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Project 2655
5 March 2010

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Dear Mr Sargis

157 TO 163 CLEVELAND STREET CHIPPENDALE – MIXED USE DEVELOPMENT
ROAD TRAFFIC NOISE INTRUSION ASSESSMENT

1 INTRODUCTION

Acoustic Dynamics is engaged by Hudson Square Pty Ltd to prepare road traffic noise intrusion assessment for compliance with the Director-General's Requirements for the subject development at 157 to 163 Cleveland Street and 136 to 144 Abercrombie Street, Chippendale, NSW (Application number 07_1080).

This document is prepared in accordance with the Director General's Requirements, the relevant NSW State Environmental Planning Policies (SEPP's), the relevant planning instruments of the Redfern-Waterloo Authority and the City of Sydney Council, and the various relevant Legislation, Guidelines and Australian Standards.

2 DESCRIPTION OF PROPOSAL AND LOCATION

The development proposal is to demolish the existing premises currently situated on site at the 157 to 163 Cleveland Street, Chippendale and erect a five storey mixed use premises containing basement off street car parking, commercial tenancies on the ground, first and second floors, and residential boarding house accommodation on the third floor of the development.

Acoustic Dynamics understands that the adjacent existing mixed-use building located on-site at 136 to 144 Abercrombie Street, Chippendale is to remain unchanged.

The proposed development site has three road frontages. The northern boundary is direct to Cleveland Street, the southern boundary is direct to Hudson Street, and the eastern boundary is direct to Hart Street. The western boundary is shared with the adjacent mixed use building at 136 to 144 Abercrombie Street.

The subject development is also shown on the Location Map, Aerial Photograph, Drawings and Photos presented within **Appendix A**.

3 RELEVANT ACOUSTIC CRITERIA AND STANDARDS

Acoustic Dynamics advises that external noise intrusion must be able to be adequately reduced to provide development occupants an appropriate acoustic amenity.

The location of the proposed development falls within the “Eveleigh Streets Precinct” state significant site area, within the operational area of the Redfern-Waterloo Authority. Due to this, consent authority for the proposed development is the NSW Minister for Planning and the Redfern-Waterloo Authority.

In section 3 of this document, we explain acoustic terms and symbols used to describe noise. The origin and applicability of each acoustic criterion is set out. Detail of the relevant applicable noise criteria is also provided.

3.1 Noise Descriptors and Definitions

Noise is a variation in sound pressure at audible frequencies. In addition to such rapid frequency variations, the **overall level of noise almost always varies with time**. To describe a noise environment, more than one descriptor is necessary to show both a level and how the noise ranges about that level. By sampling sound levels at a measurement location eight times per second, a great deal of data is generated. To reduce that data to useful information, the levels exceeded for different percentages of the total period are calculated. The statistical descriptor L_{A10} measures the A-weighted noise level exceeded for 10% of the sample time. The statistical values measured and assessed for this noise survey are the L_{A10} and L_{A90} noise levels. Also measured and assessed are L_{Aeq} noise levels.

The "A-weighting" refers to prescribed amplitude versus frequency curve used to "weight" noise measurements, to represent the frequency response of the human ear. Put more simply, the human ear is less sensitive to noise at some frequencies than it is to noise at other frequencies. The A-weighting is an attempt to measure a result with a single overall number to represent how we subjectively hear different frequencies at different levels.

3.2 Audibility, Identification and Annoyance

It is important to realise that the acceptability of a given noise depends on both its character and the character of the background sound. The **many parameters** that **influence noise character** also influence how identifiable, audible and of course, annoying is the noise under investigation. It is often unstated that the number marking the marginal difference at the acceptable/unacceptable boundary depends a great deal on noise character (as well as which descriptors are used, as described in section 3.1).

In this assessment of environmental noise, Acoustic Dynamics has considered the character of the noise under investigation which is compared against the character of the background noise. A trained professional's judgement is required to assess audibility, identifiability and the potential for annoyance. The assessment in this report is made using the measured objective noise descriptors together with descriptions of both the noise under investigation and the background noise character.

3.3 Director General's Requirements

The Director General's Requirements relating to the subject project application for 157 to 163 Cleveland Street and 136 to 144 Abercrombie Street, Chippendale, NSW (Application number 07_1080) details the following conditions relating to acoustics:

> ***"Key Issues***
>
> *The Environmental Assessment (EA) must address the following key issues:*
>
> 1. ***Relevant EPI's policies and Guidelines to be Addressed***
>   - *Address planning provisions applying to the site, including permissibility and the provisions of all plans and policies including:*
>   - *SEPP (Major Projects) 2005 Schedule 3 – The Redfern–Waterloo Authority Sites;*
>   - *SEPP (Infrastructure) 2007;*
>   - *SEPP Building Sustainable Development Index: (BASIX);*
>   - *SEPP 55 – Remediation of Land;*
>   - *SEPP 65 – Residential Flat Design Code;*
>   - *Draft SEPP 66 – Integration of Land Use and Transport;*
>   - *Standard Instrument (Local Environmental Plans) Order 2006;*
>   - *Redfern-Waterloo Built Environment Plan (Stage One) August 2006; and*
>   - *Redfern-Waterloo Authority Contribution Plan 2006 and the Redfern-Waterloo Authority Affordable Housing Contributions Plan 2006.*
>   - *Address nature and extent of any non-compliance with relevant environmental planning instruments, plans and guidelines and justify any non-compliance.*
>   - *Note: For Part 3A Project Applications, there is no ability to permit noncompliance with the development standards set out in Clause 21 of Schedule 3, Part 5 – The Redfern-Waterloo Authority Sites of State Environmental Planning Policy (Major Projects) 2005 (MP SEPP). Therefore, the proposal must be amended to comply with these standards.*
>
> 2. ***Environmental and Residential Amenity***
>   - *Address solar access, acoustic privacy, visual amenity, view loss and wind impacts and achieve a high level of environmental and residential amenity.*
>   - *Demonstrate that road traffic noise from Cleveland Street will be mitigated by durable materials and maintained so that there are no unacceptable impacts from noise.*"

The above requirements can be enforced under the Environmental Planning and Assessment Act of 1979.

3.4 NSW State Environmental Planning Policies (SEPP's)

Acoustic Dynamics has conducted a review of the NSW Department of Planning's State Environmental Planning Policies (SEPP's) relevant to the proposed project, including the following documents:

- SEPP (Major Projects) 2005;
- SEPP (Infrastructure) 2007;
- SEPP Building Sustainable Development Index: (BASIX);
- SEPP 55 – Redmediation of Land;
- SEPP 65 – Design Quality of Residential Flat Development; and
- Draft SEPP 66 – Integration of land Use and Transport.

Detail of the relevant acoustic provisions of these documents is provided below.

Acoustic Dynamics' review of the "SEPP (Major Projects) 2005", "SEPP Building Sustainable Development Index: (BASIX)", "SEPP 55 – Redmediation of Land", "SEPP 65 – Design Quality of Residential Flat Development" and the "Draft SEPP 66 – Integration of land Use and Transport" did not yield specific acoustic criteria relating to a major project development, residential or mixed use development, such as the proposed development.

The "SEPP (Infrastructure) 2007" contains the following relevant references and criteria for the assessment of proposed development near rail corridors and busy roads:

> *"**102 Impact of road noise or vibration on non-road development***
>
> *(1) This clause applies to development for any of the following purposes that is on land in or adjacent to the road corridor for a freeway, a tollway or a transitway or any other road with an annual average daily traffic volume of more than 40,000 vehicles (based on the traffic volume data published on the website of the RTA) and that the consent authority considers is likely to be adversely affected by road noise or vibration:*
> *(a) a building for residential use,*
> *(b) a place of public worship,*
> *(c) a hospital,*
> *(d) an educational establishment or child care centre.*
>
> *(3) If the development is for the purposes of a building for residential use, the consent authority must not grant consent to the development unless it is satisfied that appropriate measures will be taken to ensure that the following L_{Aeq} levels are not exceeded:*
> *(a) in any bedroom in the building—35 dB(A) at any time between 10 pm and 7 am,*
> *(b) anywhere else in the building (other than a garage, kitchen, bathroom or hallway)—40 dB(A) at any time.*
>
> *(4) In this clause, freeway, tollway and transitway have the same meanings as they have in the Roads Act 1993."*

The above planning conditions can be enforced under the Environmental Planning and Assessment Act of 1979.

3.5 Redfern-Waterloo Authority and City of Sydney Council Noise Criteria

Further to the above Director General's Requirements and SEPP conditions, Acoustic Dynamics conducted a review of the relevant planning instruments of the Redfern-Waterloo Authority (RWA) and the City of Sydney Council, including the following documents:

- Redfern-Waterloo Built Environment Plan (Stage One) August 2006;
- Redfern-Waterloo Authority Contribution Plan 2006; and
- City of Sydney Council Boarding Houses Development Control Plan (DCP) 2004.

Review of the RWA planning control documents, did not yield specific acoustic criteria relating to the proposed development.

