APPENDIX J

Acoustic Assessment and Addendum

22 November 2016

Ref: 14919/6440

Coeve Designs
PO Box 1107
NEWCASTLE NSW 2300

RE: ACOUSTIC ASSESSMENT – BROOKS PARADE SHARP STREET AND EDGAR STREET, BELMONT

This letter report presents the results of a noise impact assessment conducted for a proposed commercial and residential development at 32-44 Brooks Parade, 2-10 Sharp Street and 5-11 Edgar Street, Belmont. The proposal is to demolish the existing structures on site and construct a multi-storey residential building with ground floor commercial areas. The assessment has been prepared to address traffic noise impacts in accordance with the Infrastructure SEPP (2007) and impacts from potential noise emissions from the proposal, for inclusion with a Development Application to Lake Macquarie City Council.

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The logger was programmed to continuously register environmental noise levels over the 15 minute intervals, with internal software calculating and storing Ln percentile noise levels for each sampling period. Calibration of the logger was performed during the instrument's initialisation procedures, with calibration results being within the allowable $\pm$ 0.5 dB(A) range.

Figure 1 shows the project site and the noise logger locations.

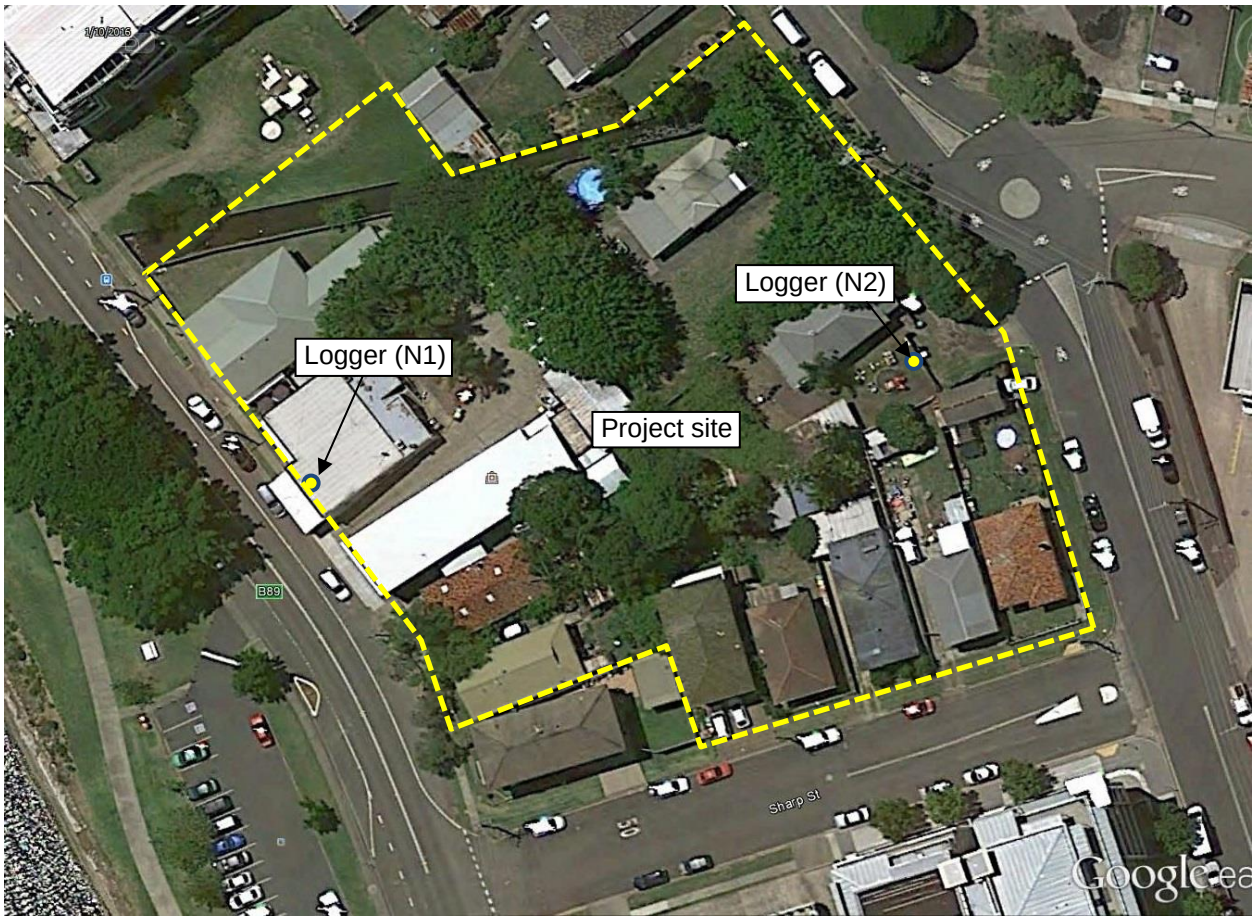


Figure 1. Project site and logger locations (Source: Google Earth).

Ambient L_{Aeq} and background (L_{A90}) noise levels, obtained from the logger, are summarised below in **Table 1** and shown graphically in **Appendix A**. Table 1 includes the background (L90) levels, the Leq over the full day (11 hour, 7am-6pm), evening (4 hour, 6pm-10pm) and night (9 hour, 10pm-7am) periods as well as the 90th percentile (P90) of the measured $L_{Aeq(15minute)}$ levels. The data for Brooks Parade is typical of the acoustic environment close to a major road.

TABLE 1
MEASURED AMBIENT NOISE LEVELS 15/2/16 to 19/2/16

Location	Day	Evening	Night
Brooks Parade, Belmont (N1)	52 dB(A) L90	41 dB(A) L90	35 dB(A) L90
	62 dB(A) Leq (period)	58 dB(A) Leq (period)	55 dB(A) Leq (period)
	65 dB(A) Leq (P90)	60 dB(A) Leq (P90)	57 dB(A) Leq (P90)
Edgar Street, Belmont (N2)	44 dB(A) L90	35 dB(A) L90	31 dB(A) L90
	55 dB(A) Leq (period)	55 dB(A) Leq (period)	45 dB(A) Leq (period)
	59 dB(A) Leq (P90)	58 dB(A) Leq (P90)	47 dB(A) Leq (P90)

TRAFFIC NOISE IMPACTS

The NSW Road Noise Policy (RNP, 2012), as adopted by the Roads and Maritime Services (RMS) of NSW, recommends various criteria for different road developments and uses. For new residential developments near roads, the RNP advises that land use developers must meet internal noise goals in

the Infrastructure SEPP (Department of Planning NSW, 2007). The SEPP (2007) is supported by the Department of Planning guideline "Development near Rail Corridors and Busy Roads – Interim Guideline" (2008) which gives the following internal noise level criteria in Section 3.5:

In any bedroom in the building: **35 dB(A),L_{eq}** at any time 10pm – 7am, and
Anywhere else in the building (other than a garage, kitchen, bathroom or hallway): **40dB(A),L_{eq}** at any time.

These criteria originated from the Rail Infrastructure Corporation (RIC) publication "Consideration of Rail Noise and Vibration in the Planning Process" (2003) where it is explicit that the criteria apply with windows and doors closed. The criteria correspond with those in AS/NZS 2107, where the noise is considered to be "quasi-continuous" in nature.

