

Mr Stuart Hodgson
Principal Manager,
Program Sustainability Environment & Planning
Sydney Metro
Transport for NSW
PO Box 588
NORTH RYDE BC NSW 1670

27 July 2017

Ref: CNVIS-Marrickville

Dear Stuart

**RE: Endorsement of Construction Noise and Vibration Impact Statement –
Marrickville Site, Sydney Metro City & Southwest**

Thank you for providing the following documents for Environmental Representative (ER) review and endorsement as required by the Condition of Approval E82 of the Sydney Metro City & Southwest project (SSI – 15_7400 January 9 2017).

- Construction Noise and Vibration Impact Statement (CNVIS) –Marrickville Site, (Revision E dated 24 July 2017).
- Acoustic Advisor (AA) Endorsement (of the above document) dated 27 July 2017

As an approved ER for the Sydney Metro City & Southwest project, I have reviewed the above document for its suitability for implementation. The review did not comprise a technical review, as the ER has relied upon the AA's review of technical aspects of the document. On the basis of the endorsement of the document by the AA, I endorse the document.

Yours sincerely



Michael Woolley
Environmental Representative – Sydney Metro – City and South West

**ENDORSEMENT
CITY & SOUTHWEST ACOUSTIC ADVISOR**

Review of	CNVIS for Delta demolition works at Marrickville	Document reference:	Construction Noise & Vibration Impact Statement MARRICKVILLE
Prepared by:	Dave Anderson		prepared by Osterman Consulting for Delta Pty Ltd
Date of issue:	27 July 2017		Report number 0116-041-07, Rev E, dated 24/7/17

As approved Acoustic Advisor for the Sydney Metro City & Southwest project, I have reviewed and provided comment on the Construction Noise and Vibration Impact Statement for the Delta demolition works at Marrickville, as required under A27 (d) of the project approval conditions.

I have met with Osterman Consulting to discuss earlier drafts of the impact statement and to discuss my formal comments. The impact statement has been revised to address my comments and I endorse Revision E of the statement.



Dave Anderson, interim City & Southwest Acoustic Advisor



Construction Noise & Vibration Impact Statement

MARRICKVILLE

Sydney Metro

Prepared for: Delta Group

24 July 2017

Report number: 0116-041-07

Prepared by: Mark Della Sabina & Rauf Osterman



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Report Revision History				
Rev no.	Date	Description	Prepared by	Reviewed by
A	26/01/2017	Initial Draft	Mark Della Sabina	Rauf Osterman
B	21/02/2017	General update and revision following review by Delta and Project AA	Mark Della Sabina	Rauf Osterman
C	16/07/2017	Updated to incorporate comments from Project AA dated 21/03/2017	Mark Della Sabina	Rauf Osterman
D	17/07/2017	Clarification of NML's for each Noise Catchment Area	Mark Della Sabina	Rauf Osterman
E	24/07/2017	Updated to incorporate comments from Project AA and ER dated 17/07/2017	Mark Della Sabina	Rauf Osterman

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1. Introduction

1.1 Context

This Construction Noise and Vibration Impact Statement (CNVIS) has been developed for Delta Pty Ltd (Delta) to assess the noise and vibration impacts associated with demolition and retention works at the Marrickville site (the site) on the Sydney Metro City & Southwest Project (the project). This CNVIS exists as a sub-plan to the Construction Noise and Vibration Management Plan 0116-041-01 (CNVMP) for the project.

The principal issues addressed within this CNVIS include:

- Identification of noise sensitive receivers near to the site;
- Prediction of the level of noise and vibration impact on these sensitive receivers from construction activities including assessment of predicted compliance with project-imposed Noise and Vibration Management Levels;
- Details of the plant and equipment to be used on site including details of sound mitigation measures to be employed to reduce noise impacts on adjacent noise sensitive receivers.

