

SITE 9, CORNER OF OLYMPIC BOULEVARD AND SARAH DURACK AVE, SYDNEY OLYMPIC PARK

Acoustic Assessment for Development Application

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ECove Group

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Executive summary

Renzo Tonin & Associates were engaged to conduct an environmental noise assessment of the proposed mixed-use apartments at corner of Olympic Boulevard and Sarah Durack Avenue, Sydney Olympic Park to accompany an application for Development Application.

As a result of our assessment of the following potential acoustic issues were identified;

- Road traffic noise associated with Sarah Durack Avenue and Olympic Boulevard
- Airborne rail noise associated with the Olympic Park railway line located in a land cutting approximately 33m north of site
- Major sporting and entertainment events at Sydney Olympic Park
- Operational noise emission from mechanical plant rooms on dedicated floor levels of the building onto areas of the proposed development and existing adjacent buildings; and

This report presents an assessment of the above acoustic components in terms of Secretary's Environmental Assessment Requirements, Sydney Olympic Park Major Events Impact Assessment guideline, State Environmental Planning Policy (Infrastructure), Australian Standards and NSW Environment Protection Authority Industrial Noise Policy.

External Noise Intrusion into the Development

External noise and vibration intrusion into the development has been assessed in accordance with three guidelines and standards:

- State Environmental Planning Policy (Infrastructure) 2007;
- Development Near Rail Corridors and Busy Roads - Interim Guideline 2008; and
- Australian Standard AS2107:2000 'Recommended Design Sound Levels and Reverberation Times for Building Interiors'.
- Sydney Olympic Park Master Plan 2030

The objectives of the noise criteria set out on the above guidelines and standards are to certify the appropriate internal noise amenity for residential dwellings. The major noise intrusion sources were determined to be road traffic and airborne rail noise.

On the basis of the external noise impacting upon the development site, the specified internal noise criteria can be readily addressed through appropriate design and specification of the building envelope. Our assessment has established laminated glass will be required on worst affected external building facades.

Noise Emission Generated by the Development

Noise emission from mechanical plant such as building exhaust systems, mechanical ventilation and air-conditioning systems associated with the development has the potential to impact on nearby residential properties and is to be controlled at nearby residential properties to meet the noise criteria set out in EPA Industrial Noise Policy. As the specifications of individual mechanical plant are not available at this stage of the development, in-principle noise control advice is present in this report.

Construction Noise

The major construction activities proposed on this site are demolition and excavation works, concrete pours and general building works. Construction and building work is to be managed in accordance with the NSW Interim Construction Noise Guideline so as to minimise disruption to the local community and the environment. As the specifications of construction equipment and operating times are not available at this stage of the project, in-principle noise and vibration measures are provided in this report.

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1 Introduction

Renzo Tonin & Associates were engaged to assess noise impacts onto and the proposed mixed-use development at corner of Olympic Boulevard and Sarah Durack Avenue, Sydney Olympic Park.

This study examines the effects of external noise intrusion onto the proposed development from road traffic and airborne rail noise. A noise survey was carried out on site by Renzo Tonin & Associates from 18/12/15 to 31/12/15 to establish the existing levels of external noise affecting development. These noise levels were used to predict noise levels inside the future apartments and then assessed against the recommended internal noise criteria for the project.

The work documented in this report was carried out in accordance with the Renzo Tonin & Associates Quality Assurance System, which is based on Australian Standard / NZS ISO 9001. Appendix A contains a glossary of acoustic terms used in this report.

The following architectural drawings from Batesmart were reviewed.

Table 1: Drawings Reviewed

Drawing No.	Issue	Date	Title
DA01.001	A	01.03.2016	Site Plan
DA01.002	A	01.03.2016	Proximity to Rail Corridor - Site Plan + Building Envelope
DA01.003	A	01.03.2016	Proximity to Rail Corridor - Aerial Photograph
DA02.000	A	01.03.2016	General Arrangement Plan - Ground
DA02.002	A	01.03.2016	General Arrangement Plan - Level 02
DA02.003	A	01.03.2016	General Arrangement Plan - Level 03
DA02.004	A	01.03.2016	General Arrangement Plan - Level 04
DA02.005	A	01.03.2016	General Arrangement Plan - Level 05
DA02.006	A	01.03.2016	General Arrangement Plan - Level 06
DA02.007	A	01.03.2016	General Arrangement Plan - Level 07
DA02.008	A	01.03.2016	General Arrangement Plan - Level 08
DA02.009	A	01.03.2016	General Arrangement Plan - Level 09
DA02.010	A	01.03.2016	General Arrangement Plan - Level 10, 12, 14
DA02.011	A	01.03.2016	General Arrangement Plan - Level 11, 13
DA02.015	A	01.03.2016	General Arrangement Plan - Level 15, 17, 19
DA02.016	A	01.03.2016	General Arrangement Plan - Level 16, 18
DA02.020	A	01.03.2016	General Arrangement Plan - Level 20, 22, 24,26
DA02.021	A	01.03.2016	General Arrangement Plan - Level 21, 23, 25
DA02.027	A	01.03.2016	General Arrangement Plan - Level 27, 29, 31, 33, 35
DA02.028	A	01.03.2016	General Arrangement Plan - Level 28, 30, 32, 34

Drawing No.	Issue	Date	Title
DA02.036	A	01.03.2016	General Arrangement Plan - Level 36-37
DA02.038	A	01.03.2016	General Arrangement Plan - Level 38
DA02.039	A	01.03.2016	General Arrangement Plan - Roof
DA07.001	A	01.03.2016	Building Elevation - Southwest
DA07.002	A	01.03.2016	Building Elevation - Northeast
DA07.003	A	01.03.2016	Building Elevation - Northwest & Southeast
DA08.001	A	01.03.2016	Building Section -A-A
DA08.002	A	01.03.2016	Building Section -B-B, C-C

2 Internal Noise Criteria

A long-term noise survey was conducted on site from 18/12/15 to 31/12/15 to determine existing levels of ambient noise surrounding the site. These levels were used to predict noise levels within the residential spaces and assessed against the internal noise criteria recommended for this development. The results of the noise survey was used to calculate noise levels within the residential and commercial spaces and assessed against the relevant internal noise and vibration criteria describe below.

2.1 Road and Rail Noise Criteria

Table 2 below presents internal noise criteria recommended for this development which was based on the following documentations;

1. Secretary's Environmental Assessment Requirements
2. State Environment Planning Policy (Infrastructure 2007)
3. Department of Planning publication "Development Near Rail Corridors & Busy Roads – Interim Guideline" 2008
4. State Environment Planning Policy (Major Development) 2005
5. State Environment Planning Policy 65 - Design Quality of Residential Flat Development
6. Sydney Olympic Park Master 2030
7. Sydney Olympic Park Major Events Impact Assessment Guideline, and
8. NSW Environment Protection Authority Industrial Noise Policy
9. Australian Standard AS/NZS 2107:2000 "Acoustics – Recommended design sound pressure levels and reverberation times for building interior"

The noise criteria outlined in the documents listed were considered, Table 2 and below summaries the relevant acoustic criteria for this development.

Table 2: Recommended Internal Noise Criteria for Road Traffic and Rail Noise

Occupancy	Period	Maximum Noise Level
Residential		
Living areas (includes kitchen, dining and family rooms)	7am – 10pm	40 dB(A) LAeq, 15hr
Sleeping areas	10pm – 7am	35 dB(A) LAeq, 9hr
Apartment common areas ¹	7am – 10pm	50 dB(A) LAeq, 1hr
Commercial and Retail		
Retail tenancies ¹	7am – 10pm	50 dB(A) LAeq, 1hr
Commercial tenancies ¹	7am – 10pm	45 dB(A) LAeq, 1hr

Notes: 1. Design sound pressure levels for these spaces (not covered in the ISEPP) were based on Australian Standard AS2107

Relevant sections of the Australia Standard AS2107, Council DCP, and Government Policies are presented in APPENDIX A of this report. Results of the background and ambient noise monitoring conducted on site are presented in APPENDIX D.

3 Site and Surrounds

The subject site is located at corner of Sarah Durack Avenue and Olympic Boulevard, Sydney Olympic Park and is approximately 33m south of the Olympic Park rail corridor. The section of the rail corridor nearest to site is in a land cutting and consists of a single operational track carrying commuter trains only. The proposed development is a 38 storey residential tower with a 7 storey podium consisting of car parks and retail and commercial tenancies.

Long-term noise monitoring has been undertaken on the northern end of site as indicated in Figure 1 below to determine existing acoustic environment.

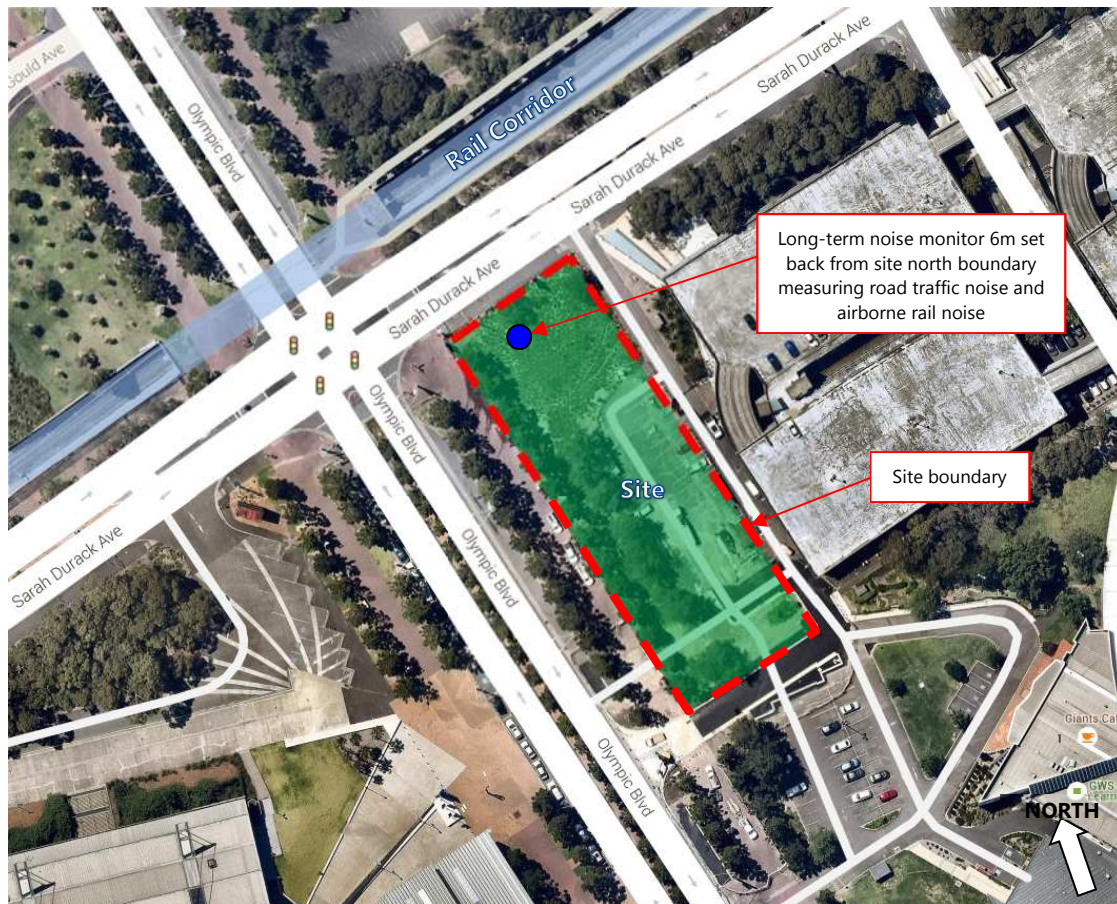


Figure 1: Site Boundary and Noise Monitoring Location

4 Measured Noise Levels

4.1 Long-term Noise Survey

The proposed development is potentially affected by road traffic noise from Sarah Durack Avenue and Olympic Boulevard and airborne rail noise from the Olympic Park rail corridor located in a land cutting approximately 33m north of the development. A noise monitor was installed on the northern end of site for a background and ambient noise survey from 18/12/15 to 31/12/15.

The noise logger records noise levels on a continuous basis and stores data every fifteen minutes. The noise logger was calibrated before and after measurements and no significant deviation in calibration was noted. The noise monitoring equipment used here complies with Australian Standard 1259.2-1990 "Acoustics - Sound Level Meters" and is designated as Type 2 instruments suitable for field use.

The results of the background and ambient noise monitoring conducted on site are presented in APPENDIX D.

4.2 Measured Road Traffic and Airborne Rail Noise Level

The design road traffic and rail noise levels are taken from the representative L_{Aeq} for the week for both the day time (7am to 10pm) and night time (10pm-7am) periods. The design external traffic noise levels are presented Table 3 below.

Table 3: Representative Day and Night Road Traffic and Rail Noise Levels

Monitoring Location	Survey Period	Measured Noise Level $L_{Aeq, T}$ ^{1,2}	Predicted Noise Level $L_{Aeq, T}$ ^{1,2} Worst Affected Residential Facade
Corner of Olympic Boulevard and Sarah Durack Avenue, Sydney Olympic Park	Day time (7am to 10pm) 18/12/15 to 31/12/15	62 dB(A)	58dB(A)
	Night time (10pm to 7am) 18/12/15 to 31/12/15	57 dB(A)	53 dB(A)

Notes:

- Noise levels presented are façade corrected.
- Representative road traffic noise level in measured L_{Aeq} over 15 hour and 9 hour day and night period respectively.

4.3 Existing Noise Environment at Development Site

The results of the long-term noise monitoring have been summarised in accordance with Industrial Noise Policy requirements published by NSW Environment Protection Authority (EPA) are presented in Table 4 below.

Table 4: Measured Site Background Noise Level

Noise Monitoring		Representative L_{A90} Background Noise Levels in dB(A)		
Location	Duration	Day ¹	Evening ²	Night ³
Corner of Olympic Boulevard and Sarah Durack Avenue, Sydney Olympic Park	Friday 18/12/15 to Thursday 31/12/15	48	47	43

Notes:

Day, Evening & Night assessment periods are defined in accordance NSW EPA's Industrial Noise Policy as follows.