The City of Sydney Council's "Boarding Houses DCP 2004" provides the following relevant acoustic criteria and references:

> ***"Part 1 - General Information, Legislative Framework & Development Assessment***
>
> ***1.10 Building Classifications under the Building Code of Australia***
>
> *The Building Code of Australia (BCA) is a further piece of legislation relevant to the planning and design of Boarding Houses. It contains the technical provisions for the design and construction requirements, including fire safety, access and structural stability. Whilst many of the relevant design and construction standards are contained within the DCP, reference should always be made to the BCA and the relevant Australian Standards (AS) to ensure compliance with all aspects where necessary.*
>
> *Applicants considering establishing a Boarding House either within an existing building, or by way of erection of a new building, should consult Council's Shared Accommodation Project Officer, or alternatively a private professional consultant to clearly determine these requirements.*
>
> ***Part 2 - Planning and Design Guidelines***
>
> ***2.5 Acoustic Impacts***
>
> *In instances where noise abatement issues are apparent from Class 3 Boarding Houses an acoustic report prepared by a suitably qualified acoustical consultant will be required to be submitted with the development application, describing and assessing the impact of noise emissions from the proposal. The investigation shall include but not be limited to the following:*
>
> - *the identification of sensitive noise receivers potentially impacted by the proposal;*
> - *the quantification of the existing acoustic environment at the receiver locations (measurement techniques and assessment period should be fully justified and in accordance with relevant Australian Standards and NSW EPA requirements);*

- *the formulation of suitable assessment criteria;*
- *details of any acoustic control measures that will be incorporated into the proposal;*
- *the identification of all noise that is likely to emanate from the Boarding House and the subsequent prediction of resultant noise at the identified sensitive receiver locations from the operation of the premises. Where appropriate the prediction*
- *a statement certifying that the development is capable of operating without causing a nuisance;*

That noise arising from within the premises shall not result in an 'offensive noise' (as defined in the Protection of the Environment Operations Act, 1997) at any adjoining residential premises."

The above planning conditions can be enforced under the Environmental Planning and Assessment Act of 1979.

3.6 The DECCW's Environmental Criteria for Road Traffic Noise

The NSW Department of Environment, Climate Change and Water (DECCW) presents guidelines for assessment of road traffic noise in its document Environmental Criteria for Road Traffic Noise (ECRTN). The document provides road traffic noise criteria for proposed road or residential developments, based on the functional category of the relevant road, as well as criteria for other sensitive land uses. Strategies for the reduction of noise levels are also provided to assist in situations where the noise level criteria are already exceeded by existing sources. **Table 3.5.1** presents the relevant ECRTN noise criteria for the subject development site.

Table 3.5.1 Road Traffic Noise Criteria for Residential Land Uses

Type of Development	Criteria		
	Day 7am – 10pm [dB(A)]	Night 10pm – 7am [dB(A)]	Where Criteria Are Already Exceeded
2. New residential land use affected by freeway / arterial traffic noise	$L_{Aeq(15hr)}$ 55	$L_{Aeq(9hr)}$ 50	Where feasible and reasonable, existing noise levels should be reduced to meet the noise criteria via judicious design and construction of the development. Locations, internal layouts, building materials and construction should be chosen so as to minimise noise impacts.
5. New residential land use affected by collector traffic noise	$L_{Aeq(1hr)}$ 60	$L_{Aeq(1hr)}$ 55	Where feasible and reasonable, existing noise levels should be reduced to meet the noise criteria via judicious design and construction of the development. Locations, internal layouts, building materials and construction should be chosen so as to minimise noise impacts.

3.6 Building Code of Australia (BCA) – Acoustic Provisions

We provide the following information, addressing the **minimum** acoustic requirements of the Building Code of Australia (BCA) 2009.

3.6.1 BCA Minimum Floor Requirements

The BCA provides the following minimum requirement for insulation rating of floors:

> ***"PERFORMANCE REQUIREMENTS***
>
> ***FP5.1***
>
> *Floors Separating –*
> *(a) sole-occupancy units; and*
> *(b) sole-occupancy unit from a plant room, lift shaft, stairway, public corridor, public lobby, or the like, or parts of a different classification,*
> *must provide insulation against the transmission of airborne and impact generated sound sufficient to prevent illness or loss of amenity to the occupants.*
>
> ***Deemed-to-Satisfy Provisions***
>
> ***F5.4 Sound insulation rating of floors***
>
> *(a) A floor in a Class 2 or 3 building must have an $R_w + C_{tr}$ (airborne) not less than 50 and an $L_{n,w} + C_l$ (impact) not more than 62 if it separates –*
> *(i) sole-occupancy units; or*
> *(ii) a sole-occupancy unit from a plant room, lift shaft, stairway, public corridor, public lobby or the like, or parts of a different classification."*

3.6.2 BCA Minimum Wall Requirements

The BCA provides the following minimum requirement for insulation rating of walls within residential developments:

> ***"PERFORMANCE REQUIREMENTS***
>
> ***FP5.2***
>
> *Walls separating sole-occupancy units or a sole-occupancy unit from a plant room, lift shaft, stairway, public corridor, public lobby, or the like, or parts of a different classification, must provide insulation against the transmission of –*
> *(a) airborne sound; and*
> *(b) impact generated sound, if the wall is separating a bathroom, sanitary compartment, laundry or kitchen in one sole-occupancy unit from a habitable room (other than a kitchen) in an adjoining unit,*
> *sufficient to prevent illness or loss of amenity to the occupants.*

Deemed-to-Satisfy Provisions

F5.5 Sound insulation rating of walls

(a) A wall in a Class 2 or 3 building must –

(i) have an R_w + C_{tr} (airborne) not less than 50, if it separates sole-occupancy units*; and*

(ii) have an R_w (airborne) not less than 50, if it separates a sole-occupancy unit from a plant room, lift shaft, stairway, public corridor, public lobby or the like, or parts of a different classification; and

*(iii) comply with **F5.3(b)** if it separates:*

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

(B) A sole-occupancy unit from a plant room or lift shaft.

(b) A door may be incorporated in a wall in a Class 2 or 3 building that separates a sole-occupancy unit from a stairway, public corridor, public lobby, or the like, provided the door assembly has an R_w not less than 30.

(e) Where a wall required to have sound insulation has a floor above, the wall must continue to –

(i) the underside of the floor above; or

(ii) a ceiling that provides the sound insulation required for the wall.

(f) Where a wall required to have sound insulation has a roof above, the wall must continue to –

(i) the underside of the roof above; or

(ii) a ceiling that provides the sound insulation required for the wall."

"F5.3 Determination of impact sound insulation ratings

(b) A wall in a building required to have an impact sound insulation must –

(i) for a class 2 or 3 building be of discontinuous construction

(c) For the purposes of this Part, discontinuous construction means a wall having a minimum 20 mm cavity between 2 separate leaves, and

(i) for masonry, where wall ties are required to connect leaves, the ties are of the resilient type; and

(ii) for other than masonry, there is no mechanical linkage between leaves, except at the periphery.

3.6.3 BCA Minimum Requirements for Mechanical Noise Intrusion

Other than the impact noise requirements specified in section 3.6.2 above, the BCA provides the following minimum requirement for airborne insulation rating of walls for service and mechanical noise, within residential developments:

"F5.6 Sound insulation rating of services

(a) If a duct, soil, waste or water supply pipe, including a duct or pipe that is located in a wall or floor cavity, serves or passes through more than one sole-occupancy unit, the duct or pipe must be separated from the rooms of any sole occupancy unit by construction with an R_w + C_{tr} (airborne) not less than –

(i) 40 if the adjacent room is a habitable room (other than a kitchen); or

(ii) 25 if the adjacent room is a kitchen or non-habitable room.

F5.7 Sound isolation of pipes

A flexible coupling must be used at the point of connection between the service pipes in a building and any circulating or other pump."

3.7 Other Relevant Noise Standards and Criteria

Australian Standard 2107 – "Acoustics – Recommended Design Sound Levels…"

Australian Standard 2107 recommends satisfactory and maximum design sound levels for various types of occupancy within buildings. AS 2107 recommends the following satisfactory and maximum design sound levels for these types of occupancies.

Table 3.7.1 Recommended Design Sound Levels for Different Areas of Occupancy in Buildings (Extract from Australian Standard 2107 Table 1)

Type of Occupancy / Activity	Recommended Design Sound Level	
	Satisfactory	Maximum
5 OFFICE BUILDINGS		
General office areas	40 dB(A)	45 dB(A)
Public spaces	40 dB(A)	50 dB(A)
Reception areas	40 dB(A)	45 dB(A)
Rest rooms and tea rooms	40 dB(A)	45 dB(A)
Toilets	50 dB(A)	55 dB(A)
Undercover carparks	55 dB(A)	65 dB(A)
7 RESIDENTIAL BUILDINGS		
Hostels, residential halls and barracks -		
Common Rooms	40 dB(A)	45 dB(A)
Sleeping Areas -		
Hostels, residential halls and barracks near major roads	35 dB(A)	40 dB(A)

Australian Standard 3671 - "Acoustics Road Traffic Noise Intrusion-Building Siting and Construction"

Australian Standard 3671 concerns the reduction of road traffic noise intrusion in buildings in areas near new or upgraded freeways, tollways, major roads and national routes or other roads carrying more than 2000 vehicles per day. The standard may also be used to assess the acoustical adequacy of existing buildings in similar areas. The standard provides methodology for the assessment of noise intrusion from road traffic and guidance for determining the type of building construction necessary to achieve acceptable noise levels indoors, as recommended in AS 2107, for different types of occupancy.

