Section 75W Acoustic Assessment

1 Denison Street, North Sydney

Winten Property Group

10/61 Lavender St

Milsons Point NSW 2061

2016-10-27 Denison Rpt01

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Section 75W Acoustic Assessment
1 Denison Street, North Sydney

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1 INTRODUCTION

Winten Property Group proposes to develop a new commercial office building at 1 Denison Street, North Sydney on the current site of the Berry Square Shopping Centre. Approval for this development was previously granted under the now repealed Part 3A Approval Process. Modifications to Part 3A projects are provided by the Minister for Planning under Section 75W of the Environmental Planning and Assessment Act 1979 NSW.

The Minister for Planning's power to modify a Part 3A approval under section 75W can only be used for changes that have 'limited environmental consequences' beyond those approved in the original project assessment. This assessment indicates that there are only minor acoustical differences between the current proposal and that assessed in the original acoustic assessment prepared by Aurecon, dated 2 April 2009 (Reference 29239-008).

Pulse Acoustic Consultancy Pty Ltd (Pulse Acoustics) been engaged to provide the Acoustical Assessment to accompany this Section 75W modifications to the original Part 3A approval. The assessment addresses the noise impact of existing road traffic on the amenity of internal spaces and sets criteria for noise emission from the development with respect to mechanical plant. An important consideration of this assessment is that it is referenced against the approved development proposal (rather than the existing shopping centre development, together with the relevant statutory regulations and guidelines.

A glossary of acoustic terminology used throughout this report is included in **Appendix A**.

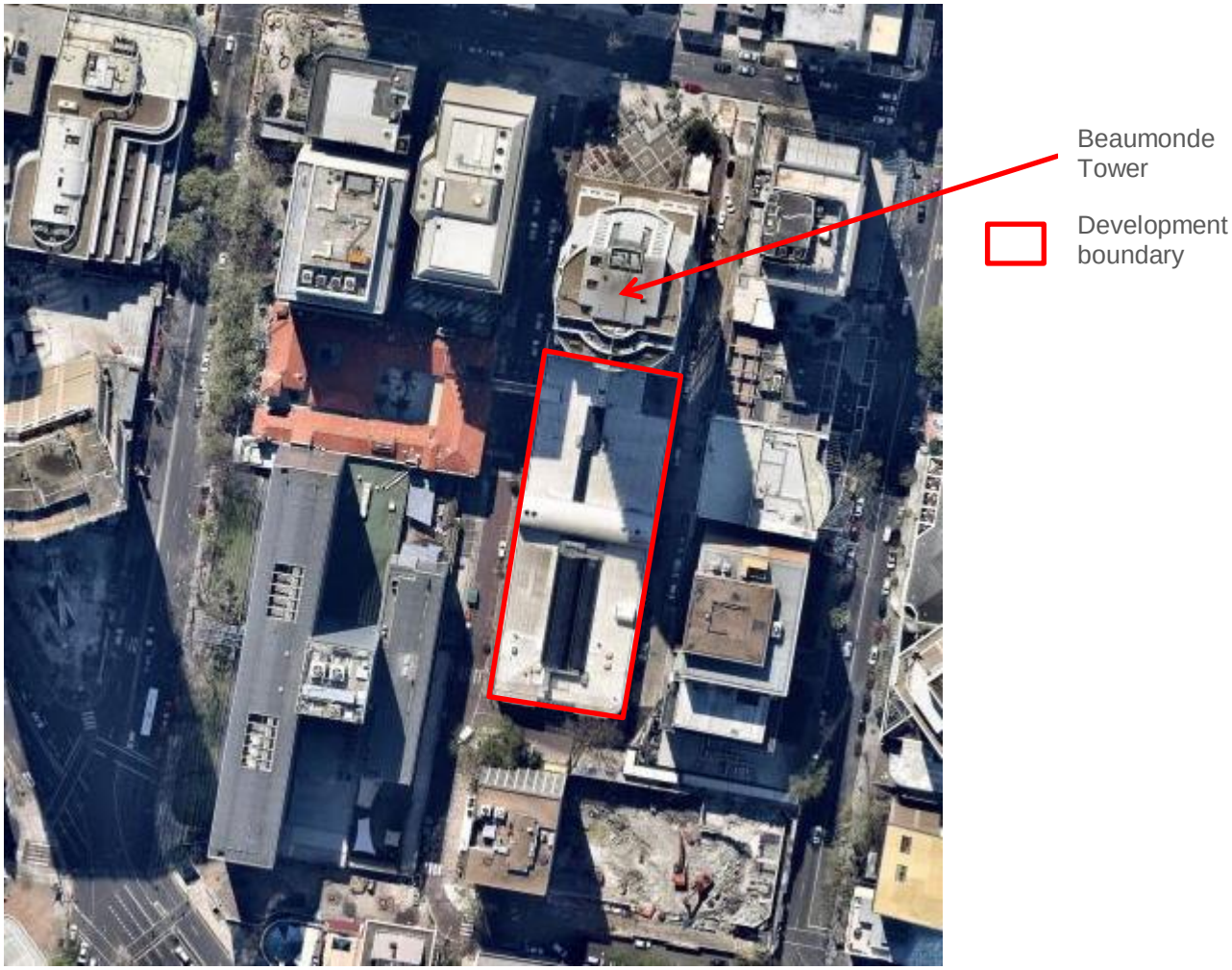
2 DEVELOPMENT DESCRIPTION

The development is bounded is bounded by Denison Street to the west, Spring Street to the south, Little Spring Street to the east and Berry Street and the existing residential building (which is part of the same lot) to the north. The development includes 5 levels of basement car parking, two levels of retail on the ground and lower ground floors, studio development on level 1, plant level above on level 2, and thirty levels of commercial on levels 3-33. Levels 34 and 35 will provide space for the upper level plant rooms.

The building will comprise approximately 60,018qm of NLA including approximately 17,078 sqm of commercial and broadcast space for Channel Nine on the ground floor and levels 1-10.

The site location, in relation to surrounding buildings, is shown in **Figure 1** below. The area is generally surrounded by commercial buildings and construction sites, with the exception of the Beaumonde Tower located immediately to the north of the proposed development. Beaumonde Tower is a mixed use development located on the same lot as the proposed development but in on a different Strata Plan. The Beaumonde Tower has with the first south facing balconies located at approximately RL 97m.

Figure 1 Site Location



Significant levels of the development are shown below and include the following:

- Ground Level (with proposed lobby, retail spaces, bar/restaurant and production studio shown)
- Mezzanine (with additional retail spaces)
- Level 1 (with indicative studios and circulation spaces)
- Level 2 (showing plant room and terrace area adjacent to the Beaumonde podium level)
- Level 9 (general arrangement plan for the transfer floor – floors L9 progressively tapper to the south)
- Level 37 (Upper plant level)
- Roof Level
- Eastern Elevation (showing the Strata Boundary on Grid Line K – and approximate distance of terrace area to resident balconies of 30m)

