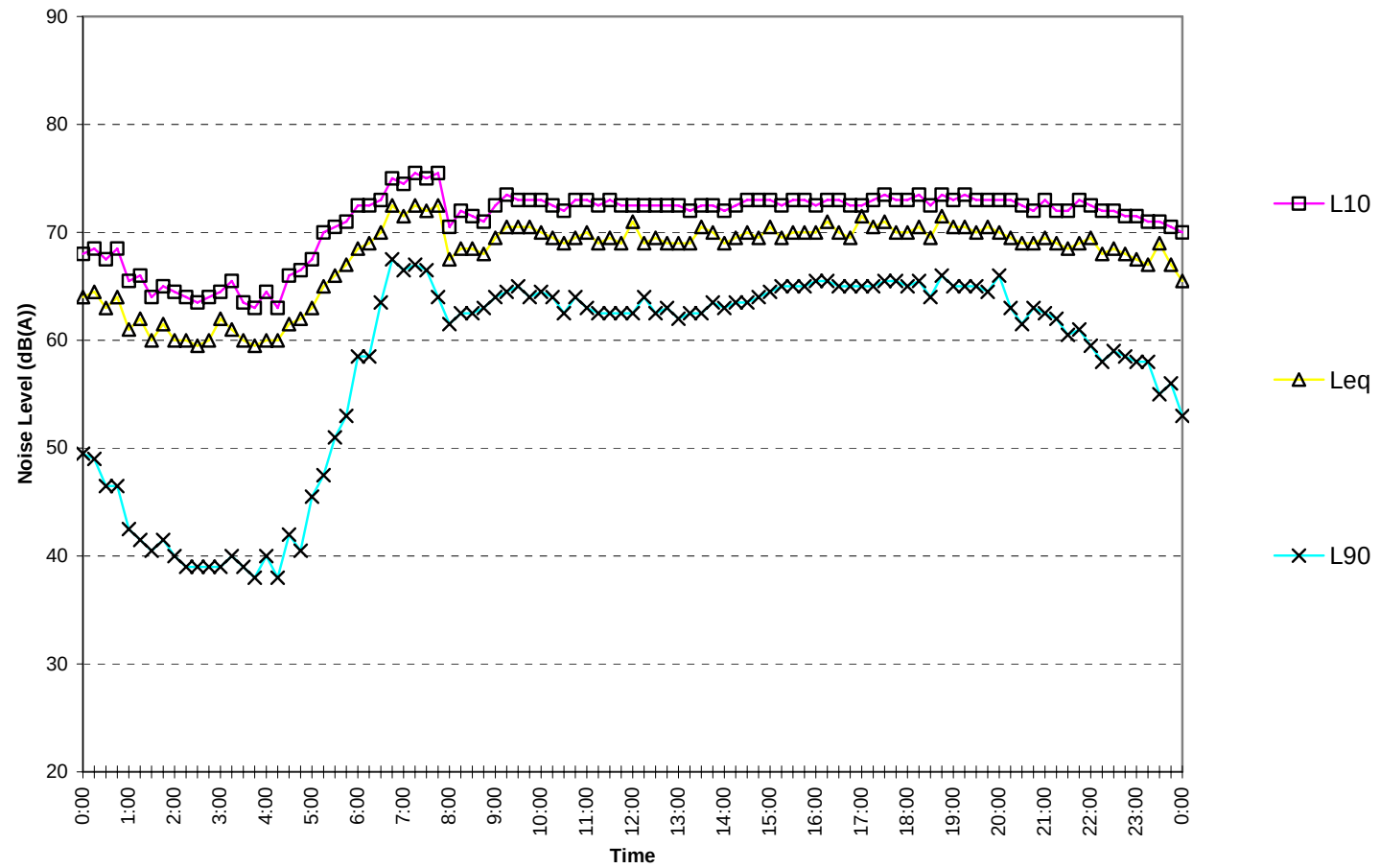
Royal Randwick Hotel

Wednesday March 14, 2012