4 NOISE MEASUREMENT STANDARDS & INSTRUMENTATION

All measurements were conducted in general accordance with Australian Standard –1997, *"Acoustics - Description and Measurement of Environmental Noise Part 1: General Procedures"*. Acoustic Dynamics' sound measurements were carried out using precision sound level meters conforming to the requirements of AS 1259-1990 *"Sound Level Meters"*.

The survey instrumentation used during the survey is set out in **Table 4.1**.

Table 4.1 Noise Survey Instrumentation

Type	Serial Number	Instrument Description
2260	2413547	Brüel & Kjaer Modular Precision Sound Level Meter
4189	2607949	Brüel & Kjaer 12.5 mm Prepolarised Condenser Microphone
4231	2412578	Brüel & Kjaer Acoustic Calibrator
ARL-EL-316	16-207-012	Acoustic Research Laboratories Noise Logger

The reference sound pressure level was checked prior to and after the measurements using the acoustic calibrator and remained within acceptable limits.

5 SITE SURVEY AND NOISE MONITORING

A site survey was conducted on 27 August 2008 and an unattended noise logger was deployed to measure noise levels. The logger was located at the most affected area of the development site in regards to noise levels, in order to obtain data on the maximum noise levels within the development site. The logger was located along Cleveland Street, at the northern facade of the current premises located on the proposed development site, and was retrieved on Thursday 4 September 2008.

During our survey of the existing ambient background noise environment, attended noise measurements were carried out at the boundary of the subject site, along Cleveland Street. Our attended noise measurements concurred with the noise data obtained from the unattended noise logger.

The following table presents the processed (calculated) L_{Aeq} noise data obtained from the unattended noise logger data.

Table 5.1 Measured $L_{Aeq(t\ hr)}$[1] Noise Levels at Most Affected Area of Development Site

Location	Time of Day	Measured $L_{Aeq(t\ hr)}$[1] Noise Level [dB(A)]
Cnr of Abercrombie & Cleveland Streets, Chippendale	Daytime (7am – 10pm)	73[2]
	Night-time (10pm – 7am)	70[2]

Note: 1) For daytime t=15hours and for night-time t=9 hours

2) Measured noise level exceeds the ECRTN criteria.

The results from the unattended noise logger are presented graphically within **Appendix B**.

6 ASSESSMENT

The following subsections provide an assessment of the proposed development against the various noise criteria and objectives outlined in section 3 above.

6.1 Road Traffic Noise Intrusion

During our attended measurements taken at the site, it was noted that the noise environment at the subject site is dominated by road traffic noise mainly from Cleveland Street.

The following assessment of external noise intrusion, into the various areas of the proposed development, uses the assessment procedure outlined in AS 3671. The unattended monitoring results are used, assuming the measured noise levels are attributable entirely to road traffic.

Future Traffic Volumes

In order to comply with the measurement guidelines set out in AS 3671, summarised in section 3 above, Acoustic Dynamics has predicted future traffic flow volume, and subsequently future traffic noise levels, on Cleveland Street for the next ten years, based on RTA AADT traffic flow figures over the past 20 years for Cleveland Street and other roads in the surrounding area. The predicted increase in noise level from future traffic flow has been incorporated into the assessment of road noise intrusion into the proposed development.

Assessment of External Noise Intrusion

Based on the measured noise levels at the subject development site (shown in **Table 5.1**), Acoustic Dynamics has calculated the maximum external road traffic noise levels at the most exposed facade of various areas within the proposed development and presented these within **Table 6.1**.

The Traffic Noise Reduction (TNR), in dB(A), to be incorporated into the subject building's envelope is determined by subtracting the internal design sound level for the various internal spaces of the development, given by AS 2107 and shown in **Table 3.6.1**, from the maximum external road traffic noise level at the facade of each area. **Table 6.1** below presents the relevant TNR's for the proposed development.

Further following the guidelines set out in Australian Standard 3671, Acoustic Dynamics has determined the required Component Traffic Noise Attenuations (TNA_c) for the various areas of the proposed development, also detailed in **Table 6.1** below.

Table 6.1 Relevant TNR's and Required TNA_C's for the Various Areas and Building Components of the Proposed Development

Type of Area / Activity	Maximum Indoor Design Sound Level (windows closed) [dB(A)]	Calculated Maximum External Traffic Noise Level [dB(A)][3]	Maximum TNR [dB(A)]	Maximum Required Component Traffic Noise Attenuation (TNA_c) [dB(A)]
Ground Floor Commercial				
External Walls	45[1]	75	30	32
Windows / Glass Doors				27
1st Floor Commercial				
External Walls	45[1]	74	29	30
Windows / Glass Doors				25
2nd Floor Commercial				
External Walls	45[1]	73	28	29
Windows / Glass Doors				24
Roof				25
Bedrooms				
External Walls	35[2]	70	35	34
Windows / Glass Doors				35
Roof				32
Living/Dining				
External Walls	40[2]	73	33	28
Windows / Glass Doors				33
Roof				31

Note: 1) Maximum indoor sound levels are in accordance with AS2107.

2) Maximum indoor sound levels are in accordance with the SEPP (infrastructure) 2007.

3) Maximum traffic noise levels for each room type and activity are calculated at the most exposed facades, for the time period relevant to the type of area being assessed (i.e. night-time noise levels for bedrooms and daytime noise levels for commercial offices and living/dining rooms). The calculated maximum traffic noise level includes distance losses and shielding provided by the structure of the development.

Note: Australian Standard 3671 notes:

"Either STC or R_W may be used as a guide to the selection of components able to provide a desired TNA_c value, provided that approximate allowance is made for the spectral composition of the noise as follows-

$$TNA_c \approx R_w - 6 \text{ or } R'_w - 6 \quad \ldots"$$

Construction systems and materials should be selected to meet the required objective design noise reduction shown in **Table 6.1** for the respective areas within the development. Incorporation of the design and construction recommendations, provided in section 7 below, into the development design will ensure that the required road traffic noise reductions, and the required internal design sound levels, are achieved.

6.2 Acoustic Privacy (BCA Assessment) and Noise Emission

Further to the Director General's Requirements, the City of Sydney Boarding Houses DCP requirements and the minimum acoustic requirements of the BCA (detailed in section 3 above), Acoustic Dynamics advises that compliance with the acoustic requirements of these documents can be achieved through judicious acoustical design during the detailed design phases of the subject development.

7 RECOMMENDATIONS

Acoustic Dynamics' calculations and analysis indicate the following recommendations are required to be incorporated into the development to ensure compliance is achieved with the various relevant acoustic assessment criteria.

External Wall Systems

Acoustic Dynamics understands a brick cavity wall construction system is proposed for the external walls of the development. In order to effectively reduce noise intrusion into the various areas of the development, the following construction system is recommended for the external walls:

Outer skin:
- Cement render or aluminium cladding (where applicable); to
- Single leaf of brickwork; to

Cavity:
- Minimum 20mm air gap; to

Inner Skin:
- Single leaf of brickwork; to
- Internal wall lining (e.g. plasterboard) as per architects details

Acoustic Dynamics advises that the above construction should sufficiently reduce road traffic noise transmission into the proposed development, and will achieve compliance with the various acoustic criteria.

Ceiling / Roof System

Acoustic Dynamics understands that the roof of the proposed development will be a trafficable roof terrace area. Accordingly, we provide the following recommendations for the roof construction systems:

Outside:
- Selected tiles; laid over
- Layer of screed, where required; over
- Layer of selected impact isolation matting; over

Concrete slab:
- 200mm concrete slab, as per architects specifications; to

Ceiling:
- Minimum 10mm plasterboard ceiling below, as per architects' details, fixed to slab.

Acoustic Dynamics advises that the above construction system should sufficiently reduce road traffic noise transmission into the proposed development and achieve compliance with the various acoustic criteria.

Windows / Glass Doors

The following table sets out the various windows within the proposed development and provides suitable glazing to meet the compliance requirements.