Figure 2 Ground floor

Figure 3 Mezzanine

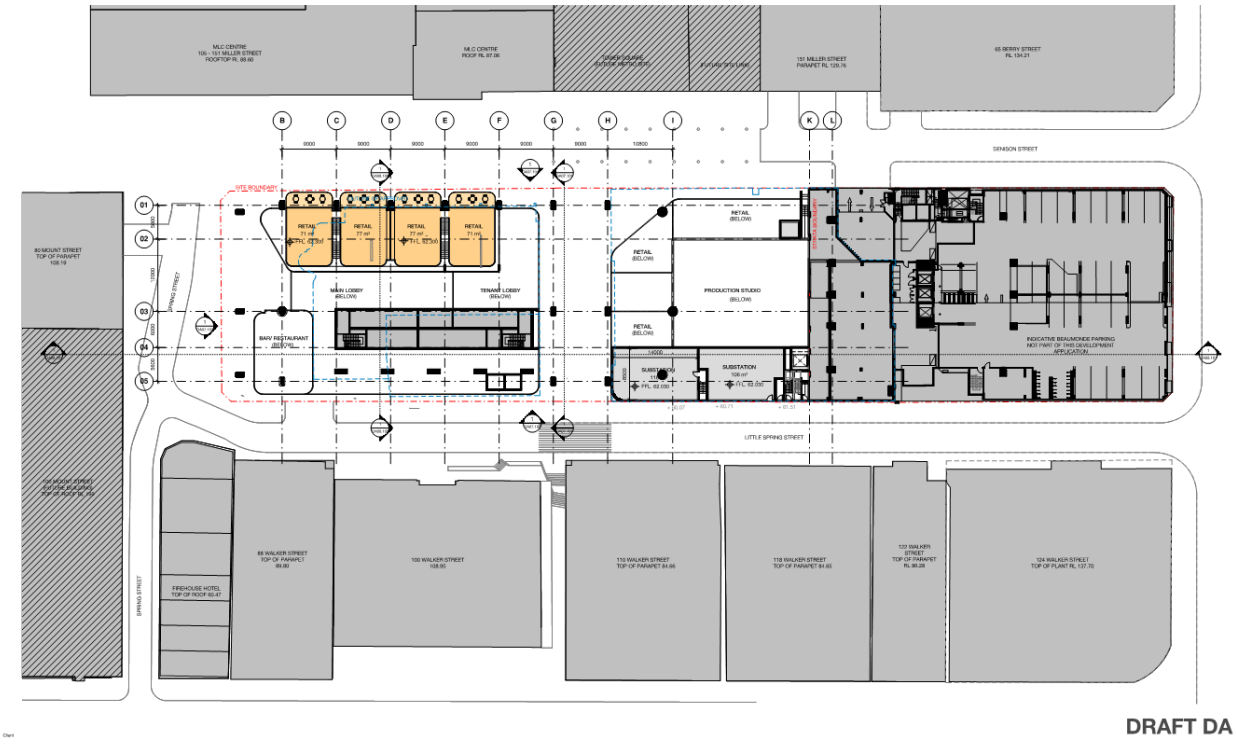


Figure 4 Level 1

Figure 5 Level 2

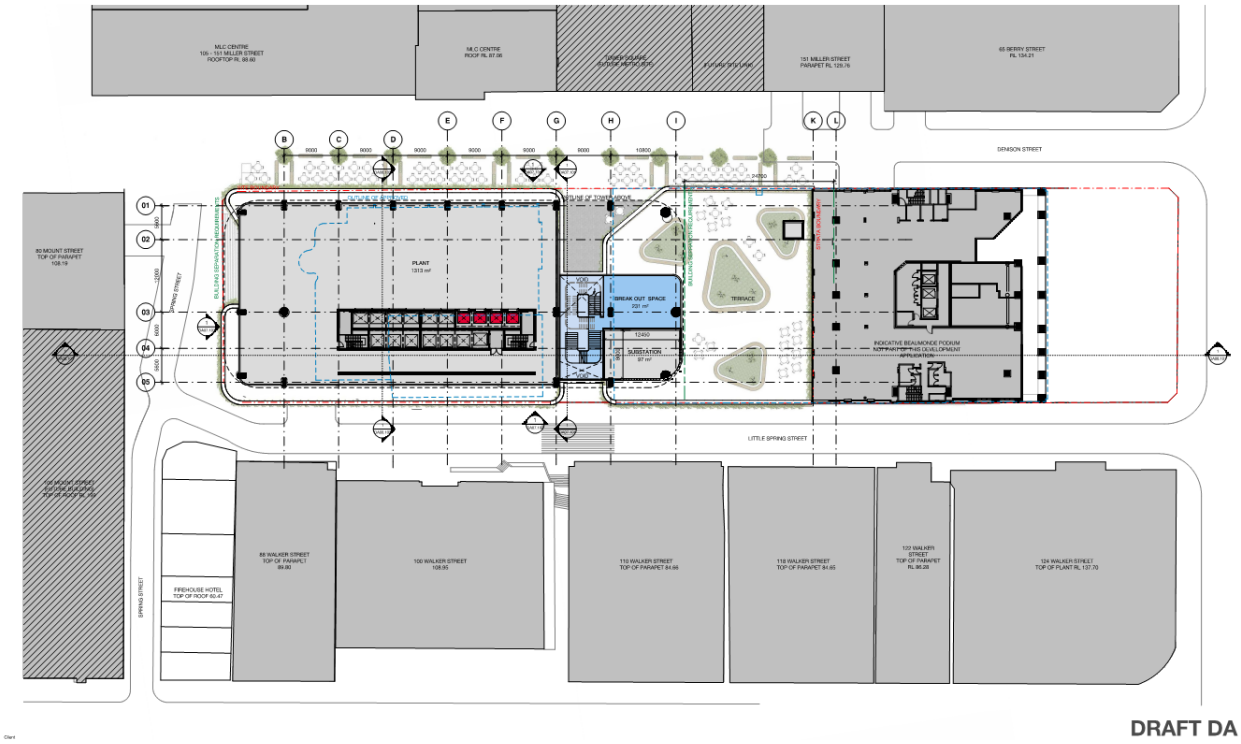


Figure 6 Level 9 – Transfer Floor

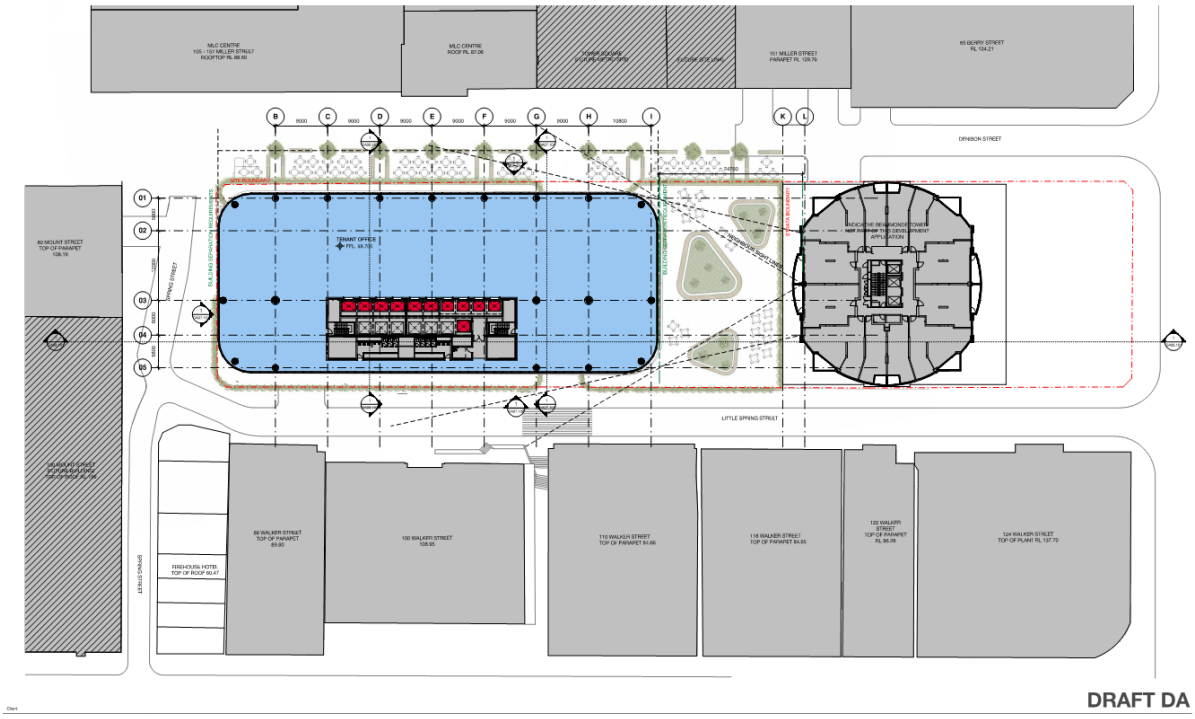


Figure 7 Level 37 – Upper Plant Level

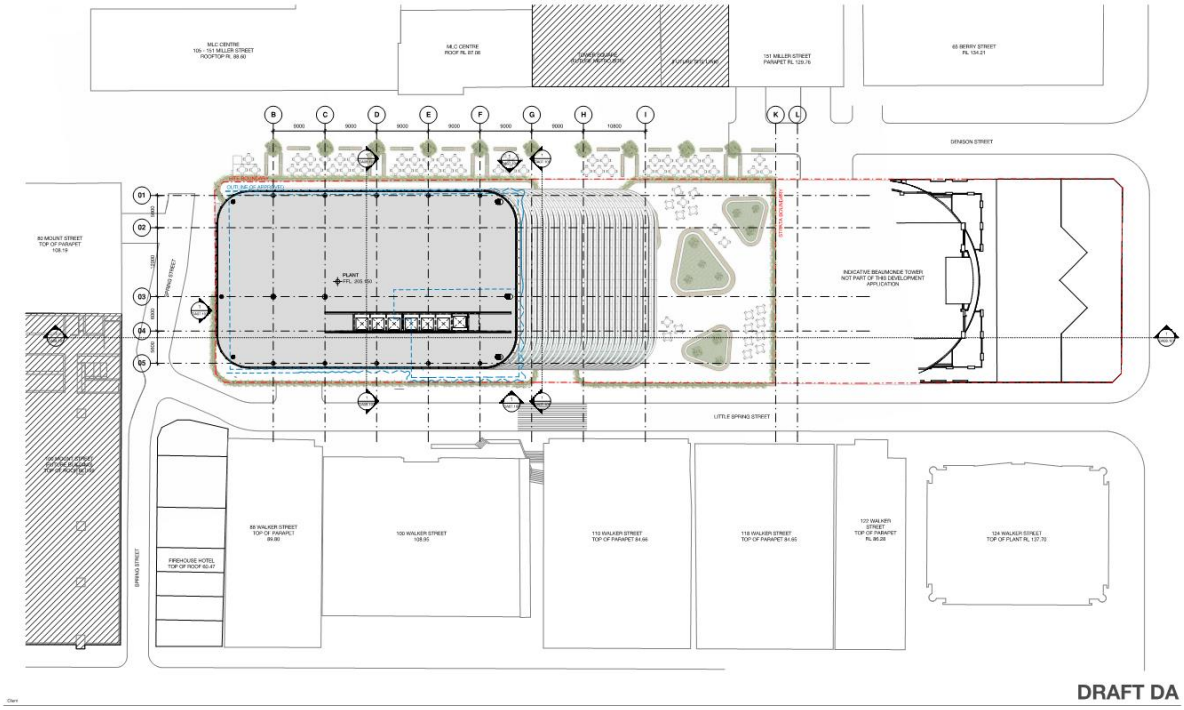


Figure 8 Roof Level

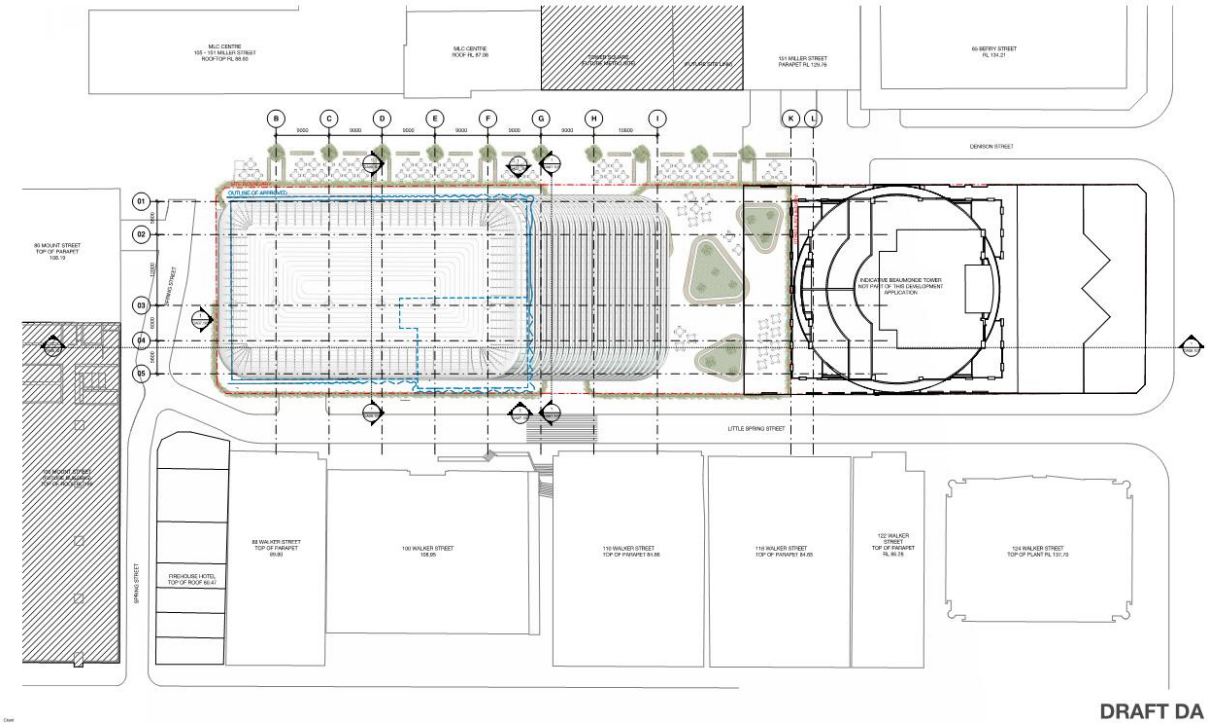
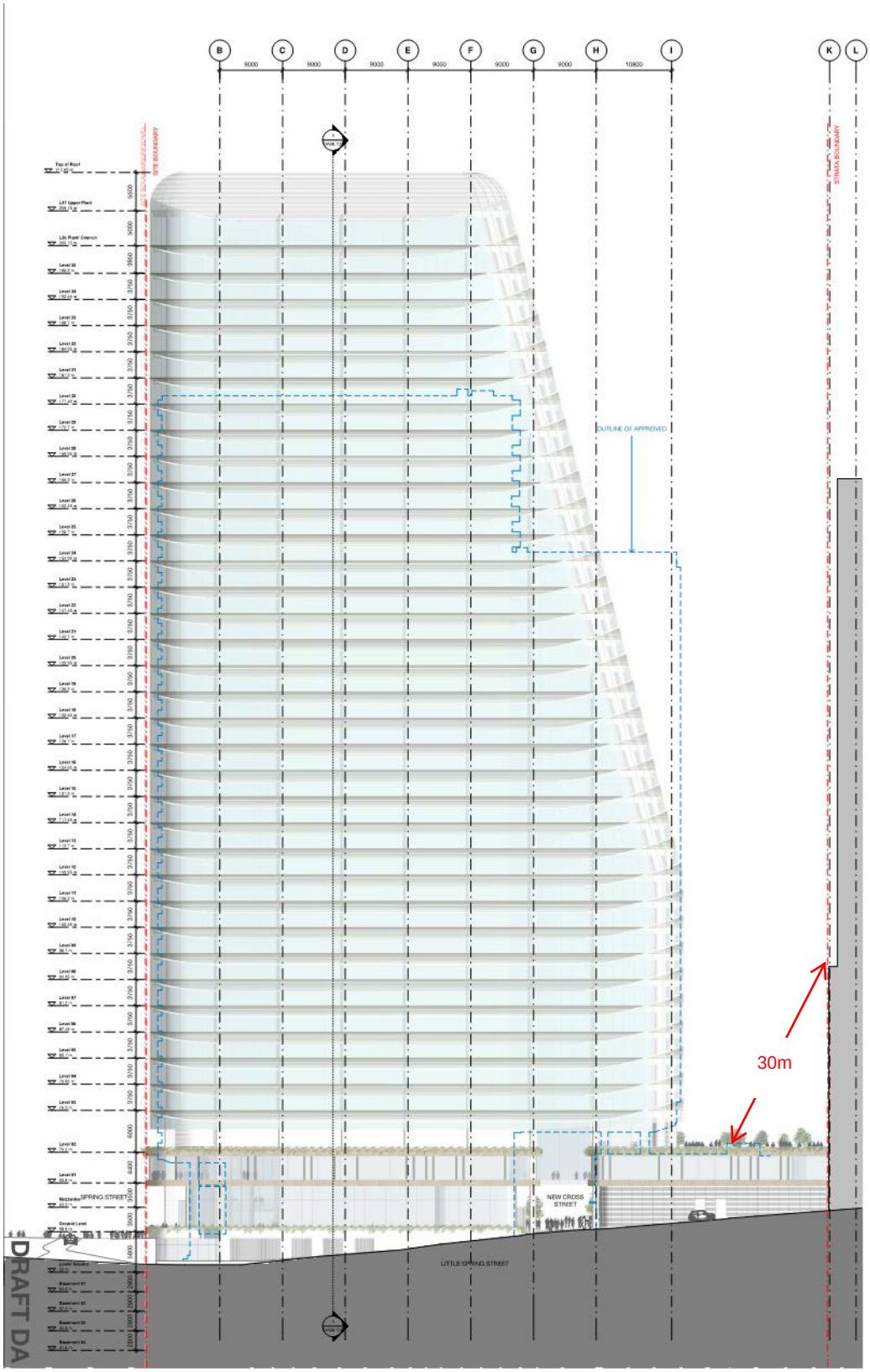


Figure 9 Eastern Elevation



3 EXISTING NOISE ENVIRONMENT

3.1 Unattended Noise Monitoring - Sydney Metro

As part of the Sydney Metro Project, SLR conducted unattended noise monitoring at sensitive receiver locations in the vicinity of all construction sites, including the Victoria Cross Station site in North Sydney. This site is immediately adjacent to the Denison Street site and these noise monitoring results can be used to characterise the existing ambient noise environment for the currently proposed development.

The location of an unattended noise monitoring survey in the area relevant to the Denison Street Development is shown as B.16 on Figure 10.4 of the EIS. This image has been reproduced below in **Figure 10.**

Figure 10 Eastern Elevation

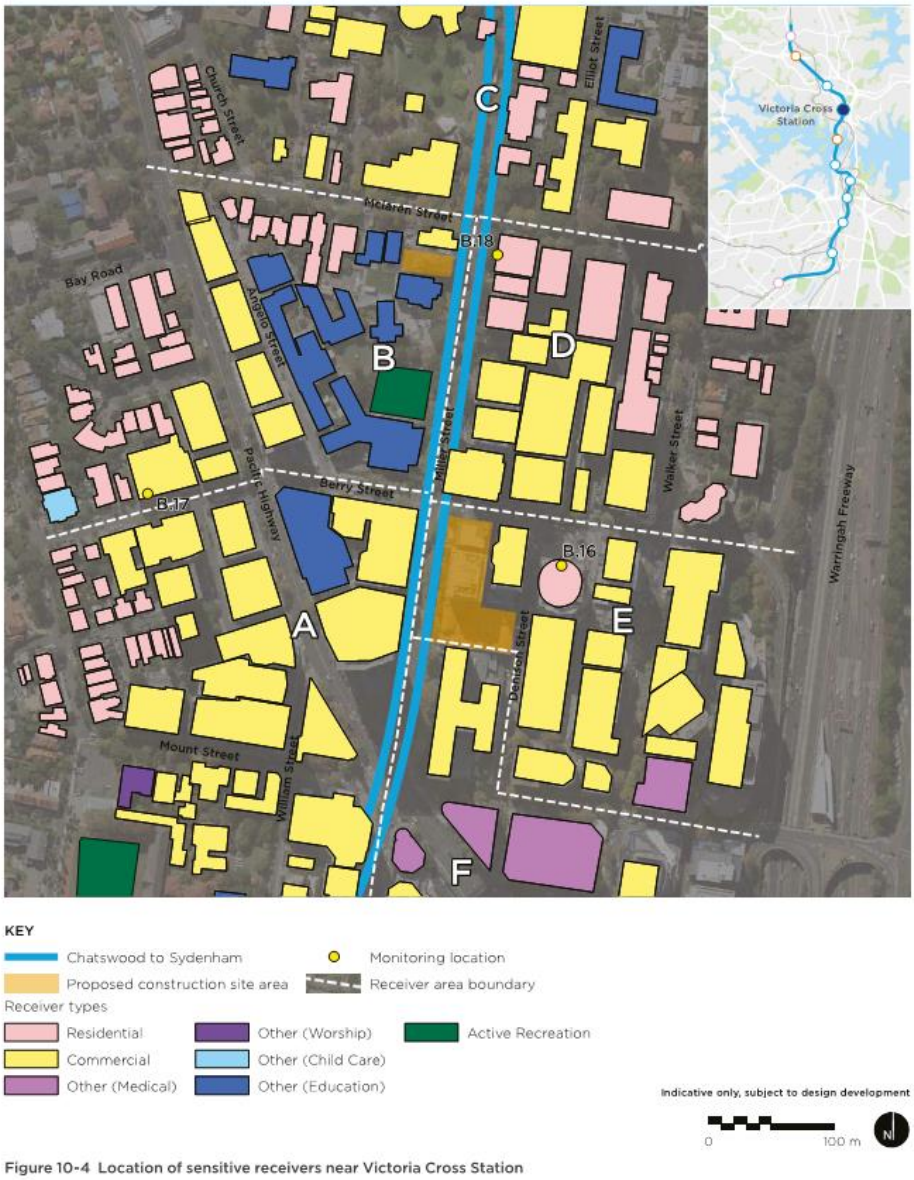


Figure 10-4 Location of sensitive receivers near Victoria Cross Station

Location B.16 was the northern balcony of Unit 3004 / 77-81 Berry Street, North Sydney. The ambient noise logger monitored noise levels between Tuesday 1st September 2015 and Tuesday 15th September, 2015. Noise levels measured at Location B.16 are considered to be representative of both the nearest noise sensitive receiver location to the proposed development and the expected level incident upon the most exposed future facade of the proposed Denison Street development.

Instrumentation for the survey consisted of a Svantek 957 environmental noise logger (serial number 20667) fitted with microphone windshields. Calibration of the loggers was checked prior to and following the measurements. Drift in calibration did not exceed ±0.5 dBA. All equipment carried appropriate and current NATA (or manufacturer) calibration certificates.

Charts presenting summaries of the measured daily noise data are attached in **Appendix B**. The charts present each 24 hour period by incorporating the L_{A1}, L_{A10}, L_{Aeq} and L_{A90} noise levels for the corresponding 15 minute periods.

The measured data has been filtered to remove periods affected by adverse weather conditions, such as excessively windy or rainy periods, recorded by the Bureau of Meteorology at the Observatory Hill weather station so that the weather affected data could be excluded. The filtered data is shown in **Appendix B**.

The measurement data at the monitoring location clearly demonstrates the influence of road traffic noise from the Warringah and Cahill Expressways, surrounding road networks and general mechanical plant hum from other commercial developments in the area.

