H.Corp National Pty Ltd

71 Park Ave Kingwoods

Acoustic and Railway Vibration DA Assessment

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1 Introduction

The following report has been prepared by Acouras Consultancy on behalf of H.Corp National Pty Ltd to assess the potential for noise impact associated with the 71 Park Ave Kingwoods. The residential development will include:

- Two (2) basement carpark.
- Childcare centre on ground level.
- Residential apartment on ground to level 4.
- Childcare centre open space and communal space on roof top.

The proposed residential development is surrounded by existing residential buildings. Traffic noise along the Park Ave, to a lesser extent the Great Western Highway and railway noise contributes to the surrounding ambient noise levels. The site location is shown in Figure 1.

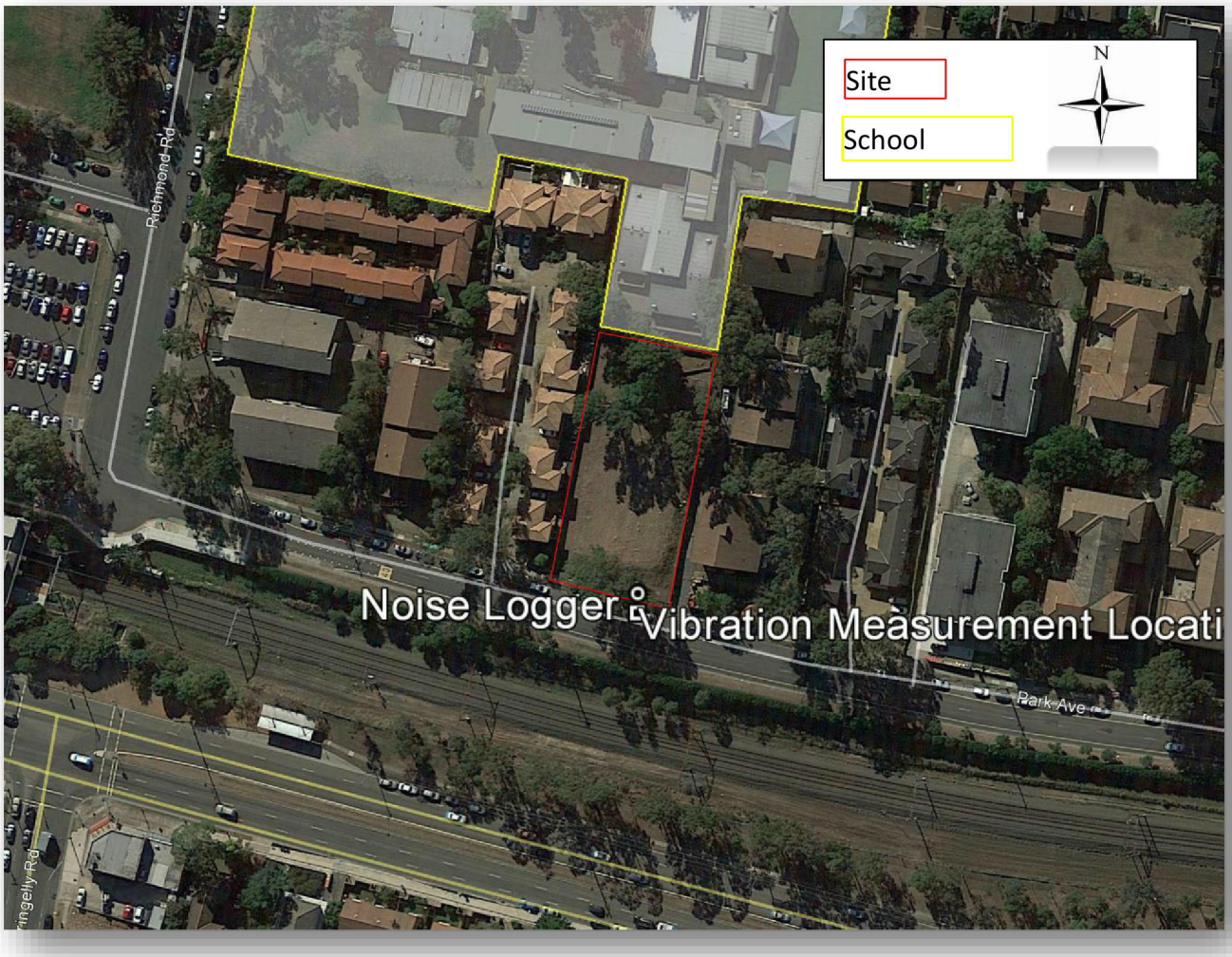

Figure 1 – Site Location, Nearest Residents and Noise Logger Position

2 Noise Criteria

The following standards and guidelines are applicable to this project:

- Penrith City Council: Development Control Plan (2014) Part C12.
- NSW Department of Planning "Development Near Rail Corridors and Busy Roads".
- NCC/BCA Part F5.
- NSW EPA "Noise Guide for Local Government" (NGLG).
- Association of Australian Acoustical Consultants (AAAC) "Guideline for Child Care Centre Acoustic Assessment" (September 2010).
- Australian standard AS/NZS 2107-2000: Acoustics – Recommended design sound levels and reverberation times for building interiors.
- Australian standard AS 1055.1-1997: Acoustics – Description and measurement of environmental noise - General procedures.

2.1 Internal Noise Levels

For road traffic noise, the DCP does not provide specific a guideline to implement. However, the NSW Department of Planning recommends Clause 102 (road) of the SEPP (Infrastructure) which requires that if the development is for the purpose of a building for residential use, the following L_{Aeq} levels are not exceeded.

Table 1— Development near Rail Corridors and Busy Roads – Interim Guideline

Residential Space	Internal Noise Criteria
in any bedroom in the building	35dB(A) at any time 10pm–7am
anywhere else in the building (other than a garage, kitchen, bathroom or hallway)	40dB(A) at any time