Table 7.1 Window Schedule

Room	Minimum Glazing Required
All Northern facing windows / glass doors of all commercial areas (on ground floor, first floor and second floor)	6.38 mm laminated; or 15 mm monolithic
All other (eastern and southern facing) windows / glass doors of commercial areas (on ground floor, first floor and second floor)	5.38 mm laminated; or 8 mm monolithic
Windows / glass doors of the bedrooms located adjacent to Cleveland Street, along the northern boundary (on the third floor)	12.38 mm laminated; Or Double Glazing as follows: 6mm monolithic; to 12mm air gap; to 6.38mmm laminated Or Double Glazing as follows: 6.38mm laminated; to 6mm air gap; to 6.38mmm laminated
Windows / glass doors of the living / dining / kitchen areas located adjacent to Cleveland Street, along the northern boundary (on the third floor)	10.38 mm laminated; Or Double Glazing as follows: 6mm monolithic; to 12mm air gap; to 6.38mmm laminated Or Double Glazing as follows: 6.38mm laminated; to 6mm air gap; to 6.38mmm laminated
All eastern and southern facing residential windows, along the eastern and southern boundaries (on the third floor)	6.38 mm laminated; or 15 mm monolithic
All other residential windows and glass doors (on the third floor)	5.38 mm laminated; or 8 mm monolithic

The glazing requirements recommended within Table 7.1 above are likely to adequately reduce road traffic noise intrusion to internal areas within the proposed development and achieve compliance with the various relevant acoustic criteria.

Ventilation and Provision of Fresh Air

Acoustic Dynamics advises that compliance with the recommendations/requirements of the SEPP (Infrastructure) 2007 and AS 2107, will only be achieved when the windows are closed. Accordingly, to enable occupants of the development an appropriate acoustic amenity, mechanical ventilation is required to be provided.

8 CONCLUSION AND ACOUSTIC OPINION

Acoustic Dynamics has conducted an acoustic assessment of road traffic noise intrusion assessment for compliance with the Director-General's Requirements for the subject development at 157 to 163 Cleveland Street and 136 to 144 Abercrombie Street, Chippendale, NSW (Application number 07_1080).

Acoustic Opinion

Further to our review of the relevant acoustic criteria and requirements and our calculations, Acoustic Dynamics advises that the proposed construction, and materials detailed above, will comply with relevant acoustic provisions of the Director General's Requirements, the relevant NSW State Environmental Planning Policies (SEPP's), the relevant planning instruments of the Redfern-Waterloo Authority and the City of Sydney Council.

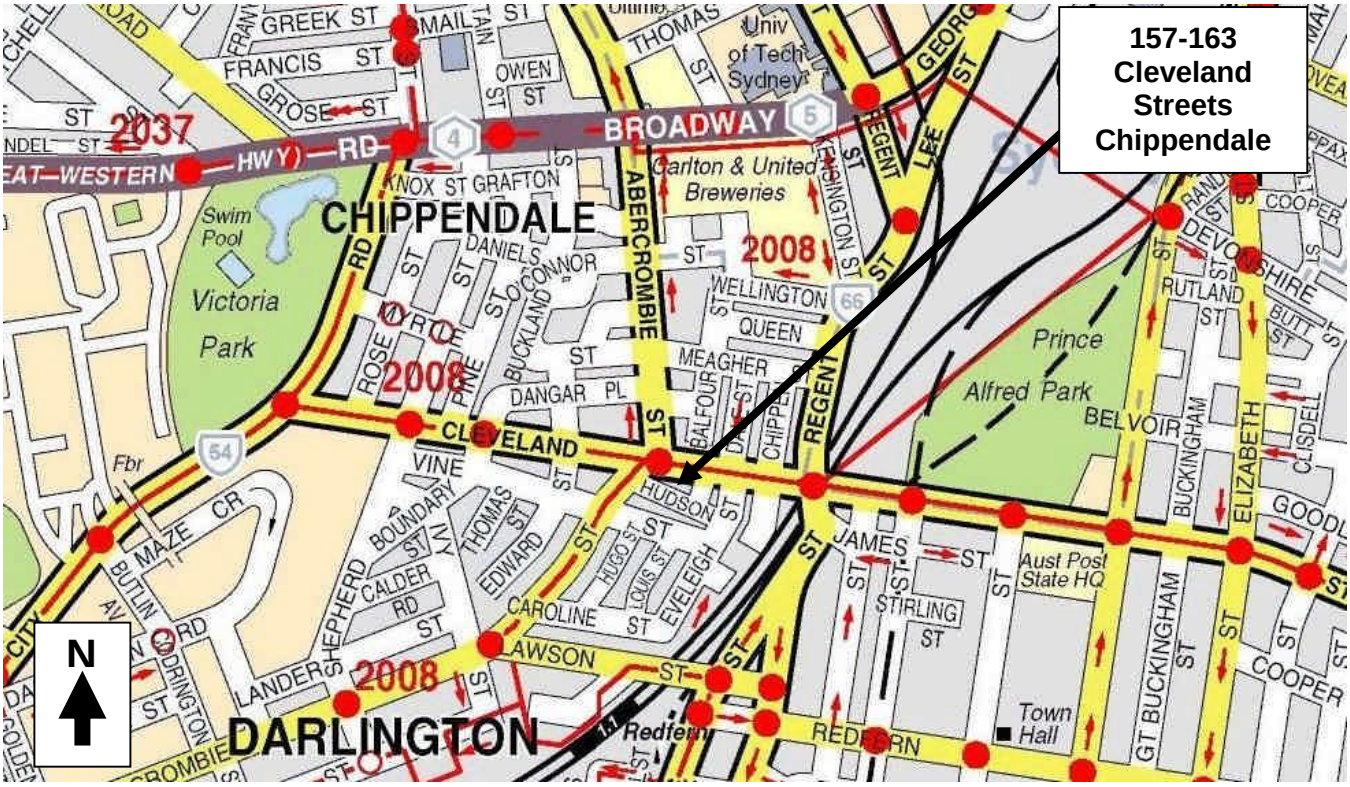
We trust that the above information meets with your requirements and expectations. Please do not hesitate to contact us on 02 9908 1270 should you require more information.

Yours Faithfully
ACOUSTIC DYNAMICS

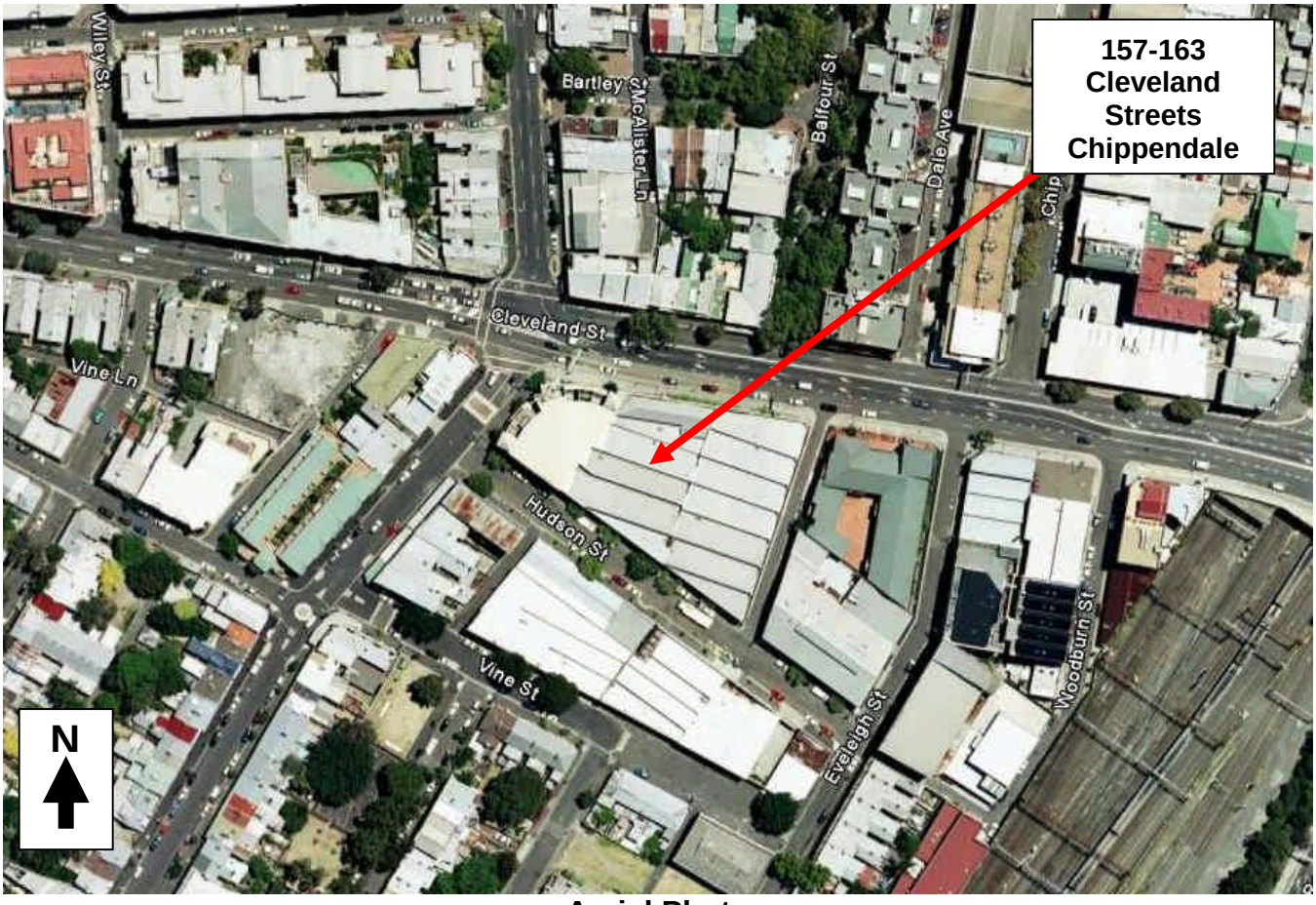
MICHAEL HOLMES

Document	Revision	Date	Prepared	Checked	Approved
2655L002.MH.080828	Revision 0	5 March 2010	MH	RH	