3.2 Unattended Noise Monitoring – Part 3A Acoustic Report

As part of the original Development Application for the Denison Street Development, Aurecon prepared Part 3A Acoustic Report, reference 29239-008 (Rev2), dated 2 April 2009. Section 5 of this report provides the results of a noise survey conducted between Thursday 19th February, 2009 and Monday 22nd February, 2009.

The noise survey consisted of a long term noise logger being setup on the roof of 88 Walker Street, with additional spot measurements being taken at various street level locations. The locations of the noise measurements are shown in **Figure 11** below. Daily noise logging graphs are shown in **Appendix C**.

Figure 11 Part 3A Acoustic Report Monitoring Locations

Site 1 – Roof Level 88 Walker St – Noise logging location
Site 2 – Roof Level 88 Walker St
Site 3 – Street level Walker St
Site 4 – Street level Spring St
Site 5 – Street level Denison St
Site 6 – Street level Little Spring St

3.3 Noise Monitoring Results

In order to assess the acoustical implications of the development at nearby sensitive receivers, such as the residences in the Beaumonde Tower, the measured background noise data was processed in accordance with the Environmental Protection Authority (EPA) *Industrial Noise Policy* (INP, January 2000).

The Rating Background Noise Level (RBL) is the background noise level used for assessment purposes at the nearest potentially affected receiver. It is the 90th percentile of the daily background noise levels during each assessment period, being day, evening and night. RBL levels $L_{A90\ (15minute)}$ and L_{Aeq} noise levels are presented in **Table 1**.

Data affected by adverse meteorological conditions and by spurious and uncharacteristic events has been excluded from the results, and also excluded from the data used to determine the noise emission criteria.

Table 1 Measured Ambient Noise Levels Corresponding to EPA Industrial Noise Policy Assessment Time Periods

Measurement Location	Daytime[1] 7:00 am to 6:00 pm		Evening[1] 6:00 pm to 10:00 pm		Night-time[1] 10:00 pm to 7:00 am	
	RBL[2]	LAeq[3]	RBL[2]	LAeq[3]	RBL[2]	LAeq[3]
Unit 3004 / 77-81 Berry Street 1-15 Sep '15	65 dBA	68 dBA	63 dBA	65 dBA	52 dBA	62 dBA
88 Walker Street 19-22 Feb '09	66 dBA	66 dBA	63 dBA	63 dBA	59 dBA	61 dBA

Note 1: For Monday to Saturday, Daytime 7:00 am – 6:00 pm; Evening 6:00 pm – 10:00 pm; Night-time 10:00 pm – 7:00 am. On Sundays and Public Holidays, Daytime 8:00 am – 6:00 pm; Evening 6:00 pm – 10:00 pm; Night-time 10:00 pm – 8:00 am

Note 2: The RBL noise level is representative of the "average minimum background sound level" (in the absence of the source under consideration), or simply the background level.

Note 3: The L_{Aeq} is the energy average sound level. It is defined as the steady sound level that contains the same amount of acoustical energy as a given time-varying sound.

The results from both measurement surveys, despite their different locations and measurement time periods, are remarkably similar with the exception of the RBL determined during the night-time period. The Aurecon report notes that the noise environment on top of the roof at 88 Walker Street (Site 1 and 2) was dominated by rooftop HVAC equipment from the various surrounding buildings. This is evident from relatively consistent noise levels throughout the day period.

3.3.1 Road Traffic Noise

In order to assess road traffic noise incident on the proposed development, the data obtained from the noise logging has been processed to establish representative ambient noise levels during defined standard time periods.

For office developments, the $L_{Aeq(1hour)}$ descriptor is reported and represents the maximum repeatable logarithmic average noise energy during the measurement period .

These results are presented in **Table 2** below.

Table 2 Measured L_{Aeq} Road Traffic Noise Descriptors (dBA)

Measurement Location	$L_{Aeq(1hour)}$ Day	$L_{Aeq(1hour)}$ Night
Unit 3004 / 77-81 Berry Street 1-15 Sep '15	68 dBA	62 dBA
88 Walker Street 19-22 Feb '09	66 dBA	61 dBA

The daytime $L_{Aeq(1hour)}$ is the appropriate external noise design level for the determination of internal noise levels for commercial developments.

4 NOISE INTRUSION CRITERIA

4.1 Road Traffic Noise Intrusion

4.1.1 AS/NZS 2107:2000

Recommended ambient noise levels for office spaces are given in a number of publications including Table 1 of Australian Standard AS/NZS 2107:2000 "*Acoustics - Recommended design sound levels and reverberation times for building interiors*". This document recommends satisfactory and maximum internal noise levels for building interiors based on room designation and location to of the development relative to external noise sources.

Internal noise levels due to the combined contributions of external noise intrusion and mechanical ventilation plant should not exceed the maximum levels recommended in this Standard. The levels for areas relevant to this development are given in **Table 3** below. The mid to maximum points of the internal noise level ranges are generally adopted as the internal design noise criteria for noise intrusion. In this report we will confine our recommendations to dBA levels.

Table 3 Recommended Design Sound Levels

Type of Occupancy/Activity	Recommended Design Sound Level, AS/NZS 2107:2000, dBA		Project Design Noise Level [1]	
	Satisfactory	Maximum	Approx. RC	dBA
Office Buildings				
Board and Conference Rooms	30	40	30	**35**
Corridors and Lobbies	45	50	43	**48**
General Office Areas	40	45	40	**45**[2]
Private Offices	35	40	33	**38**
Reception Areas	40	45	38	**43**
Public Buildings - restaurants and cafeterias				
Coffee bars / restaurants	45	55	45	**50**
Shop Buildings				
Small retail stores (general)	45	50	42	**47**
Studio Buildings[3]				
Film or television studio	25	30	25	**30**

Note 1: Recommended level for mechanical services noise and intrusive noise, combined

Note 2: It is often desirable to design office areas to the maximum noise levels recommended in AS/NZS 2107:2000 to help improve the acoustic privacy conditions between spaces, particularly open plan areas and areas adjoining meeting rooms/consultation rooms

Note 3: For New Broadcast, the recommended levels given in AS/NZ 2107:2000 are overly conservative and out of touch with the reality of modern digital and close mic recording practises. A lower noise level is more appropriate for drama and musical recording studios.

For most of these areas, the design noise levels should be considered as the noise target, as noise levels that are too low can be just as problematic (through creating poor speech privacy) as noise levels that are too high (poor intelligibility and annoyance).

Generally, where the final noise levels are within +/- 2 dB of the specified level given below, the design criteria will be considered met. Both the upper and lower limits will need to be satisfied especially where privacy is important or where noise intrusion to be avoided.

5 ENVIRONMENTAL NOISE EMISSIONS CRITERIA

5.1 North Sydney Development Control Plan 2013 (NSDCP 2013)

North Sydney Council's NSDCP 2013 supports the implementation of the provisions to North Sydney Local Environmental Plan 2013 (NSLEP 2013). Although the DCP provisions are not legally binding, they provide additional guidance and are given weight in the assessment of all development applications.

NSDCP 2013 came into force in on 13th September, 2013 and supersedes all other development control plans previously adopted by Council, including the North Sydney Development Control Plan 2002 referenced in the 2009 Part 3A Acoustic Report.

Noise emission criteria for Commercial and Mixed Use Developments are given in Section 2 of Part B of the NSDCP 2013. The Provisions contained in Section 2.3.2 are called up as P1 to P8, and are reproduced below:

P1. Noise emission associated with the operation of non-residential premises or non-residential components of a building must not exceed the maximum 1 hour noise levels ($L_{Aeq\ 1\ Hour}$) specified in Table B-2.3.

Table 4 NSDCP 2013 – Table B-2.3 - Noise Emission Limits

Time of Period			Max 1 hour noise level ($L_{Aeq\ 1\ Hour}$)[1]
Day	**Week**	**Time**	
Weekday	Day	7am – 6pm	60 dBA
	Evening	6pm-10pm	50 dBA
	Night	10pm-7am	45 dBA
Weekend	Day	7am – 6pm	60 dBA
	Evening	6pm-10pm	50 dBA
	Night	10pm-7am	45 dBA

Note 1: $L_{Aeq\ (1hour)}$ readings are to be measured during the noisiest 1 hour period between Day – 7/8am to 6/7pm, Evening – 6/7pm – 10pm and Night – 10pm to 7/8am.

P2. In terms of determining the maximum noise levels as required by P1 above, the measurement is to be taken at the property boundary of the nearest residential premises. Within a mixed use development, the boundary is taken to be nearest floor ceiling or wall to a residential dwelling on the site.

P3 Despite P1 above, the noise emission associated with the operation of non-residential premises or non-residential components of a building must not exceed 5 dBA above the background maximum 1 hour noise level ($L_{A90\ 1\ Hour}$) during the day and evening and not exceeding the background level at night when measured at the boundary of the property.

Note: NSDCP 2013 incorrectly references the background maximum 1 hour noise level as $L_{Aeq\ 1\ Hour}$ rather than $L_{A90\ 1\ Hour}$.

P4 Council may require the submission of an Acoustic Report to ensure compliance with P1 above.

P5 Plant and machinery should incorporate noise reduction measures to minimise their impacts.

P6 Developments should be designed and / or incorporate features that reduce noise transmission.

P7 Where practical, development should incorporate adequate measures for tonal, low frequency, impulsive, or intermittent noise.

P8 Developments must comply with EPA Industrial Noise Policy 2000 in particular the modification required for acceptable noise level (ANL).

5.1.1 NSDCP 2013 – Section 8 - Outdoor Dining and Display of Goods on the Footpath

Section 8.4.1 of NSDCP 2013, Outdoor Dining and Display of Goods on the Footpath, provides the following objectives and provisions with respect to noise:

Objectives

O1 To minimise acoustic impacts on nearby residents.

Provisions

P1 Live or recorded entertainment such as music, broadcast programs or the like is not permitted within outdoor dining or display areas.

5.1.2 Comparison of North Sydney Development Control Plan 2013 (NSDCP 2013) to DCP 2002

The noise emission criteria given in NSDCP 2013 are 5 dBA to 10 dBA higher than those in NSDCP 2002 referenced in the 2009 Part 3A Acoustic Report. This comparison is given in Table 5 below.

Table 5 NSDCP 2013 – Table B-2.3 - Noise Emission Limits

Time of Period			Max 1 hour noise level ($L_{Aeq\ 1\ Hour}$)[1]	Max 1 hour noise level ($L_{Aeq\ 1\ Hour}$)[1]
Day	**Week**	**Time**	**NSDCP 2002**	**NSDCP 2013**
Weekday	Day	7am – 6pm	55 dBA	60 dBA
	Evening	6pm-10pm	45 dBA	50 dBA
	Night	10pm-7am	40 dBA	45 dBA
Weekend	Day	7am – 6pm	50 dBA	60 dBA
	Evening	6pm-10pm	45 dBA	50 dBA
	Night	10pm-7am	40 dBA	45 dBA

Note 1: $L_{Aeq\ (1hour)}$ readings are to be measured during the noisiest 1 hour period between Day – 7/8am to 6/7pm, Evening – 6/7pm – 10pm and Night – 10pm to 7/8am.

Both the DCP 2002 and NSDCP 2013 require that the noise emission must not exceed 5 dBA above the background maximum 1 hour noise level ($L_{Aeq\ 1\ Hour}$) during the day and evening and not exceeding the background level at night when measured at the boundary of the property. This requirements is effectively the same as the intrusiveness requirement provided for in the NSW EPA' s INP.

5.2 Industrial Noise Policy

Responsibility for the control of noise emissions in New South Wales is vested in Local Government and the NSW Environment Protection Authority (EPA).

The EPA oversees the Industrial Noise Policy (INP) which provides a framework and process for deriving noise criteria. The INP criteria for industrial noise sources have two components:

- Controlling the intrusive noise impacts for residents and other sensitive receivers in the short term; and
- Maintaining noise level amenity of particular land uses for residents and sensitive receivers in other land uses.

5.2.1 Intrusive Noise Impacts (Residential Receivers)

The INP states that the noise from any single source should not intrude greatly above the prevailing background noise level. Industrial noises are generally considered acceptable if the equivalent continuous (energy-average) A-weighted level of noise from the source (LAeq), measured over a 15 minute period, does not exceed the background noise level measured in the absence of the source by more than 5 dB(A). This is often termed the Intrusiveness Criterion.

The 'Rating Background Level' (RBL) is the background noise level to be used for assessment purposes and is determined by the methods given in the INP. Using the rating background noise level approach results in the intrusiveness criterion being met for 90% of the time. Adjustments are to be applied to the level of noise produced by the source that is received at the assessment point where the noise source contains annoying characteristics such as tonality or impulsiveness.

5.2.2 Protecting Noise Amenity (All Receivers)

To limit continuing increase in noise levels, the maximum ambient noise level within an area from industrial noise sources should not normally exceed the acceptable noise levels specified in Table 2.1 of the INP. That is, the ambient L_{Aeq} noise level should not exceed the level appropriate for the particular locality and land use. This is often termed the 'Background Creep' or Amenity Criterion.

The amenity assessment is based on noise criteria specified for a particular land use and corresponding sensitivity to noise. The cumulative effect of noise from industrial sources needs to be considered in assessing the impact. These criteria relate only to other continuous industrial-type noise and do not include road, rail or community noise. If the existing (measured) industrial-type noise level approaches the criterion value, then the Policy sets maximum noise emission levels from new sources with the objective of ensuring that the cumulative levels do not significantly exceed the criterion.

5.2.2.1 Area Classification

The INP characterises the "Urban" noise environment as an area with an acoustical environment that:

- Is dominated by "urban hum" or industrial noise source
- Has through traffic with characteristically heavy and continuous traffic flows during peak periods
- Is near commercial or industrial districts
- Has any combination of the above

…where "urban hum" means the aggregate unidentifiable sound of man and mostly due to traffic-related sound sources.

The area surrounding the proposed development falls under the "Urban" area classification. For commercial and residential receivers in an urban area, the recommended criteria are shown in **Table 6** below.

Table 6 INP – Recommended L_{Aeq} Noise Levels from Industrial Noise Sources

Type of Receiver	Indicative Noise Amenity Area	Time of Day[1]	Recommended L_{Aeq} Noise Level (dBA)[2]	
			Acceptable	Maximum
Residence	Urban	Day	60	65
		Evening	50	55
		Night	45	50
Commercial premises	All	When in use	65	70

Note 1: For Monday to Saturday, Daytime 7:00 am – 6:00 pm; Evening 6:00 pm – 10:00 pm; Night-time 10:00 pm – 7:00 am. On Sundays and Public Holidays, Daytime 8:00 am – 6:00 pm; Evening 6:00 pm – 10:00 pm; Night-time 10:00 pm – 8:00 am

Note 2: The L_{Aeq} is the energy average sound level. It is defined as the steady sound level that contains the same amount of acoustical energy as a given time-varying sound.

When the existing noise level from industrial noise sources is close to the "Acceptable Noise Level" (ANL) given above, noise from the new source must be controlled to preserve the amenity of the area in line with the requirements of the INP.