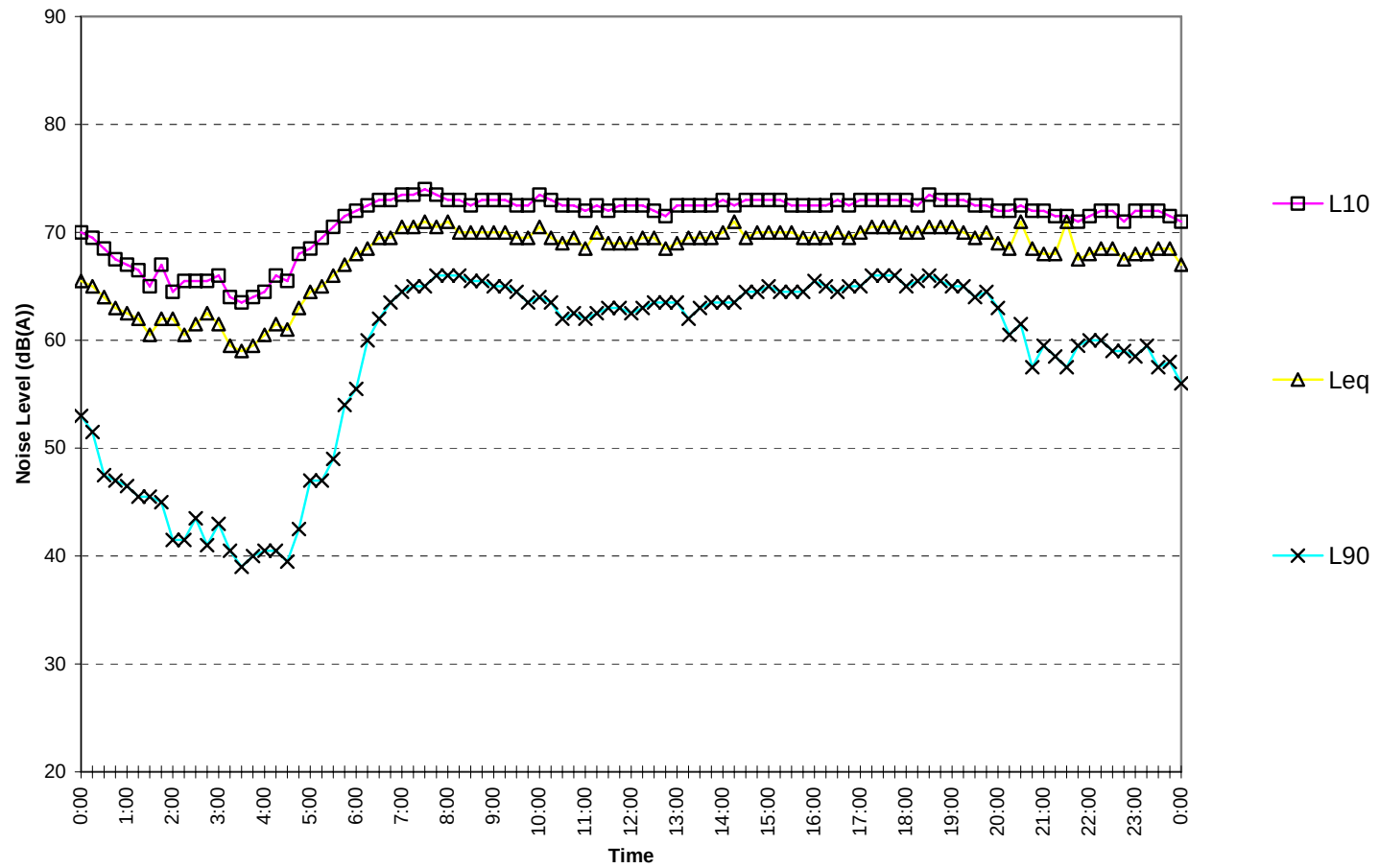
Royal Randwick Hotel

Thursday March 15, 2012



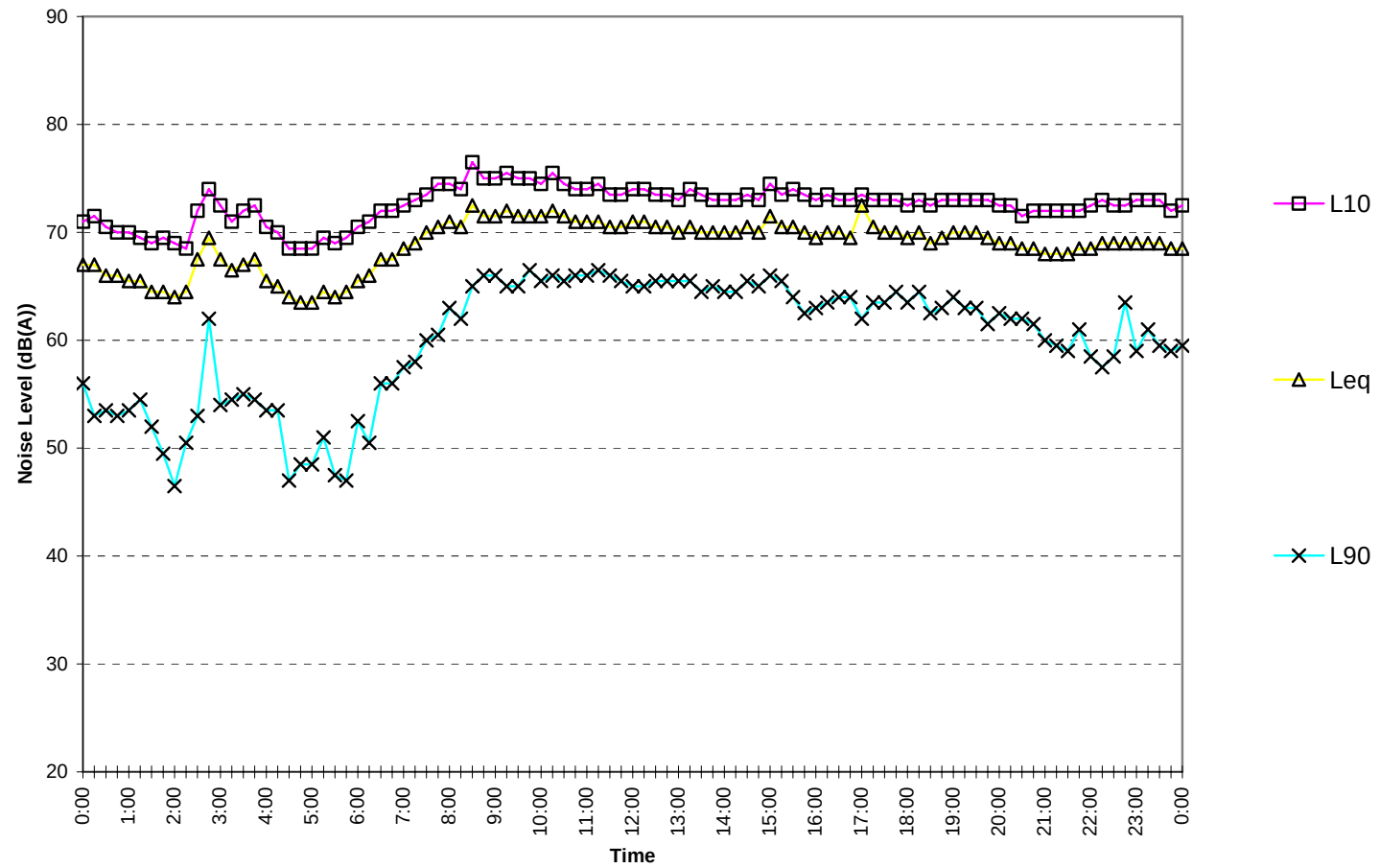