1. Day is defined as 7:00am to 6:00pm, Monday to Saturday; 8:00am to 6:00pm Sundays & Public Holidays. As results were affected by construction noise weekend day and Saturday morning, Sunday results have been presented for the Day time period
2. Evening is defined as 6:00pm to 10:00pm, Monday to Sunday & Public Holidays
3. Night is defined as 10:00pm to 7:00am, Monday to Saturday; 10:00pm to 8:00am Sundays & Public Holidays

The representative background noise levels (L_{A90}) are used in defining external noise emission from the development such as mechanical ventilation and air-conditioning systems in accordance to Office of Environment and Heritage (formally Department of Environment, Climate Change and Water).

4.4 Calculated Internal Noise Levels

Results from the noise surveys were used to calculate internal noise levels within the proposed development. Noise calculations were conducted using the OutsideIn Glazing Spreadsheet developed in this office which take into account external noise levels, facade transmission loss and room sound absorption characteristics. Noise levels were calculated for each building facade to account for any variation in the external noise levels affecting different parts of the building.

Glazing constructions required to comply with the nominated noise criteria are presented in the body of this report.

5 Recommendations

5.1 Glazing Design Requirements

Table 5 below presents recommended glazing treatment for building facades to achieve compliance with the maximum noise levels nominated in Table 2 above.

Table 5: Recommended Glazing Treatment

Facade	Level	Occupancy Type	Recommended Minimum Sound Insulation Rating of Glazing Assembly	Typical Compliance Glazing Thickness and Type	Laboratory Test Reference
All	Ground	Retail	Rw 27	6mm standard float glass or IGU consisting of 6mm monolithic glass/12mm air gap/6mm monolithic glass	ESTIMATE
		Lobby	Rw 24	4mm standard float glass or IGU consisting of 6mm monolithic glass/12mm air gap/6mm monolithic glass	ESTIMATE
		Bicycle storage	Rw 24	4mm standard float glass	ESTIMATE
-	Levels 2 to 6	Car park levels	-	-	-
All	Levels 7 and 8	Bedrooms	Rw 32	6.38mm standard float glass or IGU consisting of 6mm monolithic glass/12mm air gap/6mm monolithic glass	ESTIMATE
		Open plan living/dining/kitchen	Rw 27	6mm standard float glass or IGU consisting of 6mm monolithic glass/12mm air gap/6mm monolithic glass	ESTIMATE
		Apartment common areas	Rw 24	4mm standard float glass or IGU consisting of 6mm monolithic glass/12mm air gap/6mm monolithic glass	ESTIMATE
		Commercial	Rw 27	6mm standard float glass or IGU consisting of 6mm monolithic glass/12mm air gap/6mm monolithic glass	ESTIMATE
All	Levels 9 to 38	Bedrooms	Rw 32	6.38mm standard float glass or IGU consisting of 6mm monolithic glass/12mm air gap/6mm monolithic glass	ESTIMATE

Facade	Level	Occupancy Type	Recommended Minimum Sound Insulation Rating of Glazing Assembly	Typical Compliance Glazing Thickness and Type	Laboratory Test Reference
		Open plan living/dining/kitchen	Rw 27	6mm standard float glass or IGU consisting of 6mm monolithic glass/12mm air gap/6mm monolithic	ESTIMATE
		Apartment common areas	Rw 24	4mm standard float glass or IGU consisting of 6mm monolithic glass/12mm air gap/6mm monolithic	ESTIMATE

By way of explanation, the Sound Insulation Rating Rw is a measure of the noise reduction property of the partition, a higher rating implying a higher sound reduction performance.

Note that the Rw rating of systems measured as built on site (R'w Field Test) may be up to 5 points lower than the laboratory result.

LEGEND where no appropriate test certificate exists:

1. ESTIMATE: The client is advised not to commence detailing or otherwise commit to partition construction systems which have not been tested in an approved laboratory or for which an opinion only is available. Testing of partition construction systems is a component of the quality control of the design process and should be viewed as a priority because there is no guarantee the forecast results will be achieved thereby necessitating the use of an alternative which may affect the cost and timing of the project. No responsibility is taken for use of or reliance upon untested partition construction systems, estimates or opinions. The advice provided here is in respect of acoustics only.
2. ESTIMATE – APPROVED FOR CONSTRUCTION: Use of the form of construction is approved prior to laboratory certification. To complete the quality control of the design process and confirm the acoustical performance of the construction, we recommend testing in a laboratory to confirm the Rw rating as soon as practicable. In the case of impact rating for floor systems, no particular impact rating is guaranteed to comply with either the Building Code of Australia or Strata Scheme Management Act and hence carpet runners may still be required.
3. ESTIMATE – TEST NOT REQUIRED: Use of the form of construction is approved without laboratory certification. The STC/Rw of the form of construction exceeds the project requirements.
4. The advice provided here is in respect of acoustics only. Supplementary professional advice may need to be sought in respect of fire ratings, structural design, buildability, fitness for purpose and the like.

NOTES FOR GLAZING CONSTRUCTIONS:

5. The information in this table is provided for the purpose of Council approvals process and cost planning and shall not be used for construction unless otherwise approved in writing by the acoustic consultant.
6. The design in this table is preliminary and a comprehensive assessment shall be conducted prior to Construction Certification.
7. Before committing to any form of construction or committing to any builder, advice should be sought from an acoustic consultant to ensure that adequate provisions are made for any variations which may occur as a result of changes to the form of construction where only an "estimate" is available for the sound insulation properties of recommended materials.
8. The glazing supplier shall ensure that installation techniques will not diminish the Rw performance of the glazing when installed on site.
9. All openable glass windows and doors shall incorporate full perimeter acoustic seals equivalent to Q-Lon, which enable the Rw rating performance of the glazing to not be reduced.
10. The above glazing thicknesses should be considered the minimum thicknesses to achieve acoustical ratings. Greater glazing thicknesses may be required for structural loading, wind loading etc.

GENERAL

11. The sealing of all gaps in partitions is critical in a sound rated construction. Use only sealer approved by the acoustic consultant.
12. Check design of all junction details with acoustic consultant prior to construction.
13. Check the necessity for HOLD POINTS with the acoustic consultant to ensure that all building details have been correctly interpreted and constructed.
14. The information provided in this table is subject to modification and review without notice.
15. The advice provided here is in respect of acoustics only. Supplementary professional advice may need to be sought in respect of fire ratings, structural design, buildability, fitness for purpose and the like.

5.2 Facade & Roof Sound Insulation

In principle advice is provided below for the acoustic requirements of the roof and external walls for this proposed development.

5.2.1 External Walls

All external walls shall have sound isolation ratings, R_w , of at least 15dB higher acoustic performance than that of the acoustic glazing specified in Table 5 above.

5.2.2 Roof and Ceiling

Roof/ceiling construction shall have a sound isolation rating, R_w , at least 10dB higher than that of the acoustic glazing on its facade walls.

5.2.3 Quality Assurance

The following acoustic measures should also be incorporated into the building design:

- s1. All operable glass windows and doors shall incorporate full perimeter acoustic seals equivalent to Q-Lon, which enable the R_w rating performance of the glazing to not be reduced.
- s2. The glazing thicknesses outlined in Table 5 should be considered the minimum thicknesses to achieve acoustical ratings. Greater glazing thicknesses may be required for structural loading, wind loading etc.
- s3. The glazing supplier shall ensure that installation techniques will not diminish the R_w performance of the glazing when installed on site. Sliding door meeting stiles should form an airtight seal when closed and locked.
- s4. The perimeter of all window and door frames are to be sealed airtight in the external facade using the following methods:
 - For gaps less than 10mm - Fill all gaps around the window perimeter with an acoustic mastic sealer (minimum specific gravity 1.6sg) equivalent to Promat Promaseal. The depth of sealer shall be at least equal to the width of the gap.
 - If the gap is greater than 10mm, fill the cavity with polyester insulation and a backing rod. Seal the gap airtight an acoustic mastic sealer (min specific gravity 1.6sg) equivalent to Promat Promaseal. The depth of sealer shall be at least equal to the width of the gap. The gaps between frames shall also be sealed using aluminium angle brackets (approximately 25 x 25 x 3mm).

6 Internal Sound Insulation between Tenancies

Internal walls and floors shall comply with the National Construction Code of Australia 2015 (formally Building Code of Australia). All services and doors shall comply with the requirements of the NCC 2015. APPENDIX B presents a summary of acoustic provisions outlined in Part F5 of the NCC 2015.

7 External Noise Emission from Building Services

7.1 NSW Environment Protection Authority Requirements

Noise from building services will be controlled to comply with the Industrial Noise Policy (INP) outlined in NSW Environment Protection Authority (EPA). The applicable noise limits, according to the policy, are determined in the table below.

Table 6: Design Criterion for Noise Production (EPA INP)

Time of Day	Rating Background Level (RBL) L_{A90}	Intrusiveness Criterion (RBL + 5)	Amenity Criterion (Acceptable)	Project Specific Design Criterion L_{Aeq}
Day (7am to 6pm)	48	53	55	53
Evening (6pm to 10pm)	47	52	45	45
Night (10pm to 7am)	43	48	40	40

Explanatory notes:

1. Recommended L_{Aeq} noise level based on 'Residence – Suburban' area in Section 2.2, Table 2.1 Amenity Criteria (Recommended L_{Aeq} noise levels from industrial noise sources) of the EPA's INP.
2. Project Specific Design Criterion based on EPA's INP and is the lower of the Intrusiveness or Amenity Criterion

Where necessary, noise amelioration treatment will be incorporated in the design to ensure that noise levels comply with the EPA Industrial Noise Policy. Noise from air-conditioning and building services will be examined in the detail at the design stage.

7.2 Recommended Noise Control Measures for Mechanical Plant

Mechanical plant such as exhaust systems, air-conditioning, mechanical ventilation and refrigeration associated with the development has the potential to impact on nearby residential and commercial properties. As details of mechanical plant are not available at this stage of the development the following in principle noise control advice are provided.

- Acoustic assessment of mechanical services equipment will be require to be undertaken during the detail design phase of the development to ensure that they shall not either singularly or in total emit noise levels which exceed the noise limits in established in Table 5.
- Mechanical plant noise emission can be controllable by appropriate mechanical system design and implementation of common engineering methods that may include any of the following;
 - procurement of 'quiet' plant
 - strategic positioning of roof and balcony plant equipment away from sensitive neighbouring premises, maximising the intervening shielding between the plant and sensitive neighbouring premises

- installation of commercially available silencers or acoustic attenuators for air discharge and air intakes of plant
- acoustically lined and lagged ductwork
- provide acoustic screens and/or acoustic louvres between plant and sensitive neighbouring premises
- provide partially enclosed or fully enclosed acoustic enclosure over plant
- Mechanical plant shall have their noise specifications and proposed locations checked prior to installation
- Fans shall be mounted on vibration isolators and balanced in accordance with Australian Standard 2625 "Rotating and Reciprocating Machinery - Mechanical Vibration"

8 Major Events Noise Intrusion into Development

The proposed development is potentially affected by noise associated with major sports and entertainment events held within the Sydney Olympic Park events precinct. The Sydney Olympic Park Master Plan 2030 has set internal noise criteria for noise associated with major events intruding into commercial and residential developments within the Sydney Olympic Park events precinct. The criteria for residential spaces are outline in Table 7 below.

Table 7: Sydney Olympic Park Master Plan 2030 Maximum Internal Noise Criteria for Major Events Noise Intrusion

Internal Space	Noise Criterion	Period	Noise Measure
Living rooms	45dB(A)	Day & Evening	L _{Aeq, 15min}
Working areas			
Sleeping rooms	40dB(A)	Night Time	

Renzo Tonin & Associates have previously conducted surveys of noise emission from Major Events at Sydney Olympic Park. Based on results of these surveys, it is estimated noise from Major Events at the facade of subject development to typically be in order of 60 to 70 dB(A). With the installation of acoustic glazing recommended in Table 5 of this report, noise from Major Events activities are expected to comply with noise criteria set in SOP Master Plan 2030 summarised in Table 7 above.

Sydney Olympic Park Master Plan has also mapped out the degree of noise mitigation measures required for different building heights at different locations within the Sydney Olympic Park Events precinct. Our review of Figure 4.8 (Page 95 of the Master Plan) has shown the subject development falls under the "Some Noise Mitigation Required" zone. Section 4.6.15 of the Master plan requires developments in this zone to provide air-conditioning or mechanical ventilation, door and windows which can be opened and closed at various times. It is our understanding the subject development will incorporated these measures.

9 Construction Noise

The nature of the construction processes proposed for the development does not present difficulties in ensuring that the associated noise limits at surrounding properties are achieved. The major construction activities proposed on this site are excavation works, concrete pours and general building works.

Construction and building work will be adequately managed so as to minimise disruption to the local community and the environment.

Noise generated by construction activities will comply with the Department of Environment Climate Change & Water's Interim Construction Noise Guide (ICNG). APPENDIX C presents a summary ICNG's standard construction times and conditions.

10 Conclusion

Renzo Tonin & Associates have completed an acoustic assessment of road traffic noise, airborne rail noise impacts onto the proposed mixed-use development on Site 9 at corner of Sarah Durack Ave and Olympic Boulevard, Sydney Olympic Park in accordance with the Secretary's Environmental Assessment Requirements.

Our assessment of airborne road and rail noise intrusion into the subject development has found that appropriate noise control measures can be incorporated into the building design such as acoustic glazing to achieve compliance with the acoustic requirements stipulated in State Environment Planning Policy ISEPP 2007 and Australian Standard AS/NZS 2107.

In principle acoustic advice and noise management measures have been provided to appropriately address noise emission during the construction and operational phases of the development.