Where existing road traffic noise is high enough to render stationary noise sources effectively inaudible, the ANL can be modified so that the amenity criteria is not unduly stringent in an environment where road traffic noise is the dominant source of environmental noise. If all the conditions below are satisfied, the ANL becomes $L_{Aeq,traffic}$ minus 10dB(A). The conditions are:

- The road traffic noise is the dominant noise source
- The existing noise is 10dB(A) or more above the acceptable ANL for the area
- It is highly unlikely the road traffic noise levels would reduce in the near future

5.2.3 Project Specific INP Noise Emission Criteria

The intrusive and amenity criteria for industrial noise emissions derived from the measured data are presented in **Table 7**. The noise levels measured at unit 3004 / 77-81 Berry Street during September 2015 are considered the most relevant and have been used for the purpose of determining the operational noise limits associated with the development.

For each assessment period, the lower (i.e. the more stringent) of the amenity or intrusive criteria are adopted. These are shown in bold text in **Table 7.** In this case the area surrounding the site is not influenced by industrial noise sources so the amenity criterion becomes equal to the Recommended Amenity Criteria for Residences in an Urban Area (ANL or Acceptable Noise Level).

Table 7 INP Project Specific Noise Criteria

Location	Time of Day	ANL (L_{Aeq})[1] (dBA)	Measured RBL (L_{A90})[2] (dBA)	Measured L_{Aeq} Noise Level (dBA)	Intrusive L_{Aeq} Criterion for New Sources (dBA)	Amenity L_{Aeq} Criterion for New Sources (dBA)[4]
Beaumonde residences	Day	60	65	68	69	**58**
	Evening	50	63	65	68	**55**
	Night	45	52	62	57	**52**

Note 1: ANL Acceptable Noise Level for an Urban area
Note 2: RBL Rating Background Level based on 2015 measurements
Note 3: Project Specific Criteria are shown in bold
Note 4: This is based on the assumption that the existing noise levels are unlikely to decrease in the future

5.2.4 Overall Project Specific Noise Emission Criteria

The noise emission criteria, taking into account both the INP and NSDCP 2013 controls on noise emissions, are given below in Error! Reference source not found..

Table 8 Overall Project Specific Noise Criteria

Location	Time of Day[1]	Max 1 hour noise level ($L_{Aeq\ Hour}$)
Beaumonde residences	Day	60
	Evening	50
	Night	45

Note 1: Day – 7/8am to 6/7pm, Evening – 6/7pm – 10pm and Night – 10pm to 7/8am.

5.3 Traffic Generating Development

In 1999, the Environment Protection Authority published *Environmental criteria for road traffic noise* (ECRTN). This policy was used in the original Part 3A Acoustic Report to establish the traffic noise criteria as follows:

- New traffic noise $L_{Aeq,1hour}$ ≤ Existing $L_{Aeq,1hour}$ + 2 dBA

  Note: the original Part 3A Acoustic Report incorrectly quoted referenced an LA90 level rather than the LAeq level in the criterion

The NSW Government approved the NSW road noise policy (RNP), to replace the ECRTN for road traffic noise with effect from 1st July 2011. This new policy outlines the range of measures needed to minimise road traffic noise and its impacts. It is intended for use by projects and land use developments that generate additional traffic on existing roads, as well as by determining authorities, regulators involved in the approval and construction of road projects, city and transport planners and policymakers and acoustic specialists to assess and mitigate the impacts of traffic noise from new and redeveloped road projects, and traffic-generating developments on residential and other sensitive lands.

The noise assessment criteria contained in Table 4 of Section 2.3.2 of the RNP should be applied for assessing the impact and of a land use development with the potential to generate additional traffic on local, sub-arterial or arterial roads.

For isolated residences in a commercial zone, internal noise levels are more appropriate in assessing any road traffic noise impacts. Suitable internal noise level targets can be established by using the recommended levels contained in Australian Standard 2107:2000.

Although a relative change in traffic noise levels to noise sensitive receivers, as recommended in the ECRTN, is not a specified criterion in the RNP, an assessment of this change will provide an indication of whether increased traffic noise levels are likely be noticeable or problematic.

6 NOISE INTRUSION ASSESSMENT

6.1 Road Traffic Noise Intrusion

Based upon the measured noise levels indicated in **Table 2**, design noise levels incident upon the proposed development facades are summarised in **Table 9**.

Table 9 Measured L_{Aeq} Road Traffic Noise Descriptors (dBA)

Location	$L_{Aeq(1hour)}$ Day	$L_{Aeq(1hour)}$ Night
Eastern facade	68	62
Northern and Southern facades	65	59
Western facade	58	52

Note 1: The noise levels on the eastern façade were determined by the levels measured on the Beaumonde apartment balcony. Noise levels incident on the other facades of the proposed building are based anticipated shielding and exposure to others sources of traffic noise, such as the Pacific Highway and Millar Street.

The façade is to consist generally of a glazed curtain wall. Since the external noise levels have not varied significantly since the original Part 2 A Acoustic Assessment was prepared, the indicative glazing recommendations contained in Table 10 of the original assessment report remain valid for the eastern elevation. The glazing construction required to meet the internal noise level criterion are given in **Table 10** below.

Table 10 Indicative Glazing Recommendations (for Eastern Façade)

Internal Space	Glazing type	Indicative glazing thickness
Open plan office, reception areas, rest and team rooms	Single glazed	10 mm float or 8.38 mm laminated
	Double glazed	6 mm / 12 mm air gap / 6 mm float glass
Boardroom, meeting rooms, private office	Single glazed	16.76 laminated
	Double glazed	6 mm / 12 mm air gap / 8 mm float glass

Note 1: The noise levels on the eastern façade were determined by the levels measured on the Beaumonde apartment balcony. Noise levels incident on the other facades of the proposed building are based anticipated shielding and exposure to others sources of traffic noise, such as the Pacific Highway and Millar Street.

Detailed design of the glazing will be conducted during design development and detailed design stages of the project to identify and special requirements for the internal spaces that will be located along the building perimeter. This will be particularly relevant for the Studio facades.

Glazing recommendations can also be refined for the different facades of the building, since the western façade in particular will be exposed to lower noise levels than the eastern façade. This will be considered together with other factors such as thermal insulation and structural requirements, in the final façade glazing design.

7 EXTERNAL NOISE EMISSION ASSESSMENT

7.1 Mechanical Plant

Precise mechanical selection for the plant areas is unknown at this stage, as plant selection will take place during the detailed design phase of the project.

It is likely that the criteria set out in **Table 8** will be met through the use of conventional noise control methods (e.g. selection of equipment on the basis of quiet operation and, where necessary, providing enclosures, localised barriers, silencers and lined ductwork).

All mechanical plant and equipment with the potential to operate during the daytime and evening periods (i.e. up until 10.00 pm) would need to be selected, positioned, and, if necessary, treated, to ensure compliance with the limiting noise criteria of 50 dBA at the Beaumonde residences.

Any plant requiring continuous operation (i.e. refrigeration plant and the like) must comply with the 45 dBA limiting night time criterion for surrounding residential receivers.

For the rooftop plantroom, noise emission will need to be limited to a maximum sound power level of 95 dBA if open on the northern façade. If shielding can be provided to this building façade at plantroom level, total noise emission levels of greater than 100 dBA can be accommodated. This will likely to easily accommodate cooling tower noise emission levels without further treatment. Other plant items such as chillers and carpark exhaust fans will be reviewed in detail at later development stages.

7.2 Landscaped Terrace area located on Level 2 (at RL 70.2)

The outdoor terrace area located on Level 2 is located approximately 30m from the first south facing balconies of the residences in the Beaumonde tower (situated at approximately RL 97). The terrace area has an approximate area of 1,000 m^2.

There is considerable diversity in the way that people engage in outdoor areas and the noise generated from the terrace area will in large part be a function of how this space is used by the tenant. When the terrace is used for casual seating (such as might be expected for those eating their lunch) the occupants will be engaging in minimal, casual conversation or quiet personal activities such as reading. The likely maximum occupant density during this type of usage is 1 person per 10 m^2 (note: clause D1.13 of the NCC effectively sets the maximum office occupancy density as 1:10m^2.).

When the terrace is used for the occasional corporate function, higher occupancy densities might be expected, with the space used for people to mostly stand and converse. In this usage mode, occupant densities are likely to be higher and noise emission levels also greater. The likely maximum occupant density during this type of usage is 1 person per 5 m^2.

The terrace area is partly enclosed, with a building overhang coving a southern section of the terrace area, and building facades to the east and west renders the acoustic environment partially reverberant. Reflections therefore can play an important role in determining the overall sound pressure levels in the area.

In outdoor terrace areas, the combination of the number of people talking, the style of gathering and the local acoustic environment results in the people talking in a raised voice to overcome the background noise level. This phenomenon is known as with the Lombard effect.

Haynes (Proceedings of Acoustics 2011) suggests that the A-weighted sound power levels for a crowd size, N, can be approximated by:

- L_{WAeq} = 15 log N + 64 dBA

The above equation suggests the following conservative noise levels are likely when the terrace space is heavily utilised for the anticipated usage.

Table 11 Allowable Terrace Noise Levels

Receiver Location (at 30m)	Time of Day[1]	Intrusive L_{Aeq} Criterion for New Sources (dBA)	Maximum expected noise level, dBA (10m2 / person)	Maximum expected noise level, dBA (5 m2 / person)
Beaumonde residences	Day	69	61 dBA	65
	Evening	68	61 dBA	65

Note 1: Day – 7/8am to 6/7pm, Evening – 6/7pm – 10pm and Night – 10pm to 7/8am.

The assessment shows that the noise levels satisfy the intrusiveness criterion during the day and evening period when this space is likely to be used.

Note: the Project Specific Criterion specified in the NSDCP 2013 are not considered relevant to the occasional noise emissions from an outdoor terrace area since the NSDCP 2013 criterion are based on the Amenity Criteria given in the INP, and are therefore relevant to controlling “creeping” background noise levels.

7.3 Loading Bay

The proposed development includes a loading bay located in the lower ground level of the development. Since the loading area is internal to the building, noise emission issues associated with this potential source is unlikely and has not been considered further in this report.

7.4 Additional Road Traffic

Based on Transport and ARUP Assessment of Traffic and Parking Implications (the Traffic Consultant Report) dated November 2016, the proposed development will generate 64 vtph (vehicle trips per hour) during the morning and afternoon peak periods. The traffic generation of the currently approved scheme is estimated to be 61 vtph. Therefore, in terms of additional traffic on nearby streets, a marginal increase in traffic flow is expected due to the proposed S75W amendment to the approved development. The access driveway to the car park and loading dock remains on Little Spring Street

On this basis, the noise level contribution from additional vehicle movements on roads surrounding the proposed mixed use development would be considered to be negligible, being approximately 0.2 dB, and very unlikely to result in an change in the noise impact to the closest sensitive receivers relative to the approved DA Scheme.

8 CONCLUSION

Pulse Acoustics has prepared an Acoustical Assessment of the proposed new commercial office building to be located at 1 Denison Street, North Sydney; on the current site of the Berry Square Shopping Centre. The acoustic impacts of the proposed S75W development have been assessed as being substantially the same as the originally proposed development.

Noise emission criteria have been established and project specific noise limits are summarised in **Section 5.2.4**.

8.1 Sound Insulation

Based upon the findings of this assessment, the development as proposed is suitable on the basis of acoustics. Acceptable internal noise levels can be achieved with appropriate facade glazing installation. Indicative glazing selections are provided in **Section 6.1**.

The glazing specification must be reviewed at the detailed design stage to optimise glass selection and will be based on the combined requirements of acoustics, thermal and structural considerations.

8.2 Mechanical Noise Sources

Mechanical services design information is unavailable at this stage of the development, as plant selection and design, where required, will take place during the detailed design phase of the project.

It is likely that the criteria set out in **Section 5.2.4** will be met through the use of conventional noise control methods and the selection of equipment on the basis of quiet operation.

Any mechanical plant associated with the development should be reviewed for acoustical compliance at the detailed design stage when the mechanical services design is finalised and plant selection has been made.

8.3 Terrace Area

Noise emissions from outdoor terrace areas are highly variable and depend on a number of factors such as space usage and occupancy densities.

The assessment made in **Section 7.2** shows that the INP Intrusiveness Noise Criteria is likely to be satisfied during the day and evening period when this space is likely to be used.

8.4 Additional Traffic

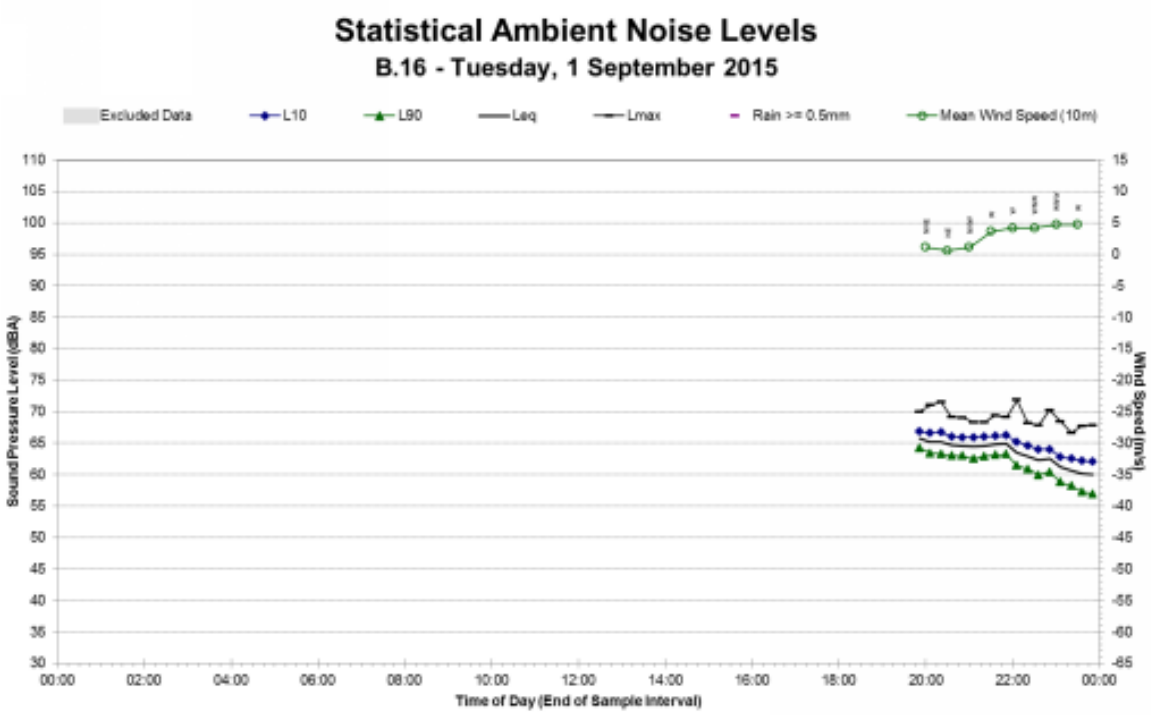
The proposed development will induce a marginal increase in vehicle movement which is unlikely to result in an adverse noise impact to the closest sensitive receivers.

APPENDIX A

The following is a brief description of the acoustic terminology used in this report.