Mitigation measures are based on having windows and external doors closed. If internal noise levels with windows or doors open exceed the criteria by more than 10dBA, the design of the ventilation for these rooms should be such that occupants can leave windows closed, if they so desire, and also to meet the ventilation requirements of the Building Code of Australia.

The AS/NZS 2107–2000 outlines the acceptable internal noise levels such that a satisfactory acoustic environment within non-residential spaces in new buildings.

2.2 Childcare Centre Internal Noise

For the childcare centre on the ground floor of Building G, Australian Acoustical Consultants (AAAC) "Guideline for Child Care Centre Acoustic Assessment" (September 2010) recommends the following criteria for noise intrusion from traffic, rail and industry.

> *The noise level $L_{eq,1hr}$ from road, rail traffic or industry at any location within the outdoor play or activity area during the hours when the Centre is operating shall not exceed 55 dB(A). The noise level $L_{eq,1hr}$ from road, rail traffic or industry at any location within the indoor play or sleeping areas of the Centre during the hours when the centre is operating shall not exceed 40 dB(A).*

Also, AS/NZS 2107–2000 outlines the acceptable internal noise levels within occupied spaces in new and existing buildings. Table 2 presents the recommended internal design noise levels for the various spaces in a childcare centre.

Table 2— Recommended Internal Design Noise Levels (AS/NZS 2107)

Type of occupancy/activity	Recommended design sound level, L_{eq} in dB(A)	
	Satisfactory	Maximum
Reception and lobbies	45	50
Staff common rooms	40	45
Toilets	45	55

2.3 Railway Vibration Criteria

The proposed development is located within 60m of the nearest railway corridor, therefore vibration levels such as the intermittent vibration emitted by trains should be assessed in accordance with the criteria given in the EPA/DECC "Assessing Vibration: a technical guideline (2006)". Human comfort is normally assessed with reference to the above British Standard or Australian Standard AS 2670.2 1990. When assessing intermittent vibration, the vibration dose value (VDV) is used to determine the vibration energy received over the daytime and night-time periods. Acceptable values of vibration dose are presented in Table 3.