Appendix A
Location Map, Aerial Photo, Drawings & Photos

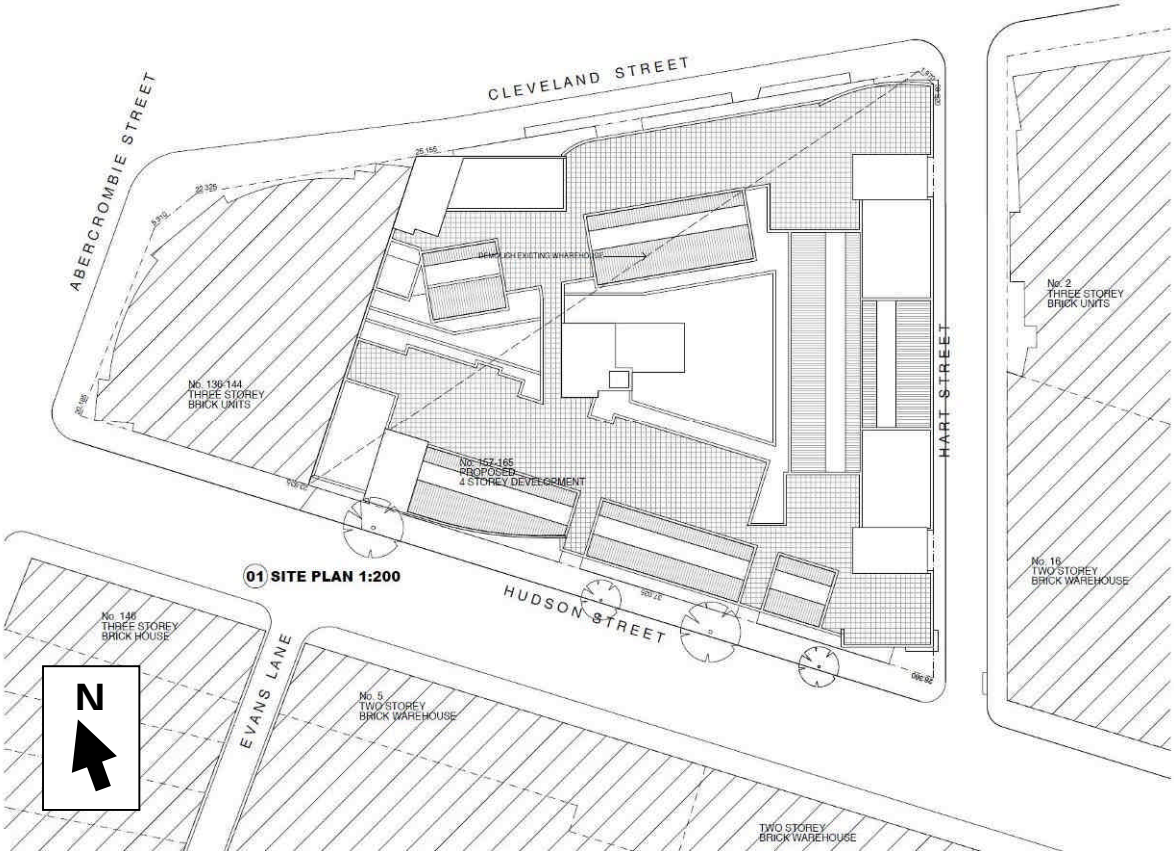


Location Map

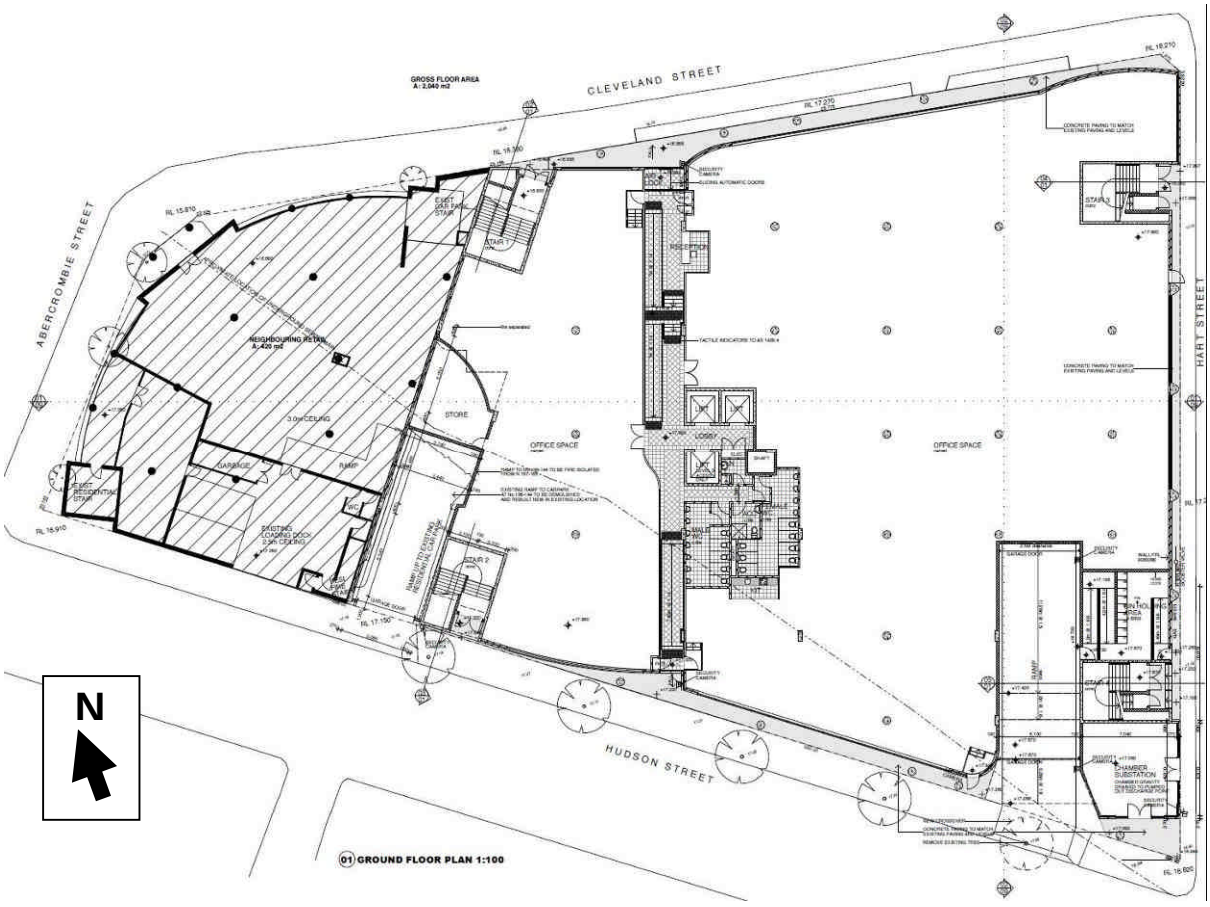


Aerial Photo

Appendix A
Location Map, Aerial Photo, Drawings & Photos

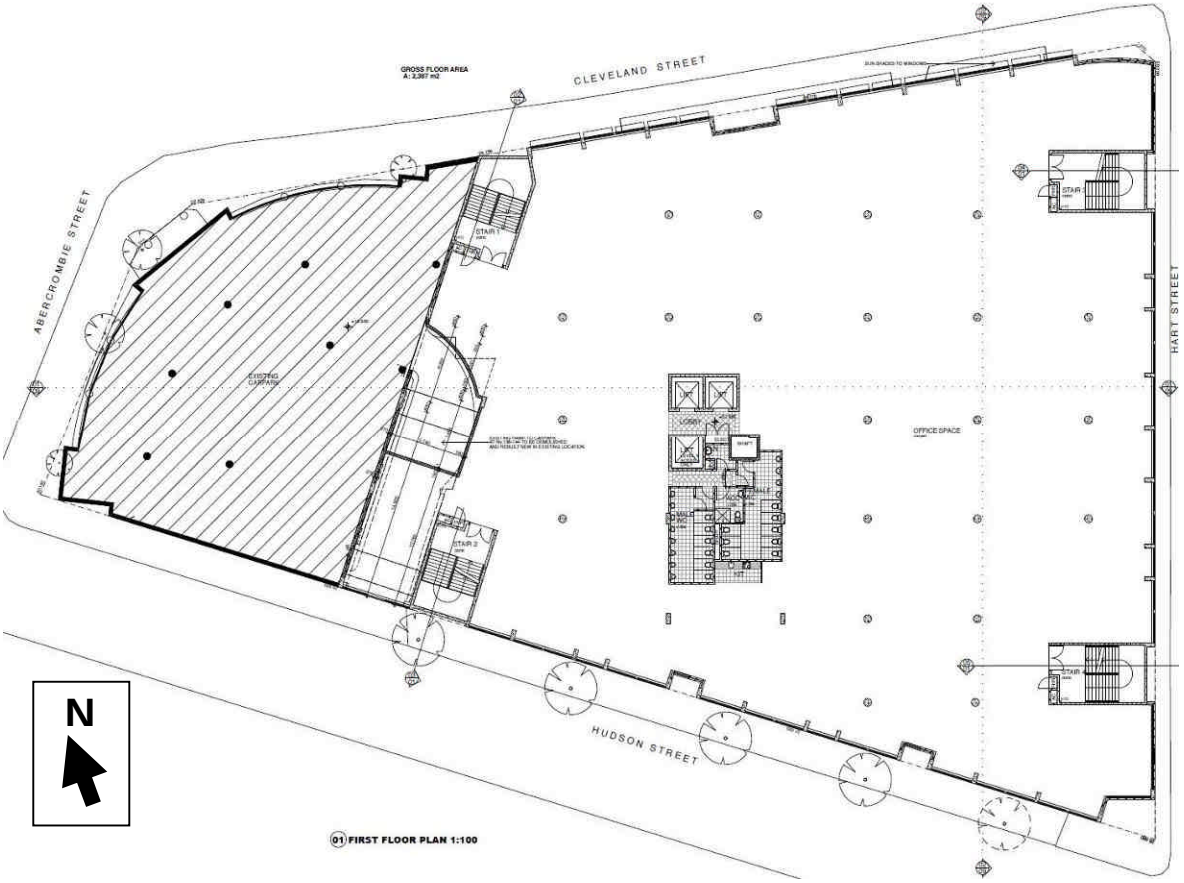


Site Plan Drawing

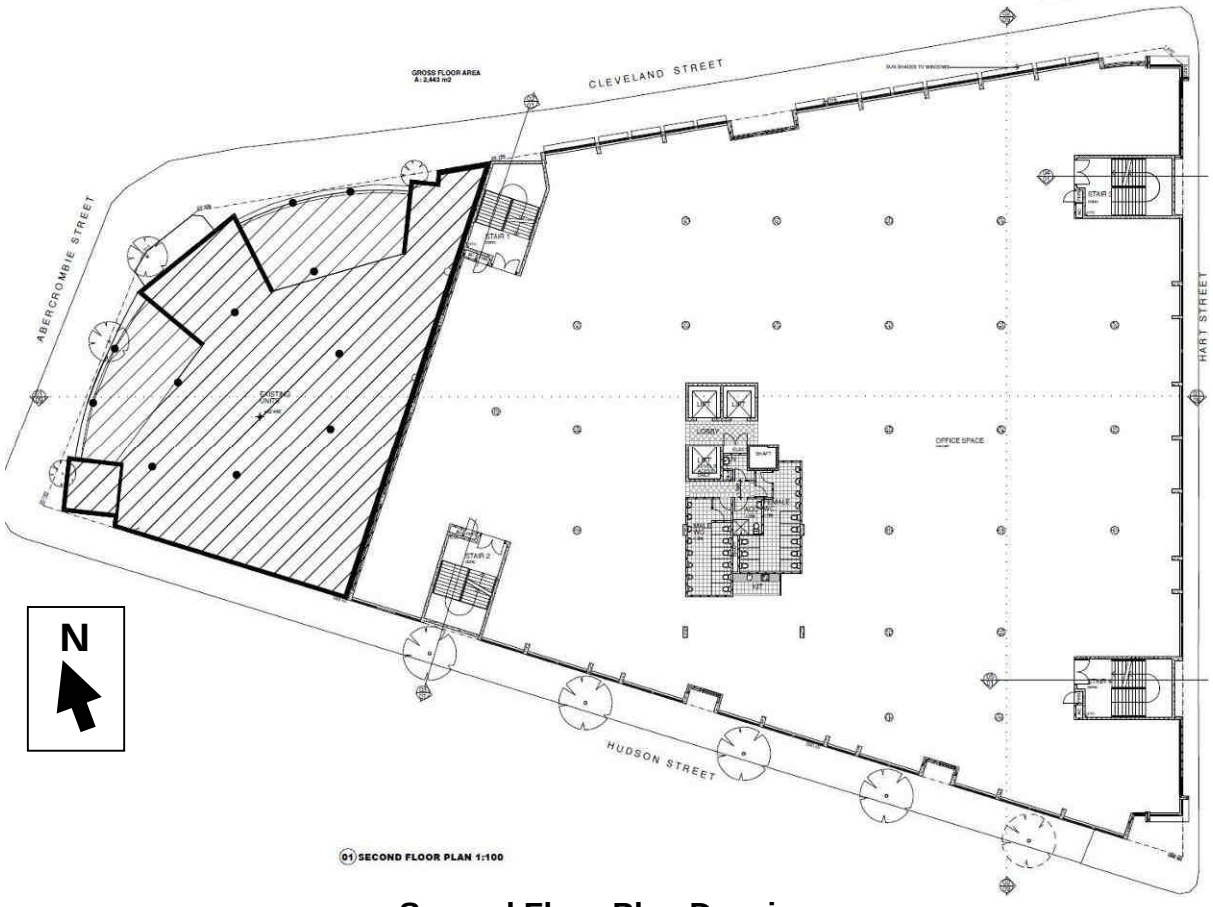


Ground Floor Plan Drawing

Appendix A