Ambient Sound	The totally encompassing sound in a given situation at a given time, usually composed of sound from all sources near and far.
Audible Range	The limits of frequency which are audible or heard as sound. The normal ear in young adults detects sound having frequencies in the region 20 Hz to 20 kHz, although it is possible for some people to detect frequencies outside these limits.
Character, acoustic	The total of the qualities making up the individuality of the noise. The pitch or shape of a sound's frequency content (spectrum) dictate a sound's character.
Decibel [dB]	The level of noise is measured objectively using a Sound Level Meter. The following are examples of the decibel readings of every day sounds; 0dB the faintest sound we can hear 30dB a quiet library or in a quiet location in the country 45dB typical office space. Ambience in the city at night 60dB Martin Place at lunch time 70dB the sound of a car passing on the street 80dB loud music played at home 90dB the sound of a truck passing on the street 100dB the sound of a rock band 115dB limit of sound permitted in industry 120dB deafening
dB(A)	*A-weighted decibels* The ear is not as effective in hearing low frequency sounds as it is hearing high frequency sounds. That is, low frequency sounds of the same dB level are not heard as loud as high frequency sounds. The sound level meter replicates the human response of the ear by using an electronic filter which is called the "A" filter. A sound level measured with this filter switched on is denoted as dB(A). Practically all noise is measured using the A filter. The sound pressure level in dB(A) gives a close indication of the subjective loudness of the noise.
Frequency	Frequency is synonymous to *pitch*. Sounds have a pitch which is peculiar to the nature of the sound generator. For example, the sound of a tiny bell has a high pitch and the sound of a bass drum has a low pitch. Frequency or pitch can be measured on a scale in units of Hertz or Hz.
Loudness	A rise of 10 dB in sound level corresponds approximately to a doubling of subjective loudness. That is, a sound of 85 dB is twice as loud as a sound of 75 dB which is twice as loud as a sound of 65 dB and so on
L_{max}	The maximum sound pressure level measured over a given period.
L_{min}	The minimum sound pressure level measured over a given period.
L_1	The sound pressure level that is exceeded for 1% of the time for which the given sound is measured.
L_{10}	The sound pressure level that is exceeded for 10% of the time for which the given sound is measured.
L_{90}	The level of noise exceeded for 90% of the time. The bottom 10% of the sample is the L_{90} noise level expressed in units of dB(A).
L_{eq}	The "equivalent noise level" is the summation of noise events and integrated over a selected period of time.

APPENDIX B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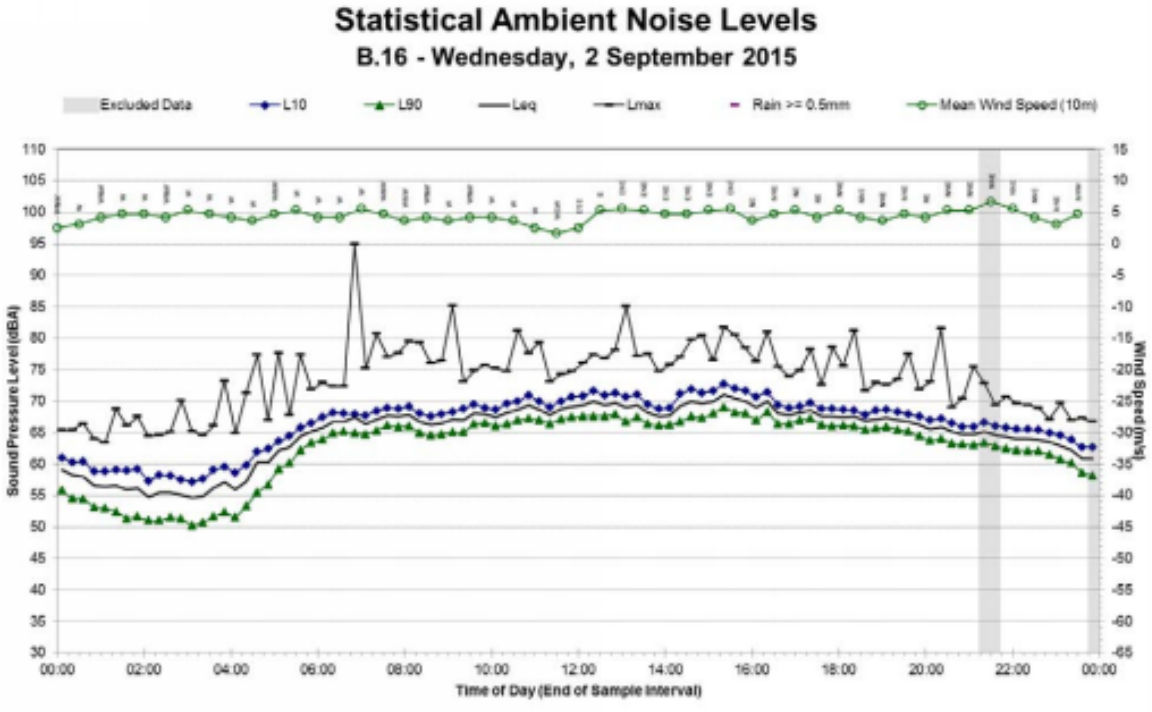
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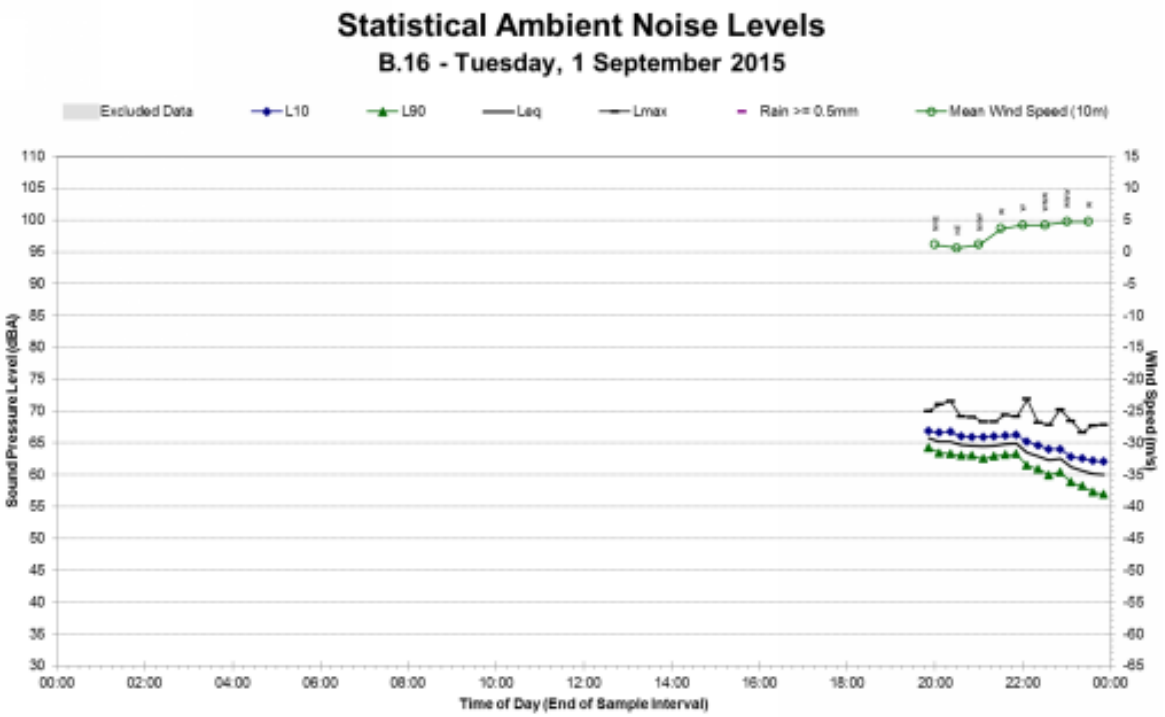
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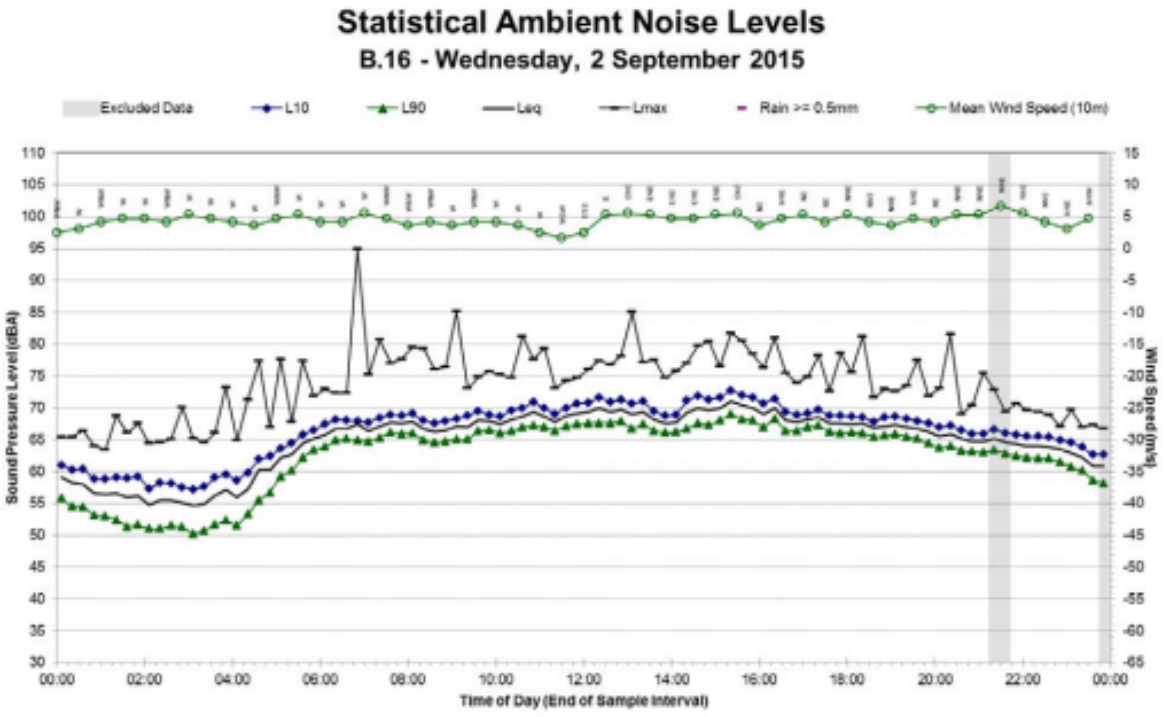
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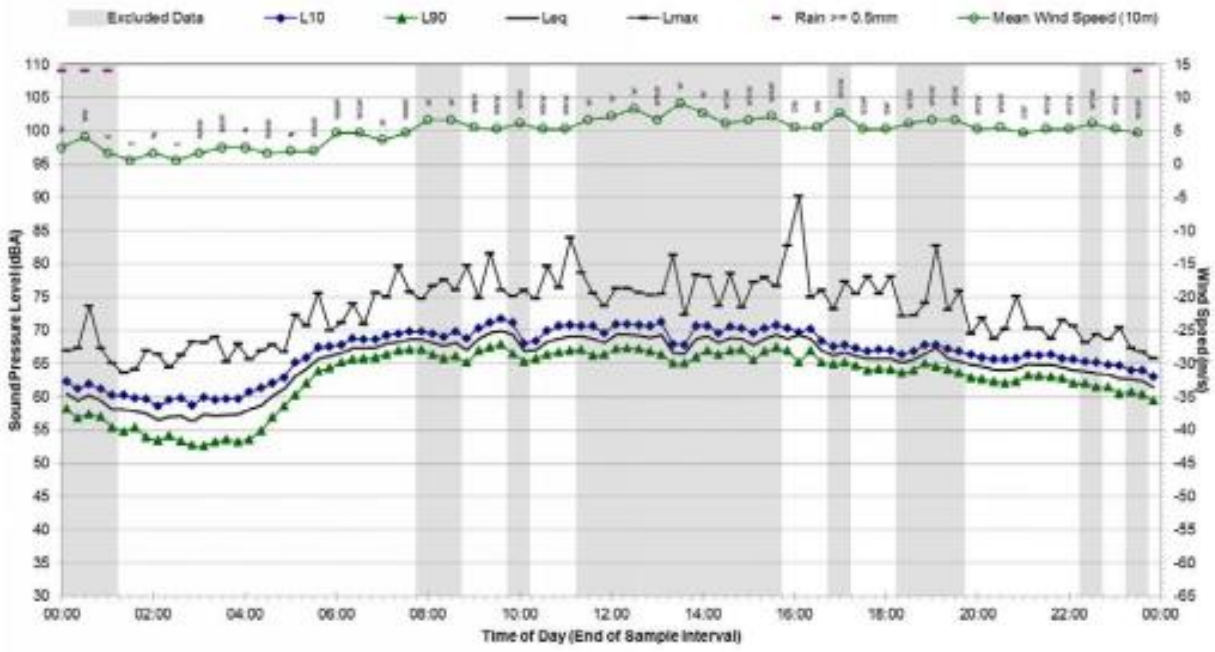

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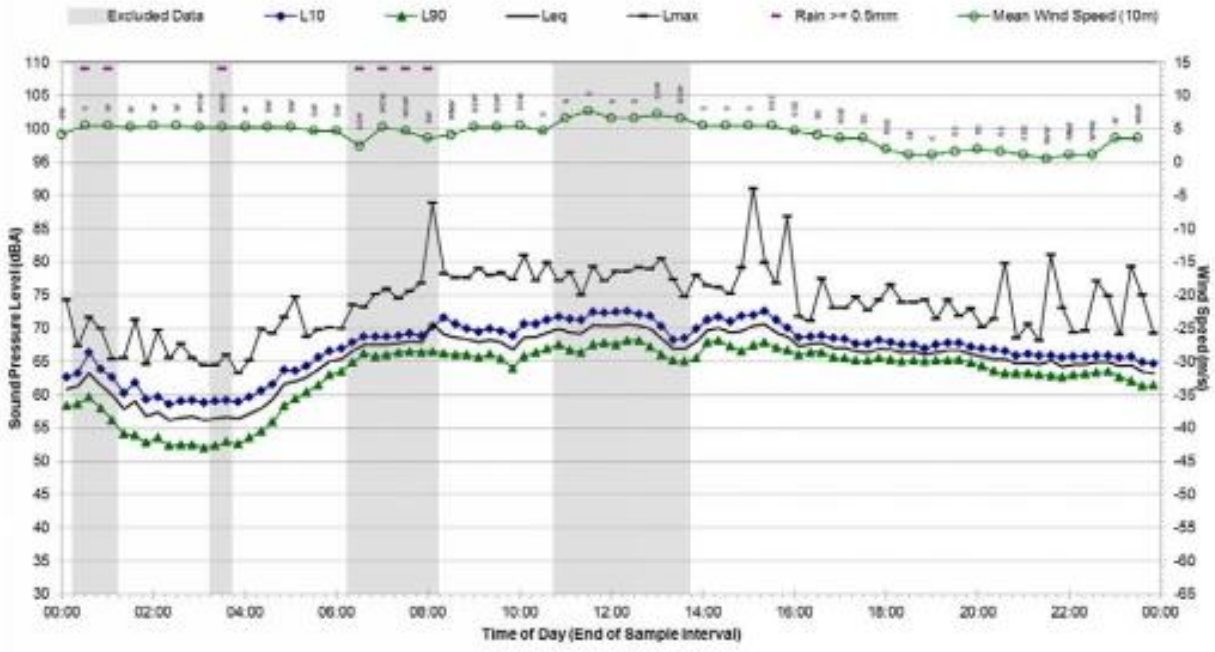

