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TRAFFIC • PARKING • ACOUSTICS

Water Street,

Bowen Hills Qld

Project Waters, Stage One

Apartments

Prepared for: Metro Developments

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ABN 65 010 868 621

Level 1/129 Logan Road, Woolloongabba
PO Box 1310 Coorparoo BC QLD 4151
T: (07) 3327 9500 **F**: (07) 3327 9501 **E**: ttmbris@ttmgroup.com.au

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		Name	Signature		
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1. INTRODUCTION

TTM has been engaged by Metro Property Development Pty Ltd to prepare an environmental noise impact assessment for a proposed mixed-use development located at Water Street, Fortitude Valley. While the whole site is subject to DA this report will form part of the development application for Stage 1 only. For this assessment we have:

- Conducted unattended road traffic noise monitoring,
- Conducted unattended ambient noise monitoring,
- Made observations of offsite activity

SoundPLAN modelling of noise sources has not been conducted for this site. Observations on site identified that individual noise sources could be identified or measured, and that numerous noise sources were present including road traffic and mechanical plant. As individual noise sources could not be separated there is no way to accurately input these into a SoundPlan model, which relies on pin pointing the location and the noise level of each source. This applies to roads as well which are inputted as a line source. Subsequently recommended acoustic treatments are specified in order to attenuate **all** noises impacting the site, which was based on the unattended noise monitoring data.

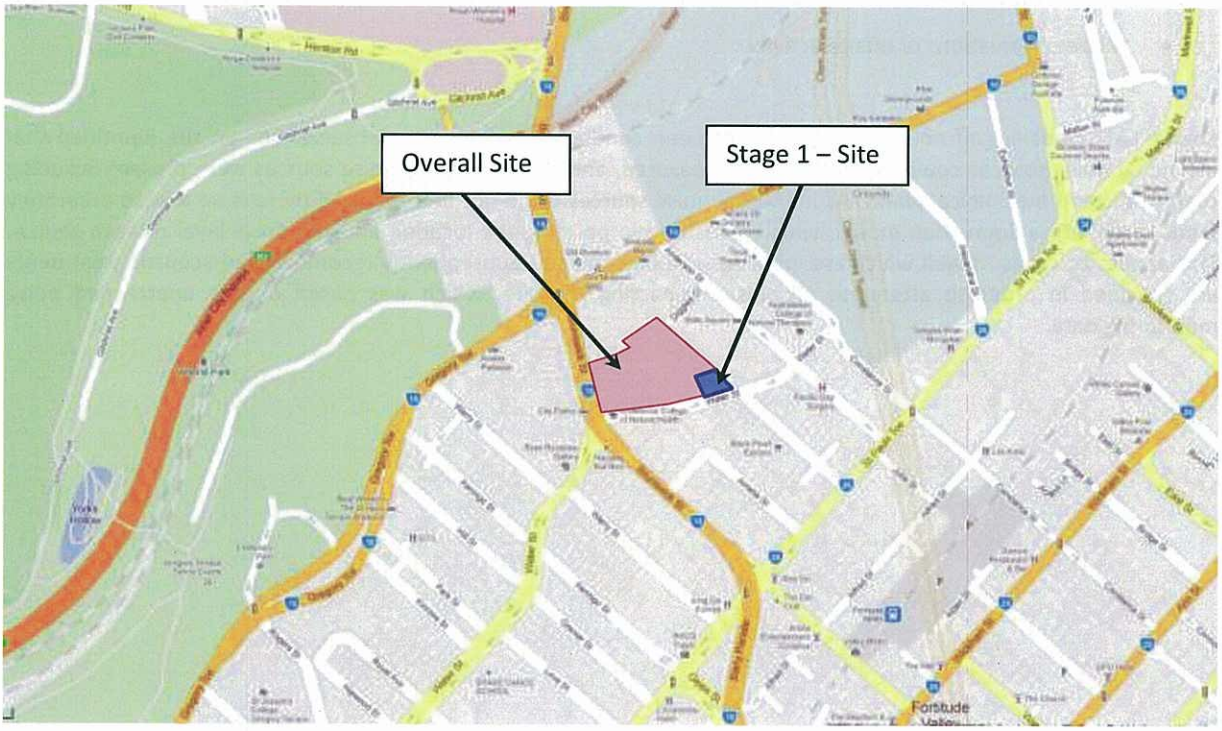
2. Site Description

The site is located at:

332-342 Water Street and 62-68 Brunswick Street Fortitude Valley,

Lot 1 on RP 110079.

Figure 1: Site Location



A comprehensive site survey was conducted on the 28 October, 2011. The survey identified the following:

- The proposed development is located on the northern side of Water Street, east of Brunswick Street;
- To the west is the Endeavour College of Natural Health, and car parking;
- To the east are two storey townhouses / mixed use;
- The southern side of Water Street is occupied by commercial terraces.

2.1 Proposed Development

The proposal is to develop the site containing the following:

- 1 basement
- 3 levels of cars for 101 cars;
- Level 1 Ground Floor:
    - SOHO/retail tenancies;
    - Designated waste collection and loading bay areas; and

- Services rooms.

- Level 1 Mezzanine Level:
  - Upper level of SOHO;
  - Bicycle storage;
- Levels 2 to 16:
  - Apartments;

Site access is proposed via Water Street. As operating hours of the commercial premises onsite are unknown, this assessment has assumed 24 hour operation, 7 days a week.

The following drawings by Bureau Proberts were utilised in the assessment (presented in Section 5):

Sheet Number	Sheet Name	Current Revision	Current Revision Date	Current Revision Description
0.00	COVER SHEET	A	24/05/2012	DA ISSUE
1.00	PROJECT SUMMARY	A	24/05/2012	DA ISSUE
1.01	SITE LOCATION	A	24/05/2012	DA ISSUE
1.02	EXISTING SITE PLAN	A	24/05/2012	DA ISSUE
1.03	PROPOSED SITE PLAN	A	24/05/2012	DA ISSUE
2.01	BASEMENT 1 – PART 1	A	24/05/2012	DA ISSUE
2.02	BASEMENT 1 – PART 2	A	24/05/2012	DA ISSUE
2.03	PODIUM 1 – PART 1	A	24/05/2012	DA ISSUE
2.04	PODIUM 1 – PART 2	A	24/05/2012	DA ISSUE
2.05	PODIUM 2 – PART 1	A	24/05/2012	DA ISSUE
2.06	PODIUM 2 – PART 2	A	24/05/2012	DA ISSUE
2.07	PODIUM 3 - PART 1	A	24/05/2012	DA ISSUE
2.08	PODIUM 3 –PART 2	A	24/05/2012	DA ISSUE
2.09	LEVEL 4 PODIUM	A	24/05/2012	DA ISSUE
2.10	LEVEL 5 - 11 TYPICAL	A	24/05/2012	DA ISSUE
2.11	LEVEL 12 PODIUM	A	24/05/2012	DA ISSUE
2.12	LEVEL 13 – 18 TYPICAL	A	24/05/2012	DA ISSUE
2.13	ROOF PLAN	A	24/05/2012	DA ISSUE
3.01	SOUTH & NORTH ELEVATIONS	A	24/05/2012	DA ISSUE
3.02	EAST & WEST ELEVATIONS	A	24/05/2012	DA ISSUE
4.01	SECTIONS	A	24/05/2012	DA ISSUE
7.01	TYPICAL APARTMENT TYPE A	A	24/05/2012	DA ISSUE
7.02	TYPICAL APARTMENT TYPE B	A	24/05/2012	DA ISSUE
7.03	TYPICAL APARTMENT TYPE C	A	24/05/2012	DA ISSUE
7.04	TYPICAL APARTMENT TYPE D	A	24/05/2012	DA ISSUE
7.05	TYPICAL APARTMENT TYPE E	A	24/05/2012	DA ISSUE
7.06	TYPICAL APARTMENT TYPE F	A	24/05/2012	DA ISSUE
7.07	TYPICAL APARTMENT TYPE G	A	24/05/2012	DA ISSUE
7.08	TYPICAL APARTMENT TYPE H	A	24/05/2012	DA ISSUE