Noise criteria for traffic noise impacts on new housing near busy roads have historically been based on the geometric average (LAeq) levels over a 15-hour period (7am – 10pm) for day and 9-hour period (10pm – 7am) for night. To allow for fluctuations in noise levels throughout the day/night periods, the 90th percentile LAeq noise levels of 65dB(A)(day) and 57dB(A)(night) as recorded in Table 1 will be used in the assessment of traffic noise impacts along the Brooks Parade frontage.

Figure 2 is a reproduction of Figure B2 from the Interim Guideline (2008) showing a typical situation of a dwelling adjacent to a busy road and fully calculated internal noise levels relative to external noise levels using the UK Calculation of Road Traffic Noise (CoRTN) methodology. Acoustic consultants often use this Guideline (and Figure B2 specifically) in recommending architectural modifications to achieve the recommended noise levels.

Figure 2 shows a traffic noise level of 68 dB(A) at windows W1 and W2 directly facing the road. Windows W3 and W4 are on facades perpendicular to the road, thereby being shielded from 50% of the traffic noise by the building structure, and noise levels are 2-3 dB below the traffic noise level at W1 and W2. Window W5 is approximately twice the distance from the road as W4 and experiences an external traffic noise level 4 dB below the level at W4.

Figure 2 also gives the traffic noise loss for three constriction scenarios labelled A, B and C. The following specifications for these construction scenarios are reproduced from the Guideline. The specification for walls includes insulation in the wall cavity, however brick veneer achieves Rw >45 without insulation, which will not reduce the overall noise insulation of the room as a whole, since windows are the acoustically weakest elements. Any recommendations regarding the following construction specifications assume no insulation in facade walls.

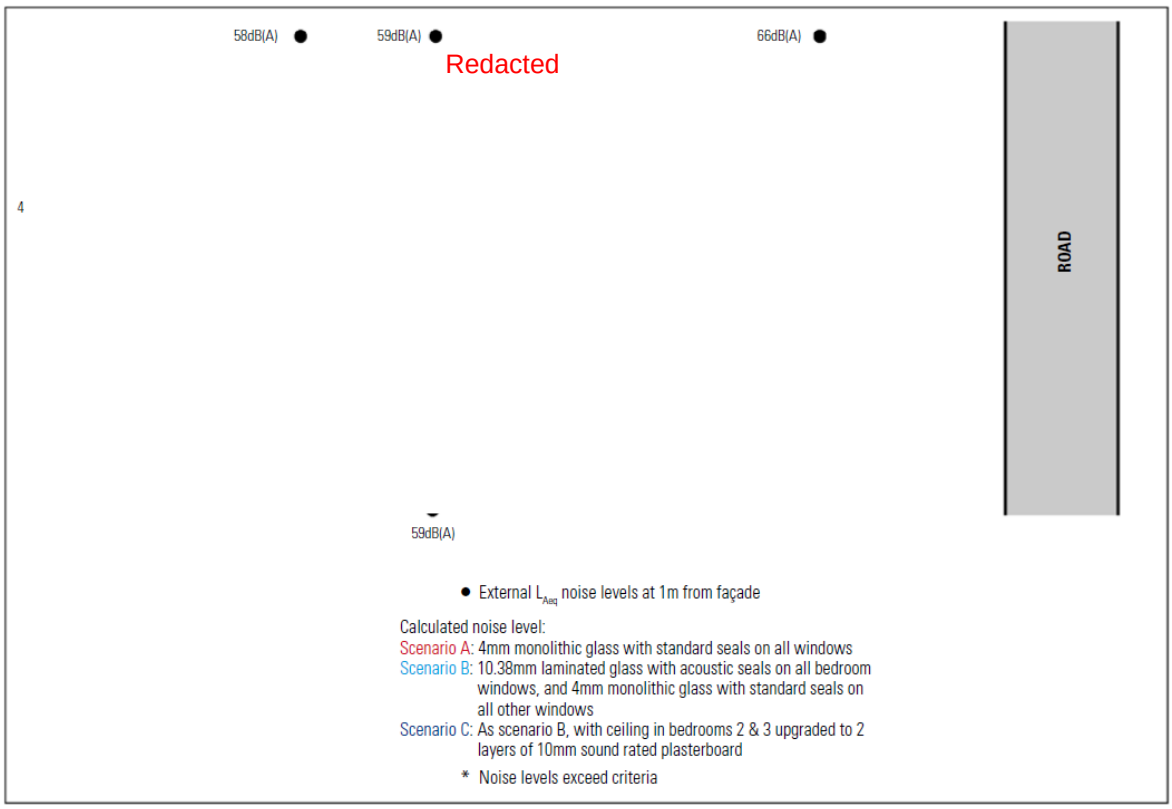


Figure 2. Traffic noise reduction for various construction types.

Specification A

Windows	standard 4mm monolithic glass with standard weather seals on all windows	(Rw 25)
Doors	30mm solid core timber – lounge room aluminium framed glass sliding door – lounge and dining rooms	(Rw 24)
Walls	brick-veneer and standard plasterboard on timber studs with insulation in cavity	(Rw 52)
Roof	tiled roof and standard plasterboard ceiling with insulation	(Rw 43)
Floor	concrete slab	

Note: 'Rw' is the weighted sound reduction index of a building element

Specification B

Windows	10.38mm laminated glass with acoustic seals on all bedroom windows, standard 4mm monolithic glass with standard seals on all other windows	(Rw 35)
Doors	30mm solid core timber – lounge room aluminium framed glass sliding door – lounge and dining rooms	(Rw 24)
Walls	brick-veneer and standard plasterboard on timber studs with insulation in cavity	(Rw 52)
Roof	tiled roof and standard plasterboard ceiling with insulation	(Rw 43)
Floor	concrete slab	

Note: 'Rw' is the weighted sound reduction index of a building element

Specification C

Windows	10.38mm laminated glass with acoustic seals on all bedroom windows, standard 4mm monolithic glass with standard seals on all other windows	(Rw 35)
Doors	30mm solid core timber – lounge room aluminium framed glass sliding door – lounge and dining rooms	(Rw 24)
Walls	brick-veneer and standard plasterboard on timber studs with insulation in cavity	(Rw 52)
Roof	as per Specification B, except the single layer of standard plasterboard ceiling is replaced with a double-layer of 10mm sound-rated plasterboard ceiling	(Rw 52)
Floor	concrete slab	

Note: 'Rw' is the weighted sound reduction index of a building element

Table 2 summarises the traffic noise reduction provided by each construction scenario for the cases in Figure 2 where a room contains either one or two windows.

TABLE 2 Traffic noise reduction in dB (from Figure B2 of the Interim Guideline (2008))		
Construction scenario	**Noise reduction (2 windows)**	**Noise reduction (1 window)**
Scenario A	23	25
Scenario B	29	31
Scenario C	32	34 (estimated)

Between the minimum 23dB reduction for Scenario A and minimum 29dB reduction for Scenario B lies what will be called Scenario A/B in which 23-28 dB traffic noise reduction is required[1]. This will be achieved with the same construction as scenario B except using 6.5mm Vlam Hush (or equivalent) in lieu of the 10.38mm glazing (for which 8.5mm Vlam Hush provides the same acoustic rating). This conservative measure is based on adopting the 23dB noise reduction for 4mm glass, whether there are one or two windows in the room.

