7.0 Conclusions

The impacts of noise and vibration associated with the upgrade of Wynyard Station have been assessed.

The scope of the assessment included noise measurement surveys, establishing noise and vibration criteria, noise and vibration predictions for construction scenarios, a noise and vibration impact assessment relative to appropriate noise management levels and recommendations for noise and vibration control measures where necessary.

The noise and vibration assessment was carried out in accordance with NSW regulatory requirements which results in addressing the assessment as follows:

Construction noise and vibration

The construction noise assessment was conducted in accordance with EPA's ICNG. Typical worst case construction scenarios have been considered. Construction activities would occur during the day and the night. Worst case construction scenarios in the following areas have been considered:

- works behind hoardings within the station concourse areas;
- works in open areas within the station concourse areas; and
- works within Wynyard Park.

The noise assessment associated with the WSU indicates some exceedances of the NSW ICNG noise management levels at the nearest educational and commercial receivers. Measures have been recommended to mitigate the construction noise impact at adjacent residential, commercial and educational receivers. The measures include the:

- completion of a CNVMP;
- community consultation;
- appropriate selection and maintenance of equipment;
- use of hoardings;
- scheduling of work for less sensitive time periods, where feasible;
- situating plant in less noise sensitive locations;
- induction and training of construction site workers;
- construction traffic management; and
- noise monitoring.

The construction vibration assessment indicates some exceedances of the structure-borne noise management levels at the nearest retail and commercial receivers. These exceedances are considered typical worst case scenarios. . The mitigation measures recommended to control airborne construction noise are also considered appropriate to control regenerated construction noise.

No exceedances of the construction VDV management levels are predicted.

Construction road traffic noise

The road traffic noise associated with construction activities was assessed in accordance with EPA's NSW RNP guidelines.

The road traffic noise assessment associated with construction indicates compliance with the NSW RNP acoustic criteria as the noise increase on construction routes is predicted to be negligible, i.e. less than 1 dB.

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Appendix A

Acoustic Terminology

Appendix A Acoustic Terminology

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

Sound power level	The total sound emitted by a source
Sound pressure level	The amount of sound at a specified point
Decibel [dB]	The measurement unit of sound
A Weighted decibels [dB(A])	The A weighting is a frequency filter applied to measured noise levels to represent how humans hear sounds. The A-weighting filter emphasises frequencies in the speech range (between 1kHz and 4 kHz) which the human ear is most sensitive to, and places less emphasis on low frequencies at which the human ear is not so sensitive. When an overall sound level is A-weighted it is expressed in units of dB(A).
Decibel scale	The decibel scale is logarithmic in order to produce a better representation of the response of the human ear. A 3 dB increase in the sound pressure level corresponds to a doubling in the sound energy. A 10 dB increase in the sound pressure level corresponds to a perceived doubling in volume. Examples of decibel levels of common sounds are as follows:

0dB(A)	Threshold of human hearing
30dB(A)	A quiet country park
40dB(A)	Whisper in a library
50dB(A)	Open office space
70dB(A)	Inside a car on a freeway
80dB(A)	Outboard motor
90dB(A)	Heavy truck pass-by
100dB(A)	Jackhammer/Subway train
110 dB(A)	Rock Concert
115dB(A)	Limit of sound permitted in industry
120dB(A)	747 take off at 250 metres

Frequency [f]	The repetition rate of the cycle measured in Hertz (Hz). The frequency corresponds to the pitch of the sound. A high frequency corresponds to a high pitched sound and a low frequency to a low pitched sound.
Equivalent continuous sound level [L_{eq}]	The constant sound level which, when occurring over the same period of time, would result in the receiver experiencing the same amount of sound energy.
L_{max}	The maximum sound pressure level measured over the measurement period
L_{min}	The minimum sound pressure level measured over the measurement period
L_{10}	The sound pressure level exceeded for 10% of the measurement period. For 10% of the measurement period it was louder than the L_{10}.
L_{90}	The sound pressure level exceeded for 90% of the measurement period. For 90% of the measurement period it was louder than the L_{90}.

Ambient noise	The all-encompassing noise at a point composed of sound from all sources near and far.
Background noise	The underlying level of noise present in the ambient noise when extraneous noise (such as transient traffic and dogs barking) is removed. The L_{90} sound pressure level is used to quantify background noise.
Traffic noise	The total noise resulting from road traffic. The L_{eq} sound pressure level is used to quantify traffic noise.
Day	The period from 0700 to 1800 h Monday to Saturday and 0800 to 1800 h Sundays and Public Holidays.
Evening	The period from 1800 to 2200 h Monday to Sunday and Public Holidays.
Night	The period from 2200 to 0700 h Monday to Saturday and 2200 to 0800 h Sundays and Public Holidays.
Assessment background level [ABL]	The overall background level for each day, evening and night period for **each day** of the noise monitoring.
Rating background level [RBL]	The overall background level for each day, evening and night period for the **entire length** of noise monitoring.

*Definitions of a number of terms have been adapted from Australian Standard AS1633:1985 *"Acoustics – Glossary of terms and related symbols"*, the EPA's NSW Industrial Noise Policy and the EPA's Road Noise Policy.