Location Map, Aerial Photo, Drawings & Photos



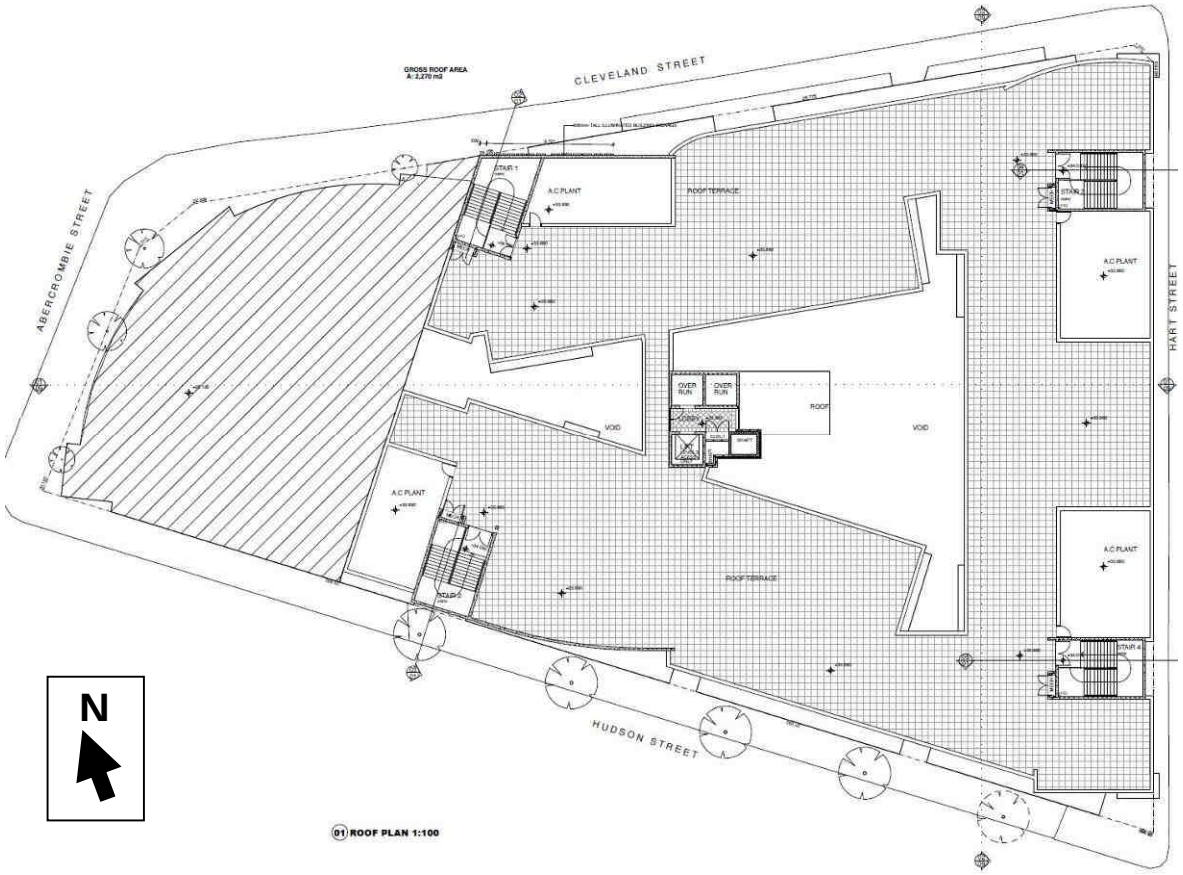
First Floor Plan Drawing



Second Floor Plan Drawing

Appendix A
Location Map, Aerial Photo, Drawings & Photos

Third Floor Plan Drawing



Roof Plan Drawing

Appendix A
Location Map, Aerial Photo, Drawings & Photos

Photo 1 – 180 degree view looking south across Cleveland Street at development site