1.2 Site Overview

The Marrickville site is located north of Sydenham Station and south of Bedwin Road, bordered by Edinburgh Road and Murray Street. Works on the site involve demolition of a number of low-rise industrial buildings. The Marrickville tunnel portal is west of the T3 Bankstown Line in Marrickville (to the north of Sydenham Station).



Figure 1: Marrickville Site Overview

1.3 Site Layout and Access

Site layout and access is illustrated in Figure 2.

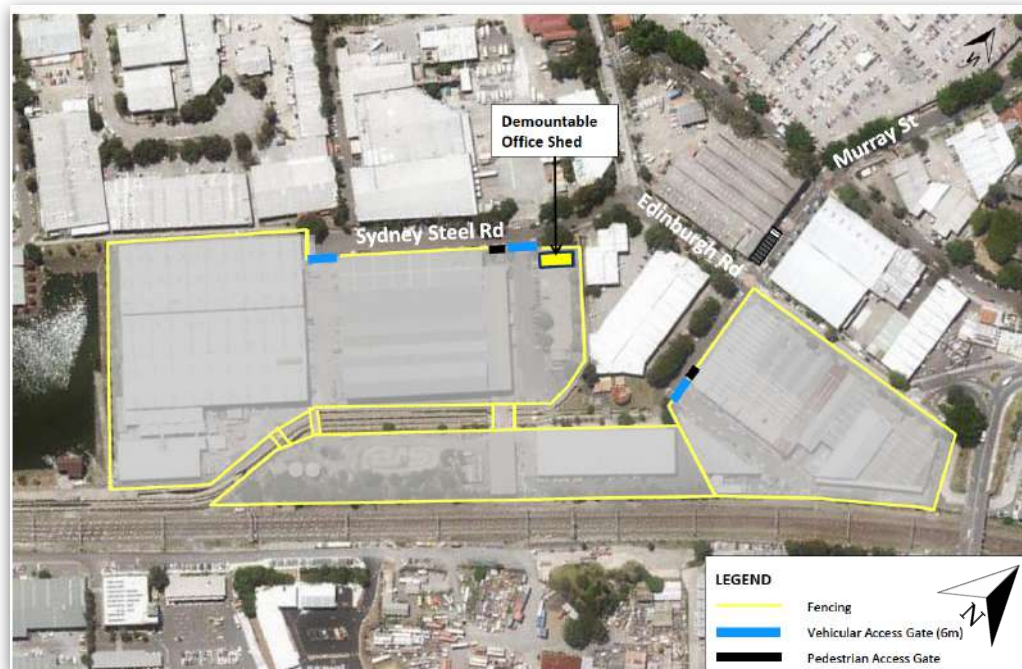


Figure 2: Marrickville Site Layout and Access

2. Applicable Criteria

2.1 Airborne Noise Management Levels

Noise Management Level's (NML's) on this site are assessed under the broader requirements of the approval conditions which are consistent with the EIS and CNVS and based on the Interim Construction Noise Guideline (ICNG). The NML's applicable to Delta's scope of works are outlined in Table 1.

Table 1. ICNG Noise Criteria

Time of Day	Management Level L _{Aeq} (15 min)*	How to apply
<p>Recommended standard hours: Monday to Friday 7am to 6pm</p> <p>Saturday 8am to 1pm</p> <p>No work on Sundays / Public Holidays</p>	Noise affected RBL + 10 dB	<p>The noise affected level represents the point above which there may be some community reaction to noise.</p> <ul style="list-style-type: none"> Where the predicted or measured L_{Aeq} (15 min) is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level. The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.
	Highly noise affected 75 dB(A)	<p>The highly noise affected level represents the point above which there may be strong community reaction to noise.</p> <ul style="list-style-type: none"> Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities can occur, taking into account: <ol style="list-style-type: none"> times identified by the community when they are less sensitive to noise (such as before and after school for works near schools, or mid-morning or mid-afternoon for works near residences) if the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.
<p>Outside recommended standard hours</p>	Noise affected RBL + 5 dB	<ul style="list-style-type: none"> A strong justification would typically be required for works outside the recommended standard hours. The proponent should apply all feasible and reasonable work practices to meet the noise affected level. Where all feasible and reasonable practices have been applied and noise is more than 5 dB(A) above the noise affected level, the proponent should negotiate with the community. For guidance on negotiating agreements see section 7.2.2.