Royal Randwick Hotel

Friday March 16, 2012



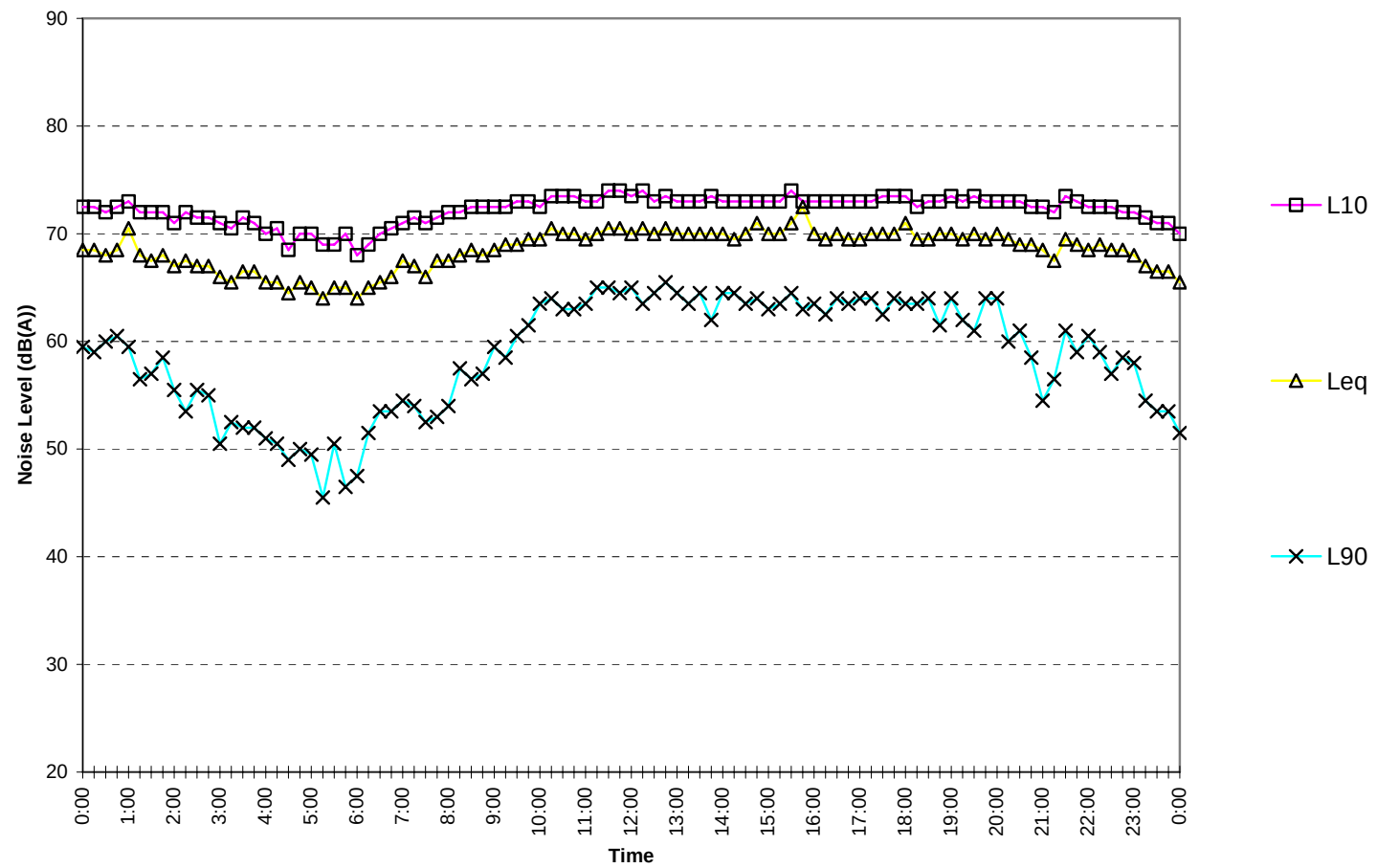