Sheet Number	Sheet Name	Current Revision	Current Revision Date	Current Revision Description
7.09	TYPICAL APARTMENT TYPE J	A	24/05/2012	DA ISSUE
7.10	TYPICAL APARTMENT TYPE K	A	24/05/2012	DA ISSUE
7.11	TYPICAL APARTMENT TYPE L	A	24/05/2012	DA ISSUE
7.12	TYPICAL APARTMENT TYPE M	A	24/05/2012	DA ISSUE
7.13	TYPICAL APARTMENT TYPE N	A	24/05/2012	DA ISSUE
7.14	TYPICAL APARTMENT TYPE P	A	24/05/2012	DA ISSUE
7.15	TYPICAL APARTMENT TYPE Q	A	24/05/2012	DA ISSUE
7.16	TYPICAL APARTMENT TYPE R	A	24/05/2012	DA ISSUE
7.17	TYPICAL APARTMENT TYPE S	A	24/05/2012	DA ISSUE
7.18	STUDIO TYPE 1	A	24/05/2012	DA ISSUE
7.19	STUDIO TYPE 2	A	24/05/2012	DA ISSUE
7.20	STUDIO TYPE 3	A	24/05/2012	DA ISSUE
8.01	GFA BASEMENT 1	A	24/05/2012	DA ISSUE
8.02	GFA LEVEL – 1 PODIUM 1	A	24/05/2012	DA ISSUE
8.03	GFA PODIUM 2	A	24/05/2012	DA ISSUE
8.04	GFA PODIUM 3	A	24/05/2012	DA ISSUE
8.05	GFA LEVEL 4 PODIUM	A	24/05/2012	DA ISSUE
8.06	GFA TYPICAL LOWER	A	24/05/2012	DA ISSUE
8.07	GFA LEVEL 12 PODIUM	A	24/05/2012	DA ISSUE
8.08	GFA TYPICAL UPPER	A	24/05/2012	DA ISSUE
8.09	GFA ROOF	A	24/05/2012	DA ISSUE

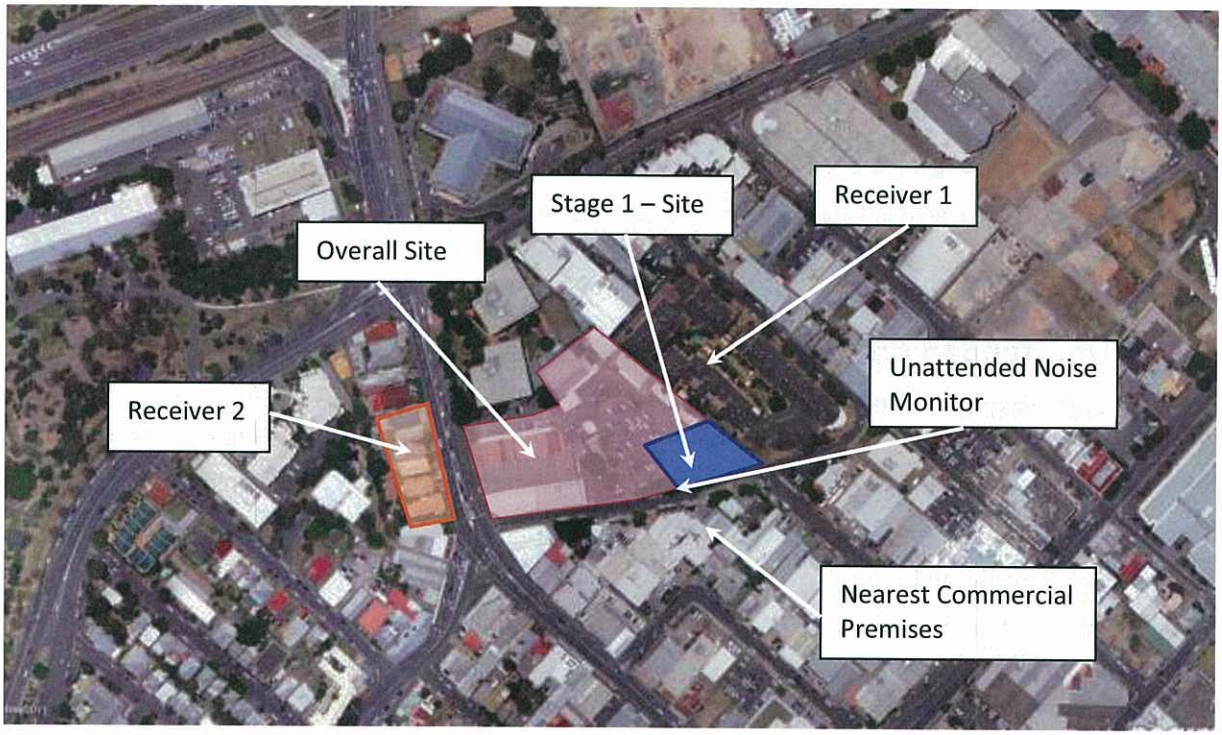
2.2 Description of Surrounding Environment

The acoustic amenity of the site is primarily affected by road traffic noise associated with the surrounding road network in particular Brunswick Street. However, due to set backs this is not undue. There is some evidence of mechanical services noise from current occupants in the area. It was not possible to pinpoint sources.

2.3 Affected Receivers

The area surrounding the site is predominantly commercial premises with some residential land uses to the east. Figure 2 shows the location of the nearest receiver in relation to the site.

Figure 2: Nearest Affected Noise Sensitive Receivers.



If compliance can be achieved at receivers 1, all remaining locations are predicted to comply due to the increased separation distance.

2.4 Offsite Commercial Activities

To adequately assess the site, consideration must be given to the activities associated with commercial office and retail premises located in the vicinity of the site. During the site survey, the following offsite premises were identified as being quite close to the site:

- *Endeavour College of Natural Health.*
- *Small natural therapy clinics.*

An assessment of the offsite activities which have the potential to impact the site was conducted with the results of the analysis presented in Section 0. Refer to **Figure 2** for the location of the nearest commercial premises.