APPENDIX A Assessment and Design Methodology

A.1 State Environmental Planning Policy (Infrastructure) 2007

The NSW State Environmental Planning Policy (Infrastructure) 2007 (known as 'ISEPP') came into force in NSW on 1 January 2008 to facilitate the effective delivery of infrastructure across the State. The aim of the policy includes identifying the environmental assessment category into which different types of infrastructure and services development fall and identifying matters to be considered in the assessment of development adjacent to particular types of infrastructure.

Pertinent to noise assessment, the ISEPP includes the following clauses:

87 Impact of rail noise or vibration on non-rail development

- 1. This clause applies to development for any of the following purposes that is on land in or adjacent to a rail corridor and that the consent authority considers is likely to be adversely affected by rail noise or vibration:*
 - a. a building for residential use,*
 - b. a place of public worship,*
 - c. a hospital,*
 - d. an educational establishment or child care centre.*
- 2. Before determining a development application for development to which this clause applies, the consent authority must take into consideration any guidelines that are issued by the Director-General for the purposes of this clause and published in the Gazette.*
- 3. 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.*

102 Impact of road noise or vibration on non-road development

- 1. 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 transitway 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:*
 - c. a building for residential use,*
 - d. a place of public worship,*

- e. *a hospital,*
 - f. *an educational establishment or child care centre.*
2. *Before determining a development application for development to which this clause applies, the consent authority must take into consideration any guidelines that are issued by the Director-General for the purposes of this clause and published in the Gazette.*
 3. *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.*
 4. *In this clause, "freeway", "tollway" and "transitway" have the same meanings as they have in the Roads Act 1993*

A.1.1 Department of Planning publication 'Development near rail corridors and busy roads – Interim guideline'

To support the Infrastructure SEPP, the NSW Department of Planning released the *Development in Rail Corridors and Busy Roads – Interim Guideline* (December 2008). The Guideline assists in the planning, design and assessment of developments in, or adjacent to, major transport corridors in terms of noise, vibration and air quality. While the ISEPP applies only to roads with an AADT greater than 40,000 vehicles, the guideline is also recommended for other road traffic noise affected sites.

A.1.2 Clarification of ISEPP noise limits

The Guideline clarifies the time period of measurement and assessment. Section 3.4 '*What Noise and Vibration Concepts are Relevant*' and Table 3.1 of Section 3.6.1 confirms that noise assessment is based over the following time periods:

- Daytime 7:00am - 10:00pm $L_{Aeq(15hr)}$
- Night-time 10:00pm - 7:00am $L_{Aeq(9hr)}$

The noise criteria nominated in the ISEPP apply to internal noise levels with windows and doors closed. However as the preliminary noise assessment is based on measurements/predictions at external locations, equivalent external noise criteria has been established. The equivalent external noise criterion is used to determine which areas of the development may require acoustic treatment in order to meet the internal noise requirements of the ISEPP. The equivalent external goals have been determined on the following basis:

- The ISEPP states: "*If internal noise levels with windows or doors open exceed the criteria by more than 10dBA, the design of the ventilation for these rooms should be such that occupants*

can leave windows closed, if they so desire, and also to meet the ventilation requirements of the Building Code of Australia." The internal criteria with windows open is therefore 10dB(A) above the criteria explicitly outlined in the ISEPP.

- The generally accepted noise reduction through an open window from a free-field external position is 10dB(A). Windows/doors are assumed to be open no more than 5% of room floor area, in accordance with the Building Code of Australia (BCA) ventilation requirements.

Table 8 presents the ISEPP internal noise criteria along with the equivalent external noise criteria for residential premises.

Table 8: ISEPP noise criteria for new residential development

Room	Location	L _{Aeq, 15hr} Day	L _{Aeq 9hr} Night
		7am – 10pm	10pm – 7am
Living rooms*	Internal, windows closed	40	40
	Internal, windows open	50	50
	External free-field (allowing windows to remain open)^	60	60
Bedrooms*	Internal, windows closed	40	35
	Internal, windows open	50	45
	External free-field (allowing windows to remain open)^	60	55

Notes: * Requisite for 40,000AADT Roads only under ISEPP 2007.

^ ISEPP Guideline states that where internal noise criteria are exceeded by more than 10dB(A) with windows open mechanical ventilation is required. External goals have been calculated on the basis of nominal 10dB(A) reduction through an open window to a free-field position. Windows open to 5% of floor area in accordance with the BCA 2011 requirements.

A.2 Australian/New Zealand Standard AS/NZS 2107:2000

As traffic noise levels are not constant, an L_{eq} noise level descriptor is used when assessing this type of noise source. The L_{eq} is the mean energy level of the noise being measured, and has been found to accurately describe the level of annoyance caused by traffic noise.

This standard provides recommended noise levels for steady state such as noise from building services and quasi-steady state sounds, such as traffic and industrial noise. The noise levels recommended in AS/NZS 2107:2000 take into account the function of the area and apply to the sound level measured within the space unoccupied although ready for occupancy.

This standard recommends the following noise levels for residential buildings.

Table 9: Recommended design sound levels for different areas of occupancy in buildings

Type of occupancy/ activity	Recommended design sound level, L _{Aeq} , dB(A)		Recommended reverberation time (T),s
	Satisfactory	Maximum	
7 RESIDENTIAL BUILDINGS (see Note 7 and Clause 5.2)			
Houses in areas with negligible transportation -			
Sleeping areas	25	30	-

Type of occupancy/ activity	Recommended design sound level, L_{Aeq} dB(A)		Recommended reverberation time (T),s
	Satisfactory	Maximum	
Houses and apartments near minor roads -			
Living areas	30	40	-
Sleeping areas	30	35	-
Work areas	35	40	-
Apartment common areas (e.g. foyer, lift lobby)	45	55	See Note 3
Houses and apartments near major roads -			
Living areas	35	45	-
Sleeping areas	30	40	-
Work areas	35	45	-
Apartment common areas (e.g. foyer, lift lobby)	45	55	See Note 3

NOTES:

1. The recommended design sound levels are for a fully fitted out and completed building. Attention is drawn to the additive noise effect of many machines within the same area and adjacent areas. Allowance for the total number and type of noise sources should therefore be made in the selection of equipment and in the design of building spaces. A building owner or developer may consider an allowance of 3-5 dB(A) to be appropriate.
2. Recommended reverberation time is 10 percent to 20 percent higher than Curve 1 of Appendix A.
3. Reverberation time should be minimized as far as practicable for noise control.
4. Certain teaching spaces, including those intended for students with learning difficulties and students with English as a second language, should have reverberation times at the lower end of the specified range.
5. Specialist advice should be sought for these spaces.
6. A very wide range of noise levels can occur in the occupied state in spaces housing manufacturing processes, and the levels are primarily subject to control as part of a noise management program (see AS/NZS 1269.2). The possibilities for segregating very noisy processes from quieter ones by partitioning vary between particular industries and plants. For reasons such as these, it is difficult to make generalized recommendations for desirable, or even maximum, design levels for the unoccupied state, but one guiding principle may still be observed - when the activity in one area of a manufacturing plant is halted, it is desirable that the local level should if possible drop to 70 dB(A) or lower to permit speech communication without undue effort.
7. In situations where traffic noise levels may vary widely over a 24-hour period, measurements to assess compliance with this Standard should be taken at the relevant time and for an appropriate measurement period according to the area of occupancy or activity in the building. Where traffic noise fluctuates rapidly with the passage of individual vehicles, the community reaction may not correlate well with the equivalent continuous noise level as measured.
8. The overall sound pressure level in dB(A) should conform to the recommended design sound level given in Table 1. In these spaces, a balanced sound pressure level across the full frequency range is essential. These spaces should therefore be evaluated in octave bands across the full frequency spectrum. The recommended maximum sound pressure levels for the individual octave bands corresponding to the overall dB(A) value are given in Appendix C.
9. In spaces in which high quality sound recordings are to be made, the levels set for low frequency octave bands should not be exceeded (see Appendix C). Subsequent replay of the recordings may cause an amplification of the ambient sound resulting in an overemphasis of its low-frequency components. Specialist advice should always be sought when these spaces are being designed. In some circumstances, for purposes of very high quality recording, lower levels than those specified in Table 1 may be required.

APPENDIX B Internal Sound Insulation

B.1 National Construction Code of Australia 2015

The National Construction Code of Australia (NCC) outlines minimum requirements for inter-tenancy (party) walls and ceiling/ floors to maintain privacy. This includes the incorporation of penetration of a service through a floor or through more than one sole-occupancy unit.

NCC 2015 nominates required Weighted Sound Reduction Indexes (R_w) and spectrum adaptation factor (C_{tr}) for partition constructions, of different space/ activity types in adjoining units. The R_w and $R_w + C_{tr}$ are single number descriptors for quantifying the attenuating performance of partitions for typical intrusive noises produced inside residences. The higher the rating, the greater the isolation provided by the partition.

Spectrum adaptation factors are commonly used to compensate for the fact that certain kinds of sounds are more readily transmitted through insulating materials than others insulate.

The adaptation factor C_{tr} has now been introduced for most building elements which require an airborne sound insulation rating. The only exception is a wall which separates a dwelling from a plant room, lift shaft, stairway, public corridor, public lobby or the like, or parts of a different classification. Therefore, both the C_{tr} factor and the R_w of the building element will need to be considered in most cases.

The C_{tr} factor takes into account lower frequency level sounds, and has been chosen in large part, in recognition of the problem of the high bass frequency outputs of modern home theatre systems and music reproduction equipment.

The Deemed-to-Satisfy Provisions also have impact sound insulation requirements for floors. The terms to describe the impact sound insulation of the floor is the weighted normalised impact sound pressure level ($L_{n,w}$) plus the spectrum adaptation term (C_i). The lower the $L_{n,w} + C_i$ of the floor, the better the performance of the floor in terms of impact sound insulation.

The following section represents a summary of acoustic provisions outlined in the Part F5 of the NCC 2015.

B.2 Sound Insulation Provision of NCC of Australia 2015

The acoustic provisions for inter-tenancy walls in Class 2 buildings are outlined in the National Construction Code of Australia and the following is an extract from the NCC:

F5.2 Determination of airborne sound insulation ratings

A form of construction required to have an airborne sound insulation rating must –

- c. *have the required value for weighted sound reduction index (R_w) or weighted sound reduction index with spectrum adaptation term ($R_w + C_{tr}$) determined in accordance with AS/NZS 1276.1 or ISO 717.1 using results from laboratory measurements; or*
- d. *comply with Specification F5.2.*

F5.3 Determination of impact sound insulation ratings

- e. *A floor in a building required to have an impact sound insulation rating must –*
 - i. *have the required value for weighted normalised impact sound pressure level with spectrum adaptation term ($L_{n,w} + C_i$) determined in accordance with AS/ISO 717.2 using results from laboratory measurements; or*
 - ii. *comply with Specification F5.2.*
- f. *A wall in a building required to have an impact sound insulation rating must –*
 - iii. *for a Class 2 or 3 building be of discontinuous construction;*
- g. *For the purposes of this part, discontinuous construction means a wall having a minimum 20 mm cavity between 2 separate leaves, and*
 - iv. *for masonry, where wall ties are required to connect leaves, the ties are of the resilient type; and*
 - v. *for other than masonry, there is no mechanical linkage between leaves except at the periphery.*

F5.4 Sound insulation rating of floors

- h. *A floor in a Class 2 or 3 building must have an $R_w + C_{tr}$ (airborne) not less than 50 and an $L_{n,w} + C_i$ (impact) not more than 62 if it separates –*
 - vi. *sole-occupancy units; or*
 - vii. *a sole-occupancy unit from a plant room, lift shaft, stairway, public corridor, public lobby or the like, or parts of a different classification.*

F5.5 Sound insulation rating of floors

- i. *A wall in a Class 2 or 3 building must –*
 - viii. *have an $R_w + C_{tr}$ (airborne) not less than 50, if it separates sole-occupancy units; and*
 - ix. *have an R_w (airborne) not less than 50, if it separates a sole-occupancy unit from a plant room, lift shaft, stairway, public corridor, public lobby or the like, or parts of a different classification; and*
 - x. *comply with F5.3(b) if it separates:*

a bathroom, sanitary compartment, laundry or kitchen in one sole-occupancy unit from a habitable room (other than a kitchen) in an adjoining unit; or

- xi. *a sole-occupancy unit from a plant room or lift shaft.*
- j. *A door may be incorporated in a wall in a Class 2 or 3 building that separates a sole-occupancy unit from a stairway, public corridor, public lobby or the like, provided the door assembly has an R_w not less than 30.*
- k. *Where a wall required to have sound insulation has a floor above, the wall must continue to –*
 - xii. *the underside of the floor above; or*
 - xiii. *a ceiling that provides the sound insulation required for the wall.*

F5.6 Sound insulation rating of services

- l. *If a duct, soil, waste or water supply pipe, including a duct or pipe that is located in a wall or floor cavity, serves or passes through more than one sole-occupancy unit, the duct or pipe must be separated from the rooms of any sole-occupancy unit by construction with an $R_w + C_{tr}$ (airborne) not less than –*
 - xiv. *40 if the adjacent room is a habitable room (other than a kitchen); or*
 - xv. *25 if the adjacent room is a kitchen or non-habitable room.*
- m. *If a storm water pipe passes through a sole-occupancy unit it must be separated in accordance with (a).*

APPENDIX C Construction Noise

The NSW *Interim Construction Noise Guideline* (ICNG, 2009) provides guidelines for assessing noise generated during the construction phase of developments.

The key components of the guideline that are incorporated into this assessment include:

- Use of L_{Aeq} as the descriptor for measuring and assessing construction noise.

NSW noise policies, including the INP, RNP and RING have moved to the primary use of L_{Aeq} over any other descriptor. As an energy average, L_{Aeq} provides ease of use when measuring or calculating noise levels since a full statistical analysis is not required as when using, for example, the L_{A10} descriptor.