Royal Randwick Hotel

Saturday March 17, 2012



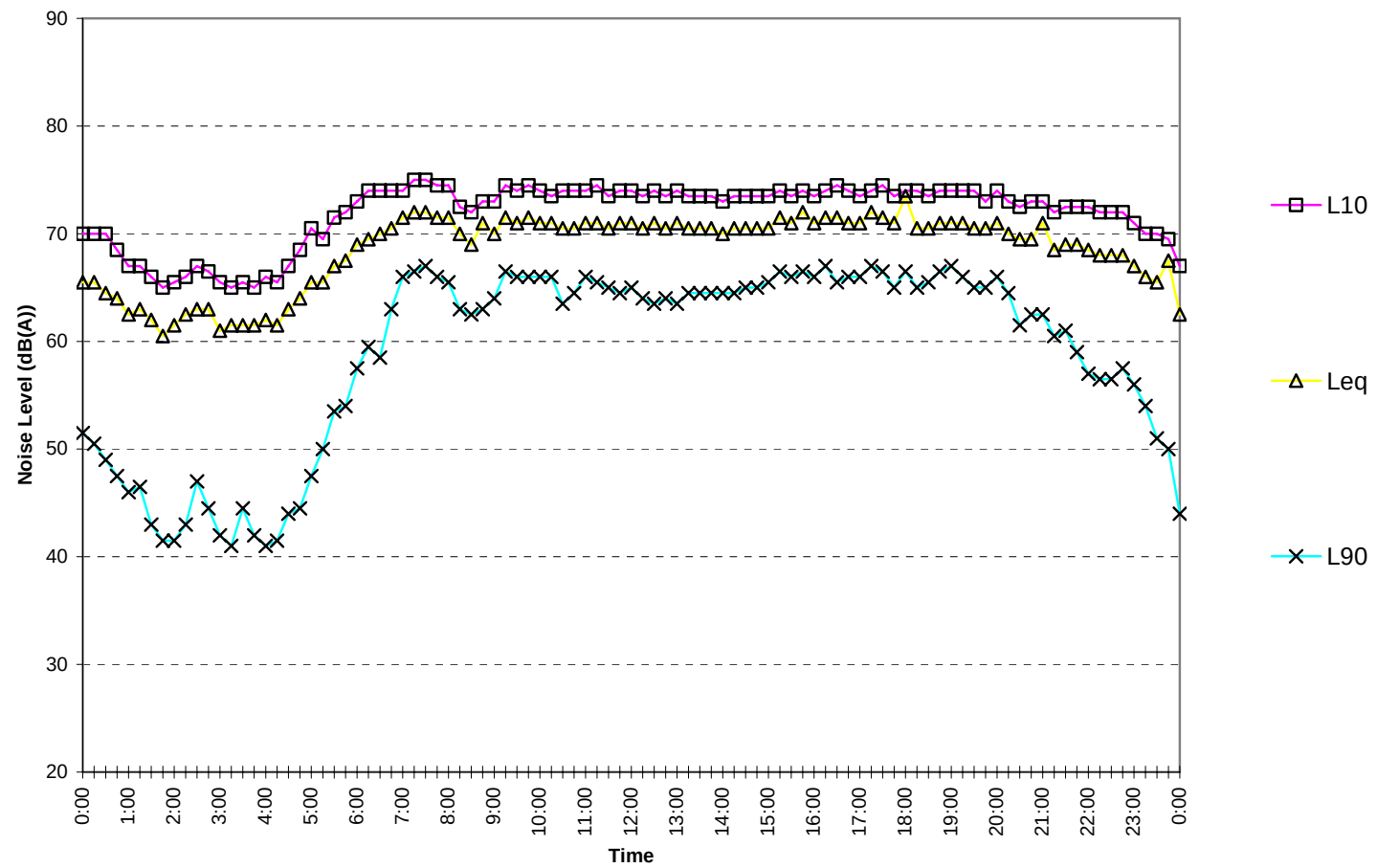
Royal Randwick Hotel