3. MEASUREMENT METHODOLOGY

3.1 Equipment

The following equipment was used to record road traffic and ambient noise levels including offsite activity measurements surrounding the site:

- One ARL EL316 Environmental Noise Monitor (SN# 16-707-010);
- RION NA-74 Sound Calibrator (SN# 35073393).

3.2 Unattended Road Traffic and Ambient Noise Monitoring

The Noise logger was placed on the site in the carpark adjacent to the footpath as indicated *Figure 2* to measure road traffic and ambient noise levels. The microphone was 1 metre in from the fence 1.5 metres above ground level.

The monitor was set to record road traffic noise from the 26 October to 2 November, 2011 as follows:

- "A" weighting,
- "Fast" response, and
- 15 minute statistical interval.

The statistical interval was chosen to allow application of Australian Standard *AS/NZS 2107:2000 Acoustics – Recommended Design Sound Level and Reverberation Times for Building Interiors* (AS 2107).

Road traffic noise monitoring was conducted generally in accordance with Australian Standard *AS 2702:1984 Acoustics - Methods for the measurement of road traffic noise* (AS 2702).

3.3 Onsite Activity Noise Measurements

Noise levels associated with typical onsite activities were taken from similar investigations conducted by TTM Acoustics. All measurements were conducted generally in accordance with Australian Standard *AS 1055:1997 Acoustics – Description & Measurement of Environmental Noise* (*AS 1055*).

3.4 Offsite Activity Noise Measurements

A site survey was conducted to determine the potential for offsite activity noise to impact the development. Attended noise measurements were conducted on Thursday 24 November, 2011 at approximately 2:30 in the afternoon. The local amenity is slightly affected by mechanical services noise, but their location was not able to be pinpointed. Typical noise levels associated with the actual offsite activities (excluding mechanical plant) were taken from similar investigations conducted by TTM Acoustics.

All measurements were conducted generally in accordance with Australian Standard *AS 1055*.

4. NOISE ASSESSMENT CRITERIA

The development is located within the Bowen Hills Urban Development Area. The site is required to comply with the criteria detailed in sections **Error! Reference source not found.** to 4.5 to achieve compliance with road traffic, onsite and offsite activities including mechanical plant noise.

4.1 Road Traffic Noise – Brisbane City Council

Brisbane City Council's (BCC) *City Plan 2000 Noise Impact Assessment Planning Scheme Policy* is the appropriate criterion. The assessment methodology requires that road traffic noise is investigated for the planning horizon. This assessment has considered road traffic for the year 2026. Road traffic noise levels are assessed as an outdoor level in recreation areas, and as internal noise levels for living, work and sleeping areas.

The internal noise limits are the recommended design sound levels from Australian/New Zealand Standard AS 2107-2000 *Acoustics – Recommended design sound levels and reverberation times for building interiors* (AS 2107) and the relevant noise levels for apartments are presented in Table 1.

Table 1: Internal Noise Limits for Residential Dwellings from AS 2107, Table 1.

Type of Occupancy/Activity	Recommended design sound level, L_{Aeq}, dB(A)	
	Satisfactory	Maximum
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

The applicable criteria for outdoor recreation areas is the BCC *City Plan Noise Impact Assessment Planning Policy* (*NIAPSP*). Table 2 outlines the assessment criteria based upon achieving the noise level objectives for Brisbane City Council.

Table 2: Road Traffic Noise Assessment Criteria.

Description	Predicted SPL dB(A)
Communal Recreational Areas	58dB(A) $L_{Aeq\ (24hour)}$ (Free Field)
Private Recreational Areas	55dB(A) $L_{Aeq\ (24hour)}$ (Façade Corrected)
External façade	55dB(A) $L_{Aeq\ (1hour)}$ (Façade Corrected)
Internal noise limits	As per *AS 2107*

4.2 Onsite and Offsite Activity Noise

Brisbane City Council require onsite activities (i.e. vehicle movements excluding mechanical plant) are assessed in accordance with *NIAPSP*. The assessment should detail the location, extent and construction specifications for proposed attenuation measures including all assumptions and methodologies used.

NIAPSP requires the following:

- Assessment of immission[1] and emission[2].

Assessment of immission and emission levels are grouped into 3 fundamental methodologies:

1) Comparison of like parameters or descriptors – Comparison, using a suitable sound descriptor, of the ambient sound character of an area without the development to that resulting with the development.
2) Application of *AS 2107* – Comparison with a defined set of sound pressure levels, for specified indoor areas occupied by people set out in Table 1 of *AS 2107*.
3) Sleep awakenings – Comparison with sleep levels. This type of assessment can be conducted using sound exposure levels (L_{AE}) to compare to the FICAN 1997 SEL(L_{AE})/percentage awakening curve

We recommend applying the comparison of like parameters for assessment of noise from all noise sources associated with the development as follows:

- L_{A10}[3] V^s L_{A10} for transient noise sources (i.e. waste collection, car parking and loading dock). *NIAPSP* allows the existing L_{A10} level to be exceeded by 3 dB by any proposed activities (taking into account the number of discreet noise events, character of the noise and time of occurrence);
- Application of *AS 2107* for control of mechanical plant noise.

The use of L_{A10} levels is recommended as it reflects the average maximum level of noise associated with a source. The use of average maximum is referenced as an acceptable assessment method of transient noise sources in the Queensland Department of Environment & Heritage *Noise Measurement Manual* (2nd Edition, 1995) (*NMM*). For short duration noise events, the application of *AS 2107* (see point (2) above) is not considered appropriate, as it applies to continuous noise, such as mechanical plant.

Based on the above assessment requirements, the assessment criteria for residential receivers in the vicinity of the site are detailed in **Table 3**.

Table 3: Assessment Criteria for Residential Receivers.

Time Period	Criteria L_{A10} dB(A)
Daytime (7am – 6pm)	54 (L_{A10} +3dB(A))
Evening (6pm – 10pm)	52 (L_{A10} +3dB(A))
Night time (10pm – 7am)	48 (L_{A10} +3dB(A))

Refer to Appendix B for graphical representation of measured noise levels.

[1] Immission is noise received by, or impacting on, the development from the surrounding environment.

[2] Emission is the noise emitted by activities within the development.

[3] L10 level is the level exceeded for 10% of the measurement time, and often termed the "average maximum"

4.3 Sleep Disturbance Criteria

The research concerning the effect of maximum noise levels of 45 to 50 dB(A) and the number of events is not complete and there is still a lot of discussion about their application. This is because people are extremely variable in their reactions to noise and how well they acclimatise to new activities. The maximum level does not mean a person is awakened at these levels, but sleep may be disturbed.