Since acoustic performance can vary greatly depending upon framing and seals, glazing suppliers should certify that their windows/doors will achieve the required noise reduction and not simply defer to the minimum glazing thickness recommended in this report. Where upgrades from standard 4mm glazing is recommended, confirmation of acoustic performance should be supplied by the glazing company for the purposes of certification for occupation certificate.

Figure 3 shows the proposed layout typical of the first three proposed residential levels, fronting Brooks Parade, and traffic noise levels incorporating corrections commensurate with Figure 2. Night time levels are shown for bedrooms and daytime levels for other habitable spaces. Levels higher up in the building(s) are assumed to be effectively screened from enough traffic noise, via greater setback, so as to not require assessment. Traffic noise levels measured on Edgar Street were sufficiently low that upgraded construction to attenuate traffic noise will not be required.

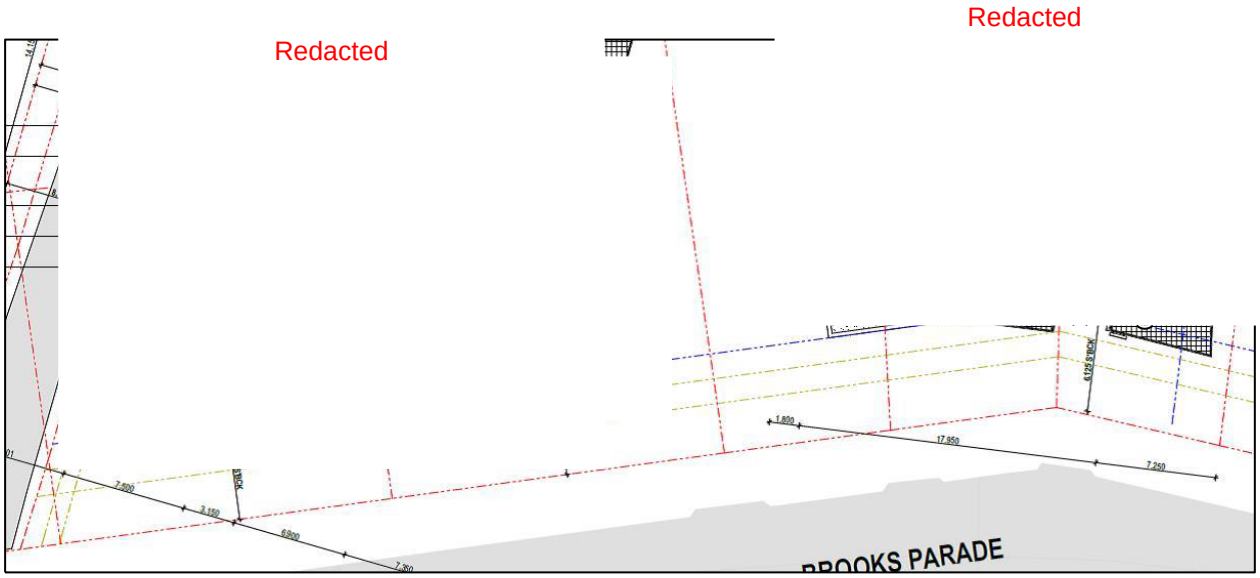


Figure 3. Traffic noise levels at building facade.

[1] The value of 23dB has been included in the Scenario A/B category as a measure of conservatism for living rooms. Traffic noise reduction of 22 dB or more for bedrooms will be included in the Scenario A/B category.

Table 3 summarises the traffic noise levels at facades exposed to the traffic, the noise criteria, traffic noise reduction and recommended minimum acoustic treatment.

TABLE 3
Required traffic noise reduction and recommended construction scenarios

Window/Room	External traffic noise dB(A)	Required internal dB(A)	Required reduction dB	Construction scenario
A – Living	63	40	23	Scenario A/B
B – Living	65	40	25	Scenario A/B
C – Bed	57	35	22	Scenario A/B
D – Bed	57	35	22	Scenario A/B
E – Living	65	40	25	Scenario A/B
F – Bed	57	35	22	Scenario A/B
G – Living	65	40	25	Scenario A/B
H – Bed	55	35	20	Scenario A
I – Living	63	40	23	Scenario A/B
J – Living	65	40	25	Scenario A/B
K – Bed	57	35	22	Scenario A/B
L – Bed	57	35	22	Scenario A/B
M – Living	65	40	25	Scenario A/B
N – Bed	57	35	22	Scenario A/B
O – Living	65	40	25	Scenario A/B
P – Living	63	40	23	Scenario A/B

* Sliding doors will require laminated glazing for safety purposes regardless of acoustic requirement.

The results in Table 3 indicate that glazing upgrade to minimum 6.5mm Vlam Hush (or similar) will be required for all windows A-P in Figure 3 except window H, although glazing upgrade to this bedroom window is recommended.

Section 3.6.1 of the Guideline states: "If internal noise levels with windows or doors open exceed the criteria by more than 10 dBA, the design of the ventilation for these rooms should be such that occupants can leave windows closed, if they so desire, and also meet the ventilation requirements of the Building Code of Australia." This condition applies to all assessed windows in Figure 3.

NOISE EMISSIONS

The NSW Industrial Noise Policy (INP) recommends a noise emission criterion of "background + 5 dB" for 15-minute LAeq noise emissions from industrial premises. Council usually accepts the INP criteria for any noise-generating development with potential to impact on residential amenity. The noise emission criteria for the proposal, based on the background noise levels at the Edgar Street logger, are

49 dB(A),$L_{eq(15minute)}$ (Day)
40 dB(A), $L_{eq(15minute)}$ (Evening)
36 dB(A), $L_{eq(15minute)}$ (Night)

The night time criterion of **36 dB(A),$L_{eq(15minute)}$** will be conservatively adopted as the governing criterion for noise impact at all receivers from all sources on the project site.

Noise emissions from mechanical plant at several locations throughout the site were computer modelled using the SoundPLAN software by EMF Griffiths (May 2012) for an assessment for a previous proposal for the site. EMF's estimated sound power levels up to 70 dB(A) for external mechanical plant such as air conditioners and exhaust fans concur with Spectrum Acoustics' file data. Based on the night time criterion of 36 dB(A) the minimum setback distance for individual mechanical noise sources from neighbouring residential boundaries is 20m if there is no barrier shielding the line of sight. Final selection and placement of external mechanical plant should be reviewed by the acoustic consultant to confirm compliance with the noise emission criterion.

To help protect against sleep disturbance at night, the EPA prefers $L_{1(1minute)}$, effectively the maximum L_{max}, noise levels from short-term impacts to be no more than 15dB above the background level when measured or calculated at 1m from any bedroom window. The sleep disturbance criterion for the current assessment is **46 dB(A),$L_{1(1min)}$**.