Table 3 – Acceptable vibration dose values for intermittent vibration ($m/s^{1.75}$)

Location	Daytime (7.00 am to 10.00 pm)		Night-time (10.00 pm to 7.00 am)	
	Preferred value	Maximum value	Preferred value	Maximum value
Residence	0.20	0.40	0.13	0.26

2.4 Sound Insulation Requirement (Part F5 NCC/BCA)

For sound transmission and insulation between sole occupancy units (SOU) within the same development, walls and floors to be constructed in accordance with requirements of Part F5 of the Building Code of Australia (BCA). Sound insulation requirements are summarised in Table 4.

Table 4 - NCC Part F5 Requirements (Class 2 or 3)

Building Element	Minimum NCC Part F5 Requirements
Sound Insulation Rating of Walls (Class 2 or 3)	
Walls between separate sole occupancy units.	Rw + Ctr 50 (airborne)
Walls between wet areas (bathrooms, sanitary compartment, laundry or kitchen) and a habitable room (other than kitchen) in adjoining apartments.	Rw + Ctr 50 (airborne) & of discontinuous construction
Walls between sole occupancy unit and stairway, public corridors, public lobby or the like or parts of a different classification.	Rw 50 (airborne)
Walls between a plant room or lift shaft and a sole occupancy unit.	Rw 50 (airborne) & of discontinuous construction
Sound Insulation Rating of Floors (Class 2 or 3)	
Floors between sole occupancy units or between a sole occupancy unit and plant room, lift shaft, stairway, public corridor, public lobby or the like.	Rw + Ctr 50 (airborne) & Ln,w + Cl < 62 (impact)
Apartment Entry Doors (Class 2 or 3)	
A door incorporated in a wall that separates a sole-occupancy unit from a stairway, public corridor, public lobby or the like.	Rw 30 (airborne)
Services (Class 2, 3 or 9c)	
If a storm water pipe, a duct, soil, waste or water supply pipe including a duct or pipe that is located in a wall or floor cavity serves or passes through more than one sole occupancy unit must be separated:	
if the adjacent room is a habitable room (other than a kitchen); or	Rw + Ctr 40
if the room is a kitchen or non-habitable room	Rw + Ctr 25

Construction Deemed to Satisfy

The forms of construction must be installed as follows:

(a) Masonry—Units must be laid with all joints filled solid, including those between the masonry and any adjoining construction.

(b) Concrete slabs—Joints between concrete slabs or panels and any adjoining construction must be filled solid.

(c) Sheeting materials—

(i) if one layer is required on both sides of a wall, it must be fastened to the studs with joints staggered on opposite sides; and

(ii) if two layers are required, the second layer must be fastened over the first layer so that the joints do not coincide with those of the first layer; and

(iii) joints between sheets or between sheets and any adjoining construction must be taped and filled solid.

(d) Timber or steel-framed construction—perimeter framing members must be securely fixed to the adjoining structure and—

(i) bedded in resilient compound; or

(ii) the joints must be caulked so that there are no voids between the framing members and the adjoining structure.

(e) Services—

(i) Services must not be chased into concrete or masonry elements.

(ii) A door or panel required to have a certain Rw + Ctr that provides access to a duct, pipe or other service must—

(A) not open into any habitable room (other than a kitchen); and

(B) be firmly fixed so as to overlap the frame or rebate of the frame by not less than 10 mm, be fitted with a sealing gasket along all edges and be constructed of—

(aa) wood, particleboard or blockboard not less than 33 mm thick; or

(bb) compressed fibre reinforced cement sheeting not less than 9Â mm thick; or

(cc) other suitable material with a mass per unit area not less than 24.4 kg/m^2

(iii) A water supply pipe must—

(A) only be installed in the cavity of discontinuous construction; and

(B) in the case of a pipe that serves only one sole-occupancy unit, not be fixed to the wall leaf on the side adjoining any other sole-occupancy unit and have a clearance not less than 10 mm to the other wall leaf.