Criterion for sleep disturbance is addressed under the User's Guide to the *Environmental Protection (Noise) Policy*, and states the following:

> *In the case of fluctuating noise, the maximum level is correlated to sleep disturbance, rather than the ambient level. For good sleep, maximum noise levels of 45 dB(A) to 50 dB(A) should not be heard in a bedroom more than 10 to 15 times a night.*
>
> *Where noise is continuous, the ambient level during the sleeping period should not exceed 30 – 35 dB(A) indoors in a bedroom.*

4.4 Intrusiveness Criteria

Further to the above, we recommend applying a limit of L_{Amax} 45dB(A) inside dwellings for fluctuating noise as the World Health Organisation's Guidelines for Community Noise 1999 states that "speech in relaxed conversation" can be "understood fairly well in background levels of 45dBA". The L_{Amax} level is therefore considered unlikely to interfere with normal speech levels, watching television and other typical household activities.

4.5 Mechanical Plant

Application of *AS 2107* for control of mechanical plant noise is in accordance with *NIAPSP*, and takes into account the acceptable R category for potentially affected premises as defined in (*AS 1055*) By categorising the dwellings adjacent to the development as being R5 "areas with very dense transportation or in commercial districts or bordering industrial districts", the noise design target level defined in *AS 2107* for dwellings near major roads is 40dB(A) $L_{eq\ (15\ min)}$ in sleeping areas.

Furthermore, in order to prevent background creep, plant must be designed to not exceed the measured background noise levels. These various criteria equate to a design target for mechanical plant of the following levels:

Table 4: Mechanical Plant Assessment Criteria for Residential Receivers.

Time Period	Criteria L_{90} dB(A)
Daytime (7am – 6pm)	41
Evening (6pm – 10pm)	43
Night time (10pm – 7am)	39

Unusually the evening period is noisier than the day time period. This could be for two reasons that we can see:

1. The nearby Natural Therapies College operates at night and this noise is due to students coming and going;
2. Afternoon peak hour traffic on Brunswick Street.

Refer to Appendix B for graphical representation of measured noise levels

The above levels are for total emissions at a location and not for each component of plant. However to prevent background creep the noise emissions should be limited to 3 dB below the background so that the ambient background is not increased.

5. ANALYSIS AND RESULTS

5.1 Road Traffic Noise

5.1.1 Measured Levels

Table 5 presents the measured road traffic noise levels recorded at the unattended monitoring location.

Table 5: Measured Road Traffic Noise Levels.

Date	Road Traffic Noise Descriptor	Time Period	Measured Level dB(A)
27 October, 2011	$L_{A10,18Hour}$	6am to midnight	57
	Noisiest day-time $L_{Aeq,1Hour}$	8pm to 9pm	58
	Noisiest night-time $L_{Aeq,1Hour}$	11pm to Midnight	59
	$L_{Aeq,24Hour}$	Midnight to midnight	55

Graphical presentation of the measured road traffic noise levels are presented in Appendix B.

5.1.2 Traffic Volumes

2008 traffic volumes and percentage of heavy vehicles for the surrounding road network were obtained from TTM Data Division. Predicted 2020 traffic volumes are presented in Table 6 and are based on a 0.5% p.a. growth rate as advised by TTM Traffic.

Table 6: Road Traffic Volumes for the Surrounding Road Network.

Description (Location):	**Traffic Volume (AADT)**		**Heavy Vehicles (% AADT)**
	2011	**2026**	
Water Street	900	3,070	4.40
Brunswick Street	28,390	35,300	2.70

The CoRTN methodology requires the input of 18 hour traffic volumes and is approximated as 95% of the Average Annual Daily Traffic.

5.1.3 Predicted Road Traffic Noise Levels

The method below is to calculate future noise levels)Road traffic noise predictions were conducted using the formula Total Increase = 10 x log (N2/N1) where N2 is the forecast vehicles, N1 is the current number of vehicles. The result is added to current noise levels to forecast the increased noise levels. This method must use the same parameters to calculate N1 and N2 such as the 18 hour traffic volumes.
The calculations give a 7 dB increase in noise. This should represent the design intent as below.

Table 7: Predicted Road Traffic Noise Levels.

Date	Road Traffic Noise Descriptor	Time Period	Predicted Level dB(A)
2026	$L_{A10,18Hour}$	6am to midnight	64
	Noisiest day-time $L_{Aeq,1Hour}$	8pm to 9pm	65
	Noisiest night-time $L_{Aeq,1Hour}$	11pm to Midnight	66
	$L_{Aeq,24Hour}$	Midnight to midnight	61

Predicted road traffic noise impacts at 10 years after the completion of the development were calculated using established formulae and are based on the following parameters:

1. The layout used for the modelling are based on the architectural plans from Bureau Probert as stated in section 2;
2. Screening from the existing buildings surrounding the site were incorporated;
3. Floor heights presented on elevation plans were utilised (refer to DA drawings);
4. The speed limit on Brunswick Street is at 60 km/hour and 50km/hr on Waters Street;
5. The façade correction factor of +2.5dB(A) was considered in the calculations (where applicable).

Outputs predicted $L_{A10,18hour}$ road traffic noise levels. These levels were converted into $L_{Aeq,1hour}$ day and night time levels (based on logged noise data) to compare with the BCC criteria (refer to Appendix C).

Table 8 presents the modelled noise level at the communal recreation area and includes screening from the development as detailed in Section 6.

Table 8: Predicted Road Traffic Impacts at Communal Recreation Area.

Location:	Predicted SPL (dB(A)) in 2026 (Free field)	
	$L_{A10,18hour}$	$L_{Aeq,24hour}$
Communal Recreation Area (Podium Level)	52	48

The communal recreation area is calculated to comply with the BCC assessment criteria due to sufficient separation distance and screening from the development.

Note if the layout is changed or if the nominated finished pad levels as stipulated in Appendix A are raised in excess of 200mm, further assessment will be required.

5.2 Onsite Activity Noise

An assessment of the proposed onsite residential/commercial activities reveals that activities will either be in the carpark area, or off site. A list of usual activity types are listed and the location shown. This is due to the layout of the proposed development effectively taking up the whole lot .See Table 9.

Table 9: Average Maximum Noise Levels from Typical Site Activity.

Noise Source:	Measured Level L_{Amax} (dB(A))	Correction Factor dB(A)*	Corrected Level L_{Amax} (dB(A))	Location
Car door closure	78	+ 5 (impulsive)	83	Car park
Car starting	75	N/A	75	Car park
Car bypass @ 5 km/h	77	N/A	77	ramp
Waste collection - Basement	92	+ 5 (impulsive)	97	Car park
Goods Delivery Basement	85	N/A	85	Car park
Conversation	70	N/A	70	Car park
Alfresco Dining	80	N/A	80	N/A
Swimming Activities	76	N/A	76	N/A

*Correction due to tonality and impulsiveness as per *AS 1055*.

The nearest noise sensitive receivers to the site were identified in Section 2.3. *Table 10* present predicted noise levels (based on the noise source levels in *Table 9*) from the development impacting the nearest residential receivers.

Table 10: Predicted Noise Impact Levels from Onsite Activities to Receiver 1.