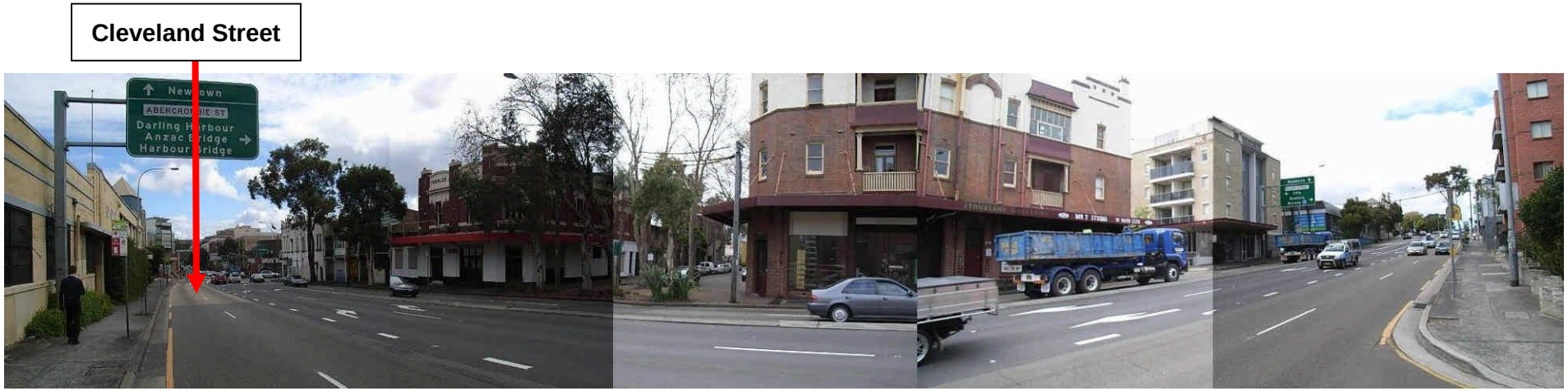
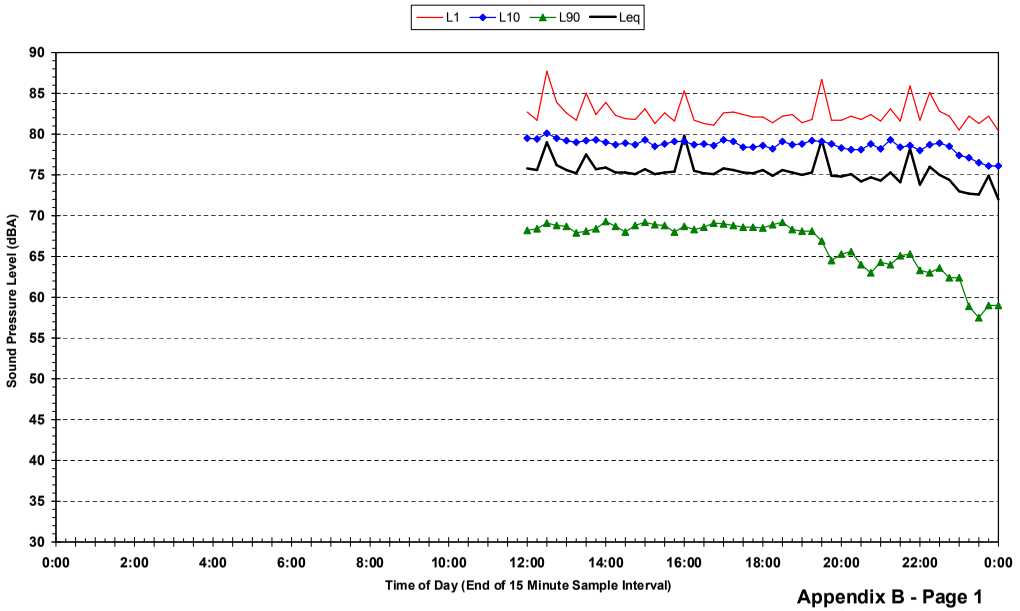


Photo 2 – 180 degree view looking north across Cleveland Street from the north-eastern corner of the development site

Statistical Ambient Noise Levels
"The Hudson" Cnr Cleveland, Abercrombie, Hart & Hudson Sts - Thursday 28 August 2008



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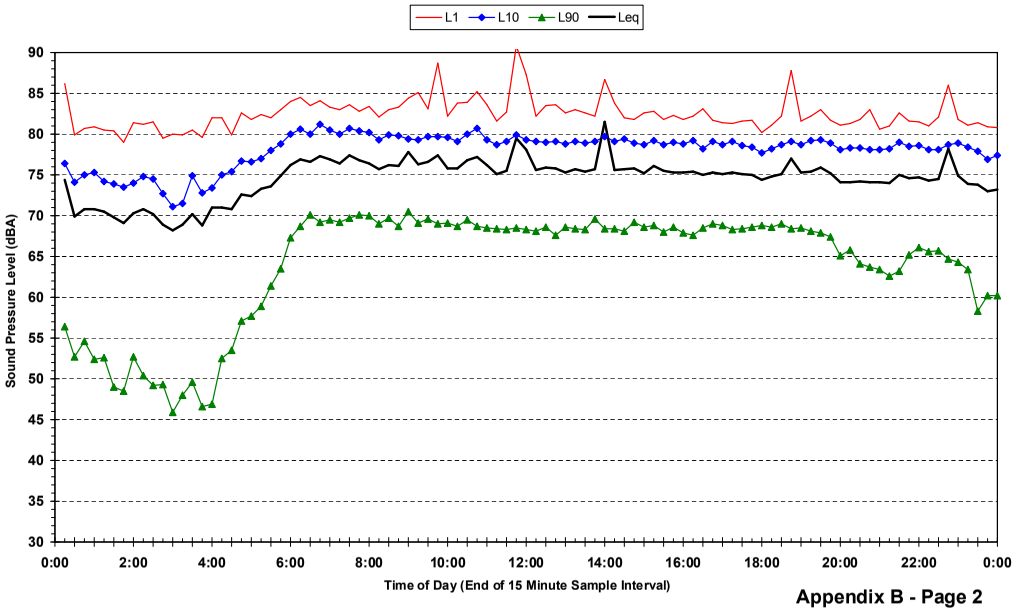
Statistical Noise Levels
AD Report 2655

Statistical Ambient Noise Levels
"The Hudson" Cnr Cleveland, Abercrombie, Hart & Hudson Sts - Friday 29 August 2008



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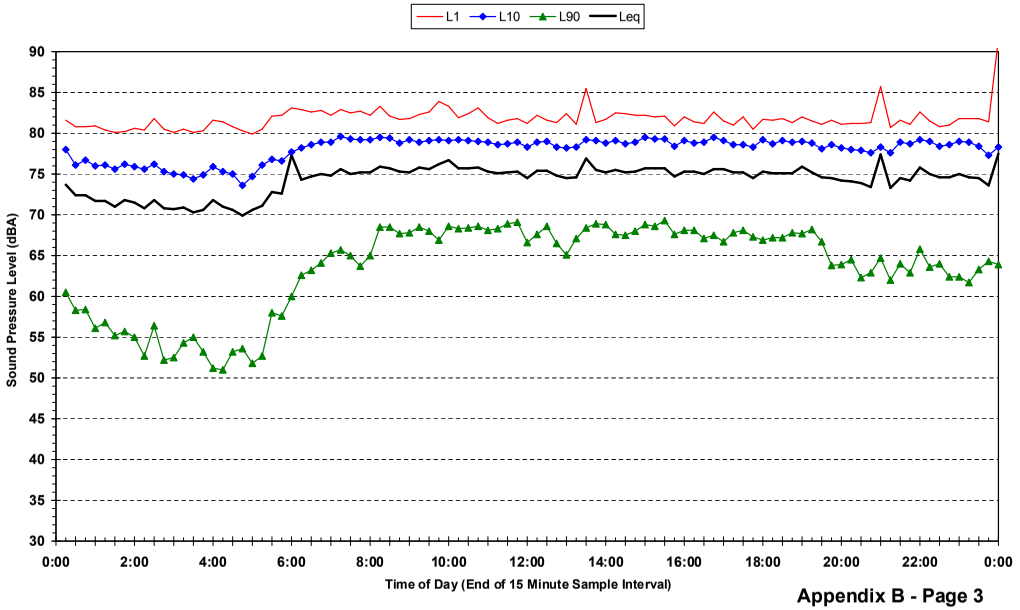
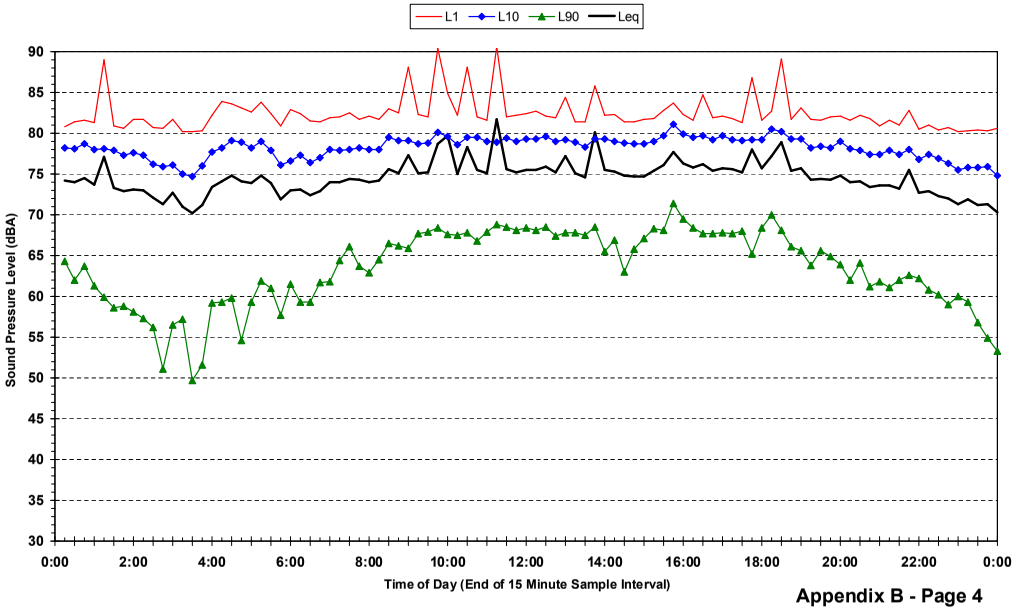
Statistical Noise Levels
AD Report 2655