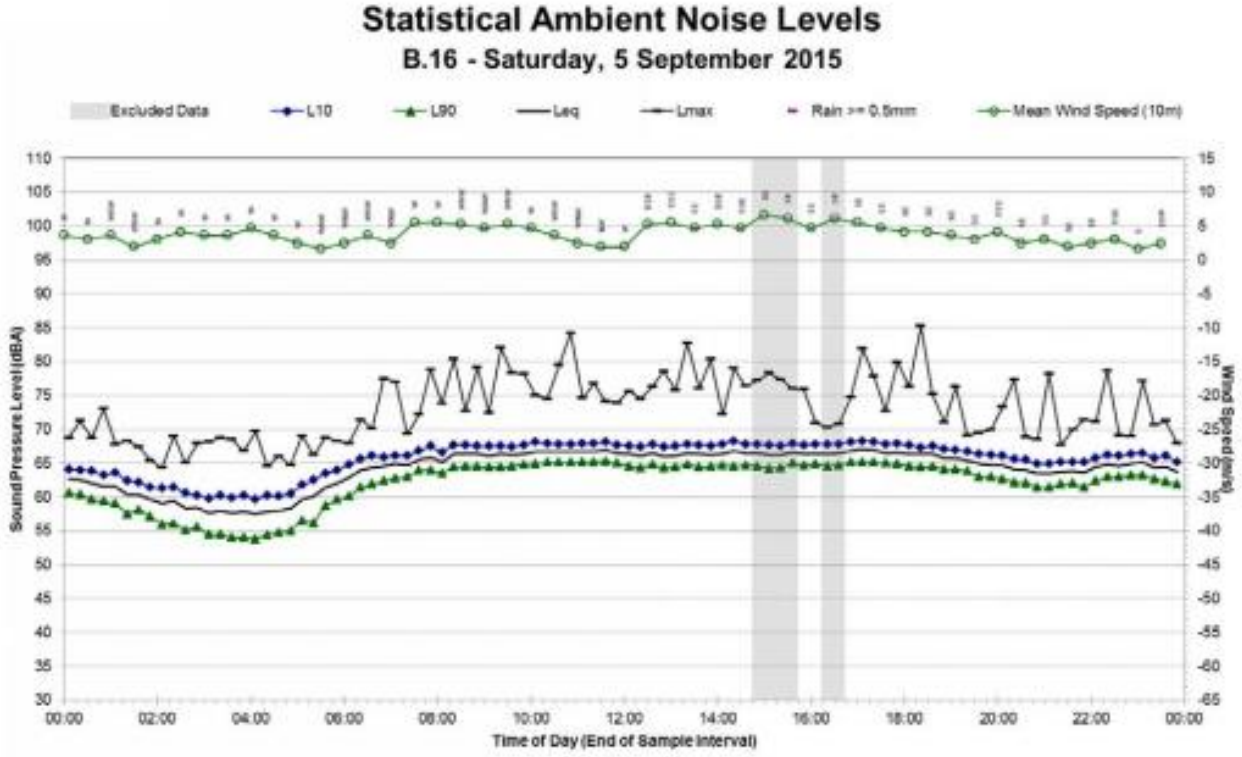
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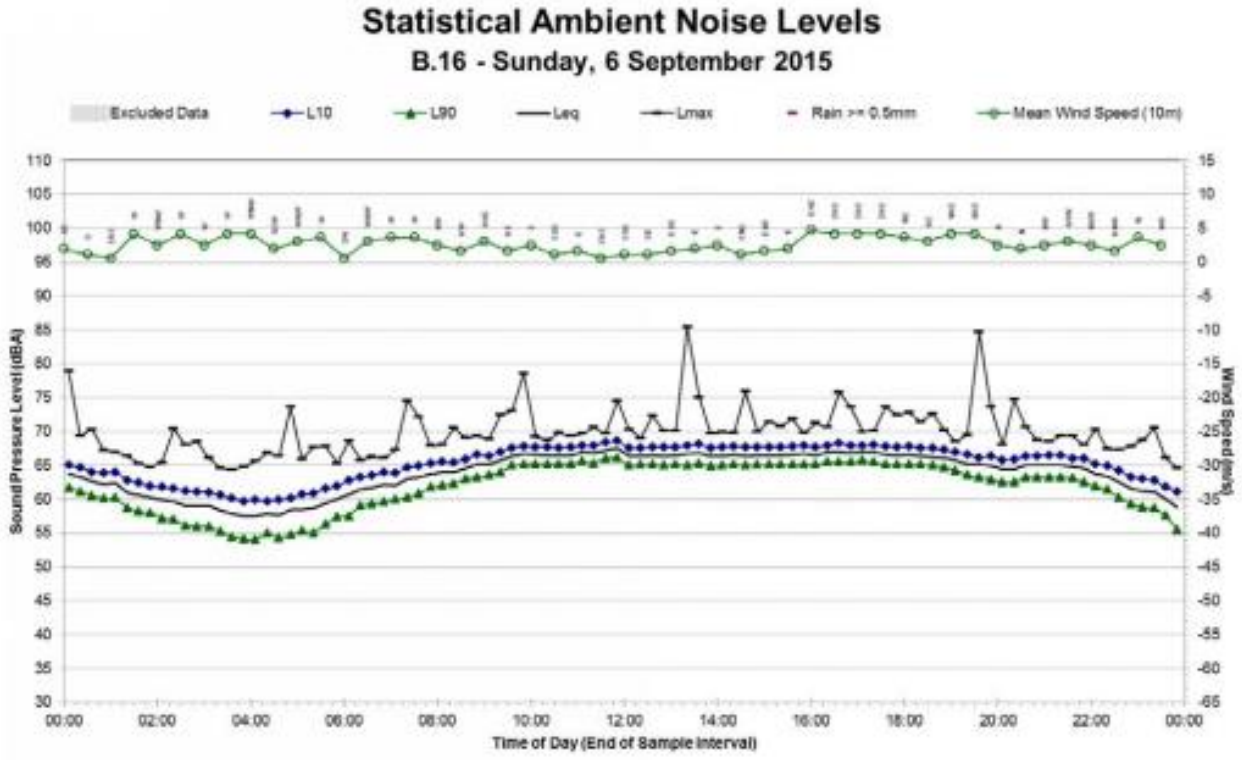
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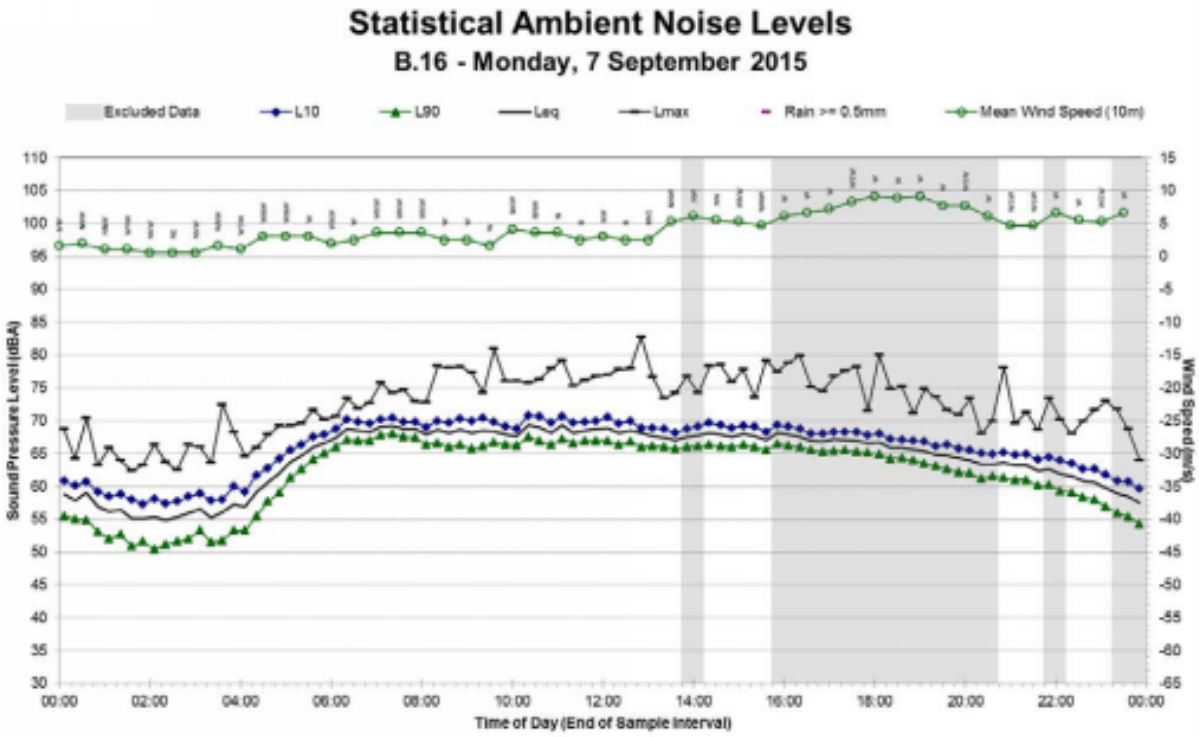
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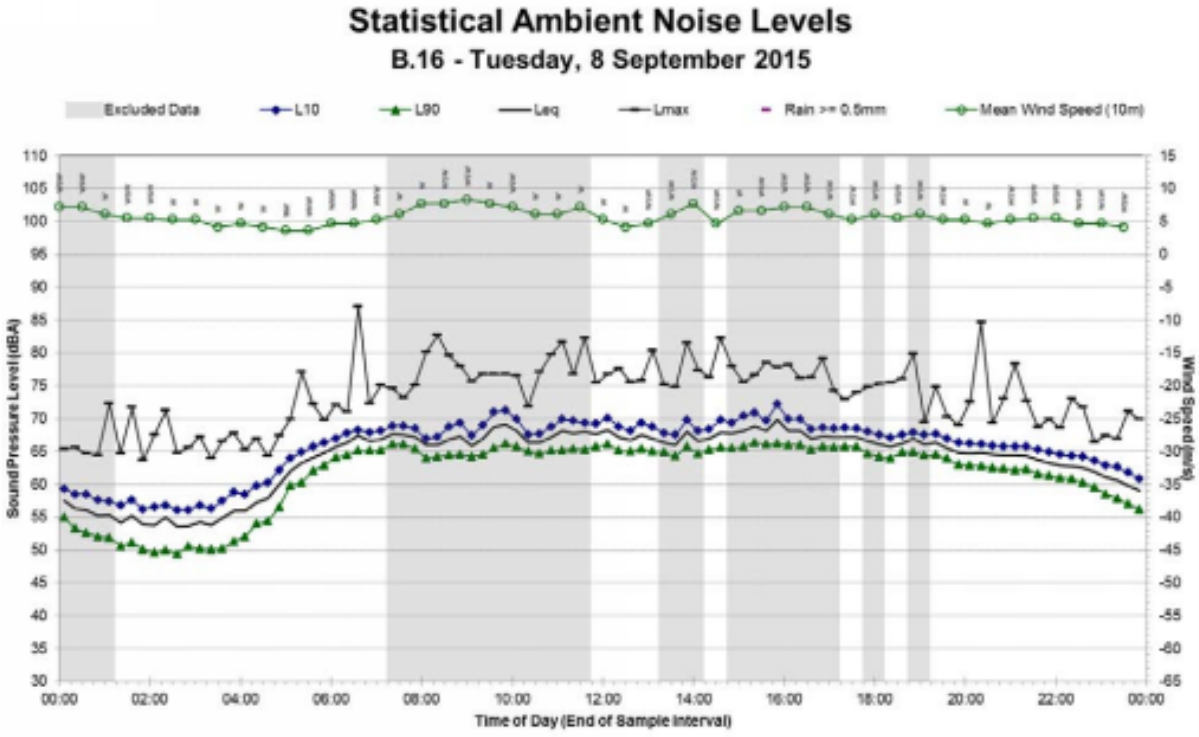
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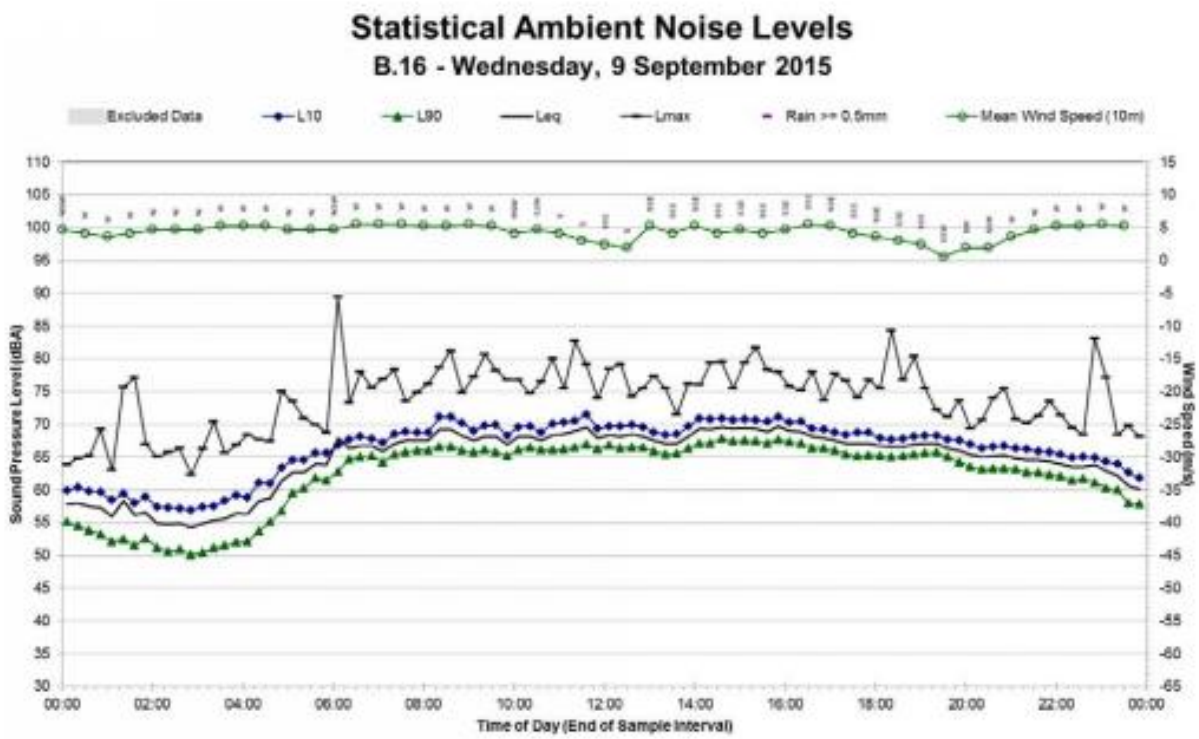
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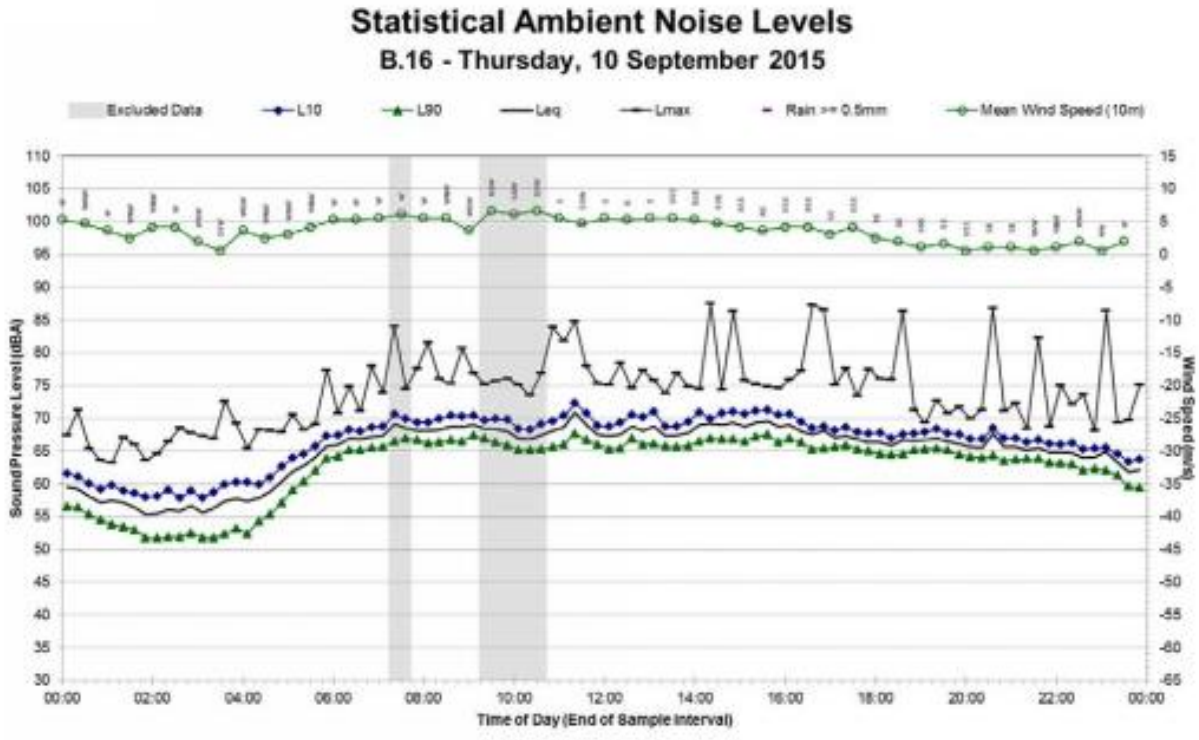
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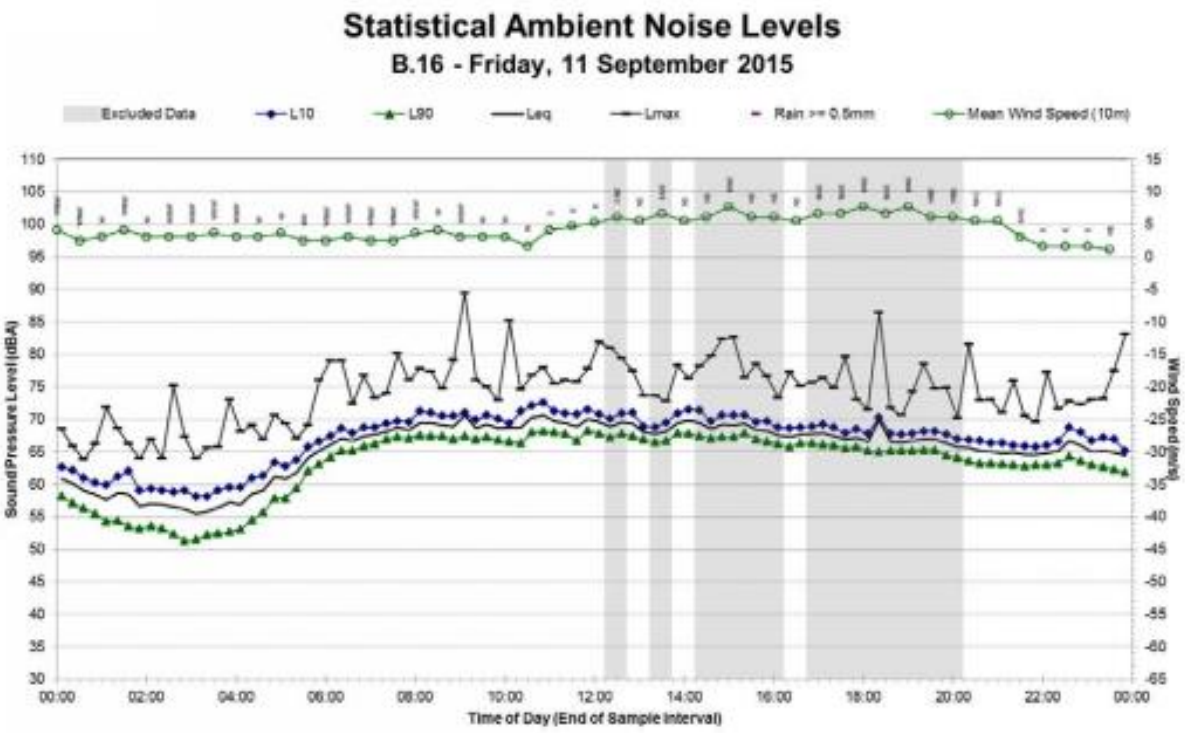
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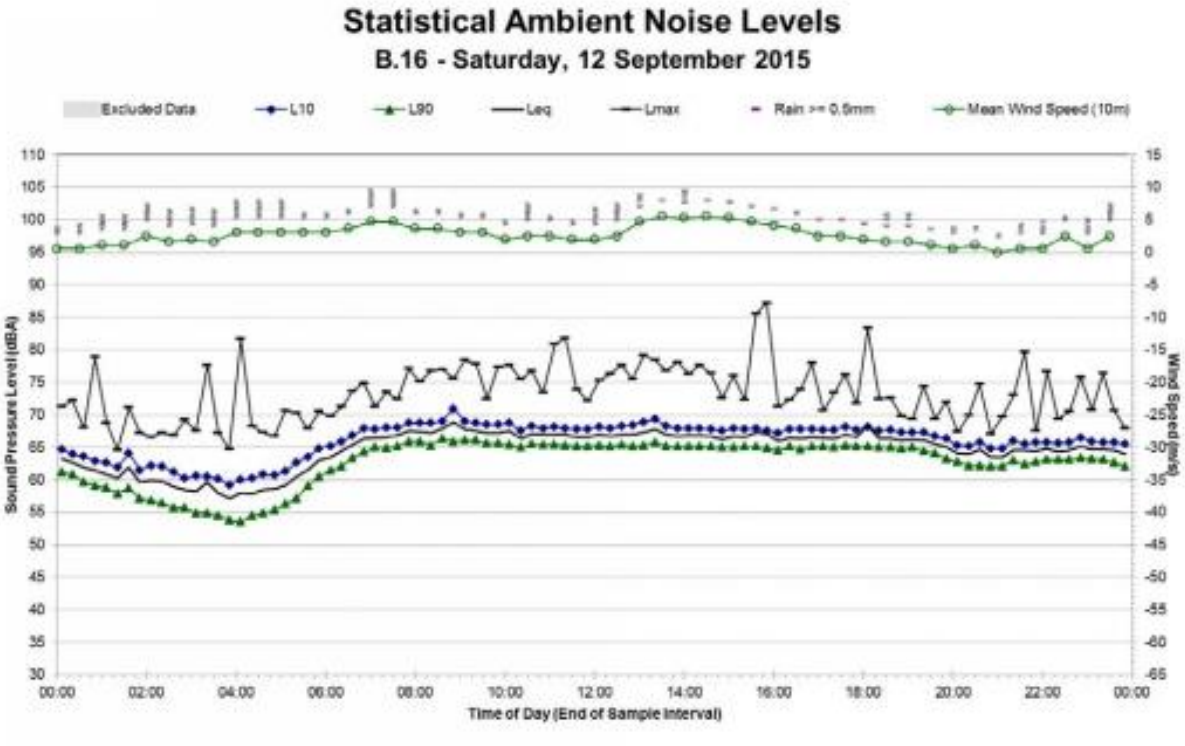
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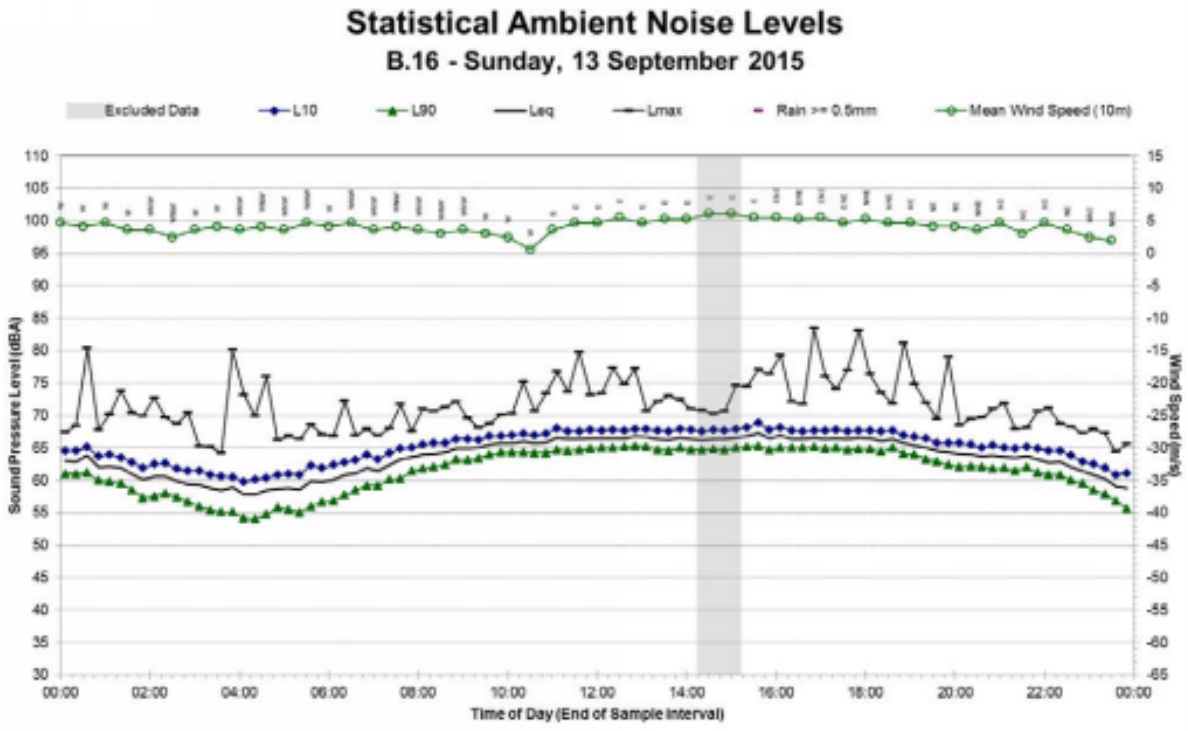
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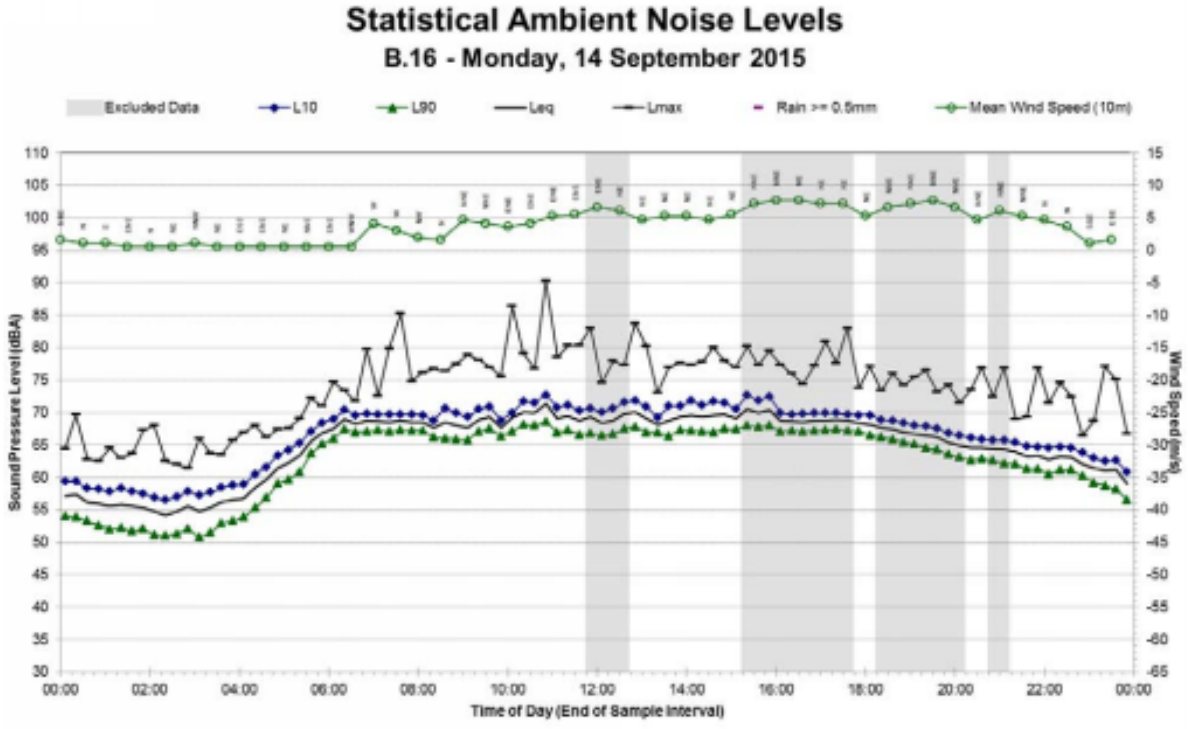
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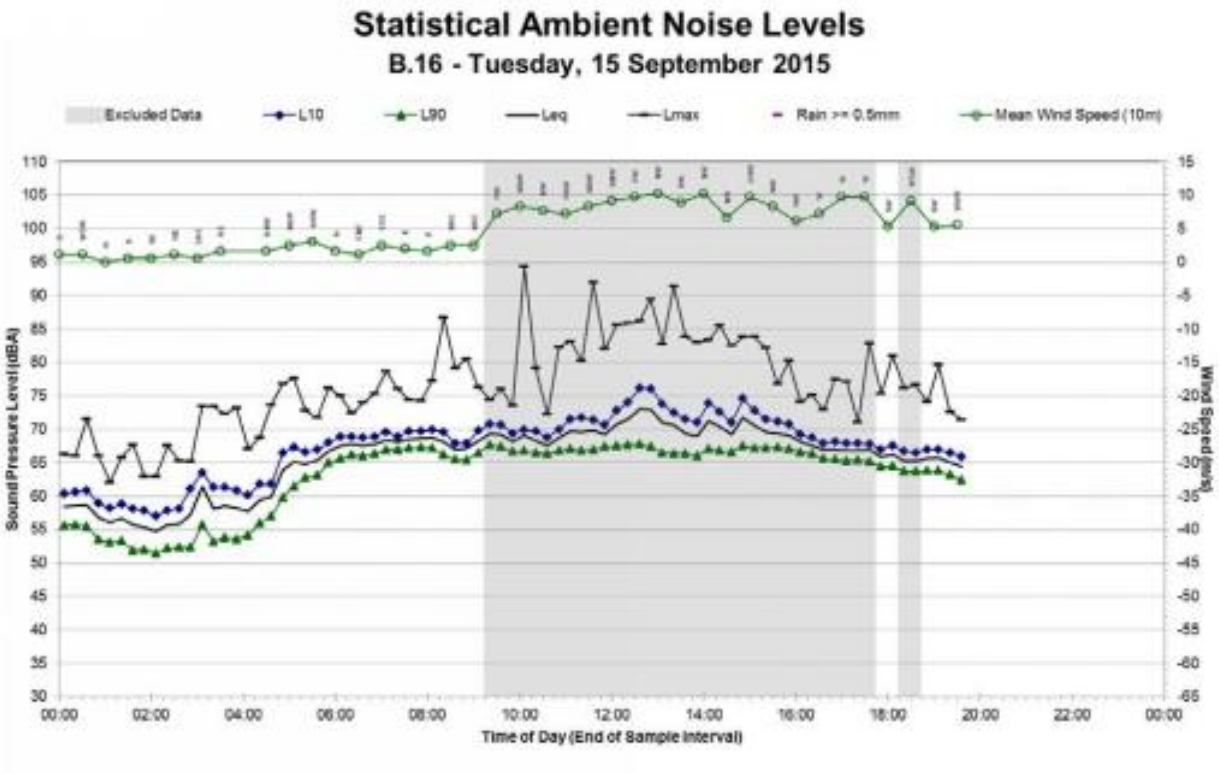
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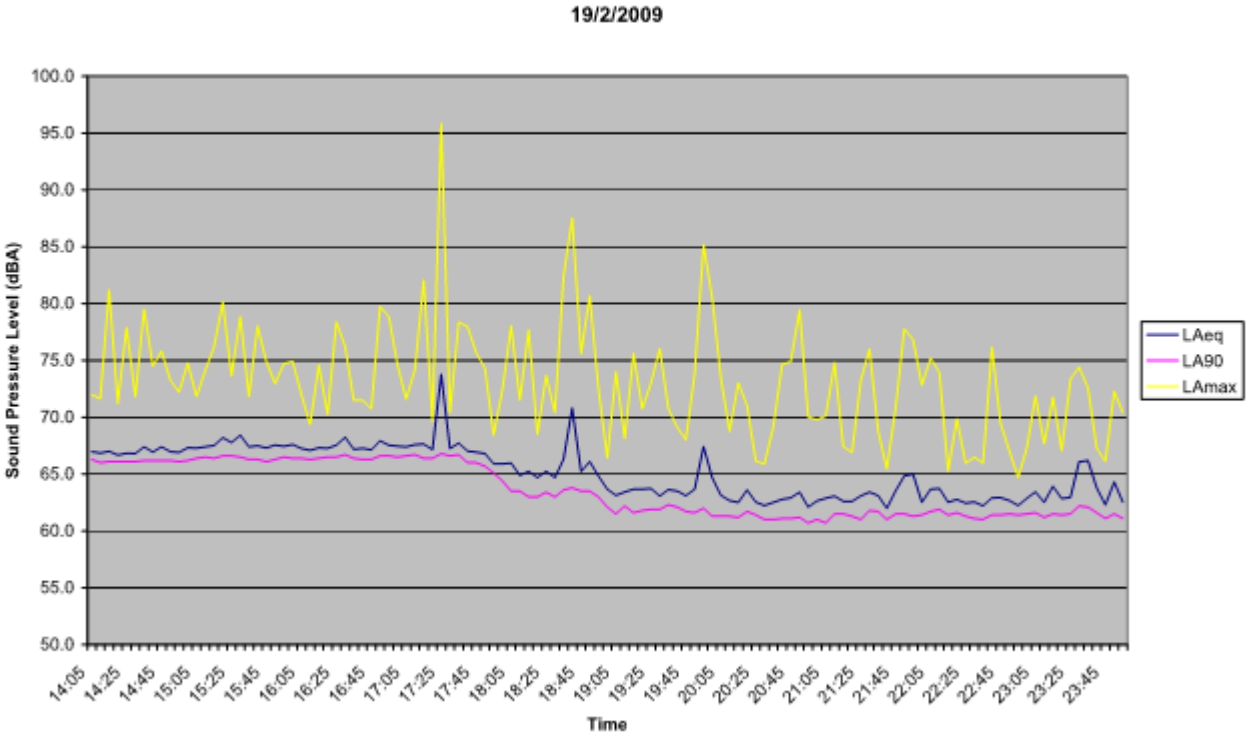
Wind Speed (m/s)
Time of Day (End of Sample Interval)