- Application of reasonable and feasible noise mitigation measures
- As stated in the ICNG, a noise mitigation measure is feasible if it is capable of being put into practice, and is practical to build given the project constraints.
- Selecting reasonable mitigation measures from those that are feasible involves making a judgement to determine whether the overall noise benefit outweighs the overall social, economic and environmental effects.

The ICNG provides two methods for assessment of construction noise, being either a quantitative or a qualitative assessment. A quantitative assessment is recommended for major construction projects of significant duration, and involves the measurement and prediction of noise levels, and assessment against set criteria. A qualitative assessment is recommended for small projects with a duration of less than three weeks and focuses on minimising noise disturbance through the implementation of reasonable and feasible work practices, and community notification.

Table 10 below (reproduced from Table 2 of the ICNG) sets out the noise management levels and how they are to be applied for residential receivers. The guideline intends to provide respite for residents exposed to excessive construction noise outside the recommended standard hours whilst allowing construction during the recommended standard hours without undue constraints.

The rating background level (RBL) is used when determining the management level. The RBL is the overall single-figure background noise level measured in each relevant assessment period (during or outside the recommended standard hours).

Table 10: Noise management levels at residential receivers

Time of day	Management level L _{Aeq} (15 min)	How to apply
Recommended standard hours: Monday to Friday 7 am to 6 pm Saturday 8 am to 1 pm No work on Sundays or public holidays	Noise affected RBL + 10dB(A)	The noise affected level represents the point above which there may be some community reaction to noise. Where the predicted or measured LAeq (15 min) is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level. The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.
	Highly noise affected 75dB(A)	The highly noise affected level represents the point above which there may be strong community reaction to noise. Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities can occur, taking into account: times identified by the community when they are less sensitive to noise (such as before and after school for works near schools, or mid-morning or mid-afternoon for works near residences if the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.
Outside recommended standard hours	Noise affected RBL + 5dB(A)	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 5dB(A) above the noise affected level, the proponent should negotiate with the community. For guidance on negotiating agreements see section 7.2.2 of the ICNG.

Sensitive Land Use

Table 11 below (reproduced from Table 3 of the ICNG) sets out the noise management levels for various sensitive land use developments.

Table 11: Noise management levels at other noise sensitive land uses

Land use	Where objective applies	Management level L _{Aeq} (15 min)
Classrooms at schools and other educational institutions	Internal noise level	45 dB(A)
Hospital wards and operating theatres	Internal noise level	45 dB(A)
Places of worship	Internal noise level	45 dB(A)
Active recreation areas	External noise level	65 dB(A)
Passive recreation areas	External noise level	60 dB(A)
Community centres	Depends on the intended use of the centre.	Refer to the 'maximum' internal levels in AS2107 for specific uses.
Commercial premises	External noise level	70 dB(A)
Industrial premises	External noise level	75 dB(A)

Notes: Noise management levels apply when receiver areas are in use only.

APPENDIX D Monitoring Location & Results of Noise Survey

D.1.1 Background and Ambient Noise Survey

Unattended noise monitoring location: Corner of Sarah Durack Avenue & Olympic Boulevard, Sydney Olympic Park. The noise logger is located 6m set back northern site boundary (Sarah Durack Ave) and 9m from western site boundary (Olympic Boulevard).

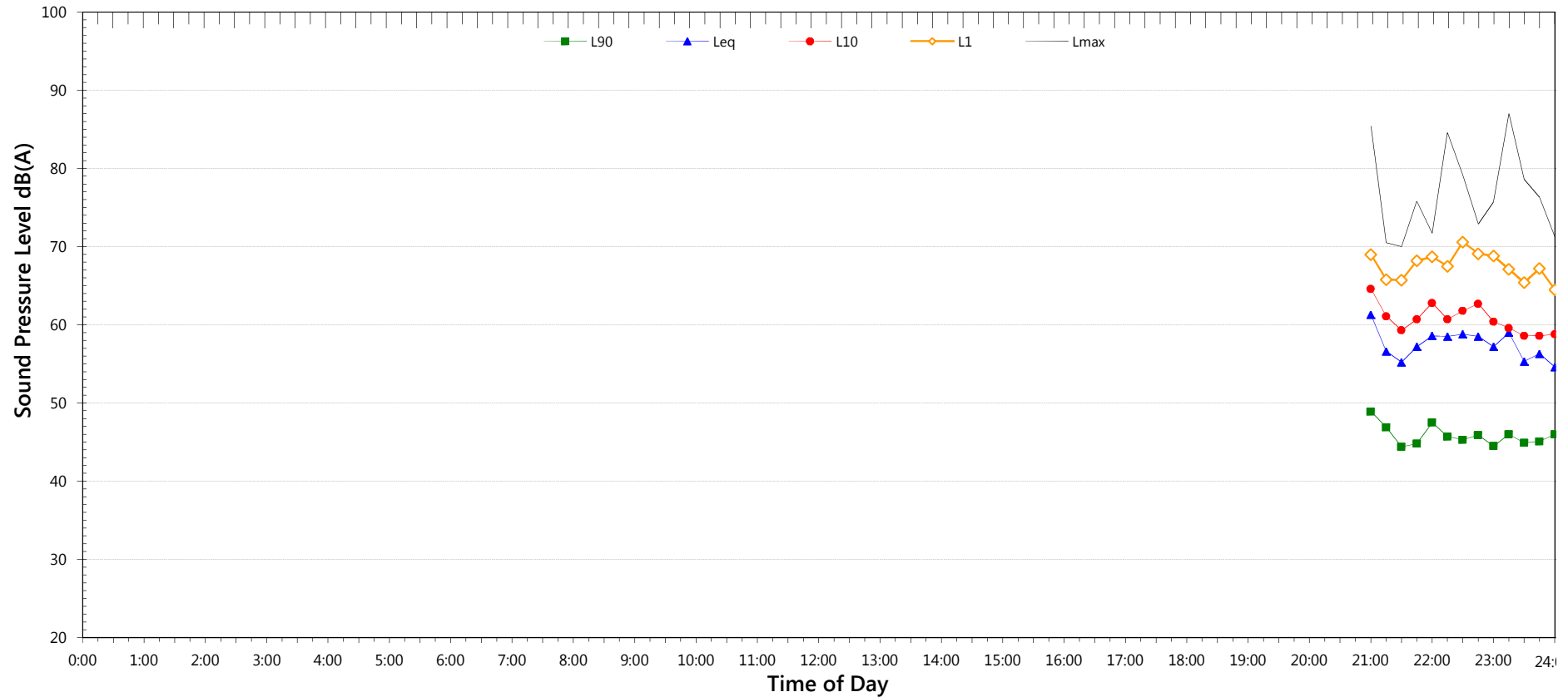
Survey Period: Friday 18/12/2015 to Thursday 31/12/2015



Unattended Noise Monitoring Results

Cnr Olympic Blvd & Sarah Durack Ave, Sydney Olympic Park

Friday, 18 December 2015



NSW Industrial Noise Policy (Free Field)			
Descriptor	Day ²	Evening ³	Night ^{4 5}
L ₉₀	-	-	42.5
LA _{eq}	-	-	55.3

Night Time Maximum Noise Levels (see note 7)			
L _{Max} (Range)	71.5	to	87.0
L _{Max} - L _{eq} (Range)	16.8	to	30.4

Notes:

- 1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
- 3. "Evening" is the period from 6pm till 10pm
- 6. Graphed data measured in free-field; tabulated results facade corrected

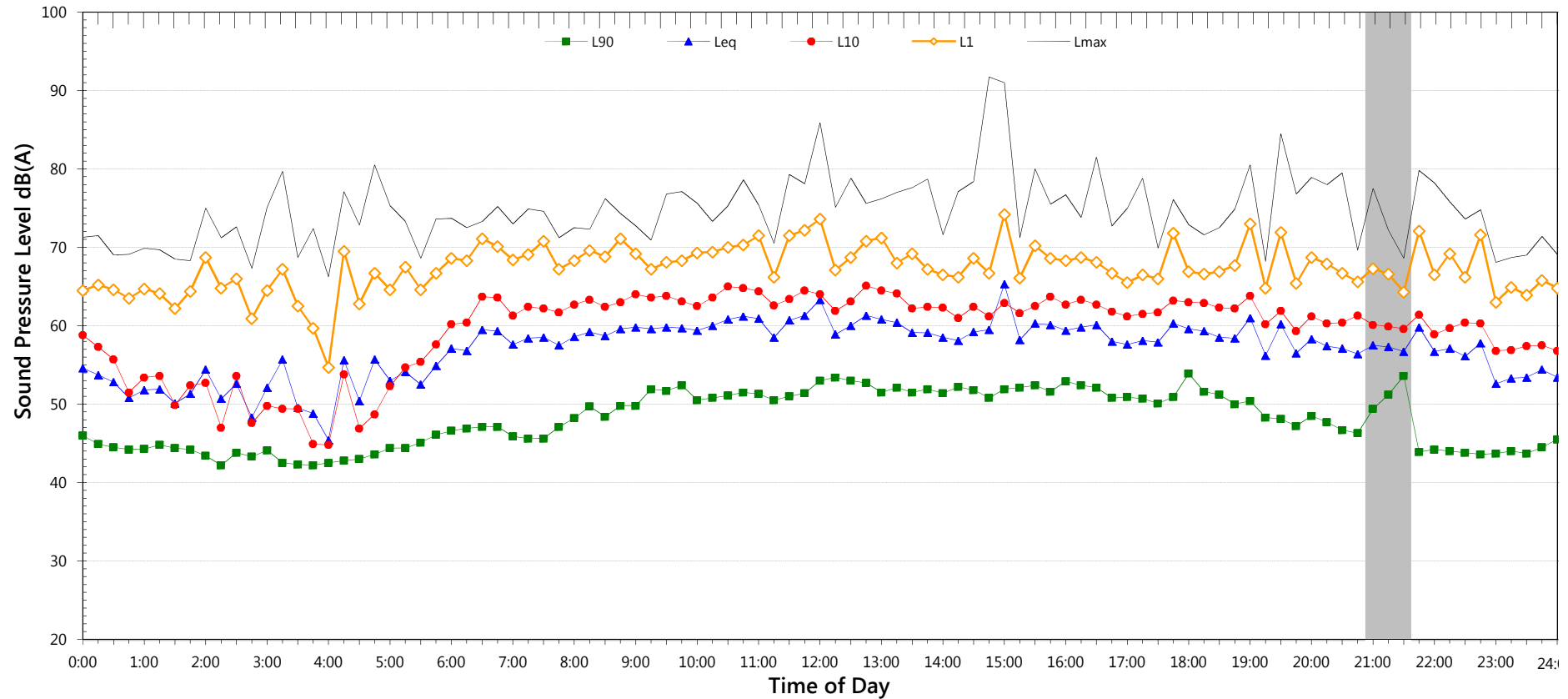
NSW Road Noise Policy (1m from facade) (see note 6)		
Descriptor	Day	Night ⁵
	7am-10pm	10pm-7am
L _{eq} 15 hr and L _{eq} 9 hr	60.8	57.8
L _{eq} 1hr upper 10 percentile	63.8	60.9
L _{eq} 1hr lower 10 percentile	59.6	53.7

- 4. "Night" relates to the remaining periods
- 5. "Night" relates to period from 10pm on this graph to morning on the following graph.
- 7. Night time L_{Max} values are shown only where L_{Max} > 65dB(A) and where L_{Max} - L_{eq} ≥ 15dB(A)

Unattended Noise Monitoring Results

Cnr Olympic Blvd & Sarah Durack Ave, Sydney Olympic Park

Saturday, 19 December 2015



NSW Industrial Noise Policy (Free Field)			
Descriptor	Day ²	Evening ³	Night ^{4,5}
L ₉₀	48.4	-	41.2
LA _{eq}	59.9	-	53.1

Night Time Maximum Noise Levels			(see note 7)
L _{Max} (Range)	68.5	to	76.5
L _{Max} - L _{eq} (Range)	17.8	to	25.3

Notes:

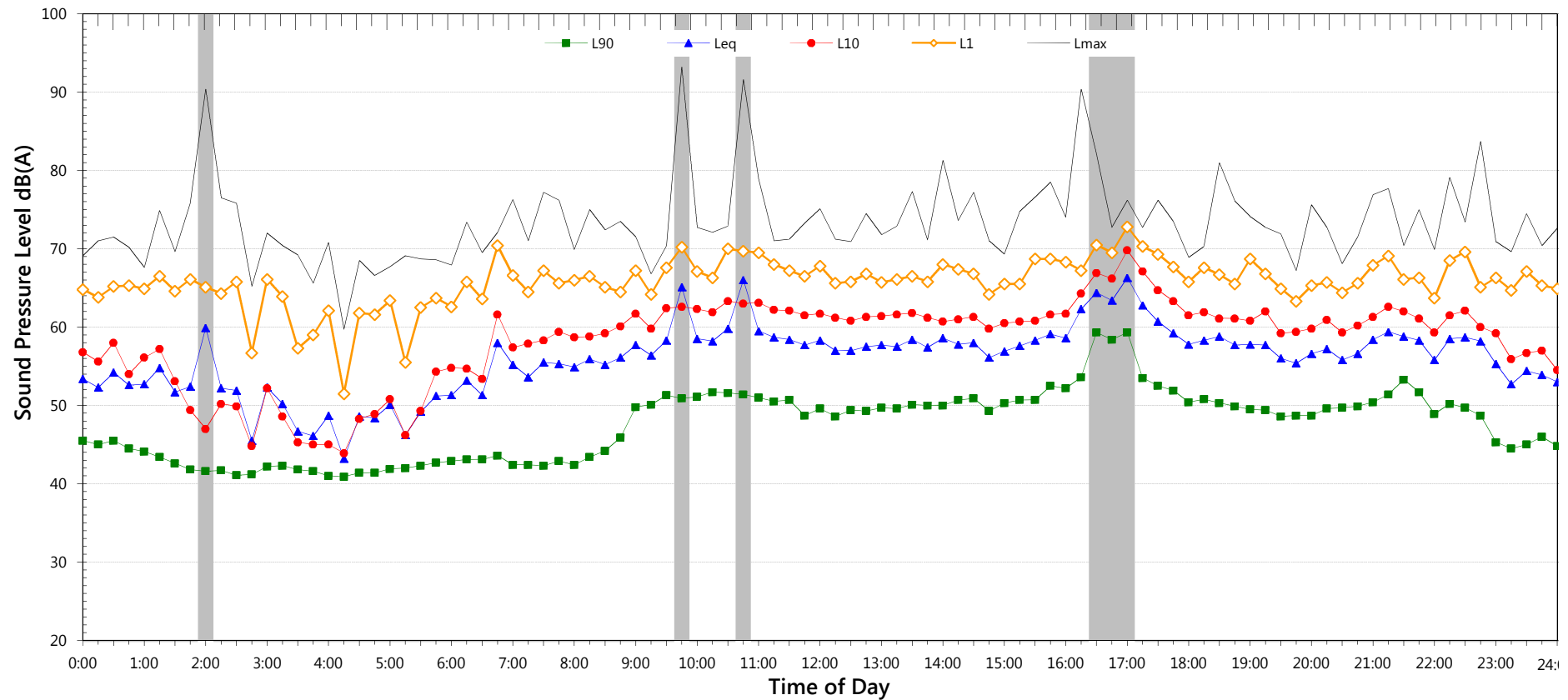
- Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
- "Day" is the period from 8am till 6pm on Sundays and 7am till 6pm on other days
- "Evening" is the period from 6pm till 10pm
- "Night" relates to the remaining periods
- "Night" relates to period from 10pm on this graph to morning on the following graph.
- Graphed data measured in free-field; tabulated results facade corrected
- Night time L_{Max} values are shown only where L_{Max} > 65dB(A) and where L_{Max} - L_{eq} ≥ 15dB(A)