*Noise levels apply at the property boundary that is most exposed to construction noise, and at a height of 1.5 m above ground level. If the property boundary is more than 30 m from the residence, the location for measuring or predicting noise levels is at the most noise-affected point within 30 m of the residence. Noise levels may be higher at upper floors of the noise affected residence.

For the purpose of establishing construction Noise Management Levels in accordance with Table 1, RBL's have been based on noise monitoring conducted by Osterman Consulting during July 2017.

Unattended noise monitors were placed at 2 locations for a minimum period of one week. The location of unattended noise monitors are shown on the site plans in Appendix B. The results of the unattended noise survey and the resultant NML's for the Site are summarised in Table 2.

Table 2. Rating Background Levels				
Location	Monday to Friday (7am - 6pm)		Saturday (8am - 1pm)	
	RBL	NML L _{Aeq} (15 min)	RBL	NML L _{Aeq} (15 min)
336 Edgeware Rd	61	71	59	69
1 Sydney Steel Rd	50	70 ¹	50	70 ¹

¹Noise Management Levels at this location are independent of RBL and are set at 70dB(A) for commercial premises

Other Sensitive Land Uses

The project specific L_{Aeq(15minute)} NML's for other non-residential noise sensitive receivers from the ICNG are provided in Table 3.

Table 3. ICNG Noise Criteria for 'Other' Sensitive Receivers	
Land Use	Management Level L _{Aeq} (15 min) (Applied when the land is in use)
Classrooms at schools and other education institutions	Internal noise level of 45dB(A)
Hospital wards and operating theatres	Internal noise level of 45dB(A)
Places of worship	Internal noise level of 45dB(A)
Active recreation areas (characterised by sporting activities and activities which generate their own noise or focus for participants, making them less sensitive to external noise intrusion)	External noise level of 65dB(A)
Passive recreation areas (characterised by contemplative activities that generate little noise and where benefits are compromised by external noise intrusion, e.g. reading, meditation)	External noise level of 60dB(A)
Community centres	Depends on the intended use of the centre. Refer to the recommended 'maximum' internal levels in Australian Standard 2107 – Acoustics – Recommended design sound levels and reverberation times for building interiors for specific uses.

Other noise-sensitive businesses require separate project specific noise goals. The Interim Construction Noise Guideline recommends that the internal construction noise levels at these premises are determined based on the 'maximum' internal levels presented in AS 2107. These recommended 'maximum' internal noise levels are provided in Table 4.

Table 4. AS2107 Noise Criteria for 'Other' Sensitive Receivers			
Description	Time Period	AS2107 Classification	Recommended 'Maximum' Internal LAeq (15 min)
Hotel	Daytime and evening	Bars and lounges	50
	Night-time	Sleeping areas (hotels near major roads)	40
Cafe	When in use	Coffee bar	50
Bar/Restaurant	When in use	Bars and lounges / Restaurant	50
Library	When in use	Reading areas	45
Recording studio	When in use	Music recording studios	25
Theatre / Auditorium	When in use	Drama theatres	30

Commercial and industrial premises

NMLs for commercial and industrial premises have been set based on the Interim Construction Noise Guidelines. For commercial premises, including offices, retail outlets and small commercial premises an external NML of LAeq(15 minute) 70 dBA has been adopted. An external NML of LAeq(15 minute) 75 dBA has been adopted for industrial premises. For both land use types, the external noise levels should be assessed at the most affected occupied point on the premises.