APPENDIX C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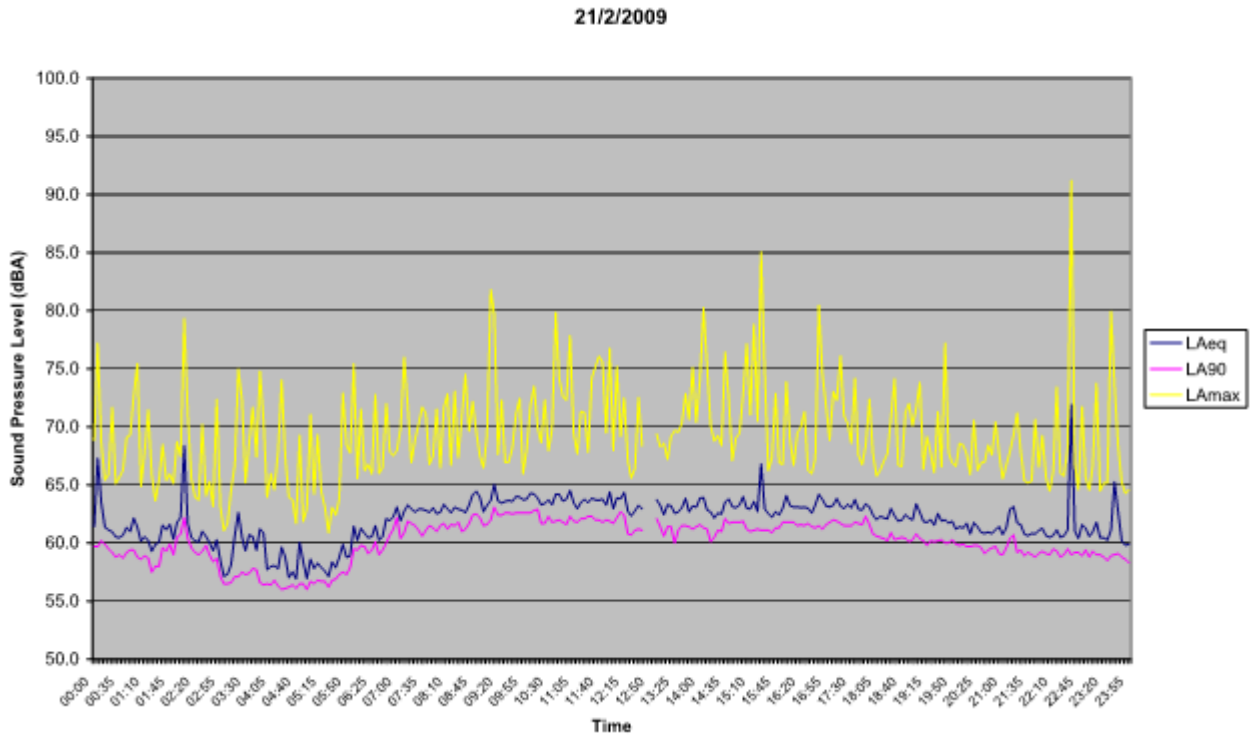
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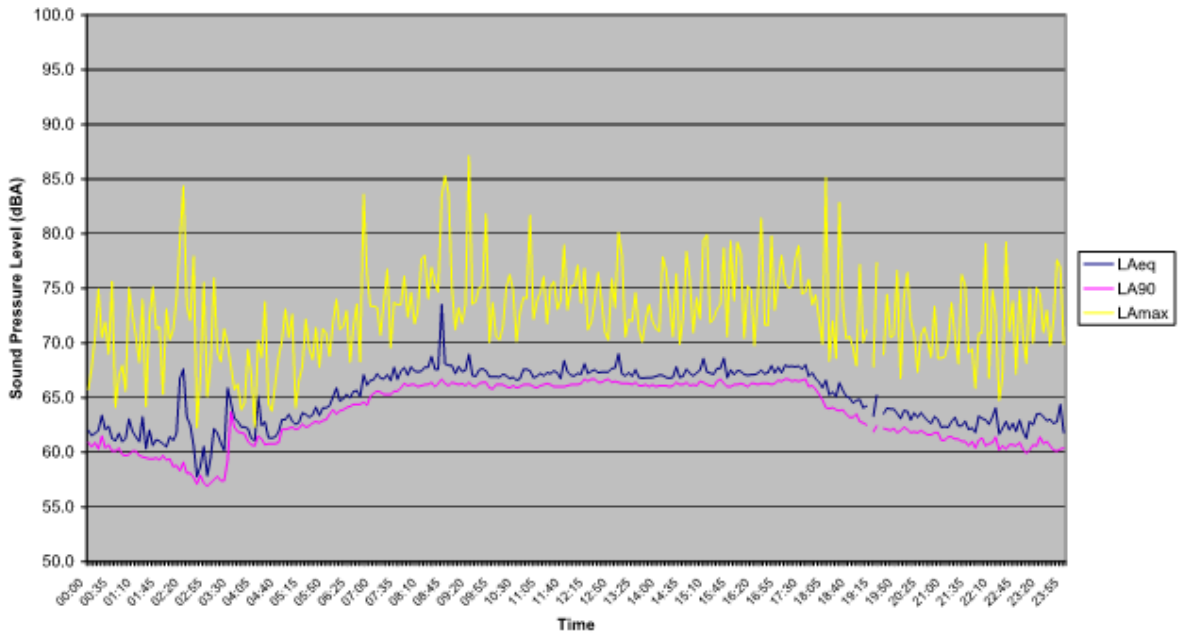