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Appendix B

Noise Logging

Appendix B Noise Logging

Travelodge on York Street

Figure 1 Tuesday 17 June 2014

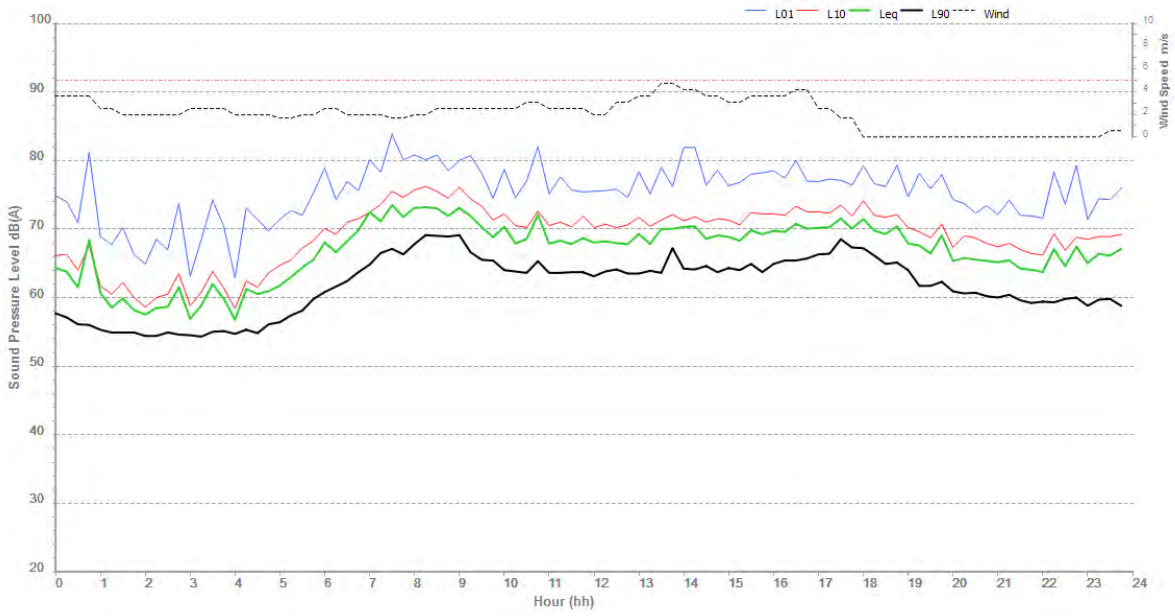


Figure 2 Wednesday 18 June 2014

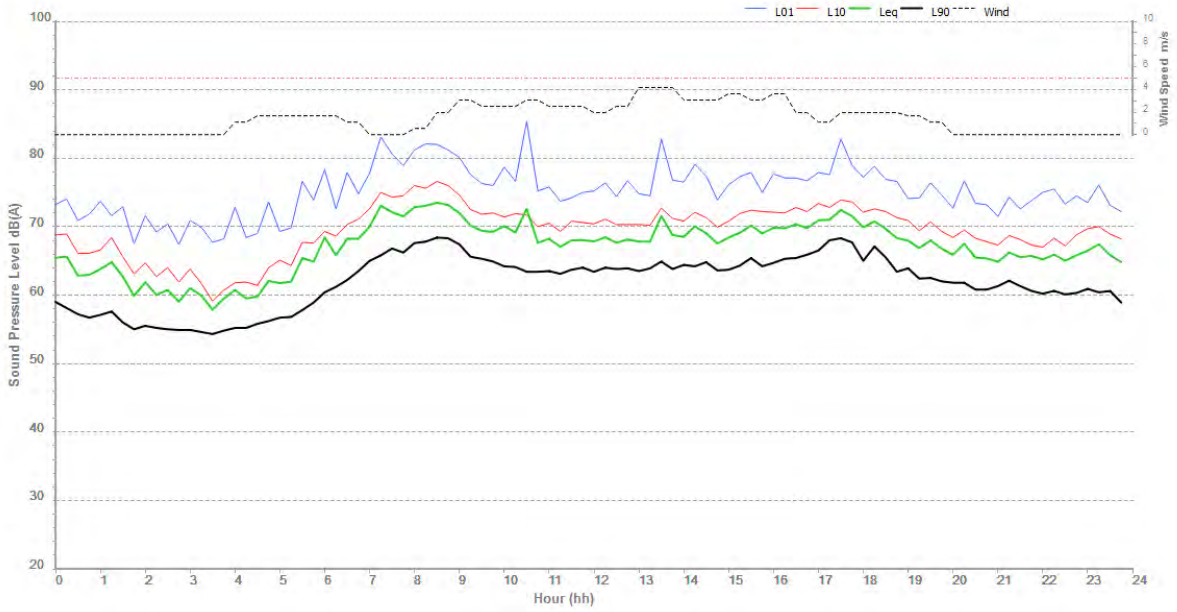


Figure 3 Thursday 19 June 2014

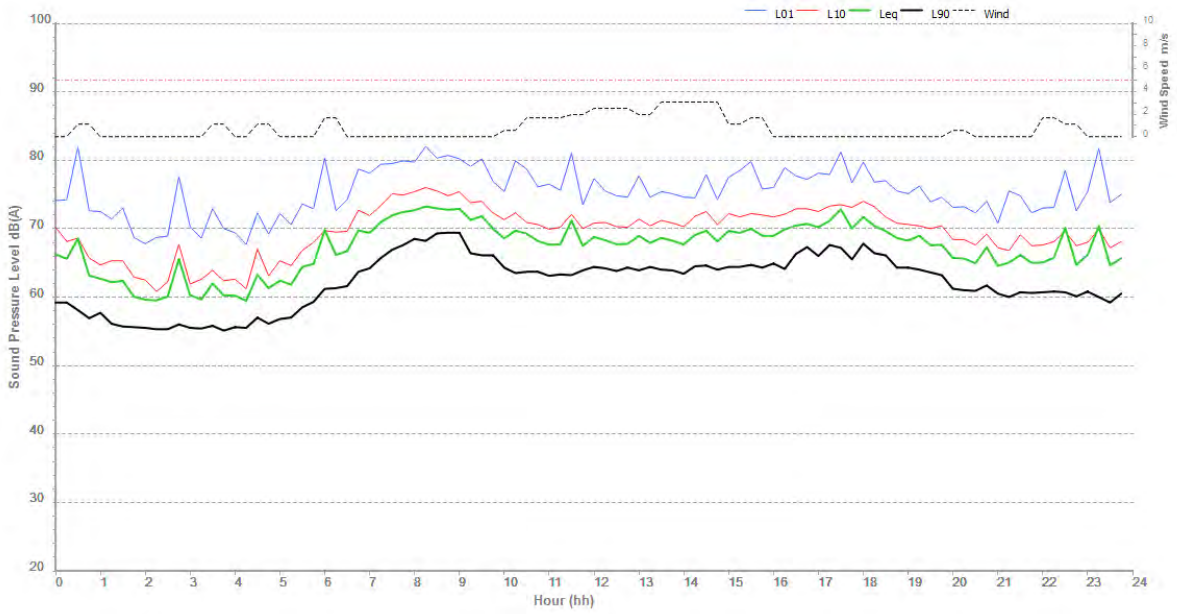


Figure 4 Friday 20 June 2014

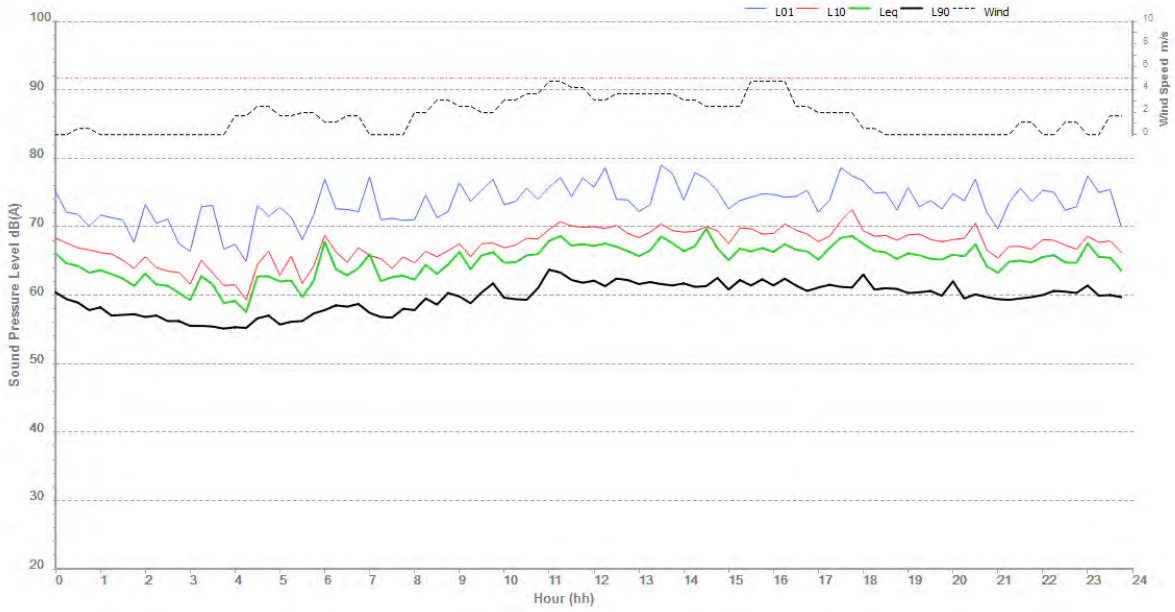


Figure 5 Saturday 21 June 2014

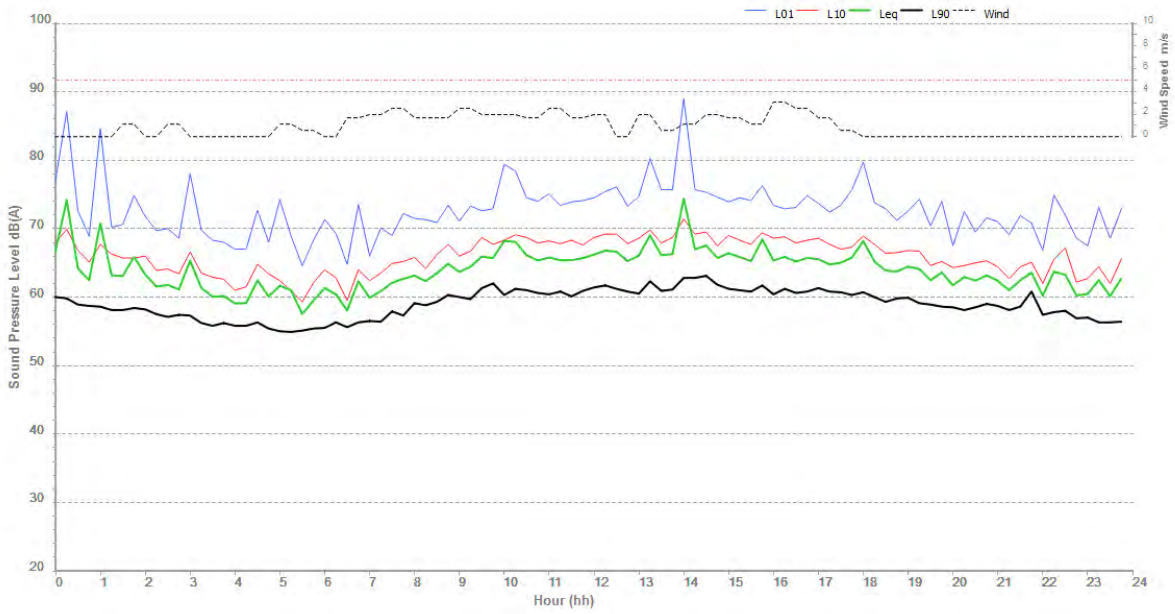


Figure 6 Sunday 22 June 2014

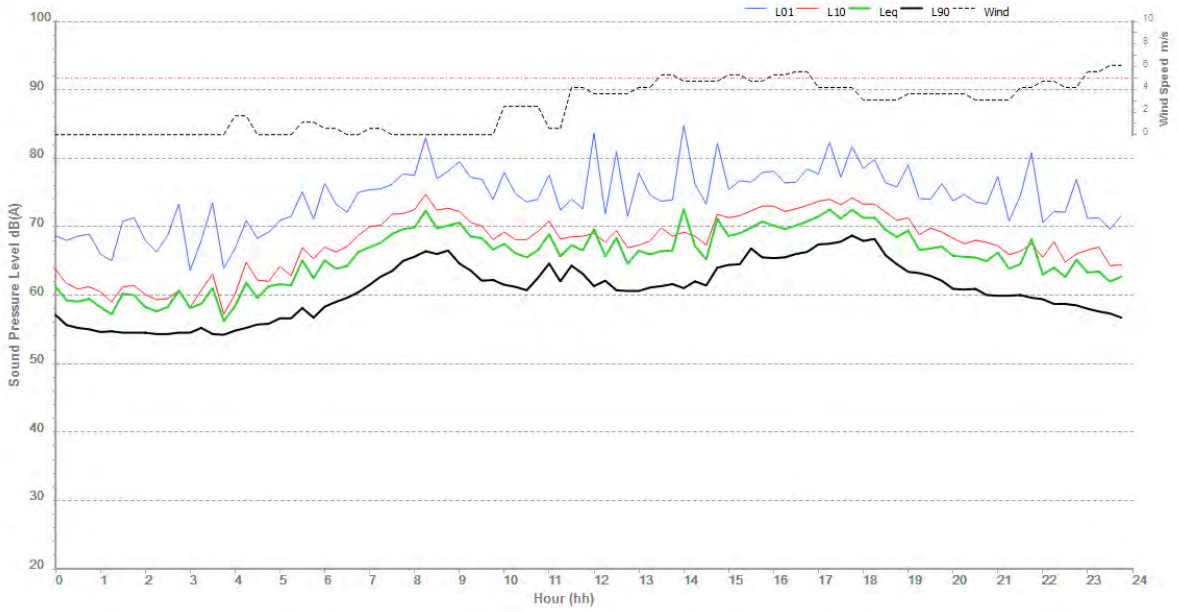
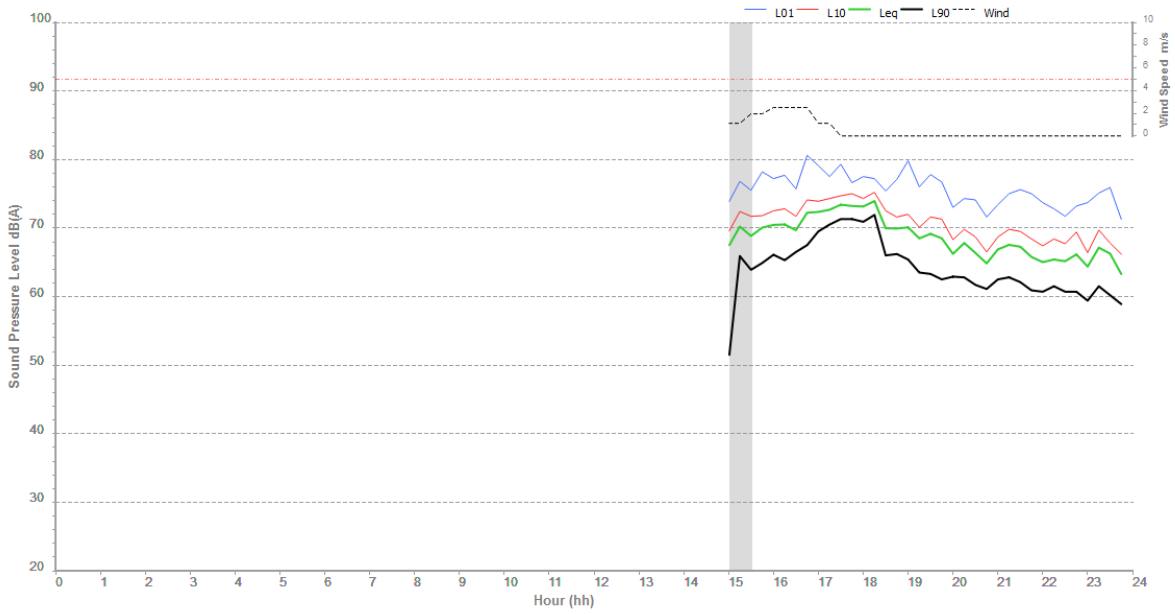