There is a proposed loading dock on the northern (Edgar Street) side of the site which is within 45m of residences on Edgar and Herbert Streets. Typical maximum impact noises and reverse alarms from trucks in loading docks are up to 100 dB(A). Allowing just for distance loss, this reduces to 59 dB(A),Lmax at the nearest residences. This is 13 dB above the night time sleep disturbance criterion. Since there is very limited scope for providing attenuation of noise emanating from the loading dock, it is recommended that use of the dock be restricted to daytime hours 7am – 6pm.

The carpark entry off Edgar Street is likely to have a remote controlled roller door. These doors have historically presented a noise problem if they suffer mechanical damage or lack of lubrication. In some instances, maximum noise levels from a squeaky roller door up to 95 dB(A) have been measured and there is a potential for sleep disturbance impacts. A properly maintained and lubricated roller door, however, emits minimal noise in the order of 70 dB(A) and levels well below the sleep disturbance criterion will be experienced at the nearest residences.

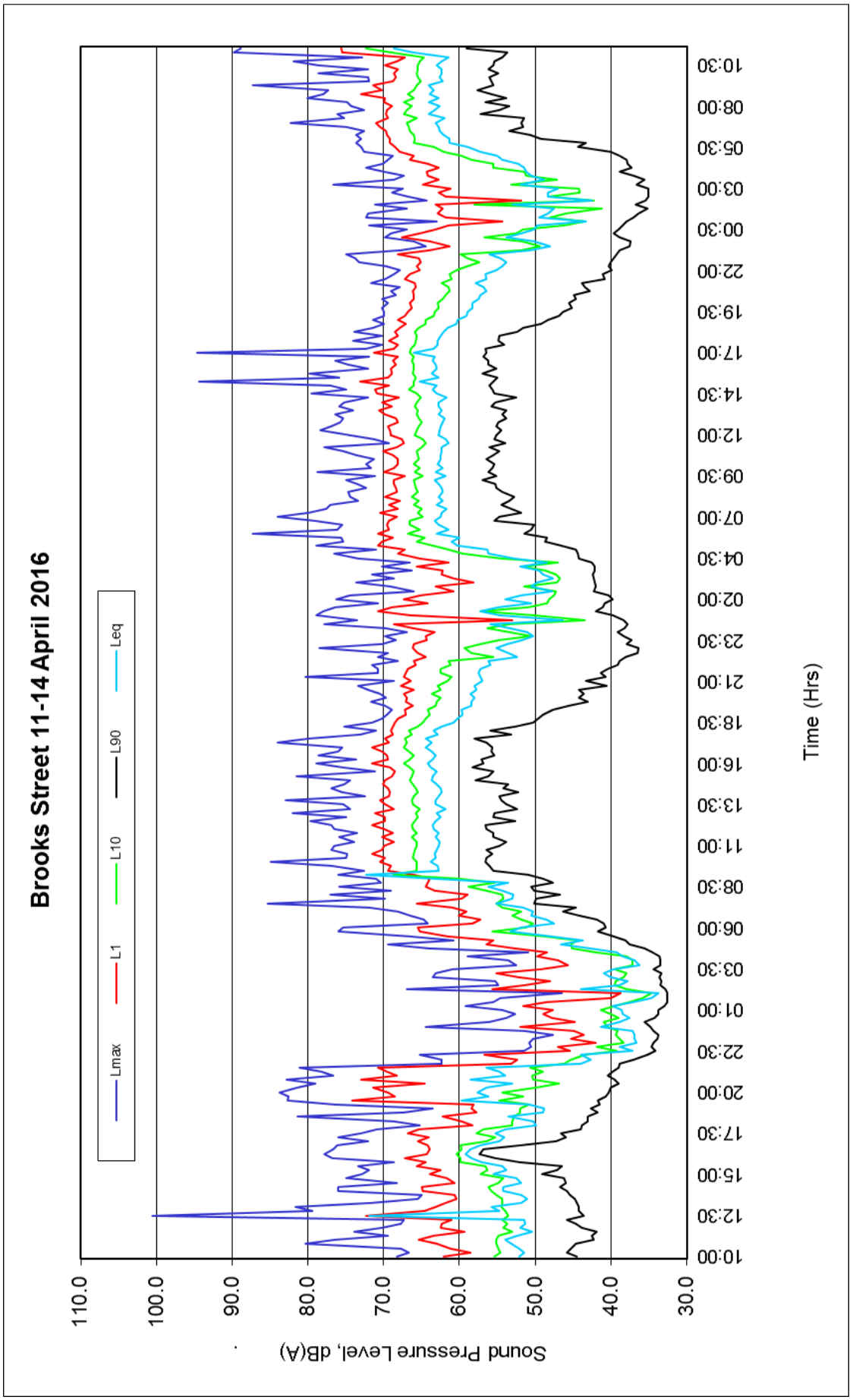
We trust this report fulfils your requirements at this time, however, should you require additional information or assistance please contact the undersigned on 49542276.