NSW Road Noise Policy (1m from facade) (see note 6)		
Descriptor	Day	Night ⁵
	7am-10pm	10pm-7am
L _{eq} 15 hr and L _{eq} 9 hr	62.1	55.4
L _{eq} 1hr upper 10 percentile	63.9	58.8
L _{eq} 1hr lower 10 percentile	60.1	50.7

Unattended Noise Monitoring Results

Cnr Olympic Blvd & Sarah Durack Ave, Sydney Olympic Park

Sunday, 20 December 2015



NSW Industrial Noise Policy (Free Field)			
Descriptor	Day ²	Evening ³	Night ^{4,5}
L ₉₀	48.6	48.7	43.0
LA _{eq}	58.5	57.6	55.6

Night Time Maximum Noise Levels			(see note 7)
L _{Max} (Range)	70.0	to	83.7
L _{Max} - L _{eq} (Range)	18.3	to	26.1

Notes:

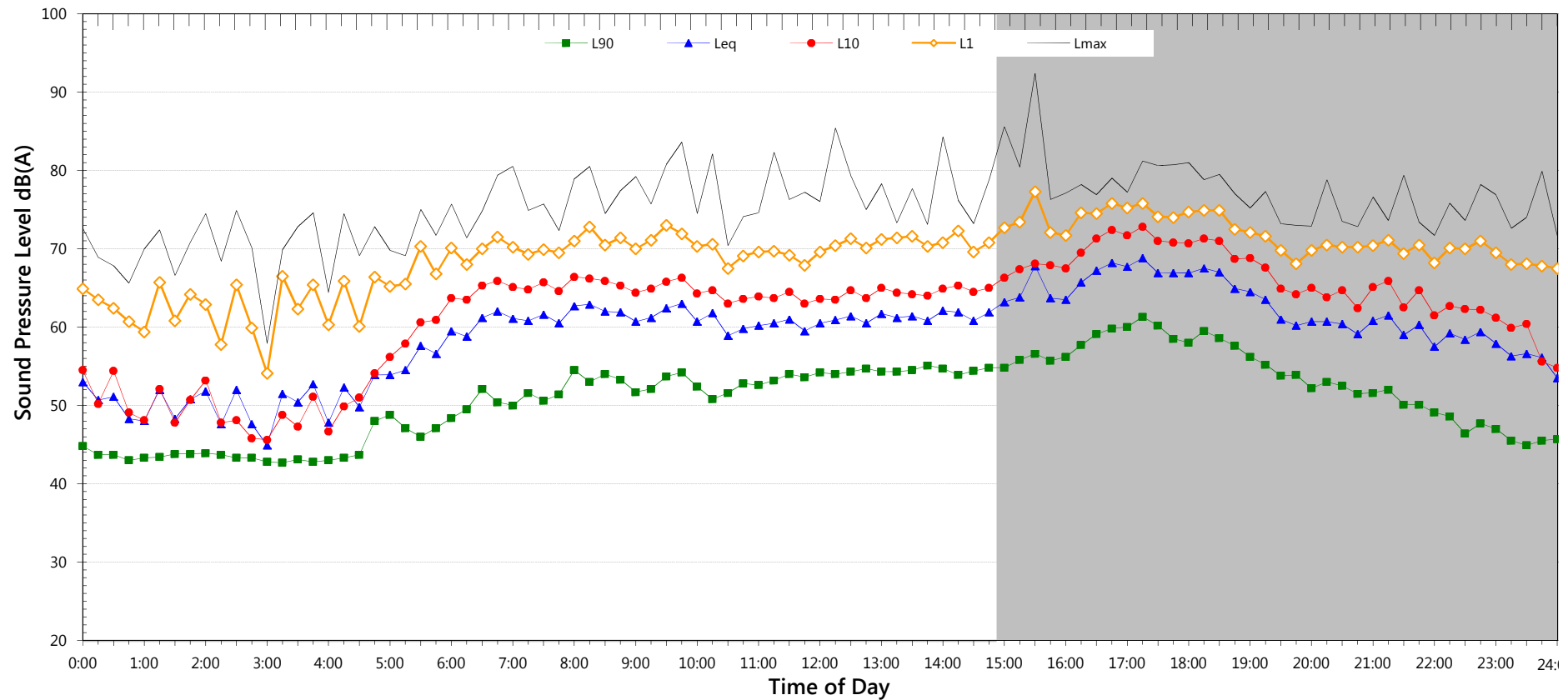
1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am till 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
5. "Night" relates to period from 10pm on this graph to morning on the following graph.
6. Graphed data measured in free-field; tabulated results facade corrected
7. Night time L_{Max} values are shown only where L_{Max} > 65dB(A) and where L_{Max} - L_{eq} ≥ 15dB(A)

NSW Road Noise Policy (1m from facade) (see note 6)		
Descriptor	Day	Night ⁵
	7am-10pm	10pm-7am
L _{eq} 15 hr and L _{eq} 9 hr	60.5	58.1
L _{eq} 1hr upper 10 percentile	64.0	63.4
L _{eq} 1hr lower 10 percentile	58.2	51.3

Unattended Noise Monitoring Results

Cnr Olympic Blvd & Sarah Durack Ave, Sydney Olympic Park

Monday, 21 December 2015



NSW Industrial Noise Policy (Free Field)			
Descriptor	Day ²	Evening ³	Night ^{4,5}
L ₉₀	-	-	-
LA _{eq}	-	-	-
Night Time Maximum Noise Levels			(see note 7)
L _{Max} (Range)	-	to	-
L _{Max} - L _{eq} (Range)	-	to	-

NSW Road Noise Policy (1m from facade) (see note 6)		
Descriptor	Day	Night ⁵
	7am-10pm	10pm-7am
L _{eq} 15 hr and L _{eq} 9 hr	63.8	-
L _{eq} 1hr upper 10 percentile	64.4	-
L _{eq} 1hr lower 10 percentile	62.8	-

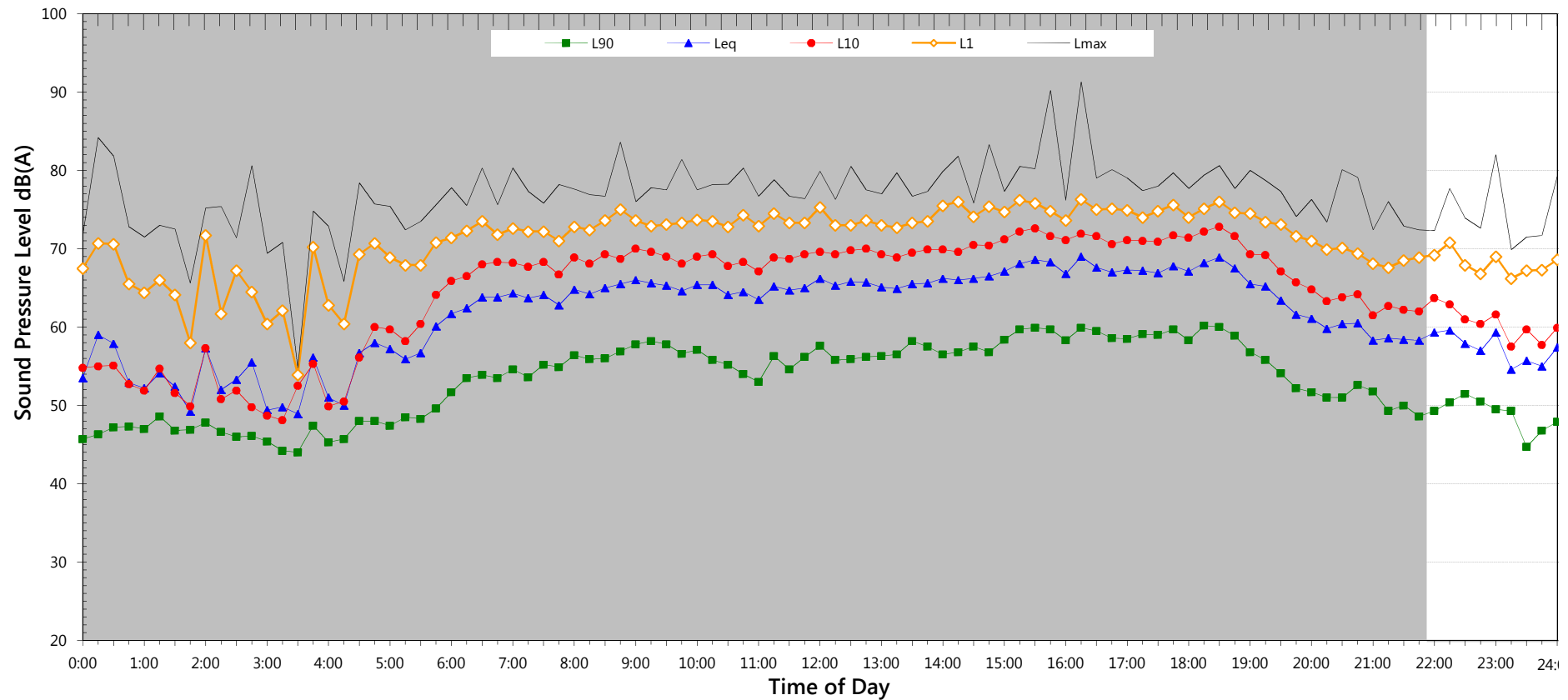
Notes:

- 1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
- 2. "Day" is the period from 8am till 6pm on Sundays and 7am till 6pm on other days
- 3. "Evening" is the period from 6pm till 10pm
- 4. "Night" relates to the remaining periods
- 5. "Night" relates to period from 10pm on this graph to morning on the following graph.
- 6. Graphed data measured in free-field; tabulated results facade corrected
- 7. Night time L_{Max} values are shown only where L_{Max} > 65dB(A) and where L_{Max} - L_{eq} ≥ 15dB(A)

Unattended Noise Monitoring Results

Cnr Olympic Blvd & Sarah Durack Ave, Sydney Olympic Park

Tuesday, 22 December 2015



NSW Industrial Noise Policy (Free Field)			
Descriptor	Day ²	Evening ³	Night ^{4,5}
L ₉₀	-	-	45.4
LA _{eq}	-	-	57.5
Night Time Maximum Noise Levels			(see note 7)
L _{Max} (Range)	75.0	to	87.0
L _{Max} - L _{eq} (Range)	19.5	to	24.0

NSW Road Noise Policy (1m from facade) (see note 6)		
Descriptor	Day	Night ⁵
	7am-10pm	10pm-7am
L _{eq} 15 hr and L _{eq} 9 hr	61.8	60.0
L _{eq} 1hr upper 10 percentile	61.8	66.0
L _{eq} 1hr lower 10 percentile	61.8	53.5