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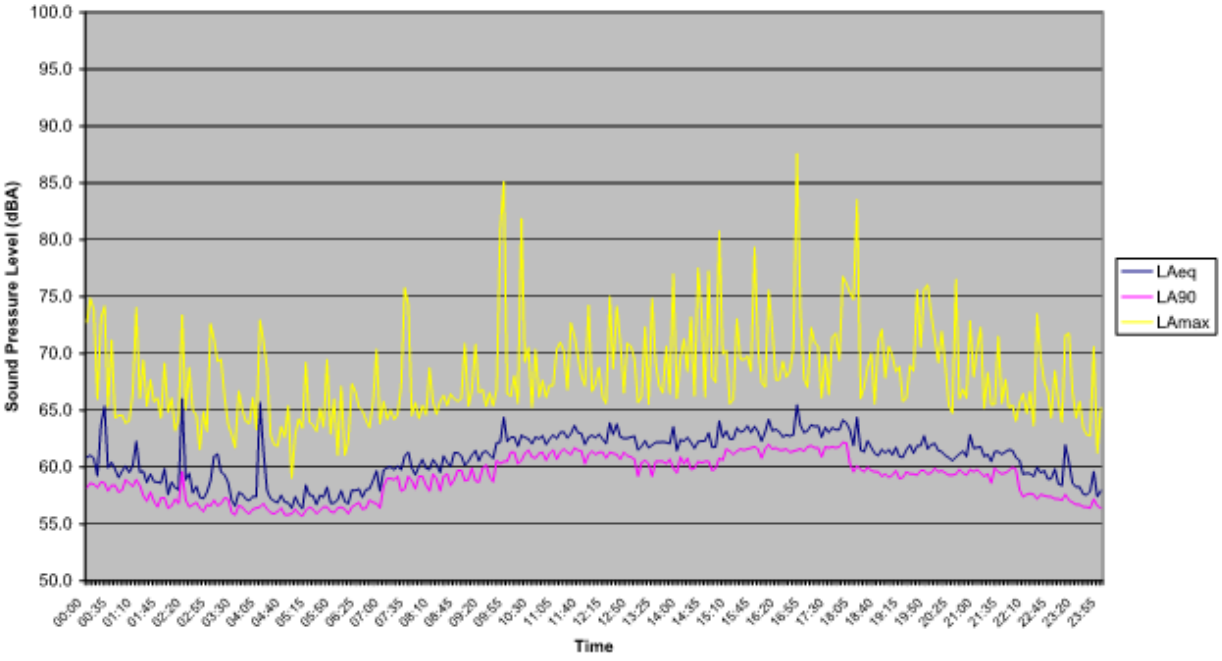

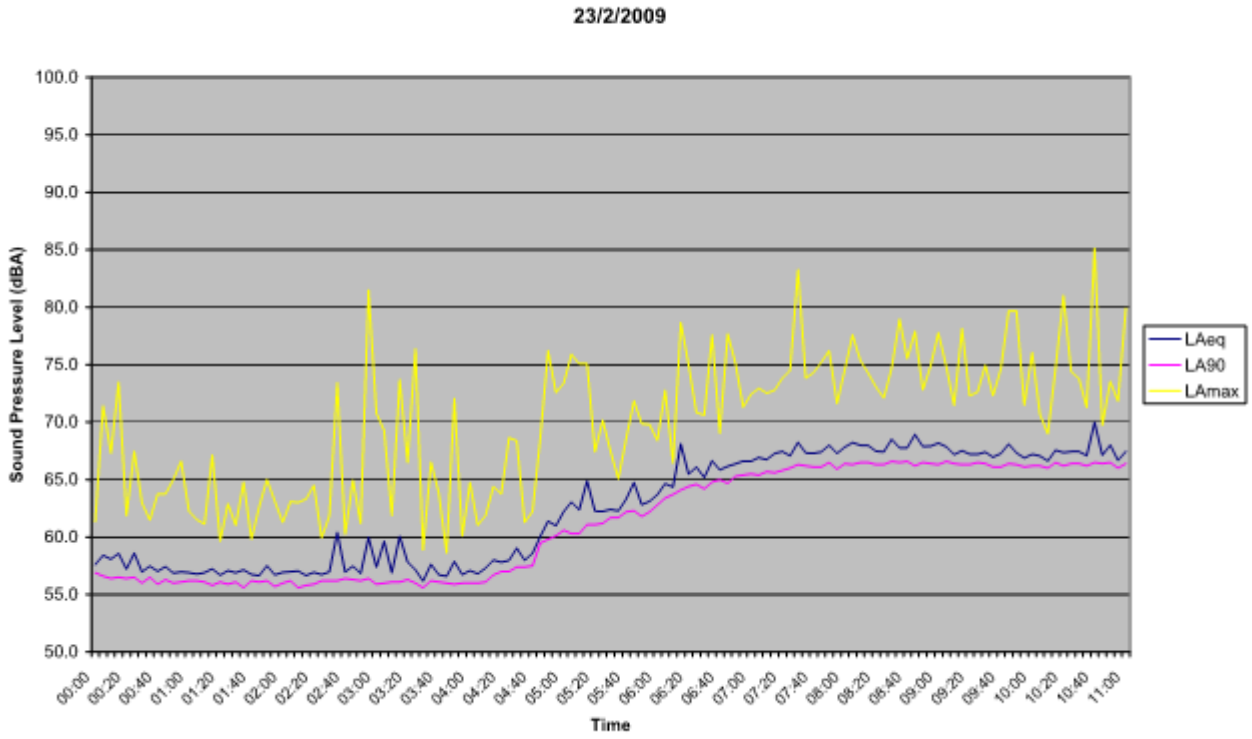
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