(iv) Electrical outlets must be offset from each other—

(A) in masonry walling, not less than 100 mm; and

(B) in timber or steel framed walling, not less than 300 mm.

2.5 Noise Survey and Project Specific Limits

An unattended noise survey was carried out at the site to measure the background and ambient noise levels. Nose monitoring was conducted between Thursday 19th to Wednesday 25th January 2015. The monitor was positioned as shown in Figure 1.

Measurements were conducted using the following equipment:

- SVAN 958A Type 1 Real time Analyser/Noise Logger. Serial No. 36624.
- SVAN SV30A Type 1 Sound Level Calibrator. Serial No. 31830.

Noise monitoring was conducted in general accordance with Australian standard AS 1055.1-1997: Acoustics-Description and measurement of environmental noise-General procedures. The noise analyser was calibrated immediately before and after measurements were taken with no discernible differences between these two recorded levels. The sound analyser is Type 1 and complies with Australian standard AS1259.2: 1990.

Table 5 presents a summary of the measured ambient noise level and traffic noise impacting the development.

Table 5 – Measured Ambient and Traffic Noise and Levels, dBA

Location	Period	Average L_{eq}	Highest L_{eq} 1hr
Park Ave	Day (07:00-22:00)	56	63
	Night (22:00-07:00)	53	58

To assess the noise impact from rail vehicle movements both day and night period, attended measurements were take of at least 20 pass-bys. The following formula has been applied to determine the $L_{Aeq(T)}$ for each period as shown in Table 6.

$$L_{Aeq(T)} = 10\log_{10}\frac{1}{T}\sum_{i=1}^{N}\left(n_i \times 10^{\left(\frac{LAE_i}{10}\right)}\right)$$

Table 6 – Railway Vehicle Noise and Levels, dBA

Period	Average	Highest
Day (07:00-22:00)	$L_{eq(15hr)}$ 58	L_{eq1hr} 60
Night (22:00-07:00)	$L_{eq(9hr)}$ 52	L_{eq1hr} 53

Table 7 presents a summary of the measured background noise level and the allowable intrusive noise limit for this project in accordance with the EPA NGLG. For the purpose of the assessment, the background noise level has been determined using the RBL in accordance with the method given in the EPA INP.

Table 7—Noise Survey Summary and Project Limits, dBA

Time Period	Existing Noise Levels		DCP Noise Limits, Leq
	$L_{eq\ (period)}$	RBL	
Day	56	46	51
Evening	55	46	51
Night	53	37	42

During detailed design stage, the design and selection of the mechanical equipment required to service the proposed development will be required to achieve the DCP noise limits as presented in the table above.

2.6 Children Activity Noise Limits (AAAC)

Penrith City Council DCP does not have any specific guide for controlling noise emission from children activity and from the operation of mechanical equipment that is associated with this type of development. Also, the EPA Noise Guide for Local Government (NGLG) and the Industrial Noise Policy (INP) does not provide an objective noise goal in assessing the intrusive impact from children activity to nearby residential receivers.

Therefore, to provide an objective assessment of the proposed childcare centre the Association of Australian Acoustical Consultants (AAAC) "Guideline for Child Care Centre Acoustic Assessment" (September 2010) as a best practice method to determine the intrusive noise levels. The AAAC guideline recommends that outdoor play be assessed as follows:

- Up to 2 hours (total) per day - The $L_{eq\ 15\ min}$ noise level emitted from the outdoor play area shall not exceed the background noise level by more than 10 dB at the assessment location.
- More than 2 hours per day - The $L_{eq\ 15}$ min noise level emitted from the outdoor play area shall not exceed the background noise level by more than 5 dB at the assessment location.

The assessment location is defined as the most affected point on or within any residential receiver property boundary. Examples of this location may be:

- 1.5 m above ground level;
- On a balcony at 1.5 m above floor level;
- Outside a window on the ground or higher floors.