Noise Source:	Predicted Level L_{Amax} dB(A)		Assessment Criteria Complies (Yes/No)		
	Façade	Internal	Day 54 dB(A)	Evening 52 dB(A)	Sleep 45 dB(A)
Car door closure – Basement	42	37	Yes	Yes	Yes
Car starting – Basement	34	29	Yes	Yes	Yes
Car bypass @ 5 km/h – Ramp	57	42	No	No	Yes
Waste collection	49	44	Yes	Yes	Yes
Goods Delivery	37	32	Yes	Yes	Yes
Conversation – Communal Recreation Area (NE)	50	45	Yes	Yes	Yes

The predicted noise levels presented in **Table 10** is based upon the noise source being at the nearest position to the receivers and assume screening from the development including adjacent commercial buildings.

Based on the modelled levels, all remaining onsite activities are predicted to comply with the day, evening and sleep disturbance criteria.

5.3 Offsite Activity Noise

There is the potential for offsite activities associated with the nearby commercial premises to impact the residential component of the development. The predicted impacts are divided into two sections (5.3.1and 5.3.2) detailing the results of modelling for offsite commercial activities and were assessed based on their respective hours of operation as discussed in Section 2.5.

5.3.1 General Commercial Activity Noise

This section has assessed the vehicle movements, goods deliveries and waste collection for the commercial premises surrounding the site. The noise sources associated with general offsite commercial activities were based on similar investigations and are presented in *Table 11*. The noise sources were selected as they represent the likely activities that have the potential to impact the onsite receivers.

Table 11: Average Maximum Noise Levels from General Offsite Activities.

Noise Source:	Measured Level L_{Amax} (dB(A))	Correction Factor dB(A)*	Corrected Level L_{Amax} (dB(A))
Car door closure	78	+ 5 (impulsive)	83
Car starting	75	N/A	75
Car bypass @ 5 km/h	77	N/A	77
Waste collection	92	+ 5 (impulsive)	97
Goods Deliveries	85	N/A	85
Conversation	70	N/A	70
Alfresco Dining	80	N/A	80

*Correction due to tonality and impulsiveness as per *AS 1055*.

Table 12 presents predicted noise levels (based on the noise source levels presented in **Table 11**) from the commercial premises impacting the residential component of the development.

Table 12: Predicted Noise Impact Levels from General Offsite Activities to the Site.

Noise Source:	Predicted Level L_{Amax} dB(A)		Assessment Criteria Complies (Yes/No)		
	Façade	Internal	Day 54dB(A)	Evening 52dB(A)	Sleep 45dB(A)
Car door closure – Think Creative	50	45	Yes	Yes	-
Car starting – Think Creative	39	34	Yes	Yes	-
Car bypass @ 5 km/h – Think Creative	50	45	Yes	Yes	-
Waste collection – Emporium	70	65	No	No	No
Goods Deliveries – Emporium	55	50	No	No	No
Conversation – Think Creative	40	35	Yes	Yes	Yes
Alfresco Dining – Emporium	44	39	Yes	Yes	Yes
Car door closure – Emporium	50	45	Yes	Yes	Yes
Car starting – Emporium	42	37	Yes	Yes	Yes
Car bypass @ 5 km/h – Emporium	45	40	Yes	Yes	Yes

The predicted noise levels presented in **Table 12** are based upon the noise source being at the nearest position to the receivers, and assumes screening from the development including surrounding commercial buildings.

Waste collection and goods deliveries are predicted to exceed the sleep disturbance criteria at the nearest onsite residential receivers. Noise impacts associated with these activities are unlikely to be a cause of annoyance, given that that they are generally an infrequent occurrence (i.e. once or twice per week) and are of short duration.

All remaining offsite activities are predicted to comply with the day, evening and sleep disturbance criteria with no additional treatments.

5.3.2 Continuous (Plant) Noise

Mechanical plant evident at the site does have the potential to impact the site. Noise measurements of the mechanical plant were conducted at the same time as noise logging and total noise levels have been included in the calculations for façade design, and all noise ingress into the residential components of the proposed development.

Note the communal area on the podium level is at the rear of the building (away from Water Street) and would be even less affected.

6. RECOMMENDATIONS

The recommended acoustic treatments are required to ensure compliance with the relevant BCC and Queensland Transport assessment criteria.

6.1 Road Traffic Noise – Brisbane City Council

Compliance is predicted with the BCC assessment criteria on the condition the following treatments are implemented.

The communal recreation area located on the podium level is predicted to comply due to sufficient separation distance and screening by the development.

Based on floor plans and elevations, glazing and building treatments were determined by using the calculation methods detailed in Australian Standard AS3671:1989 *'Road Traffic Noise Intrusion – Building Siting and Construction'*.

6.1.1 Glazing Treatments

Table 13 presents the minimum glazing required based on calculations conducted in accordance with AS3671:1989. Note that the minimum thickness of the glass as specified in Table 18 shall not be reduced regardless of the R_W/STC rating of the glazing system unless the R_W rating can be certified by the glazier. Glazing specified with acoustic seals requires a Q-Lon seal to be installed or an equivalent product. Mohair seals are not acceptable.

Table 13: Glazing Treatments for Proposed Units – Road Traffic.

Floor Level	Facade	Room	Building Component	R_W	Glazing Thickness	Acoustic Seals
G	South	SOHO	Window	27	4mm Float	Yes
	East	SOHO	Window	27	4mm Float	Yes
1	South	SOHO	Window	27	4mm Float	Yes
	East	SOHO	Window	27	4mm Float	Yes
2	South	Living/Dining	Window	27	4mm Float	Yes
	East	Living/Dining	Window	27	4mm Float	Yes
	North	Living/Dining	Window	27	4mm Float	Yes
	South	Bedroom	Window	27	4mm Float	Yes
	East	Bedroom	Window	27	4mm Float	Yes
	North	Bedroom	Window	27	4mm Float	Yes
3	South	Living/Dining	Window	27	4mm Float	Yes
	East	Living/Dining	Window	27	4mm Float	Yes
	North	Living/Dining	Window	27	4mm Float	Yes
	South	Bedroom	Window	27	4mm Float	Yes
	East	Bedroom	Window	27	4mm Float	Yes
	North	Bedroom	Window	27	4mm Float	Yes
4 to 6	South	Living/Dining	Window	27	4mm Float	Yes

Floor Level	Facade	Room	Building Component	R_w	Glazing Thickness	Acoustic Seals
	East	Living/Dining	Window	27	4mm Float	Yes
	North	Living/Dining	Window	27	4mm Float	Yes
	South	Bedroom	Window	31	6mm Float	Yes
	East	Bedroom	Window	31	6mm Float	Yes
	North	Bedroom	Window	31	6mm Float	Yes
7 to 8	South	Living/Dining	Window	32	6.38 mm Laminated	Yes
	East	Living/Dining	Window	32	6.38 mm Laminated	Yes
	North	Living/Dining	Window	32	6.38 mm Laminated	Yes
	South	Bedroom	Window	34	8.38 mm Laminated	Yes
	East	Bedroom	Window	34	8.38 mm Laminated	Yes
	North	Bedroom	Window	34	8.38 mm Laminated	Yes
9 to 16	South	Living/Dining	Window	32	6.38 mm Laminated	Yes
	East	Living/Dining	Window	32	6.38 mm Laminated	Yes
	North	Living/Dining	Window	32	6.38 mm Laminated	Yes
	South	Bedroom	Window	36	10.38 mm Laminated	Yes
	East	Bedroom	Window	36	10.38 mm Laminated	Yes
	North	Bedroom	Window	36	10.38 mm Laminated	Yes

These are the minimum glazing requirements. If for structural purposes thicker glazing is required, the acoustic performance will be improved.