Figure 7 Tuesday 23 June 2014

Lisgar House 30-32 Carrington Street, Sydney



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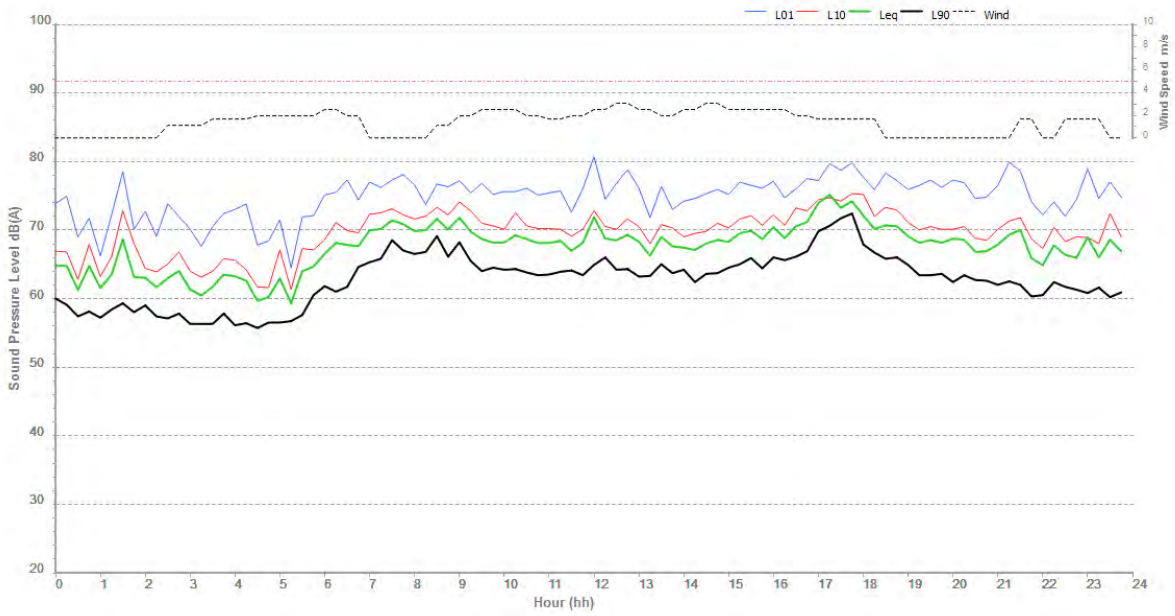

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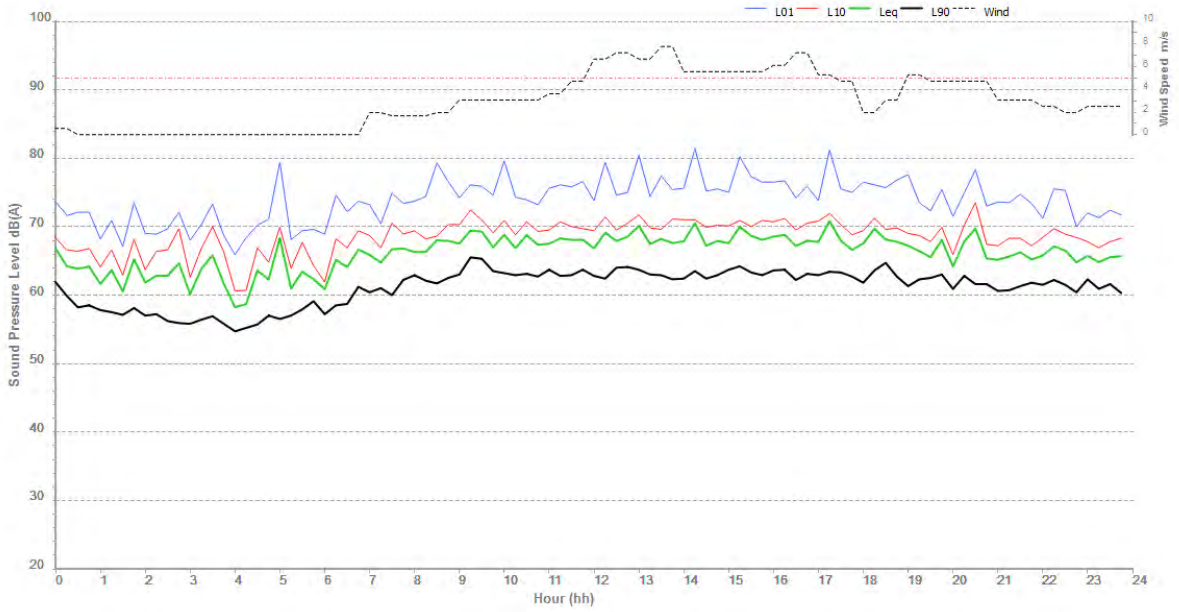
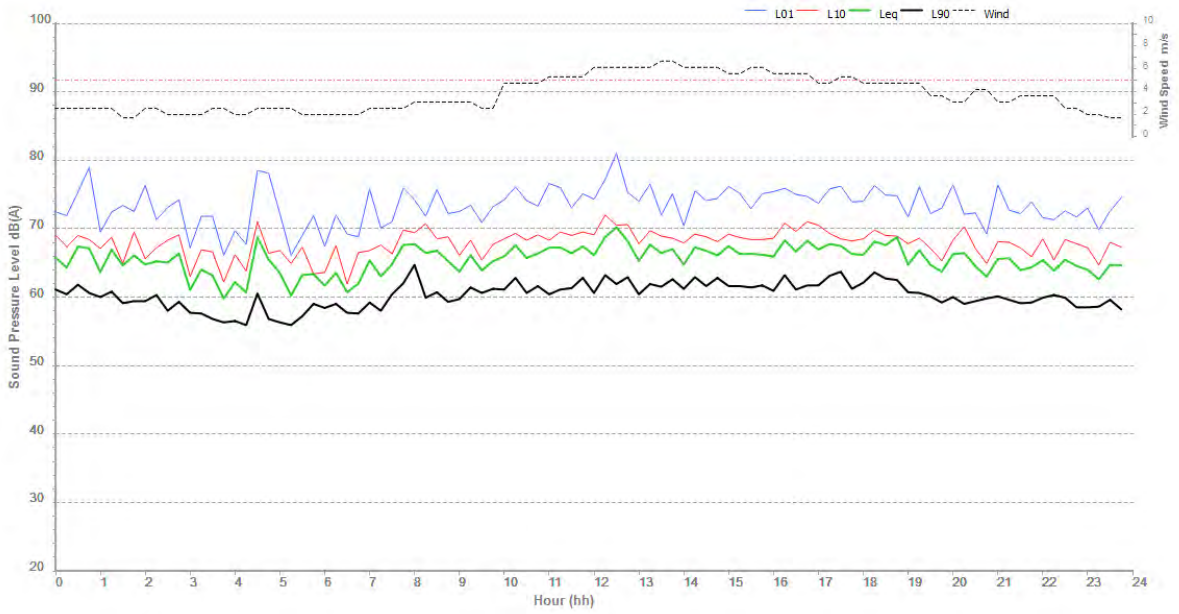


Figure 3 Saturday 5 July 2014



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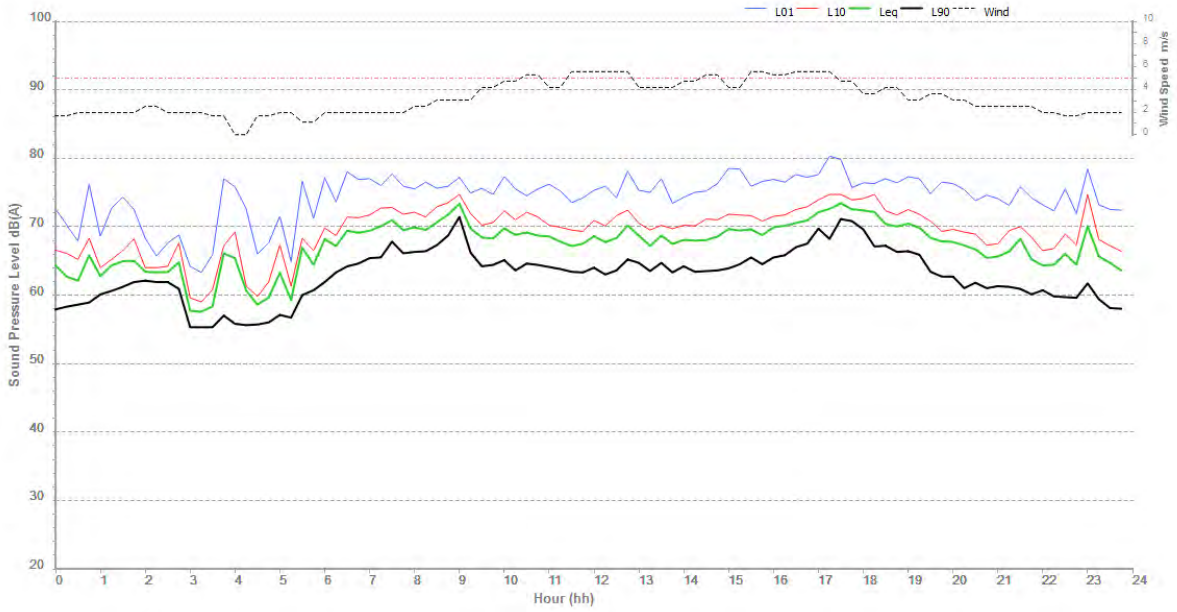