For the purpose of the assessment, the background noise level RBL has been determined based on the average noise level recorded during the expected play time periods. Table 8 presents a summary of the measured background noise level and the allowable intrusive noise limit for this project from children activity noise.

Table 8—Children Activity Noise Limits, dBA (AAAC)

Location	Time Period	Existing Noise Levels			AAAC Noise Limits, $L_{eq\ (15min)}$[1]
		$L_{eq\ (period)}$	$L_{90\ (period)}$	RBL	
	Day (07:00-18:00)	56	48	46	51
	Evening (18:00-22:00)	55	47	46	51
	Night (22:07:00)	53	41	37	N/A

At this stage of the DA assessment, the proposed future tenant and operational activities of the childcare centre have not been finalised. Following the DA approval of the future tenant for the centre is to provide a separated detailed assessment of all activities to the be undertake to ensure compliance with the AAAC noise limits as given in Table 8.

During the monitoring period any adverse weather condition have been excluded. The noise logger results are presented in Appendix C.

[1] More than 2 hours per day - not exceed the background noise level by more than 5 dB.

3 Assessment and Recommendations

3.1 Façade Glazing Requirements

Acoustic glazing for the apartments are given in Table 9 are required to reduce noise impact on the internal occupants and should result in noise levels within such units in accordance with the Department of Planning Noise Guidelines and AS/NZS 2107:2000.

Table 9 – Schedule of Window and Glazing (R_w)

Level	Apt No.	Space	Glazing Thickness	Minimum R_w (Glazing+Frame)
G	1	Living	6.38mm laminated	30
		Bed 1 & 2	10.38mm laminated	32
	Childcare centre	All	10.38mm laminated	32
1	14 & 16	Living	6.38mm laminated	30
		Bed 1	6.38mm laminated	30
		Bed 2	10.38mm laminated	32
	15	Living	6.38mm laminated	30
		Bed 1	10.38mm laminated	32
2	25 & 27	Living	6.38mm laminated	30
		Bed 1	6.38mm laminated	30
		Bed 2	10.38mm laminated	32
	26	Living	6.38mm laminated	30
		Bed 1 & 2	10.38mm laminated	32
3	37 & 38	Living	6.38mm laminated	30
		Bed 1	6.38mm laminated	30
		Bed 2	10.38mm laminated	32
4	48 & 50	Living	6.38mm laminated	30
		Bed 1	6.38mm laminated	30
		Bed 2	10.38mm laminated	32
	49	Living	6.38mm laminated	30
		Bed 1	10.38mm laminated	32
All others		Living & Bedroom	6.38mm laminated	30

All other non-habitable spaces, such as bathrooms and laundries require minimum 6mm monolithic glass (Rw 28). All Windows/doors should be well sealed (air tight) when closed with good acoustic seals around the top and bottom sliders. Mohair seals are not considered to be acoustic seals.

3.2 Building Façade Construction

To provide sufficient acoustic attention of noise, the general external construction of the proposed building would need to be constructed as detailed in Table 10.

Table 10 – External Façade Construction (R_w)

Building Element	Proposed Construction	Minimum R_w
External Wall	Masonry or cavity brick	45
Roof and ceiling	Concrete with a plasterboard cavity ceiling	45

3.3 Mechanical Services

At the DA stage, the design and selection of mechanical equipment has not been finalised. Following the DA approval of the proposed development, during the Construction Certification Stage a detail assessment of all mechanical plant and equipment will be conducted to ensure compliance with the EPA and DCP noise criteria. Typical acoustic measures may include the construction of acoustic barriers, enclosures, attenuators and/or acoustic louvres.

3.4 Railway Vibration Measurement Results

On-site measurements were conducted on 19th and on 25th January 2017 to determine the tactile vibration amplitude due to train pass-bys. Measurements of at least 20 train-pass-by events and background levels were recorded. From the measured vibration levels, the eVDV in Table 11 indicates a low probability of adverse comment during the daytime or night time. The measured vibration levels are below the base vibration curve for residential development during the day and night, as shown in Figure 2 and unlikely that there will be complaints. Based on these results, there is no further requirement to treat the rail vibration impacts.