6.1.2 Wall Treatments

The proposed walls shall be constructed to achieve an R_w 55 and therefore will comply with the minimum rating requirements.

In all rooms, penetrations through the wall shall be acoustically treated so as not to reduce the overall rating of the installed wall system.

6.1.3 Recommended Ceiling Treatments

The proposed roof shall be constructed using 150mm reinforced concrete which achieves a minimum of R_w55 and therefore will comply with the minimum rating requirements.

Any penetrations through the ceiling (such as light fittings or duct penetration) shall be acoustically treated to ensure the overall acoustic rating is maintained.

6.1.4 Provision of Alternative Ventilation

To achieve the required internal noise levels of habitable rooms, doors and windows should be closed, hence, all habitable rooms requiring glazing treatments will require the provision of an alternative ventilation system like mechanical ventilation or air-conditioning. The design and installation of the plant should not reduce the overall acoustic performance of the building shell.

6.2 Onsite Activity Noise

This assessment has investigated the 'worst case scenario', by considering potential noise impacts from onsite activities associated with the proposed development to the nearest residential receivers adjacent the site.

It is predicted that communal area activities may exceed the relevant assessment criteria during the night time period. As a result, we recommend that all terrace area activities are restricted to the day and evening periods, between 7:00 am and 6 pm only. Based on the modelled levels, all remaining onsite activities are predicted to comply with the day, evening and sleep disturbance criteria.

6.3 Offsite Activity Noise

Recommendations to attenuate off-site activity noise have been included in the glazing treatments.

6.4 Transient Activity Noise

Based on the modelled levels, all offsite activities with the exception of waste collection and goods deliveries, are predicted to comply with the day, evening and sleep disturbance criteria.

Waste collection activities are predicted to exceed the sleep disturbance criteria at the nearest onsite residential receivers. Noise impacts associated with these activities are unlikely to be a cause of annoyance, given that that they are generally and infrequent occurrence (i.e. once or twice per week) and are of short duration.

In addition goods deliveries are predicted to exceed the sleep disturbance criteria at the nearest residential component of the development. Goods deliveries are likely to occur during daytime hours and are not expected to impact the night time period.

6.5 Continuous (Plant) Noise

Compliance has already been determined to achieve the internal noise limits.

Because detailed plant selections are not available at this stage, it is not possible to carry out a detailed examination of the ameliorative measures that may be required to achieve the noise targets. Plant will be acoustically treated to achieve the criteria as previously detailed to prevent noise emissions from adversely impacting the surrounding properties. This may include selecting the quietest plant possible, or treating the plant equipment with enclosures, barriers, duct lining and silencers, etc if required to comply with the assessment criteria.

Experience with similar projects indicates that it would be possible to achieve the Council requirement with appropriate treatment of the plant. This treatment would be determined at the Building Approval/Construction Certificate stage.

A mechanical plant noise assessment should be conducted by a suitably qualified acoustic person once plant selections are finalised; and compliance tests conducted after the equipment is installed to ensure compliance with the criteria. Such measures should also be conditioned in the Development Approval.

6.6 Drill Hall

A plan should be drawn up during design. Included in the plan should be:

Management Principles, and staff training to keep on site activities to reasonable levels;

Hours of operation, 7:am to 9:pm for all activities;

Mitigation of any mechanical plant to criteria;

Limits on the noise from any music, and no outdoor music. If the façade is operable then music should only be used inside for background. If the façade is not operable then music could be louder within criteria at the nearest receiver on site or off.