Notwithstanding the above, at no time can noise generated by construction exceed the National Standard for exposure to noise in the occupational environment of an eight-hour equivalent continuous A-weighted sound pressure level of LAeq,(8h), of 85dB(A) for any employee working at a location near the CSSI.

2.2 Ground-borne Noise Management Levels

Ground-borne Noise Management Levels for residential receivers are provided in Table 5.

Table 5. ICNG NML's for Ground-borne Noise

Land Use	Noise Management Level L_{Aeq} (15 min)
Daytime 7am - 6pm	Internal noise level of 45dB(A)
Evening 6pm - 10pm	Internal noise level of 40dB(A)
Night-time 10pm - 7am	Internal noise level of 35dB(A)

2.3 Construction Vibration

Condition E28 of the Conditions of Approval for the project stipulate that vibration from construction activities shall not exceed the vibration limits set out in the British Standard BS 7385-2:1993 Evaluation and measurement for vibration in buildings. Guide to damage levels from ground-borne vibration.

British Standard 7385: Part 2 1993 suggests levels of vibration at which 'cosmetic', 'minor' and 'major' damage may occur. This standard is based on data collated from a wide range of national and international sources which collectively saw relatively few cases of damage caused by vibration. BS7385 suggests that vibration levels up to the cosmetic damage level are considered 'safe' and have produced no observable damage for particular building types.

For the purposes of this standard, damage includes minor non-structural effects such as hairline cracks on drywall surfaces, hairline cracks in mortar joints and cement render, enlargement of existing cracks and separation of partitions or intermediate walls from load bearing walls.

BS7385 is based on peak particle velocity and specifies damage criteria for transient vibration within the range of frequencies usually encountered in buildings, being 4Hz to 250Hz. This criteria is reproduced in Table 6.

Table 6. BS7385: Part 2 Structural Damage Criteria

Group	Type of Structure	Damage Level	Peak component particle velocity, mm/s		
			4 Hz - 15 Hz	15 Hz - 40 Hz	40 Hz and above
1	Reinforced or framed structures Industrial and heavy commercial buildings	Cosmetic	50 (all frequencies)		
		Minor	100 (all frequencies)		
		Major	200 (all frequencies)		
2	Unreinforced or light framed structures Residential or light commercial type buildings	Cosmetic	15 to 20	20 to 50	50
		Minor	30 to 40	40 to 100	100
		Major	60 to 80	80 to 200	200

Where dynamic loading caused by continuous vibration may result in magnification of vibration through a building structure the guideline values may need to be reduced by up to 50 per cent. Rock breaking, rock hammering and sheet piling activities are considered to have the potential to cause dynamic loading in some structures (eg residences).

For construction activities involving intermittent vibration sources such as rock breakers, piling rigs, vibratory rollers, excavators and the like, the predominant vibration energy occurs at frequencies greater than 4 Hz (and usually in the 10 Hz to 100 Hz range). On this basis, and consistent with the guidance from BS 7385, the following conservative vibration damage screening level per receiver type have been adopted for the project:

- Reinforced or framed structures: **25.0 mm/s**
- Unreinforced or light framed structures: **7.5 mm/s**
- Heritage structures: **7.5mm/s**

Where vibration levels are predicted to exceed the screening criteria, a more detailed assessment of the structure and attended vibration monitoring would be carried out to ensure vibration levels remain below appropriate limits for that structure.

Note that no heritage structures have been identified amongst the listed sensitive receivers.

2.3.1 Warning Levels

The INFRA Monitoring System used on this project features a number of real time alerts and alarms that enable instant notification where limits are approached or exceeded. Where vibration-intensive works are planned to occur in close proximity to sensitive receivers, and works are expected to approach the limits for cosmetic damage, monitoring equipment shall be equipped with visual and/or audible alarms that are triggered when the levels of vibration exceed the control criteria presented in Table 7.