Table 11 – eVDV of Ground Vibration Measurements of Rail Pass-by

Time	eVDV	Adverse Comment
Day	0.003	Low probability
Night	0.002	Low probability

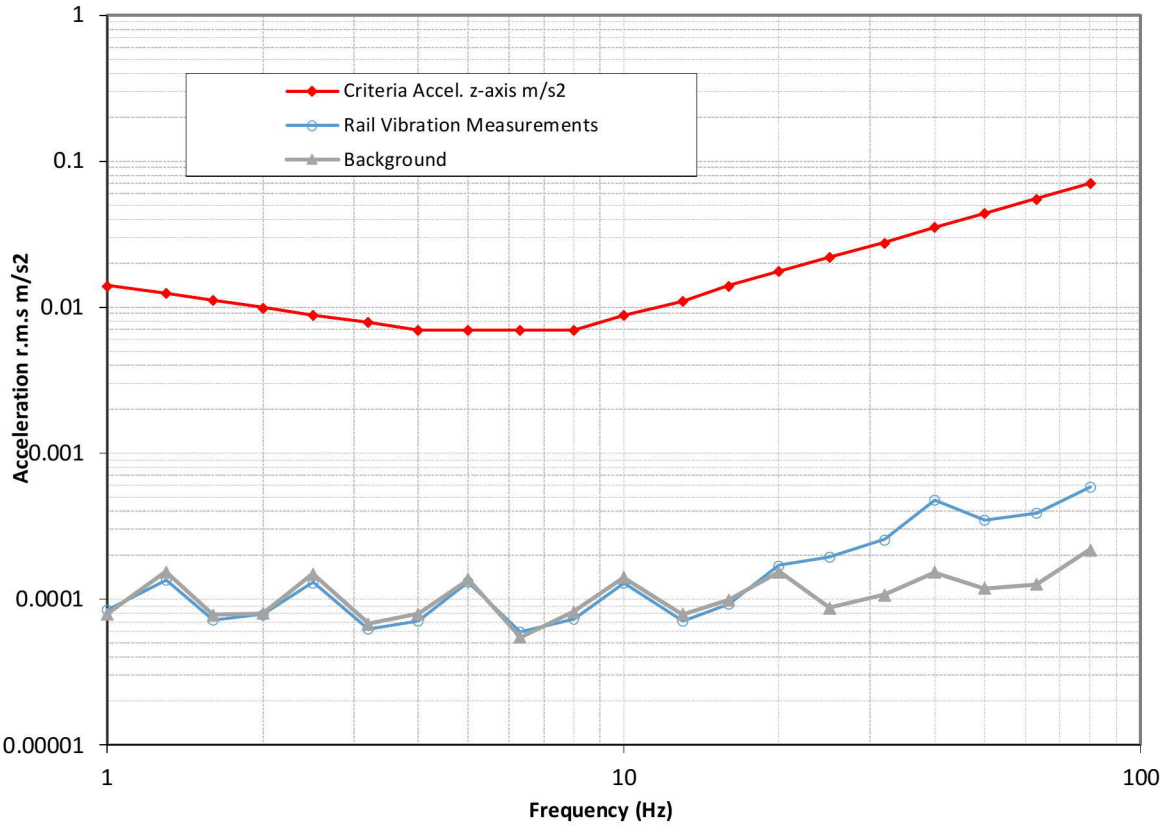

Figure 2 –Railway Train Vibration RMS Acceleration (Z-Axis)

4 Conclusion

An acoustic assessment of the proposed development has been carried out in accordance with the requirements of Penrith City Council DCP.

An environmental noise survey of the site has been conducted and the noise limiting criteria for mechanical plant/equipment noise emission has been determined based on the EPA NGLG. The limits are presented in Table 7.