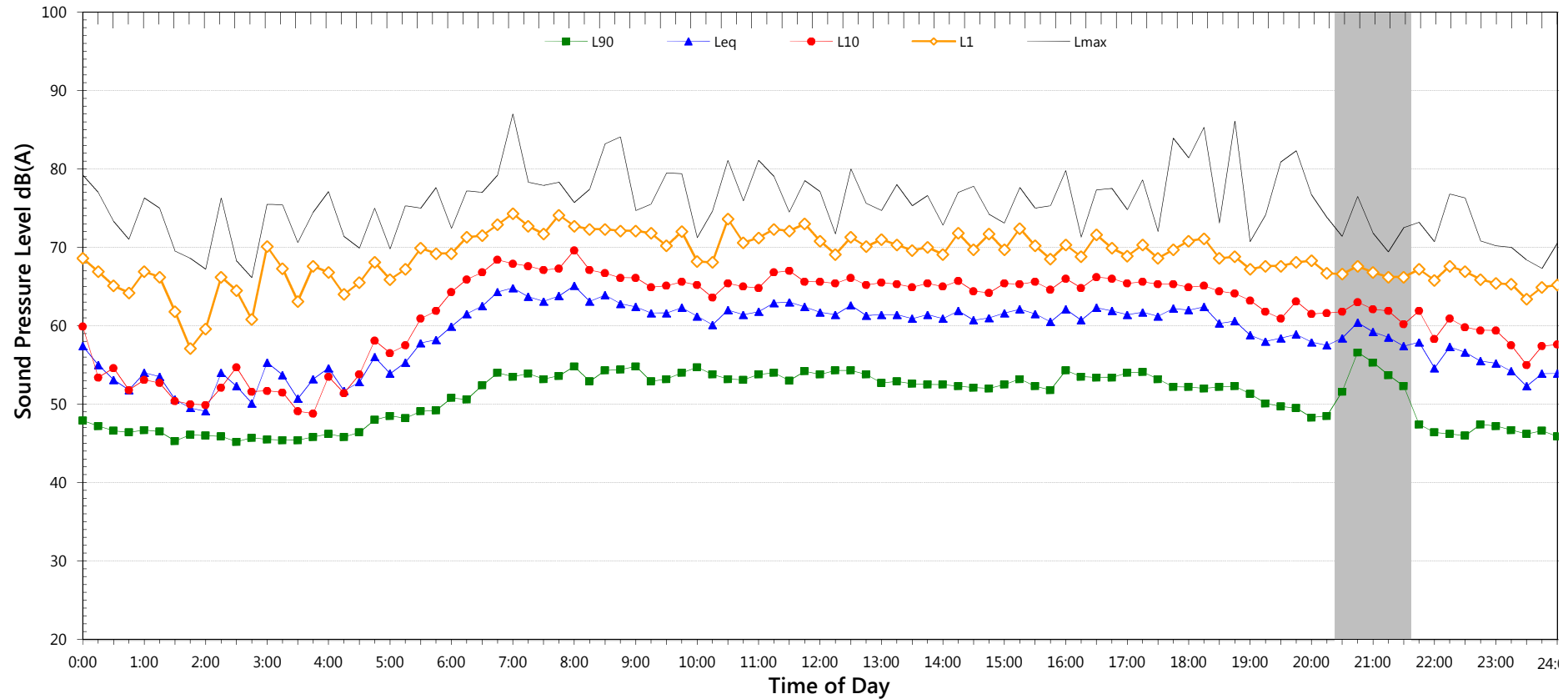
Notes:

- 1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
- 2. "Day" is the period from 8am till 6pm on Sundays and 7am till 6pm on other days
- 3. "Evening" is the period from 6pm till 10pm
- 4. "Night" relates to the remaining periods
- 5. "Night" relates to period from 10pm on this graph to morning on the following graph.
- 6. Graphed data measured in free-field; tabulated results facade corrected
- 7. Night time L_{Max} values are shown only where L_{Max} > 65dB(A) and where L_{Max} - L_{eq} ≥ 15dB(A)

Unattended Noise Monitoring Results

Cnr Olympic Blvd & Sarah Durack Ave, Sydney Olympic Park

Wednesday, 23 December 2015



NSW Industrial Noise Policy (Free Field)			
Descriptor	Day ²	Evening ³	Night ^{4,5}
L ₉₀	52.2	-	46.2
LA _{eq}	62.1	-	55.7

Night Time Maximum Noise Levels			(see note 7)
L _{Max} (Range)	70.5	to	77.6
L _{Max} - L _{eq} (Range)	16.9	to	23.4

Notes:

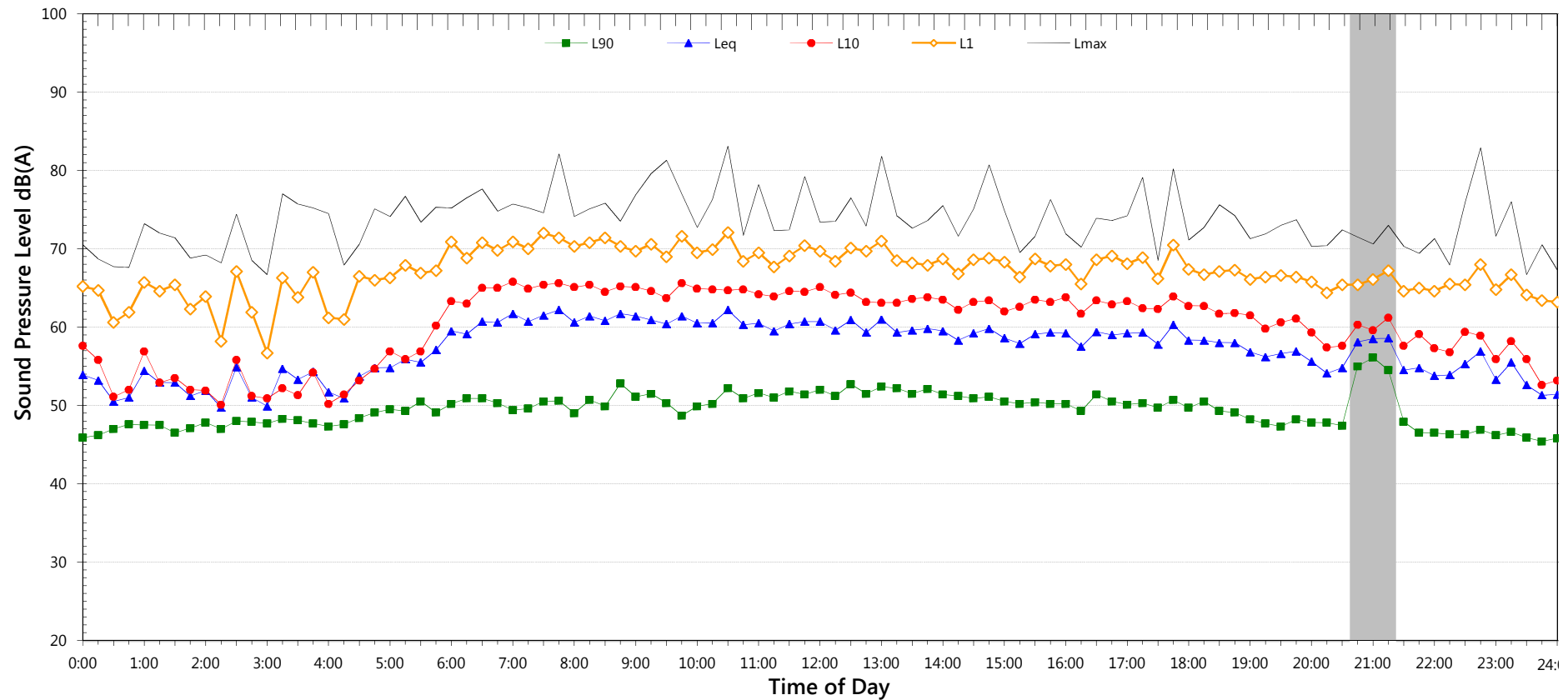
- Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
- "Day" is the period from 8am till 6pm on Sundays and 7am till 6pm on other days
- "Evening" is the period from 6pm till 10pm
- "Night" relates to the remaining periods
- "Night" relates to period from 10pm on this graph to morning on the following graph.
- Graphed data measured in free-field; tabulated results facade corrected
- Night time L_{Max} values are shown only where L_{Max} > 65dB(A) and where L_{Max} - L_{eq} ≥ 15dB(A)

NSW Road Noise Policy (1m from facade) (see note 6)		
Descriptor	Day	Night ⁵
	7am-10pm	10pm-7am
L _{eq} 15 hr and L _{eq} 9 hr	64.1	58.2
L _{eq} 1hr upper 10 percentile	66.1	63.1
L _{eq} 1hr lower 10 percentile	59.6	54.4

Unattended Noise Monitoring Results

Cnr Olympic Blvd & Sarah Durack Ave, Sydney Olympic Park

Thursday, 24 December 2015



NSW Industrial Noise Policy (Free Field)			
Descriptor	Day ²	Evening ³	Night ^{4,5}
L ₉₀	49.7	-	41.7
LA _{eq}	60.1	-	51.4

Night Time Maximum Noise Levels			(see note 7)
L _{Max} (Range)	66.9	to	82.9
L _{Max} - L _{eq} (Range)	19.6	to	27.8

Notes:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Day" is the period from 8am till 6pm on Sundays and 7am till 6pm on other days
3. "Evening" is the period from 6pm till 10pm
4. "Night" relates to the remaining periods
6. Graphed data measured in free-field; tabulated results facade corrected

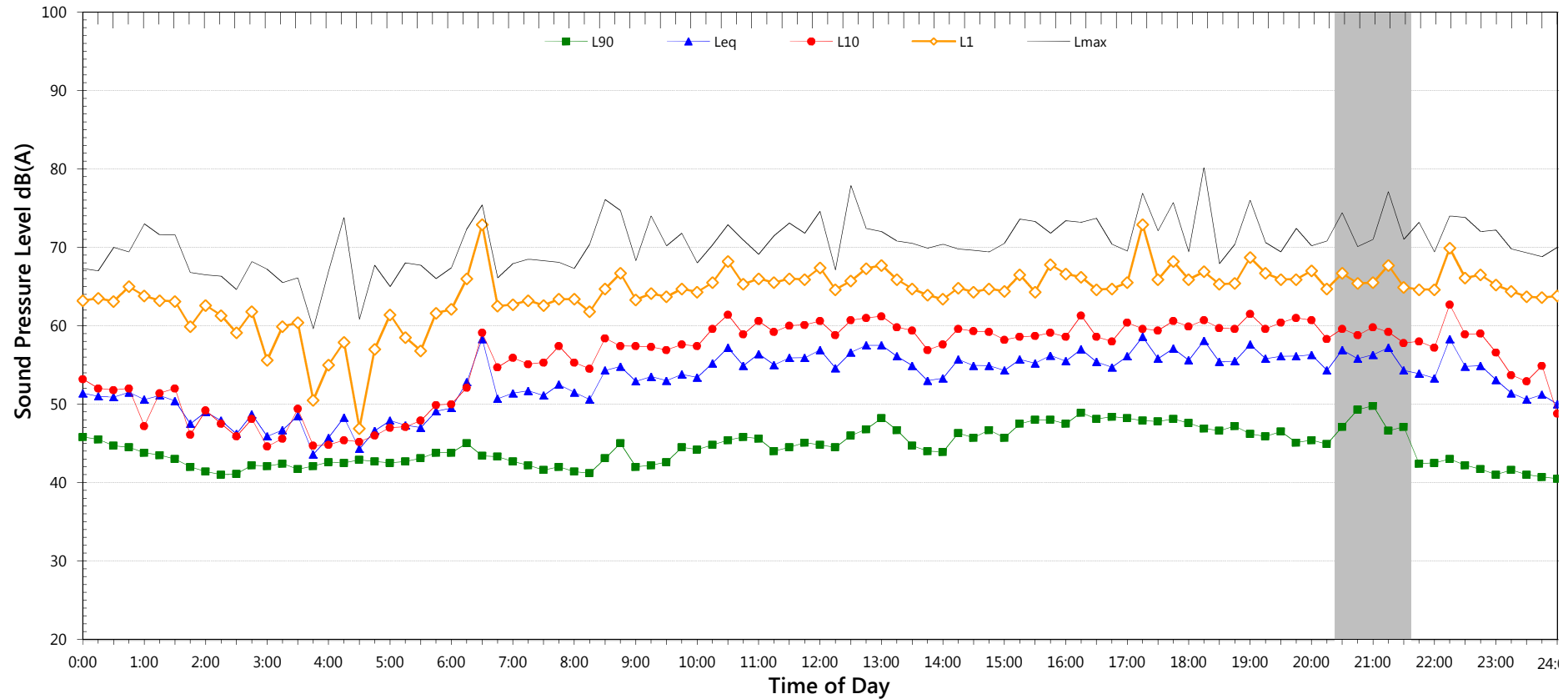
NSW Road Noise Policy (1m from facade) (see note 6)		
Descriptor	Day	Night ⁵
	7am-10pm	10pm-7am
L _{eq} 15 hr and L _{eq} 9 hr	62.0	53.9
L _{eq} 1hr upper 10 percentile	63.8	57.6
L _{eq} 1hr lower 10 percentile	56.9	49.0

7. Night time L_{Max} values are shown only where L_{Max} > 65dB(A) and where L_{Max} - L_{eq} ≥ 15dB(A)

Unattended Noise Monitoring Results

Cnr Olympic Blvd & Sarah Durack Ave, Sydney Olympic Park

Friday, 25 December 2015



NSW Industrial Noise Policy (Free Field)			
Descriptor	Day ²	Evening ³	Night ^{4,5}
L ₉₀	42.0	-	40.0
LA _{eq}	55.3	-	51.9

Night Time Maximum Noise Levels			(see note 7)
L _{Max} (Range)	70.0	to	84.5
L _{Max} - L _{eq} (Range)	18.3	to	31.7

NSW Road Noise Policy (1m from facade) (see note 6)		
Descriptor	Day	Night ⁵
	7am-10pm	10pm-7am
L _{eq} 15 hr and L _{eq} 9 hr	57.9	54.4
L _{eq} 1hr upper 10 percentile	59.4	58.2
L _{eq} 1hr lower 10 percentile	55.2	49.4