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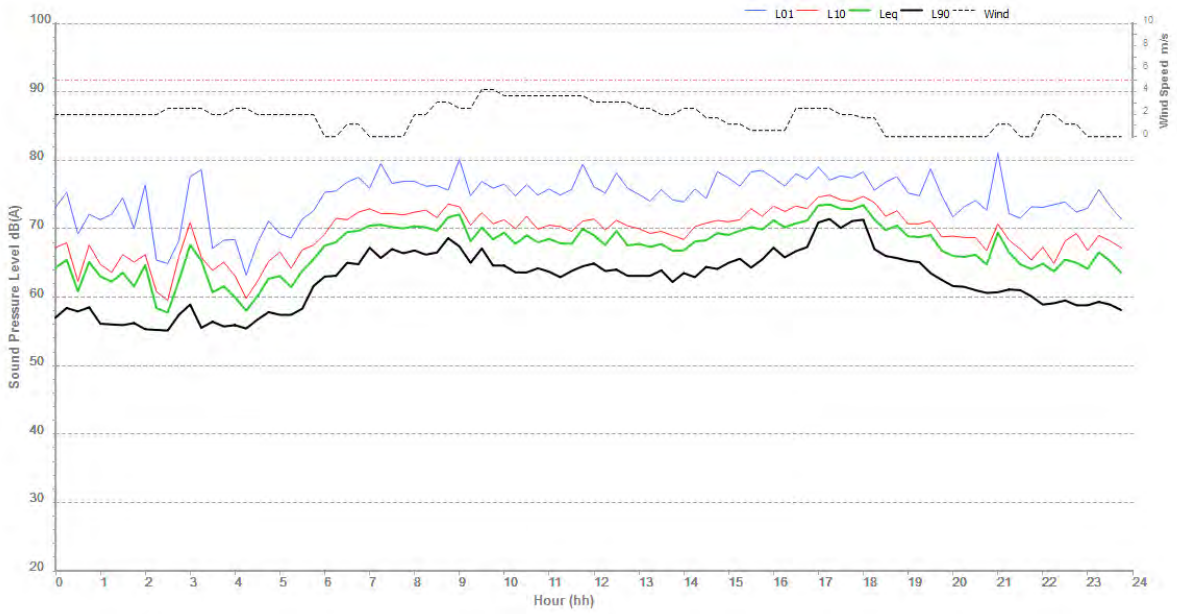


Figure 6 Tuesday 8 July 2014

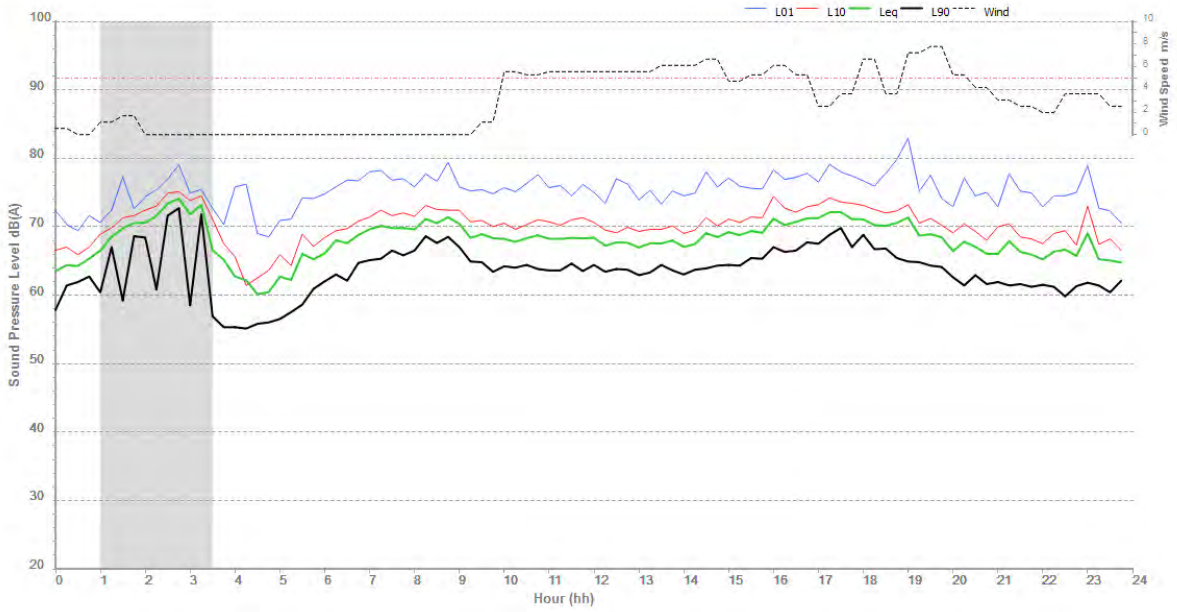


Figure 7 Wednesday 9 July 2014 (grey excluded)

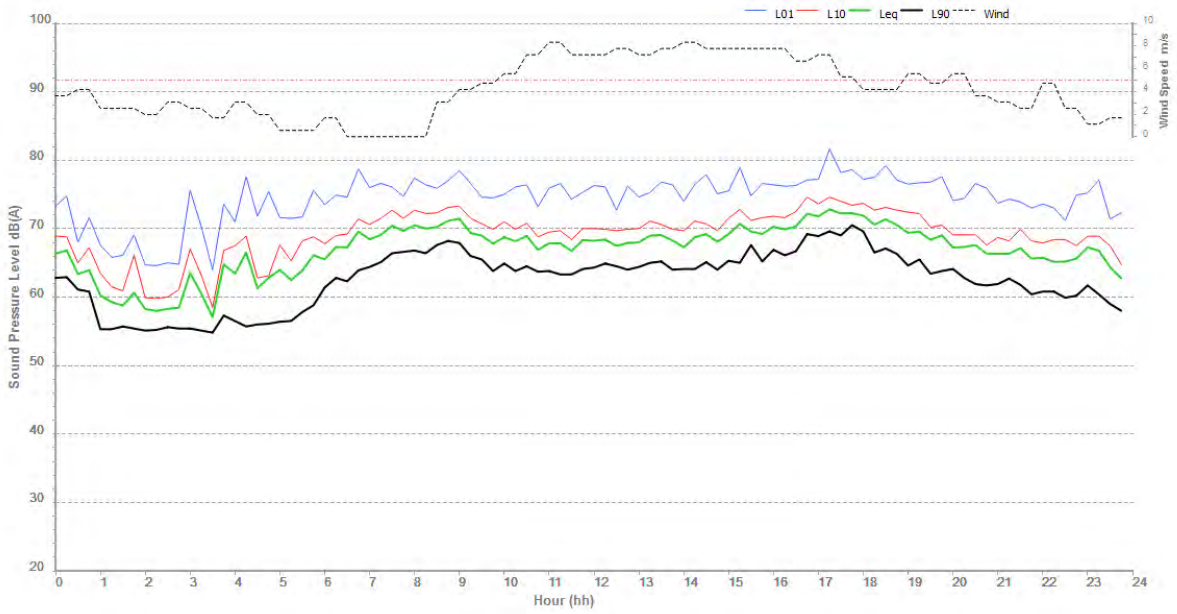
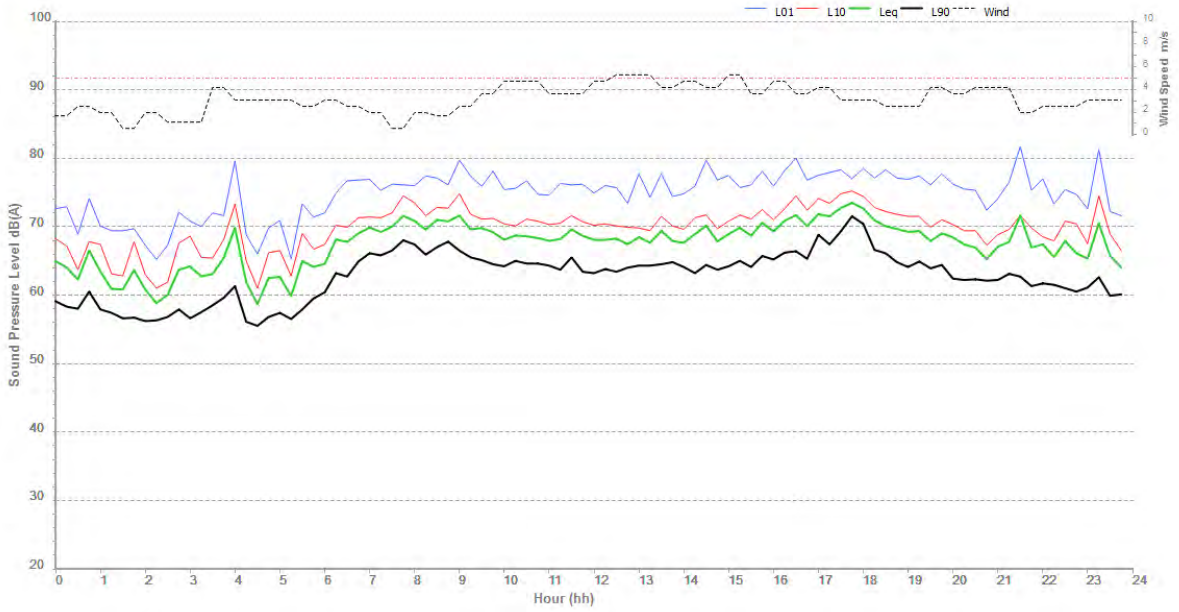