APPENDICES

Appendix A

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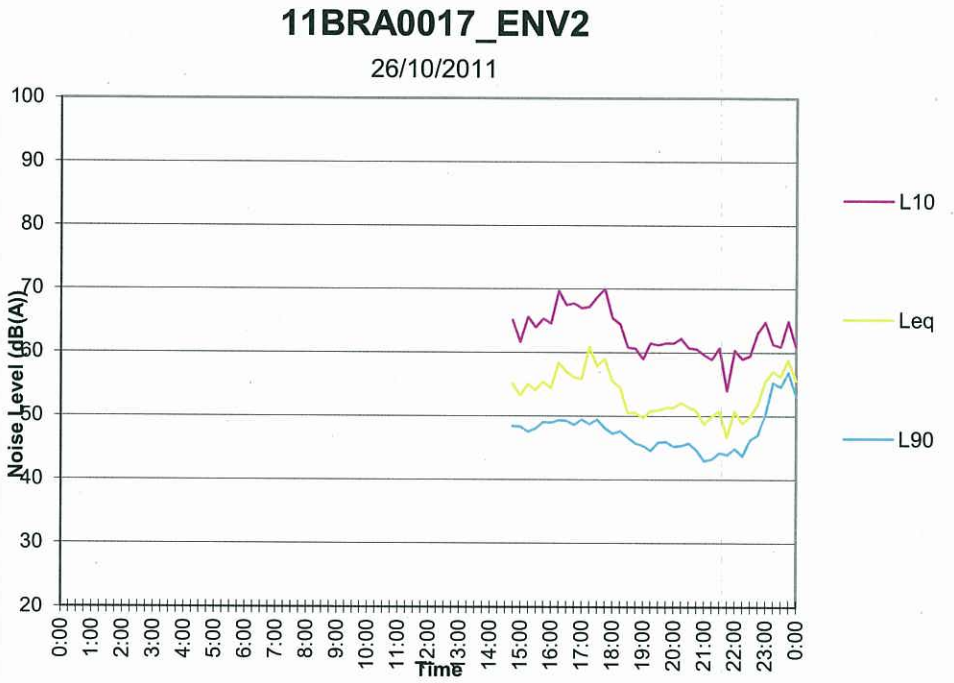
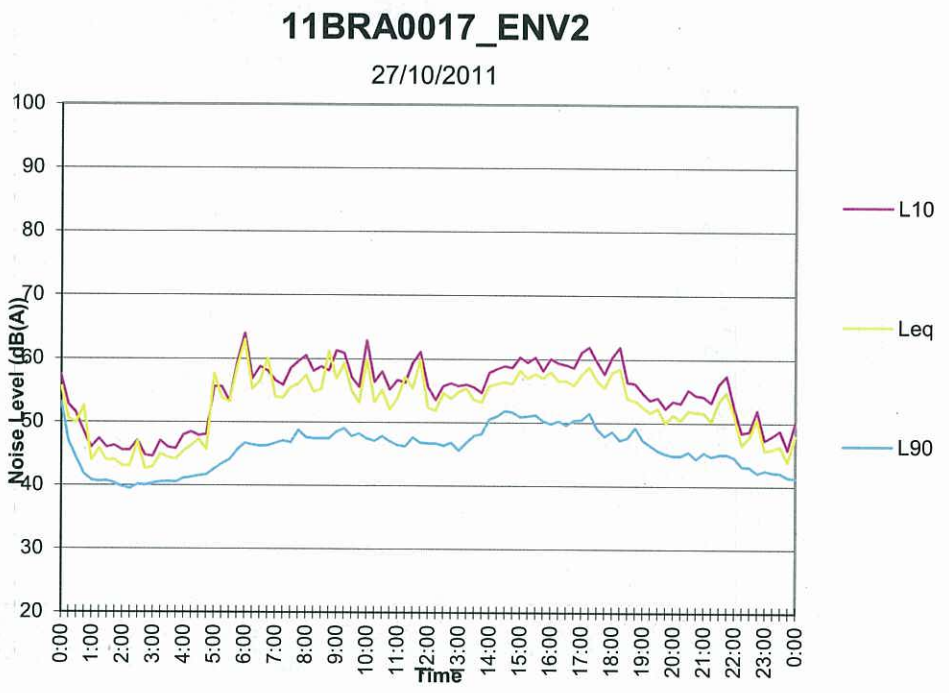
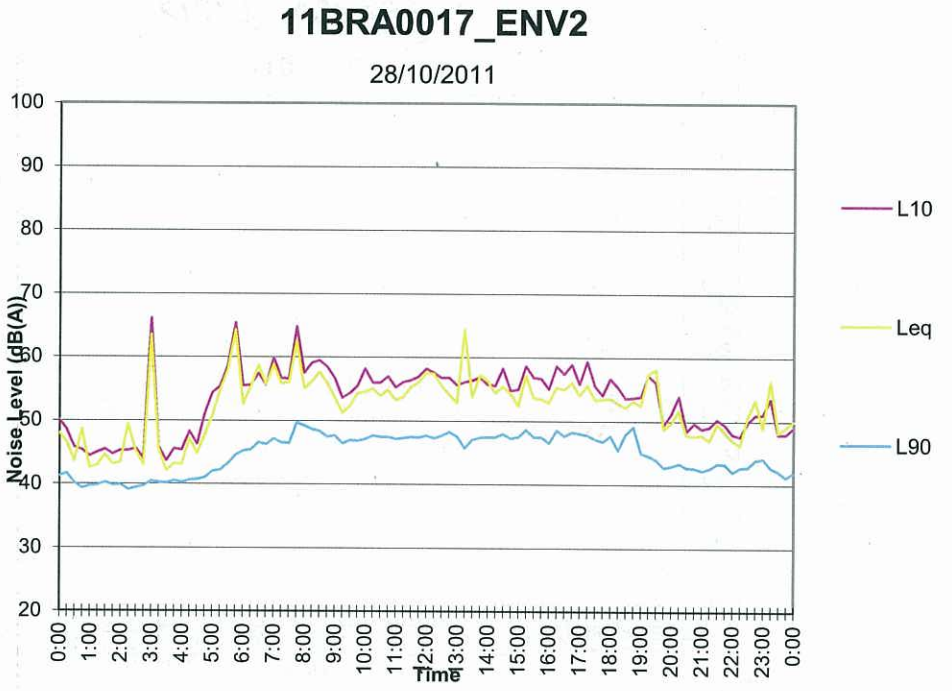
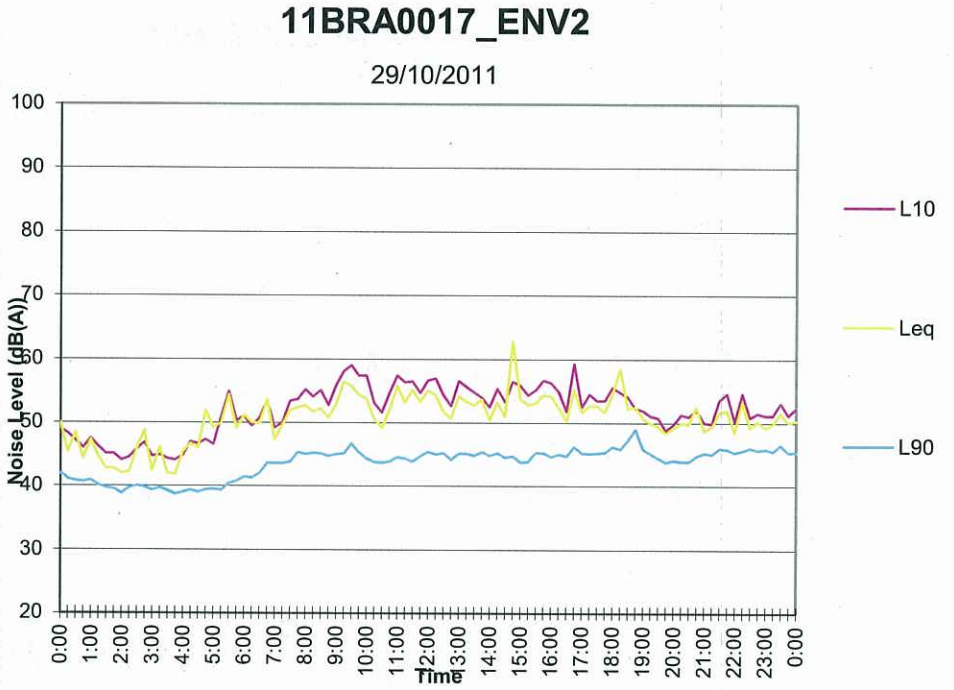
Appendix B