Table 7. Operator Warning and Halt Levels

Structure	Site Control Criteria (PPV in any Orthogonal Direction)	
	Operator Warning Level	Operator Halt Level
Reinforced or framed structures	20 mm/s	25 mm/s
Unreinforced or light framed structures	5 mm/s	7.5 mm/s
Heritage structures ¹	5 mm/s	7.5 mm/s

¹Note that no heritage structures have been identified amongst the listed sensitive receivers

3. Noise and Vibration Assessment

3.1 Sensitive Receivers

A full list of sensitive receivers surrounding the site are listed in Appendix A. A subjective classification of the noise & vibration impact has been evaluated for each sensitive receiver and documented as:

- Low Impact
- Moderate Impact
- High Impact

The classifications were determined on a case-by-case basis using the metrics defined in the CNVS, including:

- The location of the works in relation to the NSR's with consideration of the noise attenuation features such as distance to NSR's, noise barriers, attenuation factor of NSR's windows and elements, Topographical features etc.
- The type and sensitivity of the NSR's:
 - Lower impact: e.g. commercial buildings/scattered residential (low density)
 - Moderate impact: eg standard residential (typical density)
 - High impact: e.g residential home for elderly/high density unit blocks/persistent complainers/residents deemed to have "construction noise fatigue", highly sensitive commercial (jewellers, etc.) or health applications e.g. operating theatres, MRI's, Psychotherapy units, Audio & video production studios etc. and schools/childcare centres.
- Predicted noise and vibration levels and extent of noise exceedance above Noise Management Level
- The type of and intensity of noise emitted from works (ie tonal or impulsive):
 - Lower Impact: No high noise and/or vibration intensive activities
 - Moderate Impact: Short/intermittent high noise and/or vibration intensive activities
 - High Impact: Prolonged high noise and/or vibration intensive activities.
- The duration of any OOHW required.

Site plans illustrating the location of, and degree of impact to, sensitive receivers can be found in Appendix B.

3.2 Construction Activities and Sources of Noise

The degree of noise impact on adjacent sensitive receivers from demolition activities is highly dependent on the type and size of machinery used. In consultation with Delta, a list of the construction activities to be undertaken and the associated machinery is provided in Table 8.

Table 8. Construction Activities and Equipment Noise

Equipment	Number	Construction Activity	Assumed Sound Power* Level dB(A)
5T Excavators	2	Strip Out	89
20T Excavators w/ pulveriser	2	Structural Demolition	104
47T Excavators w/ hammer	3	Low Level Structural Demolition	119
Mustang Bobcats	2	Strip Out	110
Powered Hand Tools		Strip Out	100
Trucks	3	Haulage	105
Concrete Cutters		Concrete Cutting	119

* Sound power levels provided in the table above should be verified against specifications of actual equipment used onsite.

3.3 Airborne Noise Predictions

Due to the significant number of sensitive receivers across the project, and for the purposes of reducing the required number of monitors, sensitive receivers with like characteristics have been grouped into 'noise catchment areas' (NCAs) that can be represented by a single monitor. For the purpose of simplicity, NCA's have been defined according to their general direction relative to the site.

Using the sound power levels stated in Section 3.2, predicted noise levels have been calculated for each NCA based on the distance between noise-emitting activities and the closest sensitive receivers for that location. These predictions assume that equipment is operating at the nearest point of works to the sensitive receiver and therefore represent worst-case scenarios. The predictions do not take into account any mitigation measures. Due to the staging of construction works and the expected spread of equipment across the full area of the site, cumulative noise impacts are expected to be minimal. Predicted noise levels are provided in Table 9 and are highlighted according to the following:

Exceeds Noise Affected Management Level

Exceeds Highly Noise Affected Management Level

Table 9. Predicted External Noise Levels

Equipment	Noise Prediction $L_{eq}(15 \text{ minute})$				
	North - Industrial Area ¹	East - Opp. Edgeware Rd ²	South - Industrial Area ¹	West - Industrial Area ¹	102-110 Edinburgh Rd ³
5T Excavators	60	44	36	45	60
20T Excavators w/pulveriser	75	59	51	60	75
47T Excavators w/hammer	90	74	66	75	90
Mustang Bobcats	81	65	57	66	81
Powered Hand Tools	71	55	47	56	71
Trucks	76	60	52	61	76
Concrete Cutters	90	74	66	75	90

¹NML for industrial receivers is 75dB(A) ²NML for residential receivers is calculated as RBL + 10dB(A) and is equal to 71dB(A) for this location ³NML for commercial receivers is 70dB(A)

Marrickville is somewhat unique in that the nearest sensitive receivers to the North, South and West are industrial premises with a NML of 75dB(A). For completeness, noise predictions were completed for the nearest residential receivers beyond the industrial receivers to the North, South and West and were found to comply with ICNG guidelines.

3.4 Ground-borne Noise

As demolition and retention works do not involve ground excavation, ground-borne noise is expected to be an issue only where sensitive receivers are directly coupled to the works (structure-borne noise). As there are no sensitive receivers directly coupled to the works, structure-borne noise is not expected to be of concern on the Marrickville site.

3.5 Vibration Predictions

Vibration at the nearest sensitive receivers (adjacent to the building foundation) has been estimated using the formula from the FTA's Guideline "Transit Noise and Vibration Impact Assessment".

$$PPV_{Receiver} = PPV_{Ref} \times \left(\frac{d_{ref}}{d} \right)^{1.5}$$

Where: $PPV_{Receiver}$ = peak particle velocity at the receiver in mm/s

PPV_{Ref} = peak particle velocity of the source, measured at the reference distance (7.6 m)

d_{ref} = reference distance for the vibration source (7.6 m)

d = horizontal distance from the source to the receiver (m)

The values of PPV_{Ref} are based on a review of current literature and are provided in Table 10 for reference.

Equipment	PPV @ 7.6m (mm/s)
5T Excavators	2.5
20T Excavators w/pulveriser	2.5
47T Excavators w/hammer	7.6
Mustang Bobcats	0.3
Powered Hand Tools	0.2
Trucks	1.9
Concrete Cutters	0.2

The predicted levels of vibration at the nearest sensitive receivers are provided in Table 11. Note that:

- these predictions assume that equipment is operating at the nearest point of works to the sensitive receiver and therefore represent worst-case scenarios.
- these predictions represent maximum instantaneous levels for the purpose of assessing the likelihood of cosmetic damage and are not applicable for the assessment of human comfort which is measured as vibration dose values.

Equipment	Predicted PPV (mm/s)			
	North (Sydney Steel Rd)	East (Edgeware Rd)	South (Unwins Bridge Rd)	West (Shirlow St)
5T Excavators	1.5	0.1	<0.1	0.1
20T Excavators w/pulveriser	1.5	0.1	<0.1	0.1
47T Excavators w/hammer	4.4 ¹	0.3	0.1	0.3
Mustang Bobcats	0.1	<0.1	<0.1	<0.1
Powered Hand Tools	0.1	<0.1	<0.1	<0.1
Trucks	1.1	0.1	<0.1	0.1
Concrete Cutters	0.1	<0.1	<0.1	<0.1

¹ Sensitive receivers in this direction confirmed to be of low vibration sensitivity.

The German Standard DIN 4150 Part 2 - 1975 presents information on the degree of human perception of various levels of motion. The threshold for 'noticeable' vibration is stated as 1mm/s, with 'easily noticeable' at 2.2mm/s. In light of this, and with reference to Table 11, it is evident that vibration from demolition works is not anticipated to be a significant issue on this site.