SPECTRUM ACOUSTICS PTY LIMITED

Neil Pennington
B.Sc., B.Math. (Hons), MAAS, MASA
Principal/Director

APPENDIX A

NOISE LOGGER DATA CHARTS


Brooks Street 11-14 April 2016
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L1
L10
L90
Leq
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100.0
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80.0
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50.0
40.0
30.0
Time (Hrs)
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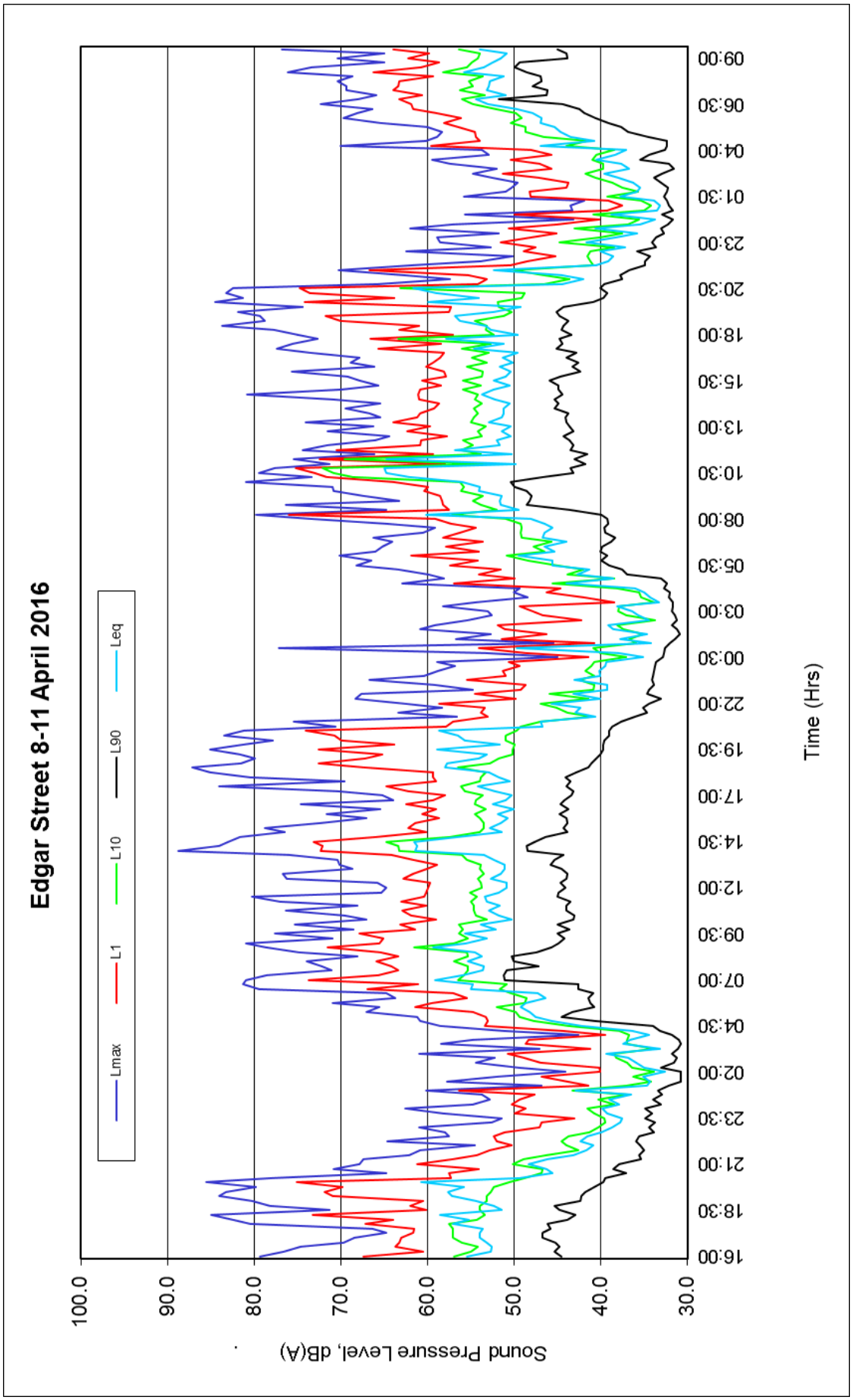
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ADDENDUM

20 August 2017

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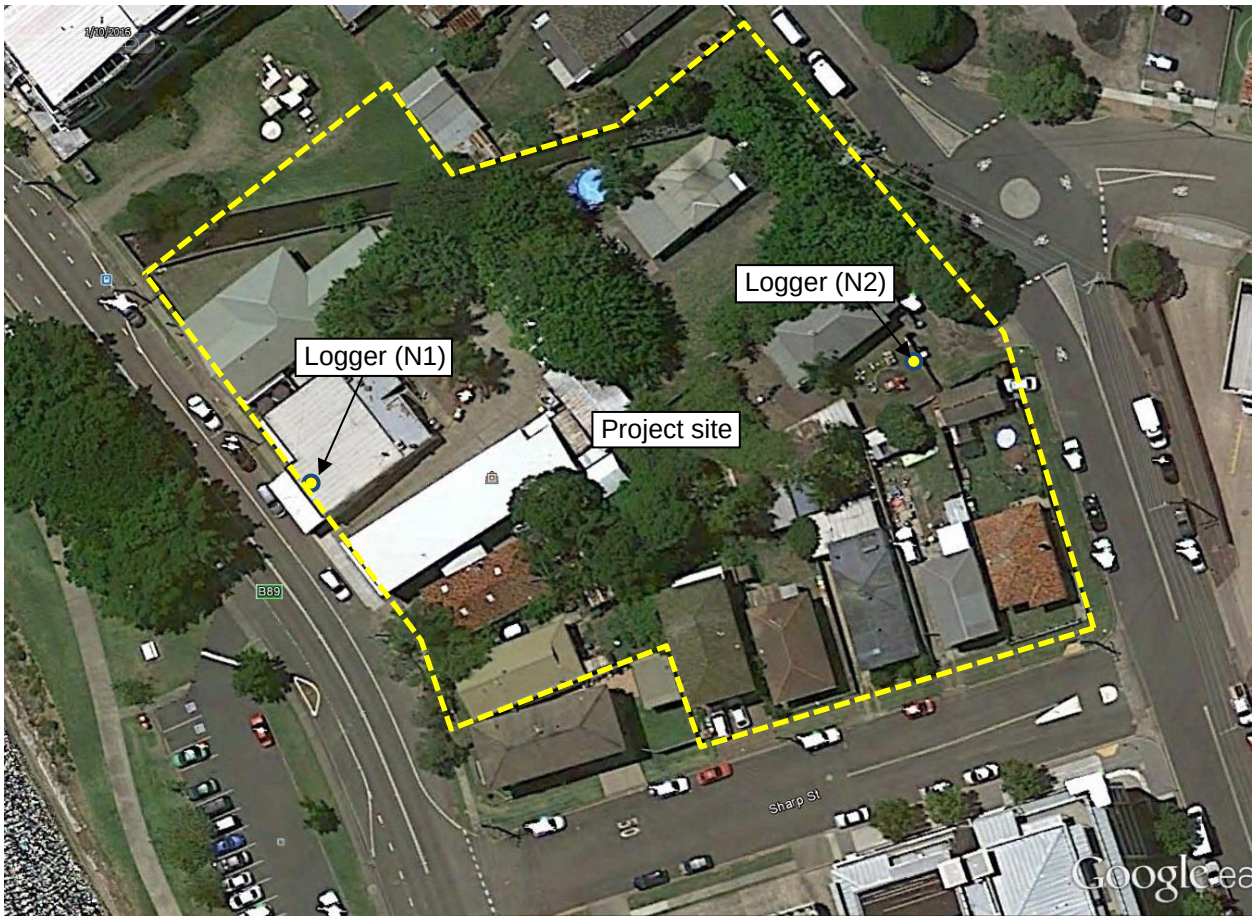