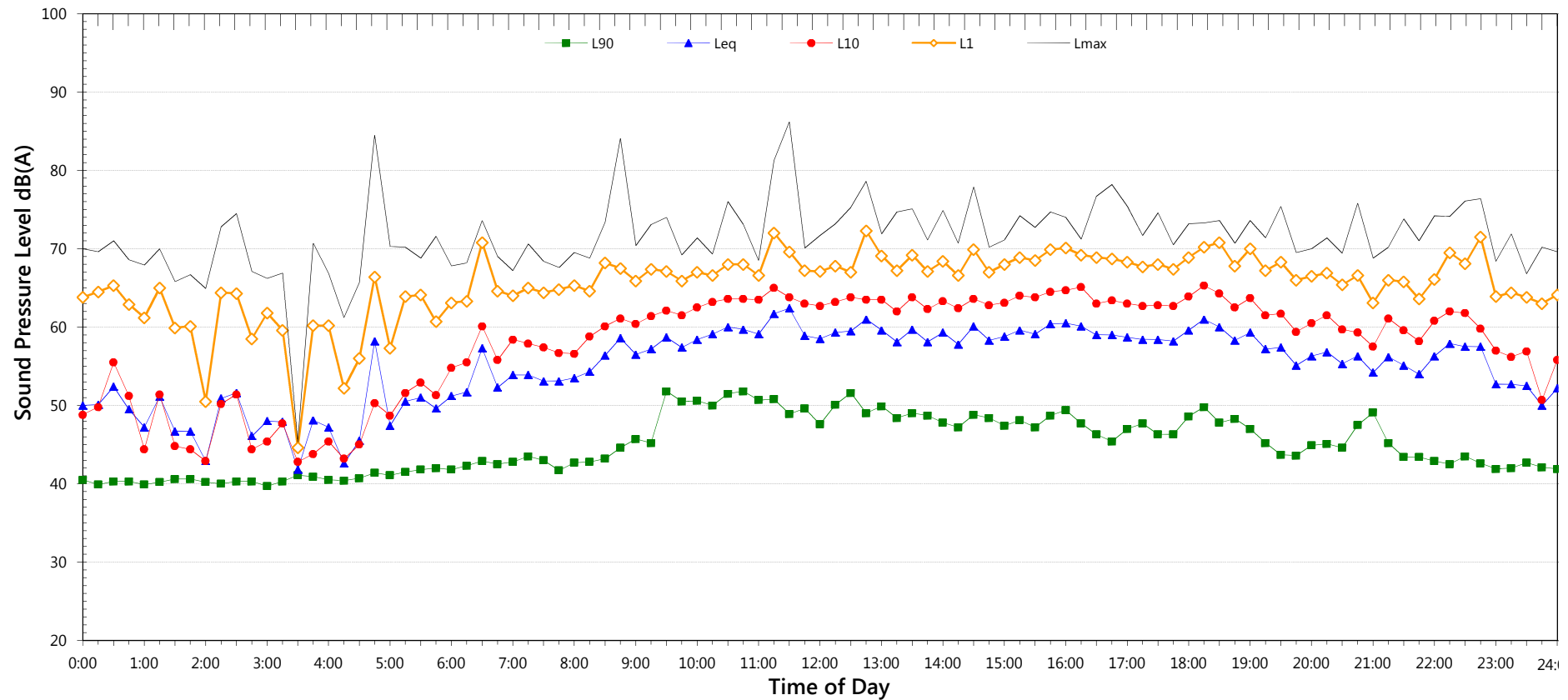
Notes:

- 1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
- 2. "Day" is the period from 8am till 6pm on Sundays and 7am till 6pm on other days
- 3. "Evening" is the period from 6pm till 10pm
- 4. "Night" relates to the remaining periods
- 5. "Night" relates to period from 10pm on this graph to morning on the following graph.
- 6. Graphed data measured in free-field; tabulated results facade corrected
- 7. Night time L_{Max} values are shown only where L_{Max} > 65dB(A) and where L_{Max} - L_{eq} ≥ 15dB(A)

Unattended Noise Monitoring Results

Cnr Olympic Blvd & Sarah Durack Ave, Sydney Olympic Park

Saturday, 26 December 2015



NSW Industrial Noise Policy (Free Field)			
Descriptor	Day ²	Evening ³	Night ^{4,5}
L ₉₀	43.2	43.4	42.3
LA _{eq}	58.9	57.3	54.2

Night Time Maximum Noise Levels			(see note 7)
L _{Max} (Range)	68.6	to	85.4
L _{Max} - L _{eq} (Range)	17.3	to	29.8

Notes:

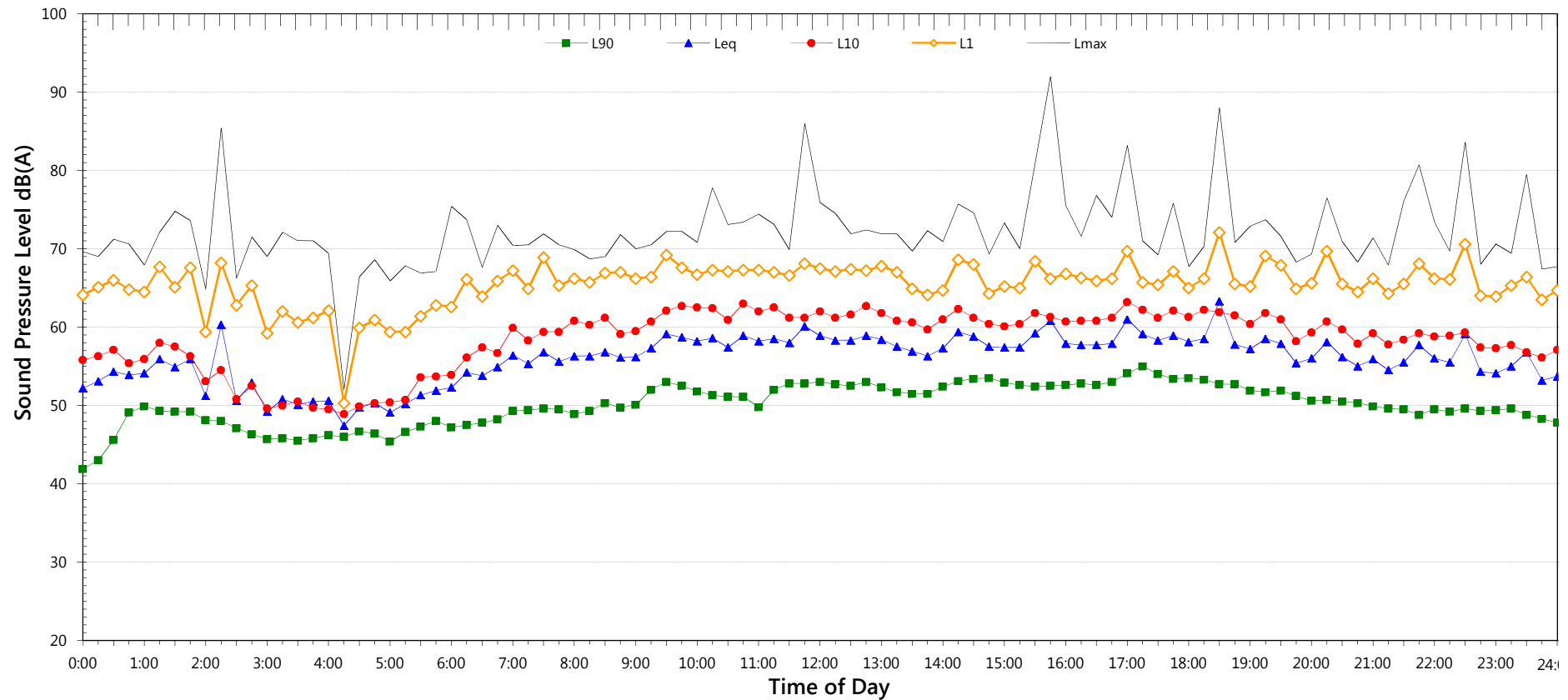
- Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
- "Day" is the period from 8am till 6pm on Sundays and 7am till 6pm on other days
- "Evening" is the period from 6pm till 10pm
- "Night" relates to the remaining periods
- "Night" relates to period from 10pm on this graph to morning on the following graph.
- Graphed data measured in free-field; tabulated results facade corrected
- Night time L_{Max} values are shown only where L_{Max} > 65dB(A) and where L_{Max} - L_{eq} ≥ 15dB(A)

NSW Road Noise Policy (1m from facade) (see note 6)		
Descriptor	Day	Night ⁵
	7am-10pm	10pm-7am
L _{eq} 15 hr and L _{eq} 9 hr	61.0	56.4
L _{eq} 1hr upper 10 percentile	62.8	59.3
L _{eq} 1hr lower 10 percentile	57.1	51.8

Unattended Noise Monitoring Results

Cnr Olympic Blvd & Sarah Durack Ave, Sydney Olympic Park

Sunday, 27 December 2015



NSW Industrial Noise Policy (Free Field)			
Descriptor	Day ²	Evening ³	Night ^{4,5}
L ₉₀	50.2	49.5	43.6
LA _{eq}	58.3	57.7	53.7

Night Time Maximum Noise Levels			(see note 7)
L _{Max} (Range)	73.8	to	83.6
L _{Max} - L _{eq} (Range)	18.2	to	28.1

Notes:

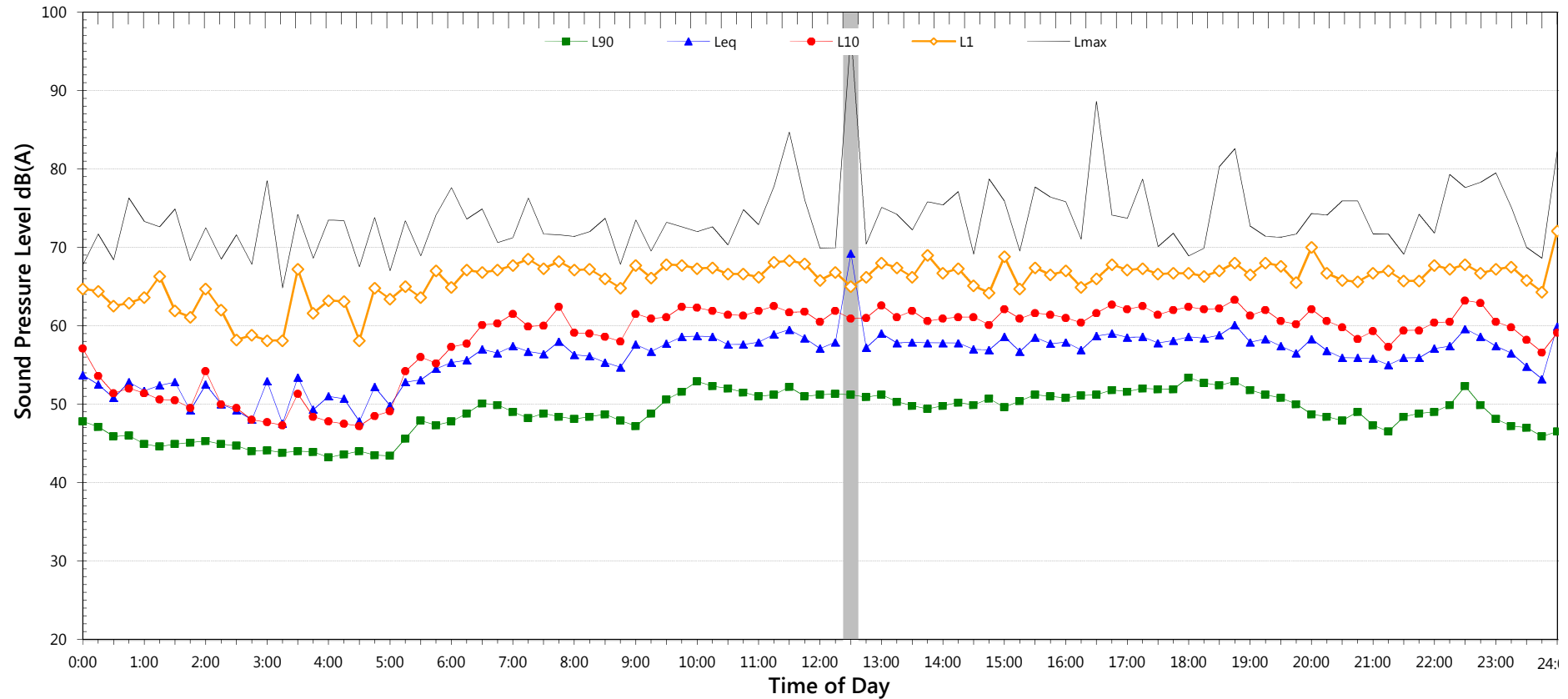
- Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
- "Day" is the period from 8am till 6pm on Sundays and 7am till 6pm on other days
- "Evening" is the period from 6pm till 10pm
- "Night" relates to the remaining periods
- "Night" relates to period from 10pm on this graph to morning on the following graph.
- Graphed data measured in free-field; tabulated results facade corrected
- Night time L_{Max} values are shown only where L_{Max} > 65dB(A) and where L_{Max} - L_{eq} ≥ 15dB(A)

NSW Road Noise Policy (1m from facade) (see note 6)		
Descriptor	Day	Night ⁵
	7am-10pm	10pm-7am
L _{eq} 15 hr and L _{eq} 9 hr	60.5	56.2
L _{eq} 1hr upper 10 percentile	62.0	59.2
L _{eq} 1hr lower 10 percentile	58.6	52.9

Unattended Noise Monitoring Results

Cnr Olympic Blvd & Sarah Durack Ave, Sydney Olympic Park

Monday, 28 December 2015



NSW Industrial Noise Policy (Free Field)			
Descriptor	Day ²	Evening ³	Night ^{4,5}
L ₉₀	48.4	47.3	45.4
LA _{eq}	57.8	57.3	55.8

Night Time Maximum Noise Levels			(see note 7)
L _{Max} (Range)	72.2	to	88.3
L _{Max} - L _{eq} (Range)	15.8	to	32.8

Notes:

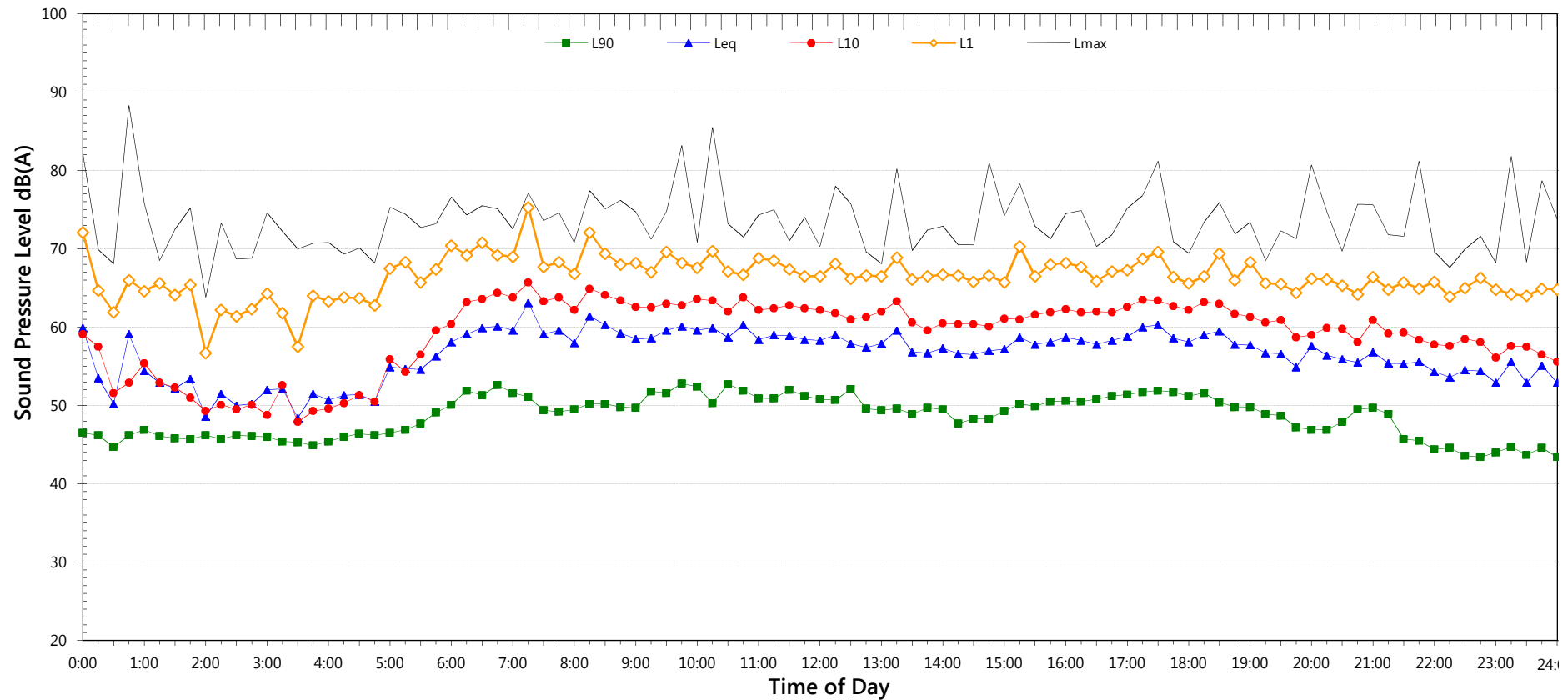
- Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
- "Day" is the period from 8am till 6pm on Sundays and 7am till 6pm on other days
- "Evening" is the period from 6pm till 10pm
- "Night" relates to the remaining periods
- "Night" relates to period from 10pm on this graph to morning on the following graph.
- Graphed data measured in free-field; tabulated results facade corrected
- Night time L_{Max} values are shown only where L_{Max} > 65dB(A) and where L_{Max} - L_{eq} ≥ 15dB(A)

NSW Road Noise Policy (1m from facade) (see note 6)		
Descriptor	Day	Night ⁵
	7am-10pm	10pm-7am
L _{eq} 15 hr and L _{eq} 9 hr	60.2	58.3
L _{eq} 1hr upper 10 percentile	61.2	62.2
L _{eq} 1hr lower 10 percentile	58.6	53.4

Unattended Noise Monitoring Results

Cnr Olympic Blvd & Sarah Durack Ave, Sydney Olympic Park

Tuesday, 29 December 2015



NSW Industrial Noise Policy (Free Field)			
Descriptor	Day ²	Evening ³	Night ^{4,5}
L ₉₀	49.2	45.5	43.2
LA _{eq}	58.9	56.8	54.6

Night Time Maximum Noise Levels			(see note 7)
L _{Max} (Range)	71.6	to	82.4
L _{Max} - L _{eq} (Range)	17.7	to	29.6

Notes:

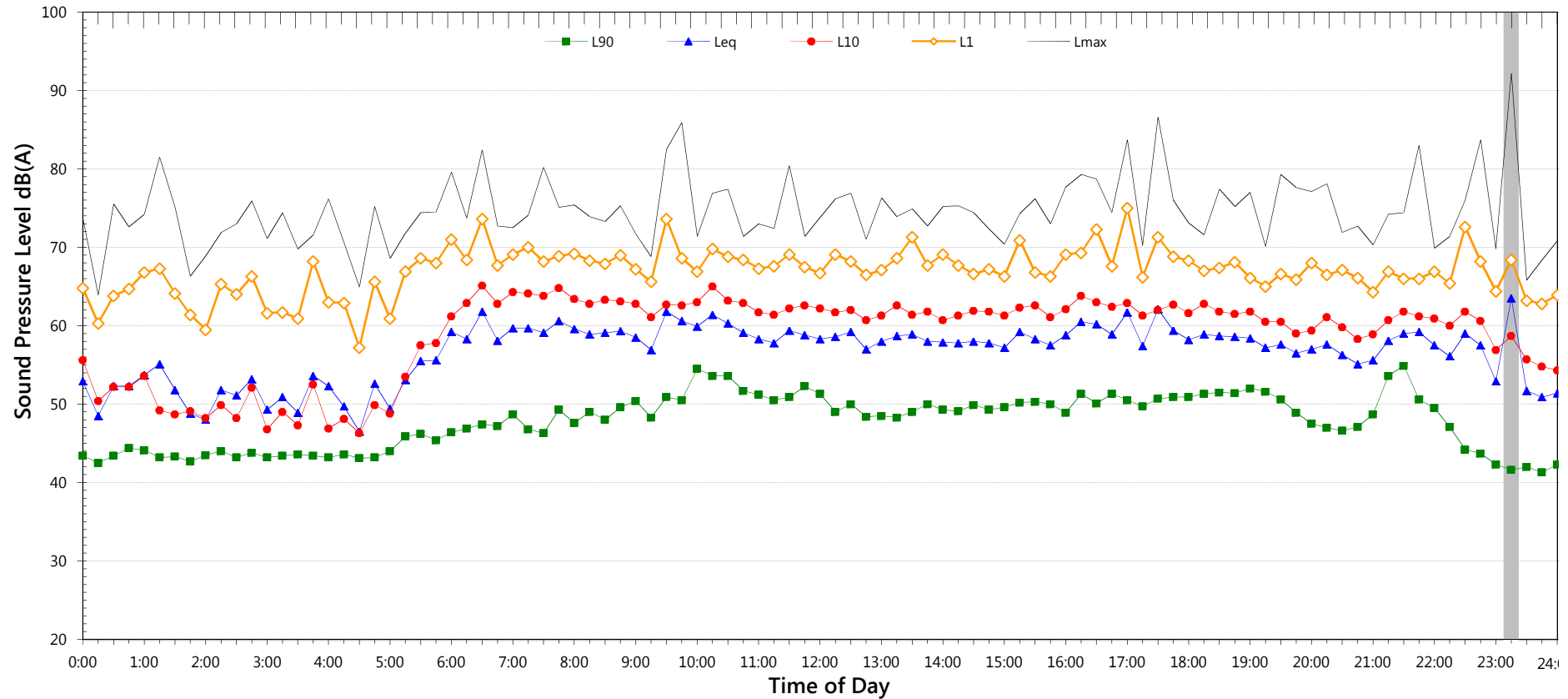
- Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
- "Day" is the period from 8am till 6pm on Sundays and 7am till 6pm on other days
- "Evening" is the period from 6pm till 10pm
- "Night" relates to the remaining periods
- "Night" relates to period from 10pm on this graph to morning on the following graph.
- Graphed data measured in free-field; tabulated results facade corrected
- Night time L_{Max} values are shown only where L_{Max} > 65dB(A) and where L_{Max} - L_{eq} ≥ 15dB(A)

NSW Road Noise Policy (1m from facade) (see note 6)		
Descriptor	Day	Night ⁵
	7am-10pm	10pm-7am
L _{eq} 15 hr and L _{eq} 9 hr	60.9	57.1
L _{eq} 1hr upper 10 percentile	62.7	62.2
L _{eq} 1hr lower 10 percentile	58.2	52.6

Unattended Noise Monitoring Results

Cnr Olympic Blvd & Sarah Durack Ave, Sydney Olympic Park

Wednesday, 30 December 2015



NSW Industrial Noise Policy (Free Field)			
Descriptor	Day ²	Evening ³	Night ^{4,5}
L ₉₀	48.3	47.0	40.6
LA _{eq}	59.2	57.7	54.0

Night Time Maximum Noise Levels			(see note 7)
L _{Max} (Range)	70.8	to	83.7
L _{Max} - L _{eq} (Range)	19.5	to	26.8

Notes:

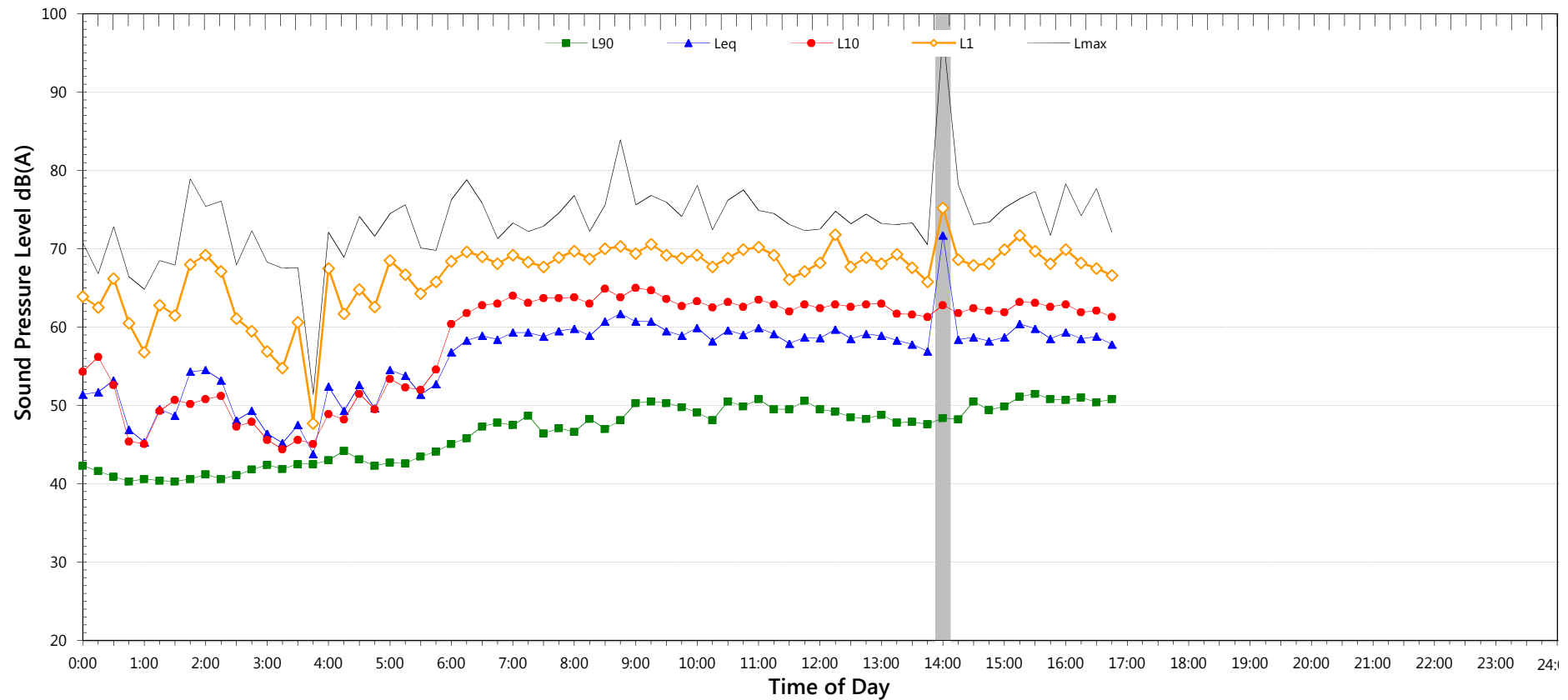
- Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
- "Day" is the period from 8am till 6pm on Sundays and 7am till 6pm on other days
- "Evening" is the period from 6pm till 10pm
- "Night" relates to the remaining periods
- "Night" relates to period from 10pm on this graph to morning on the following graph.
- Graphed data measured in free-field; tabulated results facade corrected
- Night time L_{Max} values are shown only where L_{Max} > 65dB(A) and where L_{Max} - L_{eq} ≥ 15dB(A)

NSW Road Noise Policy (1m from facade) (see note 6)		
Descriptor	Day	Night ⁵
	7am-10pm	10pm-7am
L _{eq} 15 hr and L _{eq} 9 hr	61.4	56.5
L _{eq} 1hr upper 10 percentile	62.8	61.2
L _{eq} 1hr lower 10 percentile	59.2	51.1

Unattended Noise Monitoring Results

Cnr Olympic Blvd & Sarah Durack Ave, Sydney Olympic Park

Thursday, 31 December 2015



NSW Industrial Noise Policy (Free Field)			
Descriptor	Day ²	Evening ³	Night ^{4,5}
L ₉₀	47.1	-	-
LA _{eq}	59.2	-	-

Night Time Maximum Noise Levels (see note 7)			
L _{Max} (Range)	-	to	-
L _{Max} - L _{eq} (Range)	-	to	-

Notes:

- 1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
- 2. "Day" is the period from 8am till 6pm on Sundays and 7am till 6pm on other days
- 3. "Evening" is the period from 6pm till 10pm
- 4. "Night" relates to the remaining periods
- 5. "Night" relates to period from 10pm on this graph to morning on the following graph.
- 6. Graphed data measured in free-field; tabulated results facade corrected
- 7. Night time L_{Max} values are shown only where L_{Max} > 65dB(A) and where L_{Max} - L_{eq} ≥ 15dB(A)

NSW Road Noise Policy (1m from facade) (see note 6)		
Descriptor	Day	Night ⁵
	7am-10pm	10pm-7am
L _{eq} 15 hr and L _{eq} 9 hr	61.7	-
L _{eq} 1hr upper 10 percentile	63.1	-
L _{eq} 1hr lower 10 percentile	60.2	-