Figure 8 Thursday 10 July 2014



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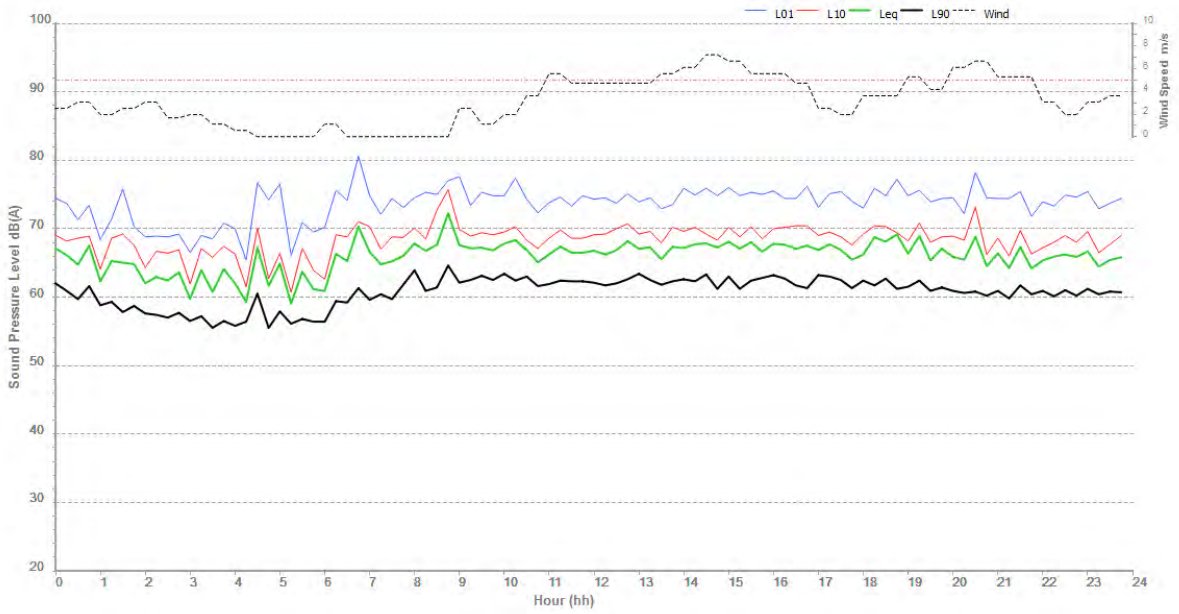

Figure 10 Saturday 12 July 2014

Figure 11 Sunday 13 July 2014 (grey excluded)

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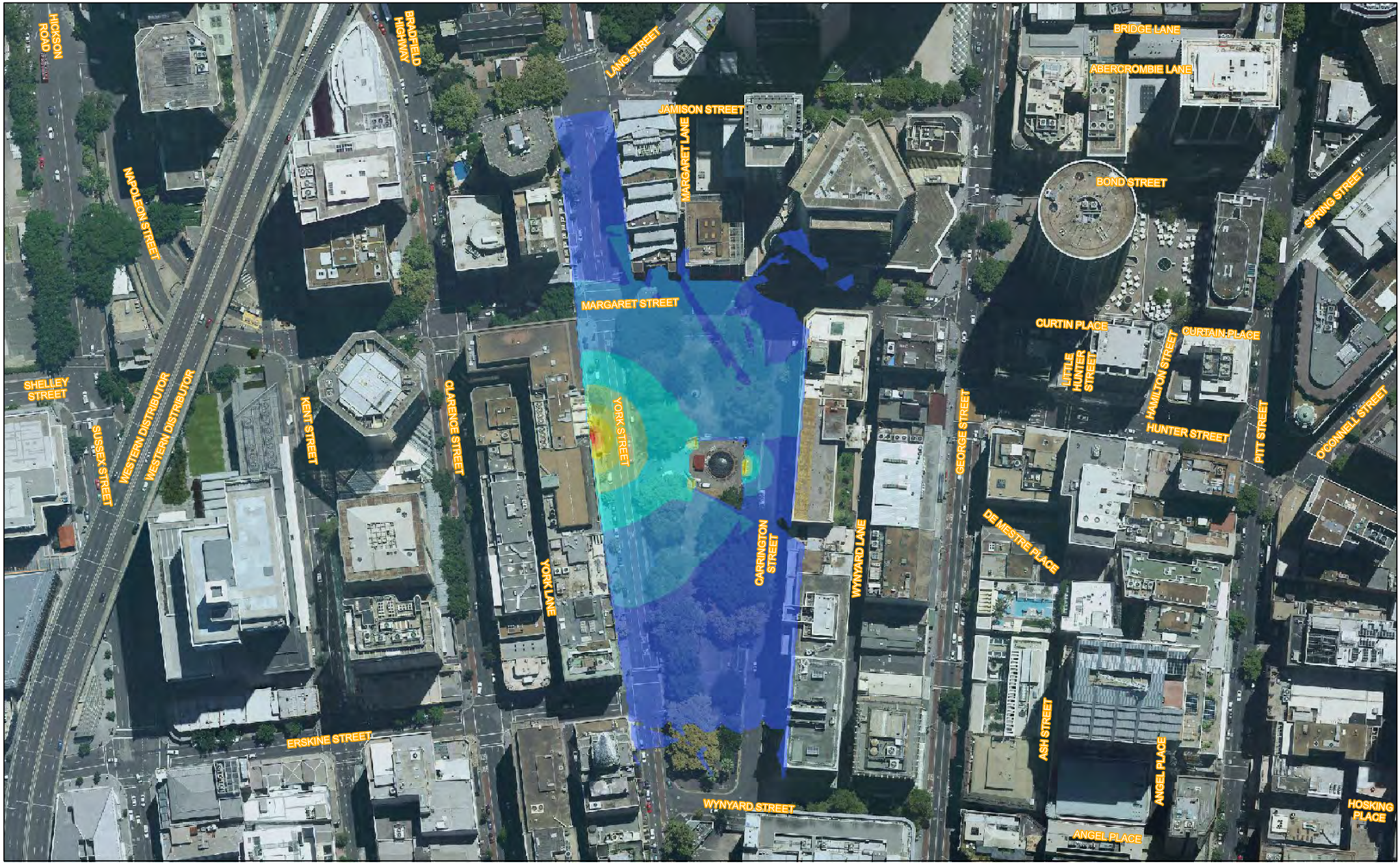
Wynyard Station Upgrade

Appendix C

Predicted Noise Contours - Construction

\\ausyd1fp001\Projects\603X\60323954\8. Issued Docs\8.1 Reports\01. Exhibition REF\Accessible versions\20141112 AECOM Noise Assessment RevF_accessible version.docx
Revision F – 12-Nov-2014
Prepared for – Transport for NSW – ABN: 18 804 239 602



Sound Pressure Level, L_{Aeq} dB(A)

< 40 | 40 - 45 | 45 - 50 | 50 - 55 | 55 - 60 | 60 - 65 | 65 - 70 | 70 - 75 | 75 - 80 | > 80

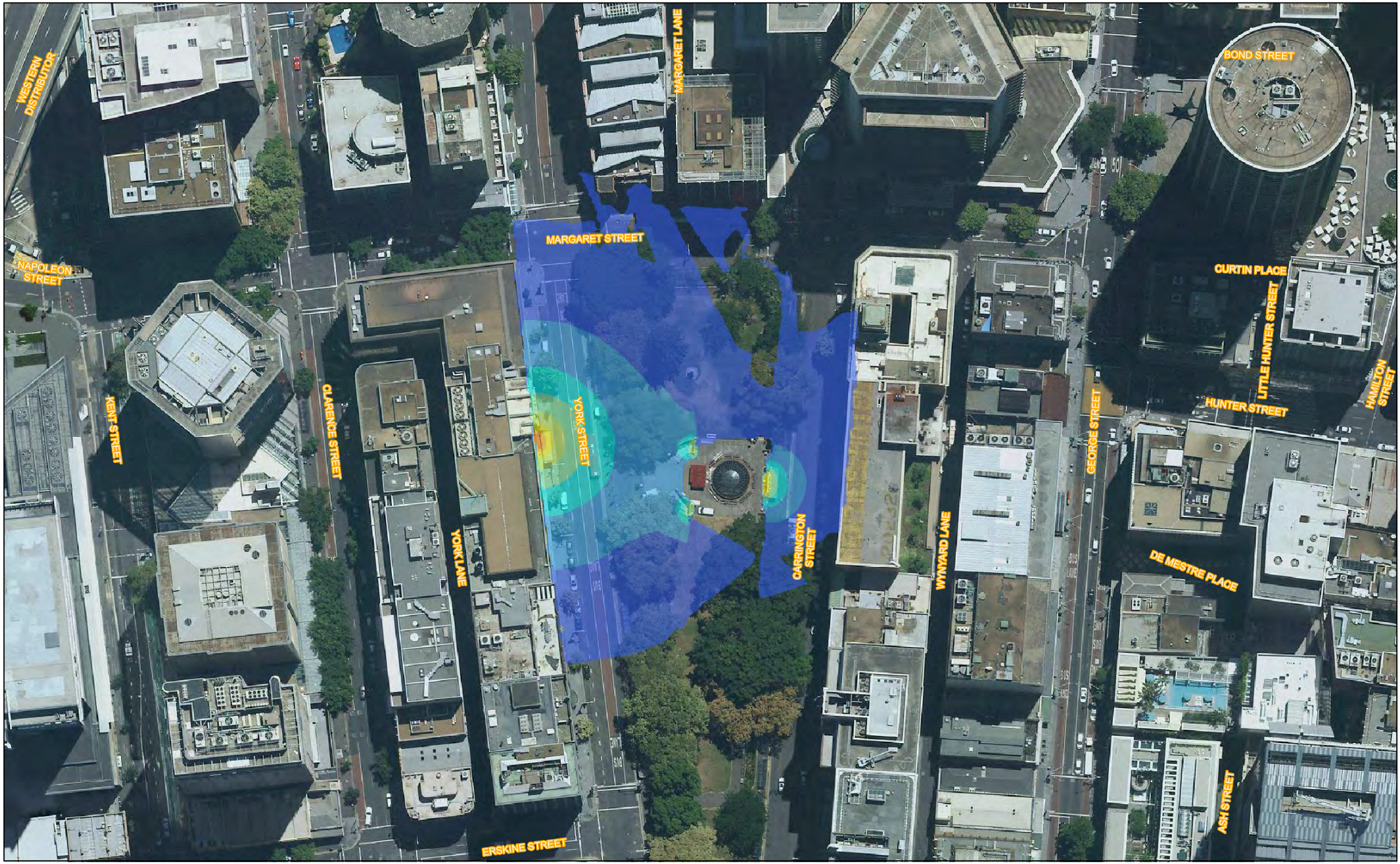
Wynyard Station Upgrade
Commissioning of Operational Systems