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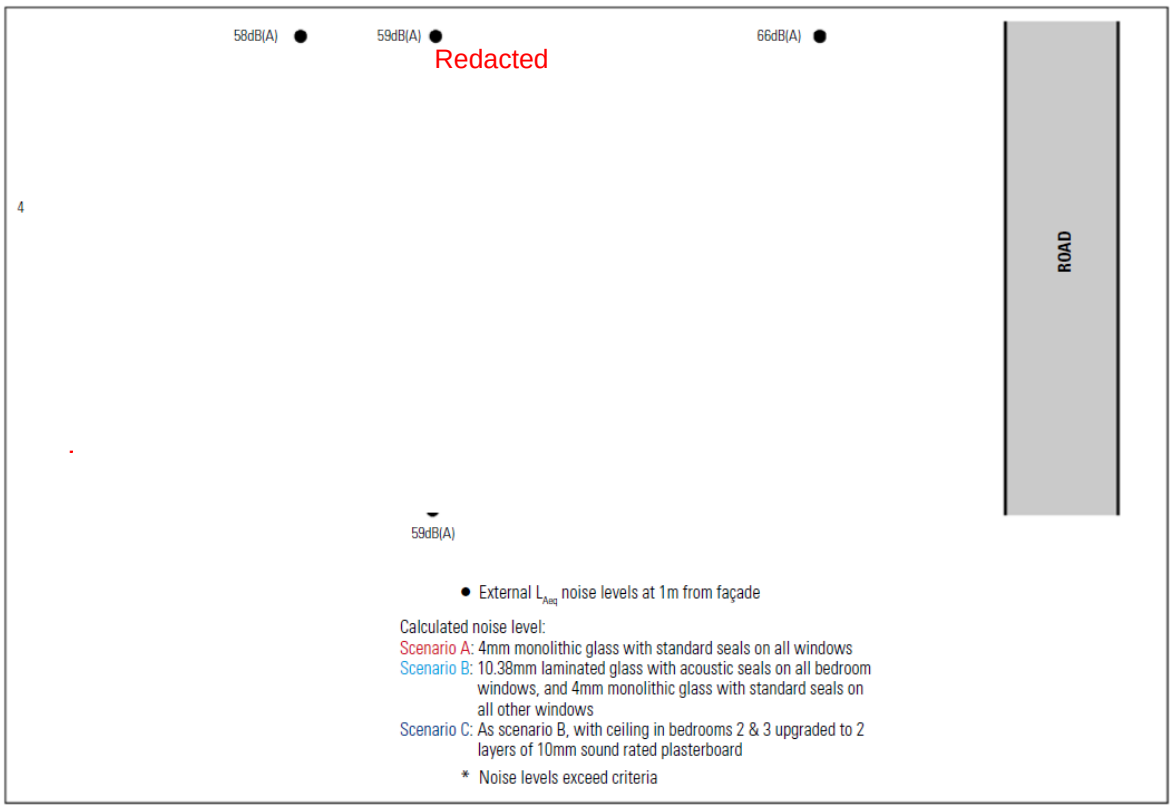

Figure 2. Traffic noise reduction for various construction types.

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Windows	10.38mm laminated glass with acoustic seals on all bedroom windows, standard 4mm monolithic glass with standard seals on all other windows	(Rw 35)
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Table 2 summarises the traffic noise reduction provided by each construction scenario for the cases in Figure 2 where a room contains either one or two windows.

TABLE 2 Traffic noise reduction in dB (from Figure B2 of the Interim Guideline (2008))		
Construction scenario	**Noise reduction (2 windows)**	**Noise reduction (1 window)**
Scenario A	23	25
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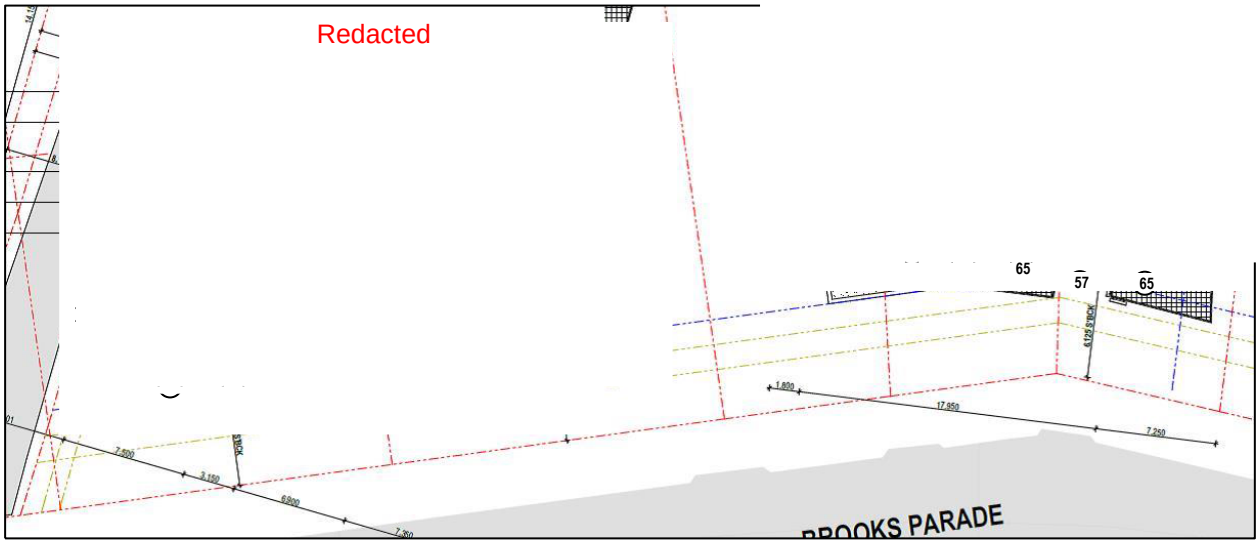

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K – Bed	57	35	22	Scenario A/B
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O – Living	65	40	25	Scenario A/B
P – Living	63	40	23	Scenario A/B

* Sliding doors will require laminated glazing for safety purposes regardless of acoustic requirement.

The results in Table 3 indicate that glazing upgrade to minimum 6.5mm Vlam Hush (or similar) will be required for all windows A-P in Figure 3 except window H, although glazing upgrade to this bedroom window is recommended.

Section 3.6.1 of the Guideline states: "If internal noise levels with windows or doors open exceed the criteria by more than 10 dBA, the design of the ventilation for these rooms should be such that occupants can leave windows closed, if they so desire, and also meet the ventilation requirements of the Building Code of Australia." This condition applies to all assessed windows in Figure 3.

NOISE EMISSIONS

Operational Noise

The NSW Industrial Noise Policy (INP) recommends a noise emission criterion of "background + 5 dB" for 15-minute LAeq noise emissions from industrial premises. Council usually accepts the INP criteria for any noise-generating development with potential to impact on residential amenity. The noise emission criteria for the proposal, based on the background noise levels at the Edgar Street logger, are

49 dB(A),$L_{eq(15minute)}$ (Day)
40 dB(A), $L_{eq(15minute)}$ (Evening)
36 dB(A), $L_{eq(15minute)}$ (Night)

The night time criterion of **36 dB(A),$L_{eq(15minute)}$** will be conservatively adopted as the governing criterion for noise impact at all receivers from all sources on the project site.

Noise emissions from mechanical plant at several locations throughout the site were computer modelled using the SoundPLAN software by EMF Griffiths (May 2012) for an assessment for a previous proposal for the site. EMF's estimated sound power levels up to 70 dB(A) for external mechanical plant such as air conditioners and exhaust fans concur with Spectrum Acoustics' file data. Based on the night time criterion of 36 dB(A) the minimum setback distance for individual mechanical noise sources from neighbouring residential boundaries is 20m if there is no barrier shielding the line of sight. Final selection and placement of external mechanical plant should be reviewed by the acoustic consultant to confirm compliance with the noise emission criterion.

There is a prosed ground floor visitor carpark with entry off Sharp Street adjacent to the rear boundary of the residence at 44 Brooks Parade as shown in **Figure 4**.