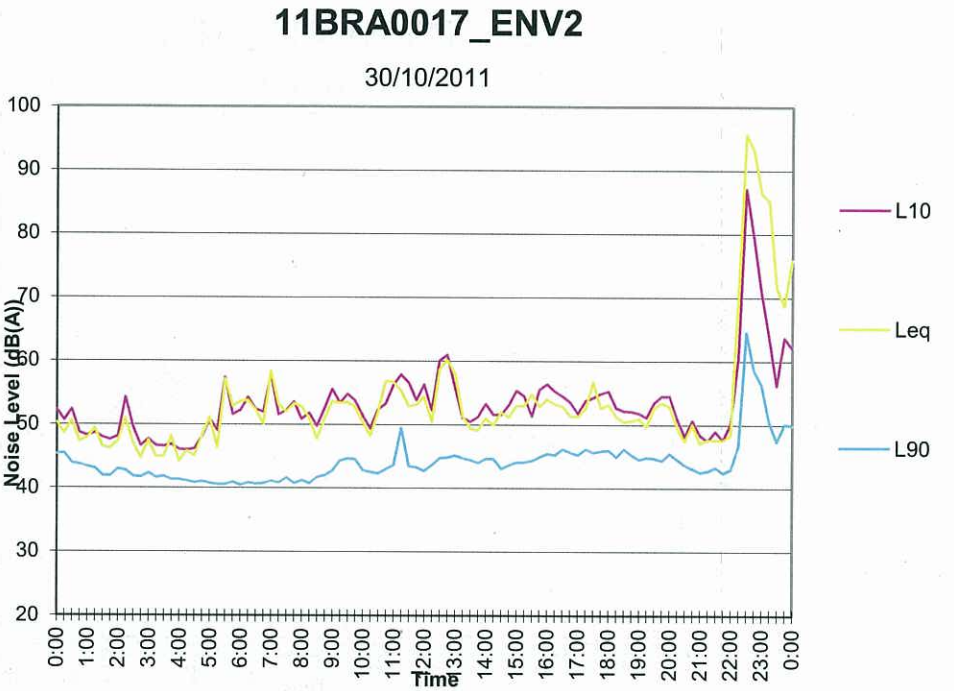
Noise Monitoring Graphs

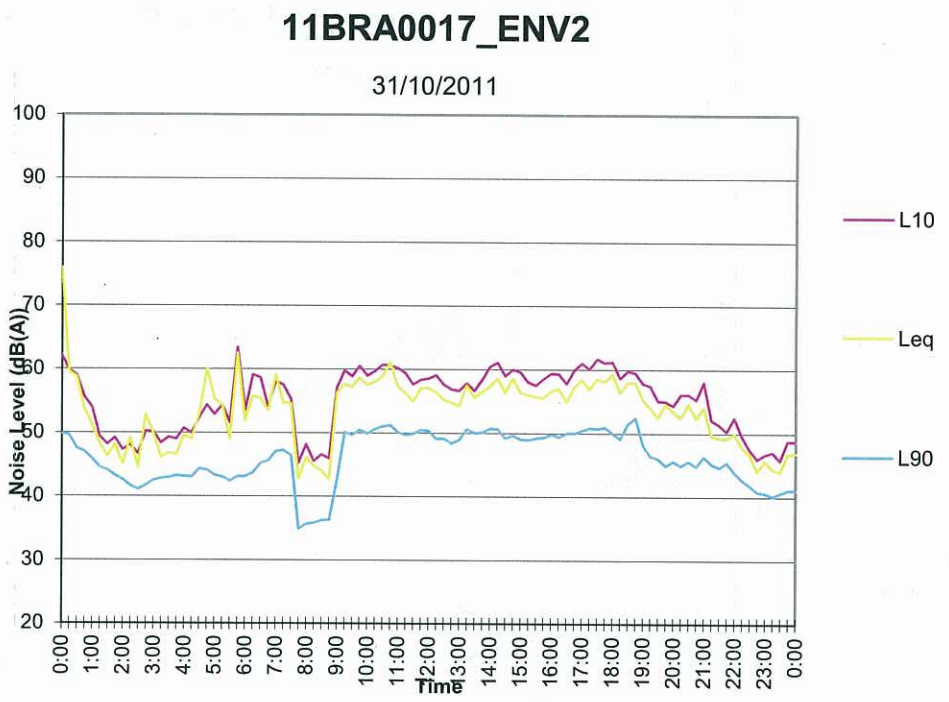


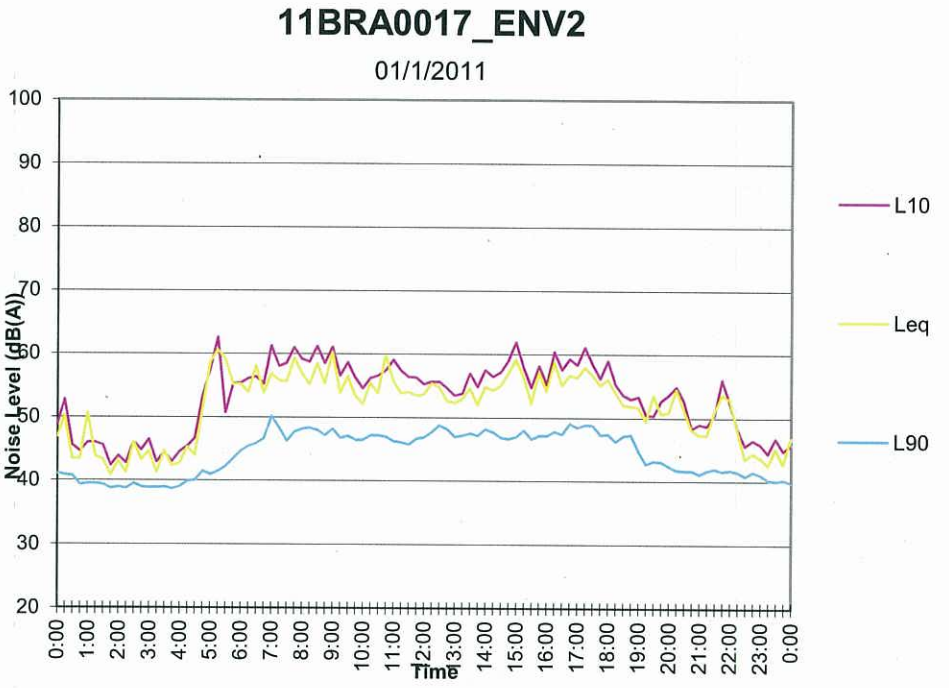


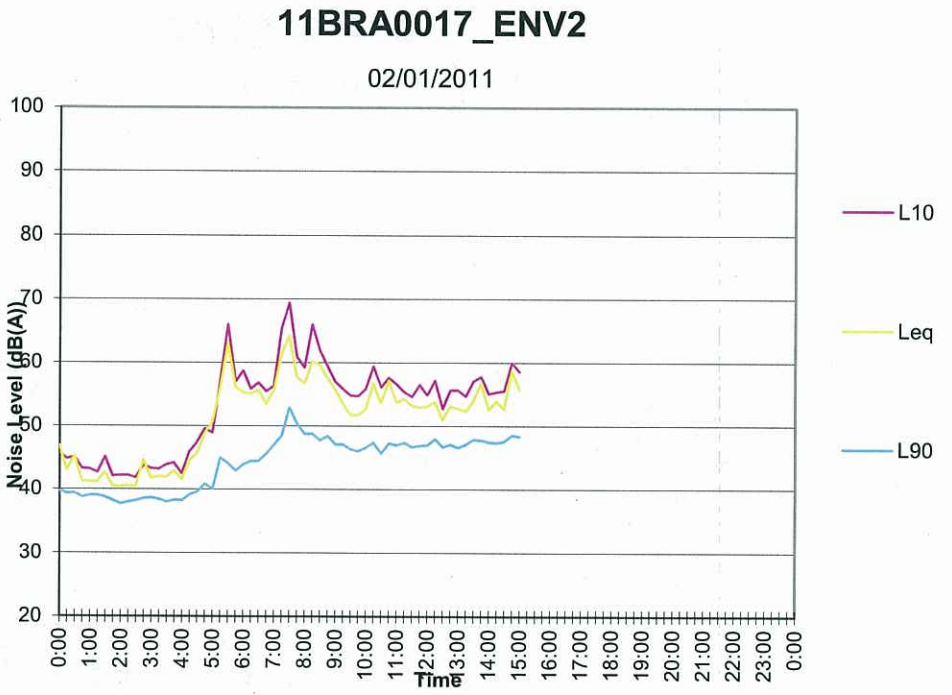












Appendix C

Sample Calculations

R_W Calculations