AUG 2014
60286134

Meters
0 25 50 100

N

Fig. **1**



Sound Pressure Level, L_{Aeq} dB(A)

< 40 | 40 - 45 | 45 - 50 | 50 - 55 | 55 - 60 | 60 - 65 | 65 - 70 | 70 - 75 | 75 - 80 | > 80

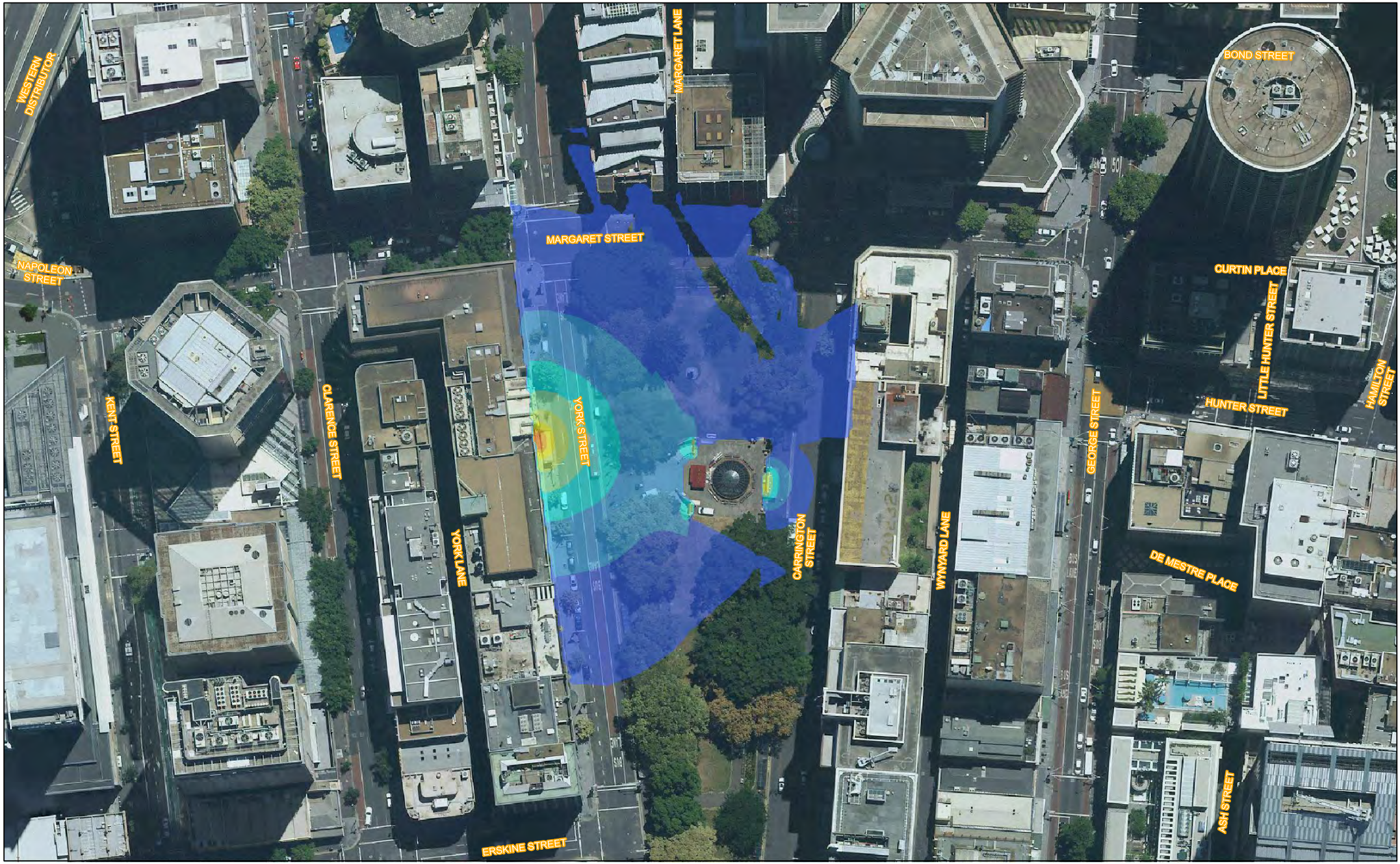
Wynyard Station Upgrade
Demolition/Break-Out

AUG 2014
60286134

0 25 50 100 Meters

N

Fig. **2**



Sound Pressure Level, L_{Aeq} dB(A)

< 40 | 40 - 45 | 45 - 50 | 50 - 55 | 55 - 60 | 60 - 65 | 65 - 70 | 70 - 75 | 75 - 80 | > 80

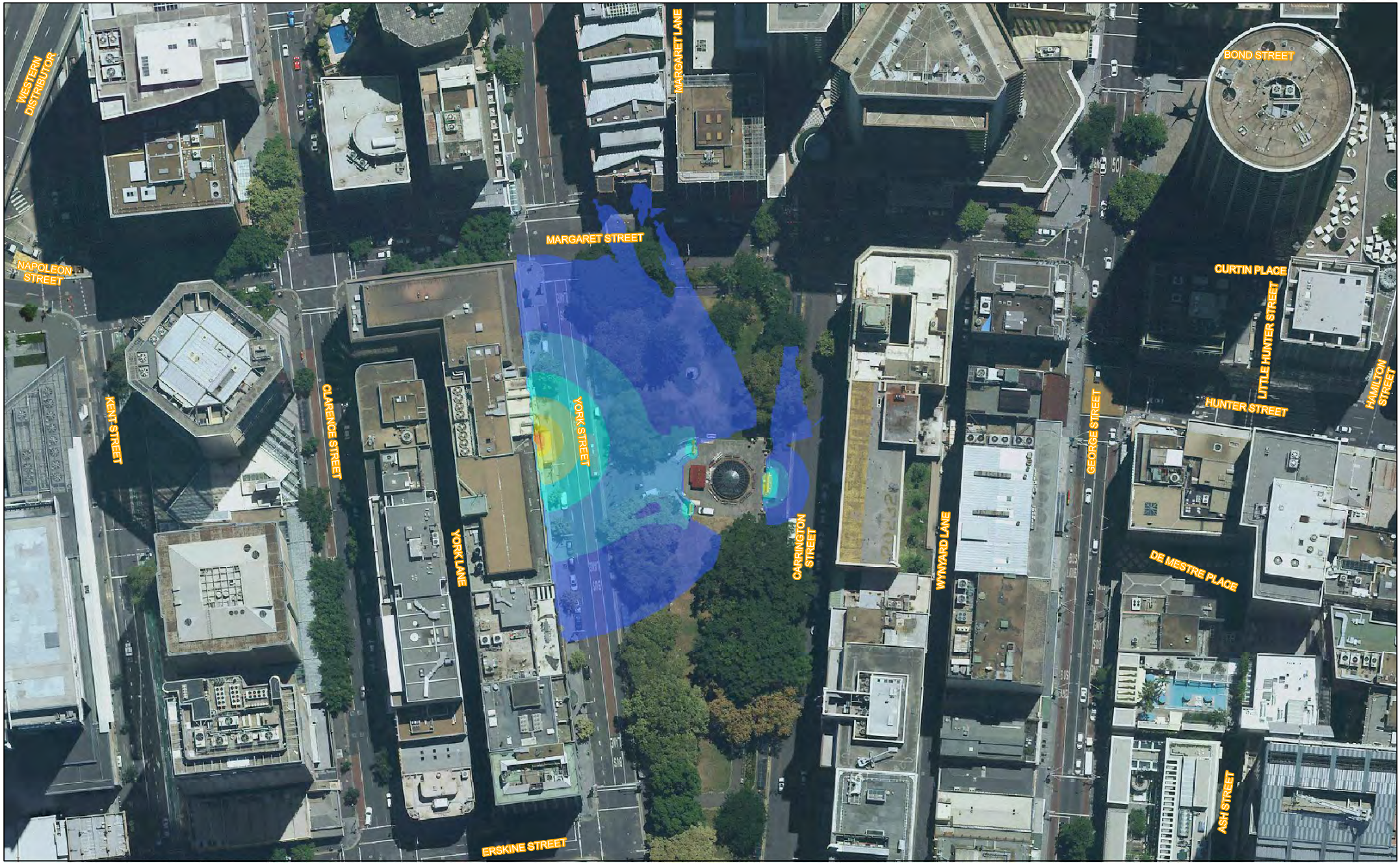
Wynyard Station Upgrade
Installation of Services

AUG 2014
60286134

0 25 50 100 Meters

N

Fig. **3**



Sound Pressure Level, L_{Aeq} dB(A)

< 40 | 40 - 45 | 45 - 50 | 50 - 55 | 55 - 60 | 60 - 65 | 65 - 70 | 70 - 75 | 75 - 80 | > 80