Statistical Ambient Noise Levels
"The Hudson" Cnr Cleveland, Abercrombie, Hart & Hudson Sts - Saturday 30 August 2008



Appendix B - Page 3
Statistical Noise Levels
AD Report 2655

Statistical Ambient Noise Levels
"The Hudson" Cnr Cleveland, Abercrombie, Hart & Hudson Sts - Sunday 31 August 2008



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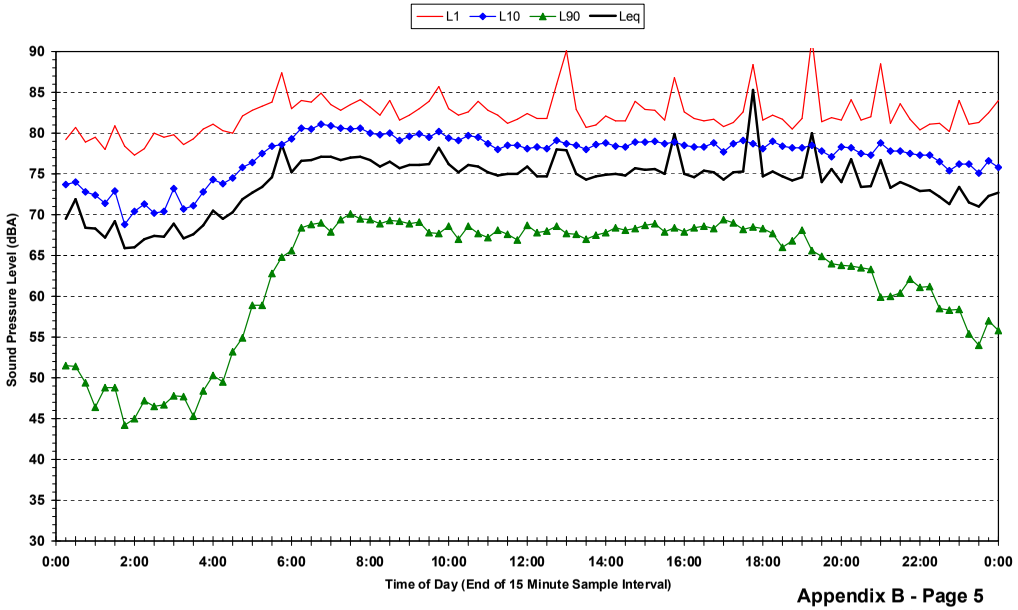
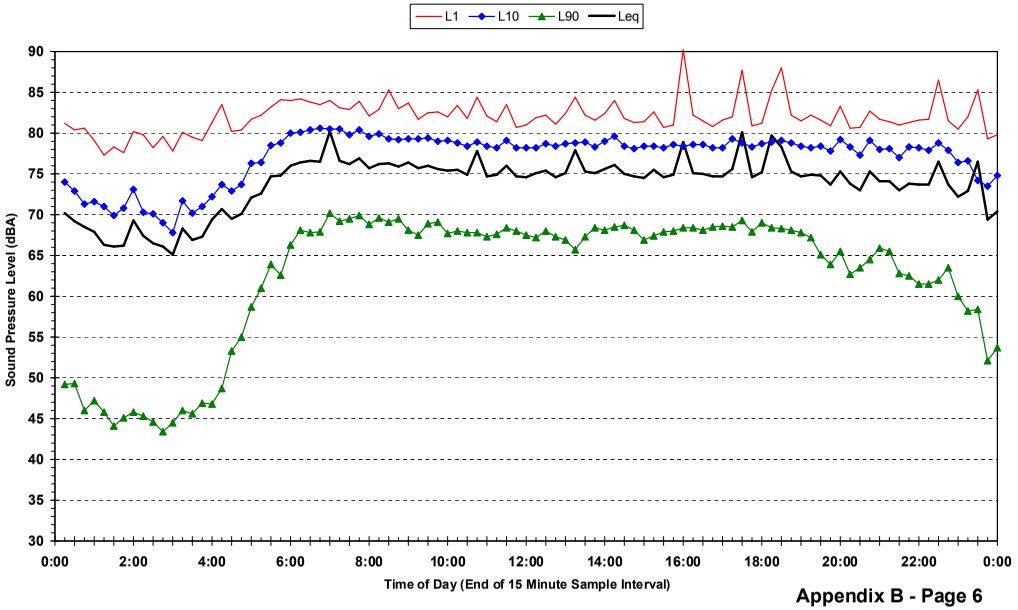
Statistical Noise Levels
AD Report 2655

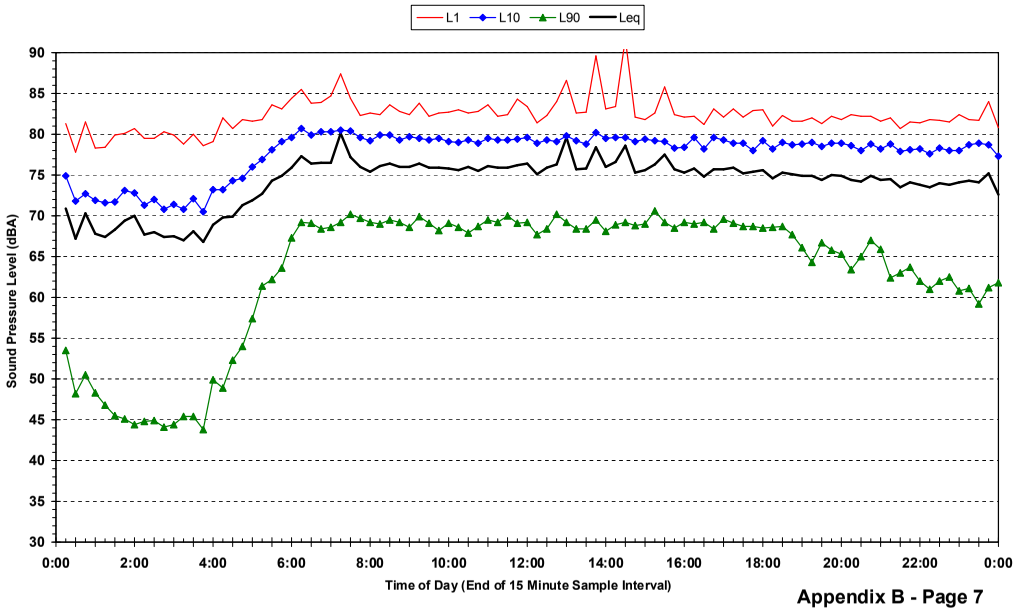
Statistical Ambient Noise Levels
"The Hudson" Cnr Cleveland, Abercrombie, Hart & Hudson Sts - Monday 1 September 2008



Statistical Ambient Noise Levels
"The Hudson" Cnr Cleveland, Abercrombie, Hart & Hudson Sts - Tuesday 2 September 2008



Statistical Ambient Noise Levels
"The Hudson" Cnr Cleveland, Abercrombie, Hart & Hudson Sts - Wednesday 3 September 2008



Statistical Ambient Noise Levels
"The Hudson" Cnr Cleveland, Abercrombie, Hart & Hudson Sts - Thursday 4 September 2008