Sunday March 17, 2012



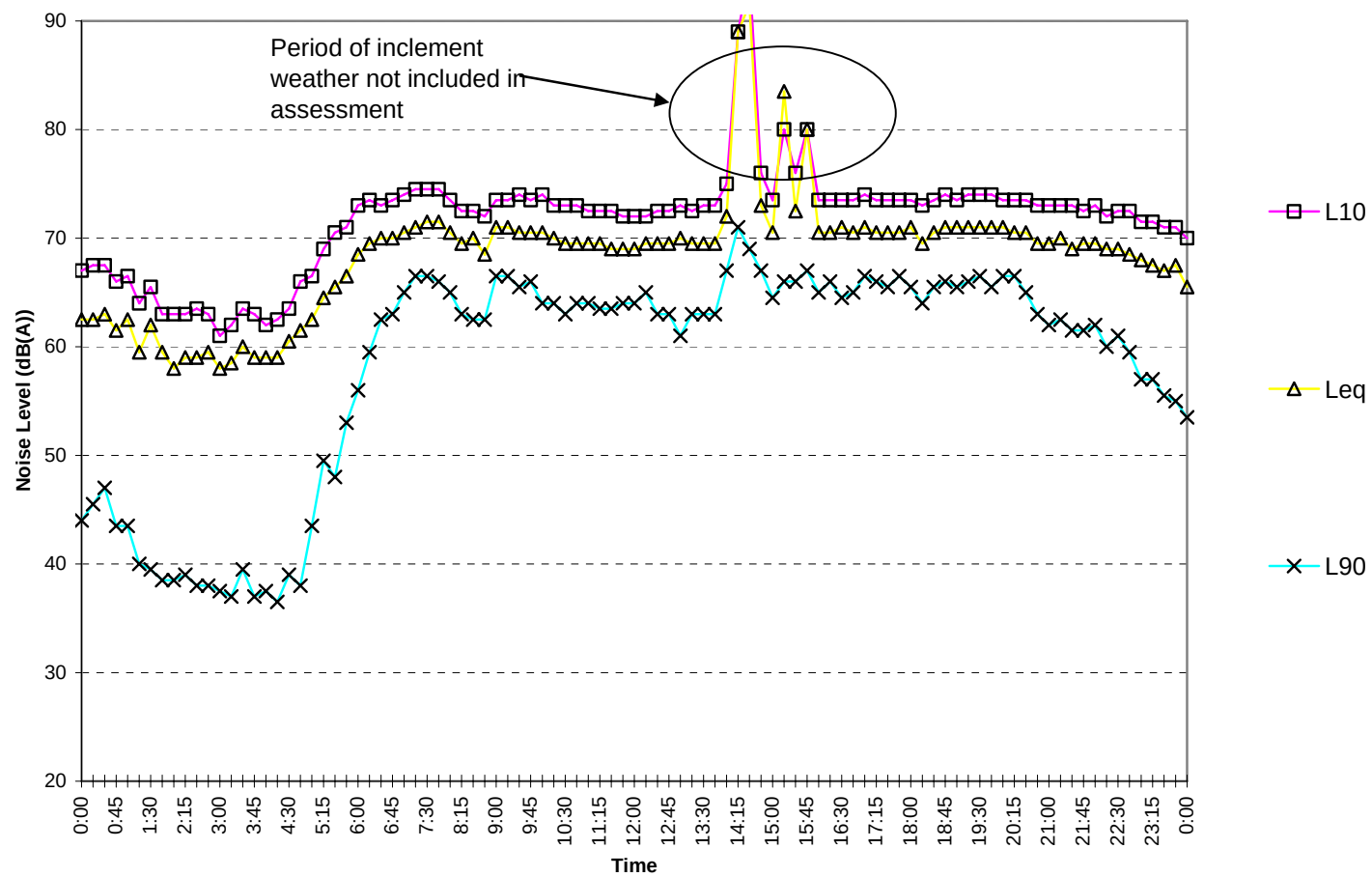
Royal Randwick Hotel

Monday March 18, 2012



Royal Randwick Hotel

Tuesday March 19, 2012



Royal Randwick Hotel

Wednesday March 20, 2012