Wynyard Station Upgrade

Removal / installation of ticket gates

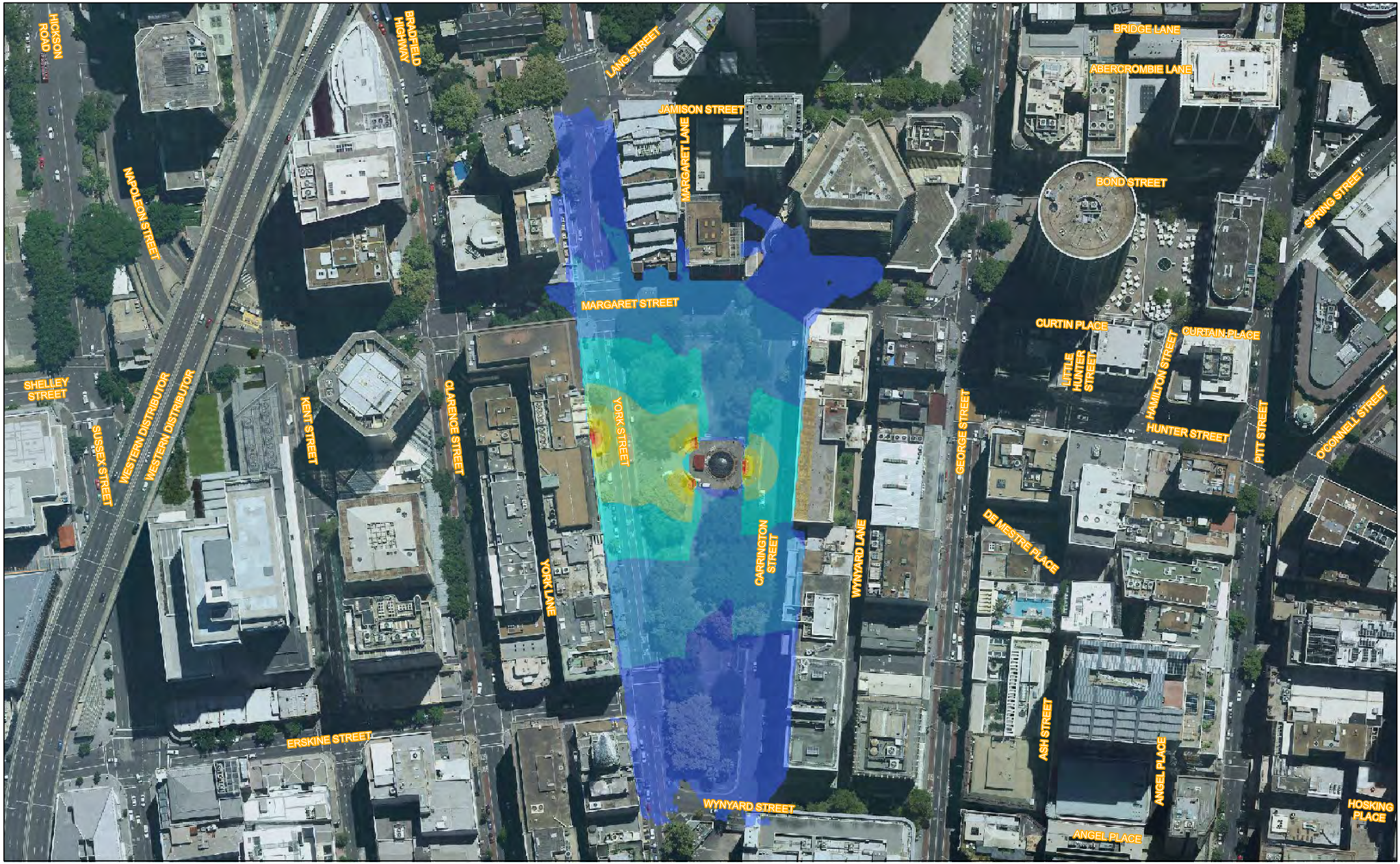
AUG 2014

60286134

0 25 50 100 Meters

N

Fig. **4**



Sound Pressure Level, L_{Aeq} dB(A)

< 40 | 40 - 45 | 45 - 50 | 50 - 55 | 55 - 60 | 60 - 65 | 65 - 70 | 70 - 75 | 75 - 80 | > 80

Wynyard Station Upgrade

Commissioning of Operational Systems

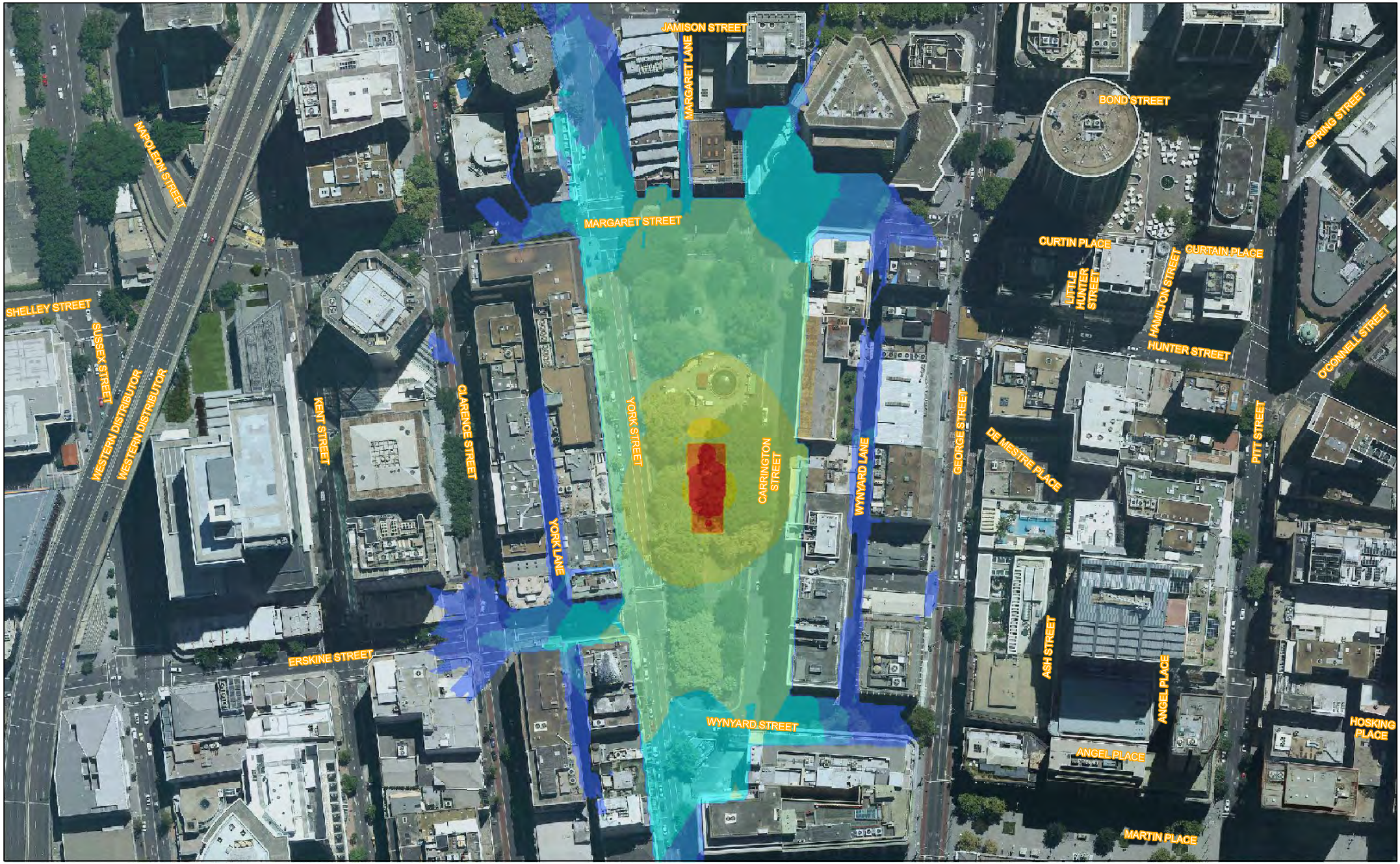
SEP 2014

60286134

0 25 50 100 Meters

N

Fig. **5**



Sound Pressure Level, L_{Aeq} dB(A)

< 40 | 40 - 45 | 45 - 50 | 50 - 55 | 55 - 60 | 60 - 65 | 65 - 70 | 70 - 75 | 75 - 80 | > 80

Wynyard Station Upgrade

Excavation of Wynyard Park access shaft

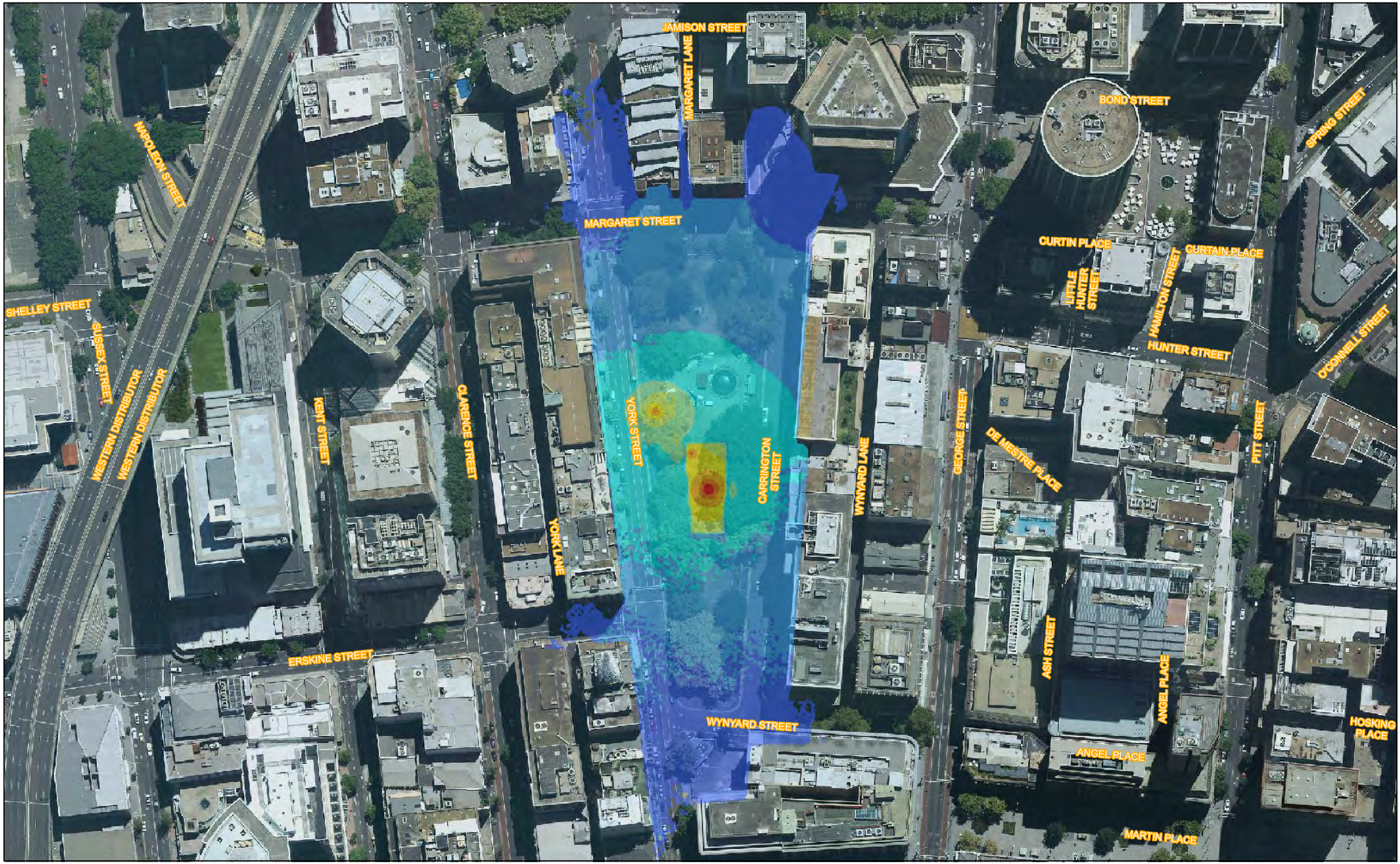
AUG 2014

60286134

0 25 50 100 Meters

N

Fig. **5**



Sound Pressure Level, L_{Aeq} dB(A)