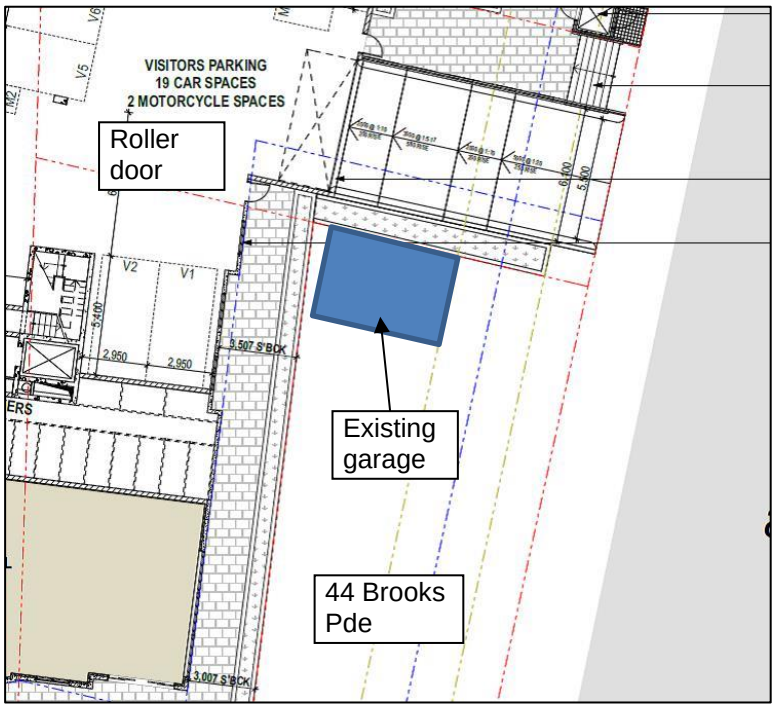


Figure 4. Sharp Street carpark entry

Assuming five vehicle movements in and/or out at low speed (5 @ 70 dB(A) x 3 sec) equals 52 dB(A),Leq(15min). A short 3-second duration has been adopted, as there is only a very short section of the proposed driveway that would not be shielded by the existing 4m high garage along the rear boundary of 44 Brooks Parade.

The centre line of the access driveway would be 3.5m from the rear boundary of 44 Brooks Parade. Taking into account distance loss gives a predicted level of 33 dB(A) which is 3 dB below the night time criterion.

The carpark entry would have a remote controlled panel lift door. These doors have historically presented a noise problem if they suffer mechanical damage or lack of lubrication. In some instances, maximum noise levels from a squeaky roller door up to 95 dB(A) have been measured and there is a potential for sleep disturbance impacts. A properly maintained and lubricated roller door, however, emits minimal noise in the order of 70 dB(A). Assuming five vehicles in 15 minutes and 10 second duration for

the roller door to open or close gives a sound power level of 57 dB(A),Leq(15min). The nearest point of 44 Brooks Street that is not occupied by the existing garage is approximately 12m from the proposed panel lift door. The predicted level of 27 dB(A),Leq(15min) at this location is 9 dB below the night time criterion of 36 dB(A). When added to the 33 dB(A) calculated above for the driveway, the combined level of 34 dB(A) is below the night time.

Commercial Premises

The proposal incorporates a ground floor commercial/retail tenancy adjacent to 44 Brooks Parade. The applicable night time noise criterion is 40 dB(A),Leq(15minute) for residences fronting Brooks Parade based on the background levels recorded in Table 1. Installation of mechanical plant for this tenancy should be guided by the acoustic considerations discussed above and should be signed off by the project acoustical consultant prior to installation.

If this tenancy is leased to a café or coffee shop there would be tables provided for patrons to sit outside. Given setback distances for the boundary as shown on drawing DA03-A and the location of the entrance to the tenancy, outdoor tables would be approximately 20m from the boundary of 44 Brooks Street. The sound power level of conversational speech is widely quoted as 75 dB(A) and the 15-minute average of intermittent conversation is estimated at 70 dB(A),Leq(15min). This reduces to 36 dB(A) at the boundary of 44 Brooks Parade, which is 4 dB Under the night time criterion. In practice, the level of customer noise at 44 Brooks parade would be insignificant compared with the existing night time traffic noise level of 57 dB(A).

Sleep Disturbance

To help protect against sleep disturbance at night, the EPA prefers $L_{1(1minute)}$, effectively the maximum L_{max}, noise levels from short-term impacts to be no more than 15dB above the background level when measured or calculated at 1m from any bedroom window. The sleep disturbance criterion for the current assessment is **46 dB(A),$L_{1(1min)}$**.

There is a proposed loading dock on the southern (Sharp Street) side of the site which is within 35m of residences on the opposite side of the street. Typical maximum impact noises and reverse alarms from trucks in loading docks are up to 100 dB(A). Allowing just for distance loss, this reduces to 61 dB(A),Lmax at the nearest residences. This is 15 dB above the night time sleep disturbance criterion. Since there is very limited scope for providing attenuation of noise emanating from the loading dock, it is recommended that use of the dock be restricted to daytime hours 7am – 6pm.

It is noted that reverse alarms are highly directional towards the rear of the vehicle, as this is the intended area of bystander warning. In any given 15-minute the alarm would sound for approximately 20 seconds as the vehicle reverses and for 15 seconds of that time there would be a typical -10dB directivity loss to receivers opposite on Sharp street. The calculated level is 78 dB(A),Leq(15min). The calculated level at residences opposite the loading dock at a distance of 35m is 39 dB(A). This exceeds the night time criterion but is below the day and evening criteria, further suggesting that the loading dock should not be used at night.

The carpark entry off Sharp Street would have a remote controlled roller door. As discussed above, a properly maintained and lubricated roller door emits minimal noise in the order of 70 dB(A). Adopting a worst case of 80 dB(A) gives a level of 41 dB(A),Lmax at the nearest Sharp Street residence. This is 5 dB below the sleep disturbance criterion.