Construction for glazing, external walls and the roof/ceiling systems have been provided to achieve the internal noise criteria and are detailed in Section 3.1 and Section 3.2 based on the impact of road, rail and aircraft noise.

An assessment of railway vibration levels has been conducted accordance with the Department of Planning guidelines and EPA criteria. Section 3.4 details the assessment and results indicate there is a “low probability” of impact.

At this stage of the DA assessment, the proposed future tenant and operational activities of the childcare centre have not been finalised. Following the DA approval of the future tenant for the centre is to provide a separated detailed assessment of all activities to the be undertake to ensure compliance with the AAAC noise limits as given in Table 8.

Providing the recommendations in this report are implemented, the noise from the proposed development is predicted to comply with acoustic requirements of the Penrith City Council DCP, Department of Planning (SEEP), BCA Part F5 and relevant Australian standards.

Appendix A – Acoustic Terminology

Decibel, dB: A dimensionless unit which denotes the ratio between two quantities that are proportional to power, energy or intensity. One of these quantities is a designated reference by which all other quantities of identical units are divided. The sound pressure level in decibels is equal to 10 times the logarithm (to the base 10) of the ratio between the pressure squared divided by the reference pressure squared. The reference pressure used in acoustics is 20 micro Pascals.

A-WEIGHTING: A measure of sound pressure level designed to reflect the response of the human ear, which does not respond equally to all frequencies. To describe sound in a manner representative of the human ear's response it is necessary to reduce the effects of the low and high frequencies with respect to medium frequencies. The resultant sound level is said to be A-weighted, and the units are in decibels (dBA). The A-weighted sound level is also called the noise level.

Sound Pressure Level, L p (dB), of a sound: 20 times the logarithm to the base 10 of the ratio of the r.m.s. sound pressure to the reference sound pressure of 20 micro Pascals. Sound pressure level is measured using a microphone and a sound level meter, and varies with distance from the source and the environment.

Ambient Noise/Sound: All noise level present in a given environment, usually being a composite of sounds from many sources far and near. Traffic, HVAC, masking sound or even low-level background music can contribute to ambient level of noise or sound.

Percentile Level - L 90 , L 10 , etc: A statistical measurement giving the sound pressure level which is exceeded for the given percentile of an observation period, e.g. L 90 is the level which is exceeded for 90% of a measurement period. L 90 is commonly referred to as the "background" sound level.

Background Noise (L 90): The sum total of all unwanted residual noise generated from all direct and reflected sound sources in a space that can represent an interface to, or interfere with good listening and speech intelligibility.

Rating Background Level – RBL: Method for determining the existing background noise level which involves calculating the tenth percentile from the L A90 measurements. This value gives the Assessment Background Noise Level (ABL). Rating Background Level is the median of the overall ABL.

L AEQ,T : Equivalent continuous A-weighted sound pressure level. The value of the A-weighted sound pressure level of a continuous steady sound that, within a measurement time interval T, has the same A-weighted sound energy as the actual time-varying sound.

Appendix B – Architectural Drawings

This assessment was based on the following architectural drawings provided by Stephen Bowers Architects.

Drawing	Issue	Date	Description
DA-009	P8	17.01.2017	Site Plan
DA-010	P8	17.01.2017	Basement 2 Plan
DA-011	P8	17.01.2017	Basement 1 Plan
DA-012	P8	17.01.2017	Ground Floor Plan
DA-013	P8	17.01.2017	Level 1 Plan
DA-014	P8	17.01.2017	Level 2 Plan
DA-015	P8	17.01.2017	Level 3 Plan
DA-016	P8	17.01.2017	Level 4 Plan
DA-017	P8	17.01.2017	Level 5 Plan
DA-021	P8	17.01.2017	South Elevation
DA-022	P8	17.01.2017	East Elevation
DA-023	P8	17.01.2017	West Elevation
DA-024	P8	17.01.2017	North Elevation

Appendix C – Noise Logger Results