< 40 | 40 - 45 | 45 - 50 | 50 - 55 | 55 - 60 | 60 - 65 | 65 - 70 | 70 - 75 | 75 - 80 | > 80

Wynyard Station Upgrade
Site deliveries

SEP 2014
60286134

Meters
0 25 50 100

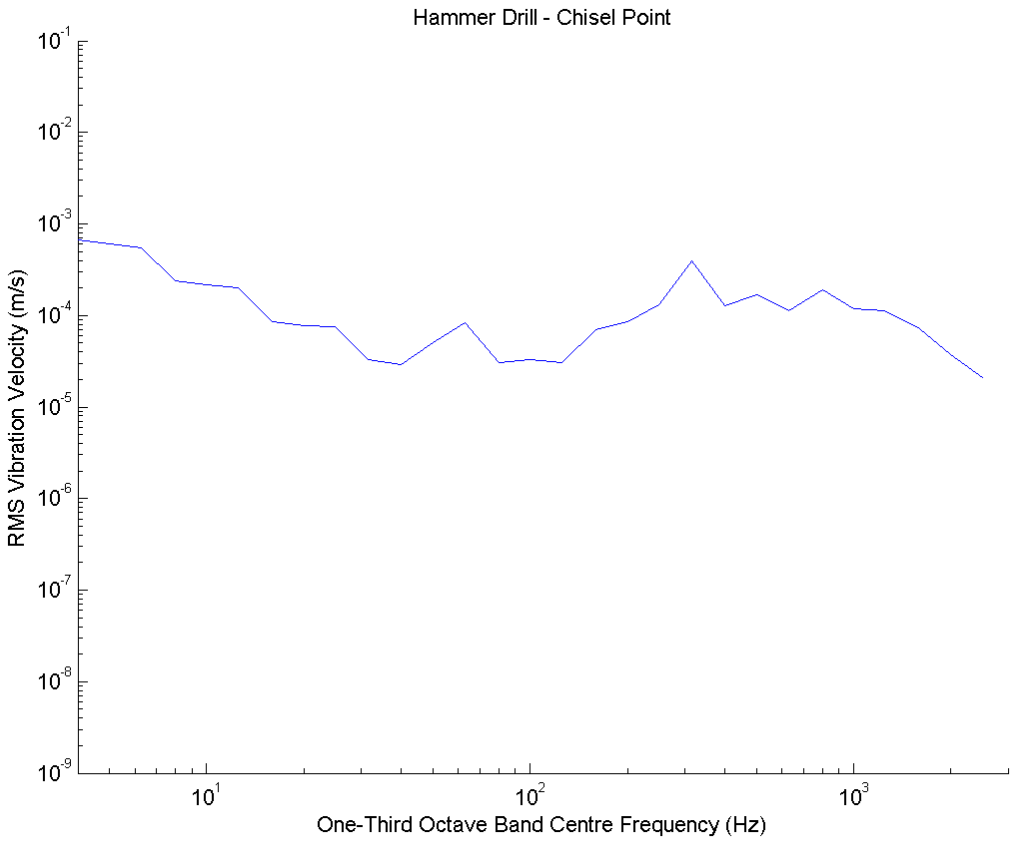
N

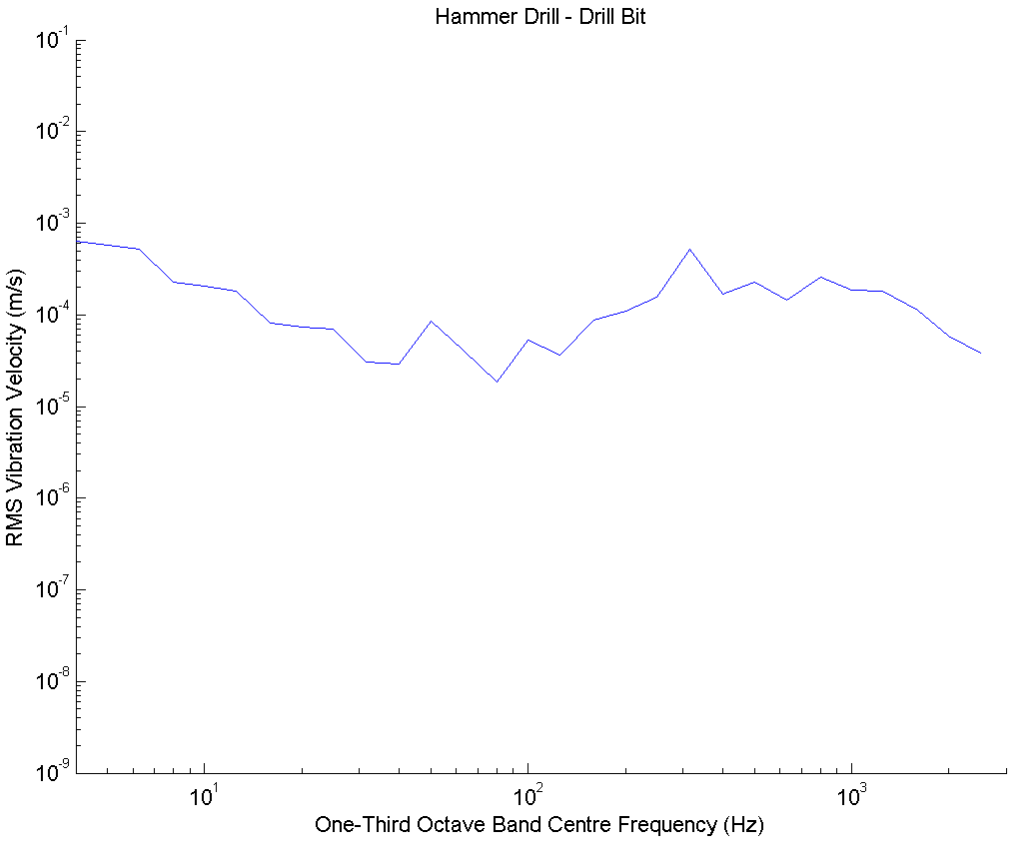
Fig. **6**

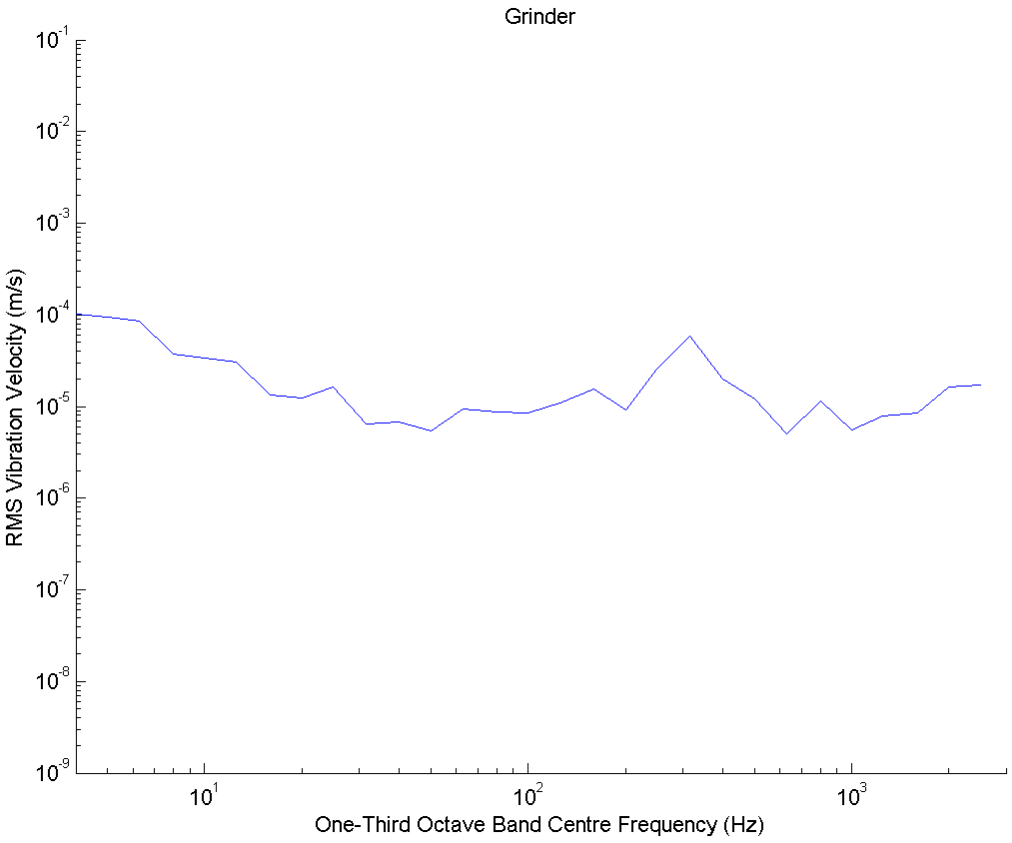
Appendix D

Measured Vibration Levels - Construction

Appendix D Measured Vibration Levels – Construction




Hammer Drill - Drill Bit
RMS Vibration Velocity (m/s)
10^{-1}
10^{-2}
10^{-3}
10^{-4}
10^{-5}
10^{-6}
10^{-7}
10^{-8}
10^{-9}
10^{1}
10^{2}
10^{3}
One-Third Octave Band Centre Frequency (Hz)


Grinder
RMS Vibration Velocity (m/s)
10^{-1}
10^{-2}
10^{-3}
10^{-4}
10^{-5}
10^{-6}
10^{-7}
10^{-8}
10^{-9}
10^{1}
10^{2}
10^{3}
One-Third Octave Band Centre Frequency (Hz)