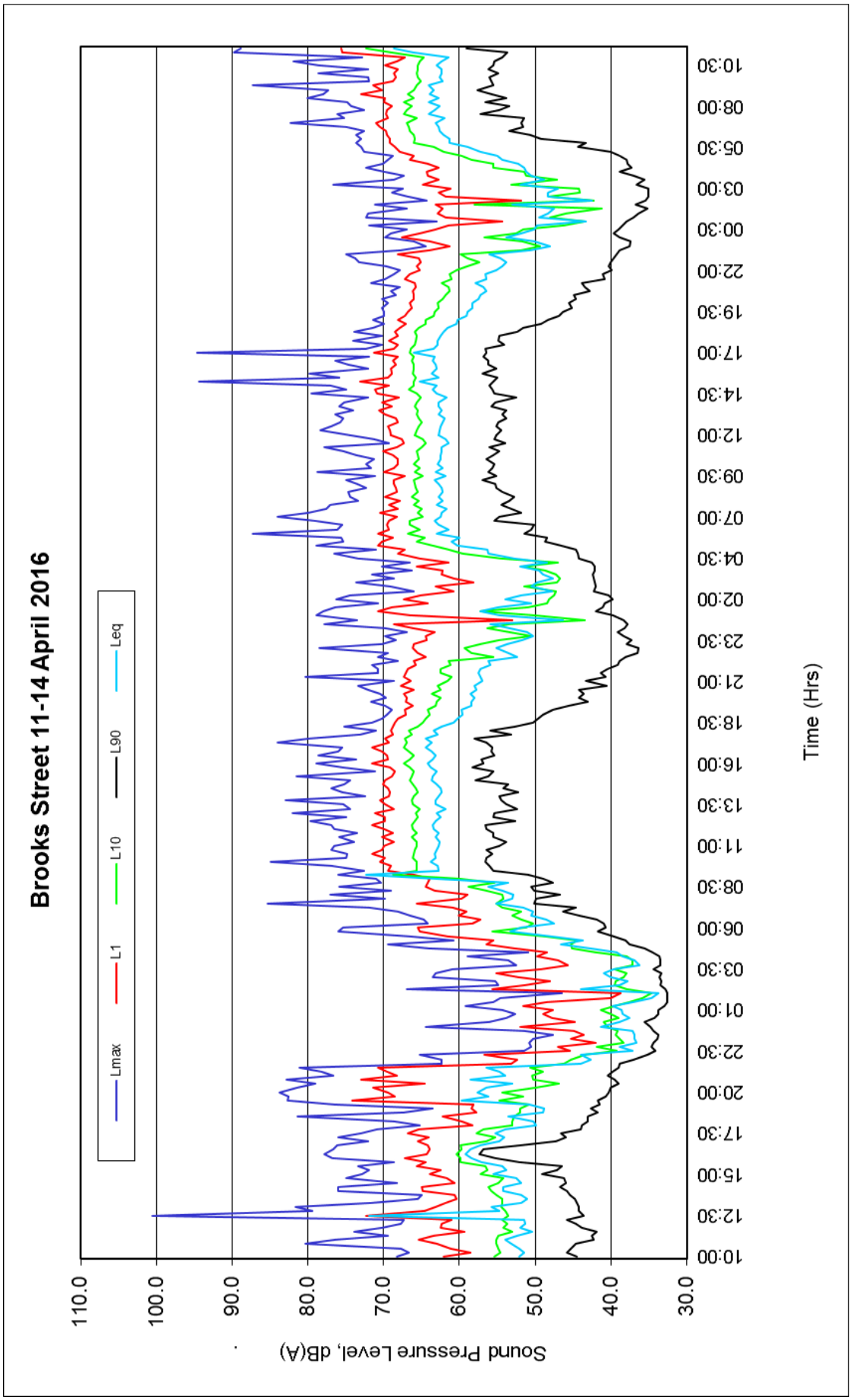
We trust this report fulfils your requirements at this time, however, should you require additional information or assistance please contact the undersigned on 49542276.

SPECTRUM ACOUSTICS PTY LIMITED

Neil Pennington
B.Sc., B.Math. (Hons), MAAS
Principal/Director

APPENDIX A

NOISE LOGGER DATA CHARTS


Brooks Street 11-14 April 2016
Lmax
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L10
L90
Leq
Sound Pressure Level, dB(A)
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100.0
90.0
80.0
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60.0
50.0
40.0
30.0
Time (Hrs)
10:00
12:30
15:00
17:30
20:00
22:30
01:00
03:30
06:00
08:30
11:00
13:30
16:00
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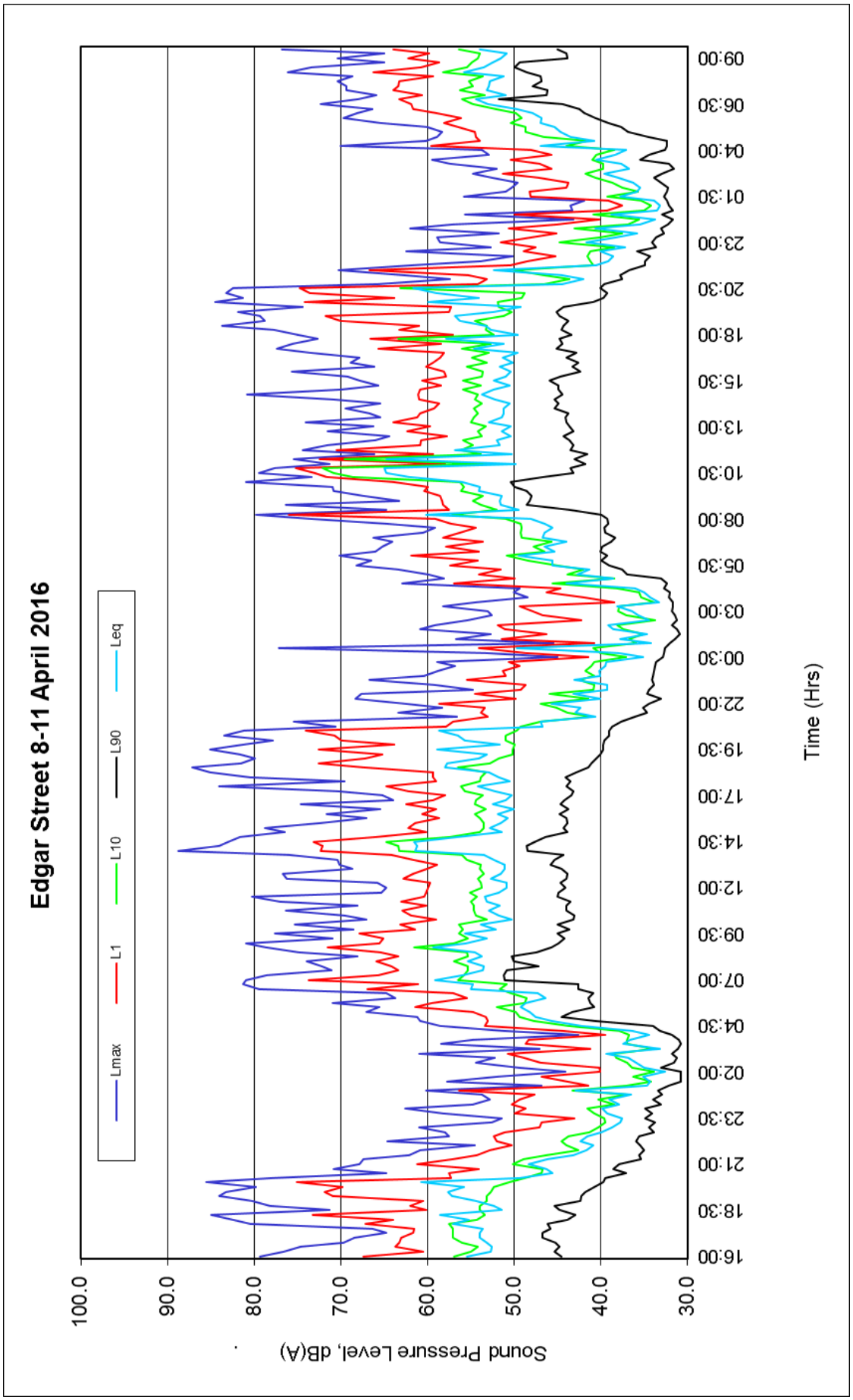
Edgar Street 8-11 April 2016
Lmax
L1
L10
L90
Leq
Sound Pressure Level, dB(A)
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90.0
80.0
70.0
60.0
50.0
40.0
30.0
Time (Hrs)
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18:30
21:00
23:30
02:00
04:30
07:00
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