4. Noise and Vibration Management

4.1 Environmental Monitoring

Noise and vibration monitoring shall be undertaken using permanent installations at the nearest representative sensitive receivers around the site. Results from these monitors shall be reviewed on a weekly basis to ensure ongoing compliance. Where complaints are received, additional monitoring may be conducted at the specific location of complaint. Monitor locations are detailed in Table 12 and illustrated in Appendix B.

Table 12. Monitoring Locations

Property	Monitor Category	Installation Type	Location	Notes
336 Edgeware Rd	Noise & Vibration	Permanent	Balcony	Representative monitor for compliance
1B Sydney Steel Rd	Noise & Vibration	Semi-permanent	Exterior wall	Monitor has been placed in this location to represent 102-112 Edinburgh Rd. Monitor will be relocated when demolition of this building is required.

The number and location of monitoring points shall be reviewed after an initial period of 2 - 3 months. Where noise and vibration levels are negligible and, in consideration of the works still to be completed, those levels are not expected to increase for the remainder of the project, consideration shall be given to the removal of redundant monitoring points.

For further detail on environmental monitoring, refer to Section 6.3 of the CNVMP.

4.1.1 Heritage-listed Structures

CoA E31 stipulates that a heritage specialist shall provide advice regarding noise and vibration monitoring of heritage-listed structures. No heritage listed structures have been identified in accordance with this condition for the Marrickville site.

4.2 Mitigation Measures

4.2.1 Standard Measures

A range of standard noise and vibration mitigation measures shall be adopted on the site so as to minimise the impact of works on neighbouring sensitive receivers. These are outlined in Table 13. Where it is predicted that NML's will be exceeded even with the implementation of standard mitigation measures, additional mitigation measures shall be put in place (See Section 4.2.2). The standard mitigation measures are outlined in Table 13 below.

Note that CoA E33 states that specific mitigation measures must be identified through consultation with affected sensitive receivers. On this site, the nearest noise sensitive receivers are predominantly industrial with some residential receivers to the East. Therefore standard hours are appropriate and no specific "sensitive periods" have been identified where provision for respite or specific mitigation is required. Evidence of consultation is contained in the Business Management Plan - Early Works as referenced in Section 6.

Table 13. Noise and Vibration Mitigation Measures

No.	Control	Anticipated Noise Reduction	Timing
Administration			
NVM1	Conduct a site induction addressing the requirements of this CNVMP for all new personnel undertaking site activities	N/A	Prior to starting works
NVM2	Educate staff on noise and the impacts of workers activities on the noise environment	N/A	Prior to starting works / following noise complaints
NVM3	Develop a complaints handling procedure and respond to complaints	N/A	Prior to starting works / as required
NVM4	Conduct regular toolbox talks to reiterate the appropriate noise and vibration management methodologies	N/A	Periodically
Procedural			
NVM5	Turn off machinery when not in use	Up to 10 dB	Daily
NVM6	Conduct regular noise measurements in the vicinity of the site to assess compliance with noise criteria	N/A	As needed / following changes in activities
NVM7	The coincidence of noisy plant working simultaneously close together would be avoided	Up to 10 dB	Daily
NVM8	Operate and maintain equipment according to manufacturers' specifications.	Up to 3 dB	Daily
NVM9	Do not use crane whistles, amplified external telephone ringers/ horns or alarms (excluding emergencies)	N/A	Daily
NVM10	Preference the use of the following in lieu of hydraulic hammers: <ul style="list-style-type: none"> • hydraulic concrete shears • hydraulic concrete pulverisers • saw cutting and lifting 	Up to 15 dB	At all times so far as is practicable

Table 13. Noise and Vibration Mitigation Measures

No.	Control	Anticipated Noise Reduction	Timing
NVM11	Maximise offset of noisy plant to sensitive receivers as much as possible.	N/A	Where practicable
NVM12	Sequencing of demolition work to retain noise shields (walls, etc.) as long as possible ie floor by floor leaving the perimeter wall	5 to 15 dB	Where practicable
NVM13	Positioning of load out areas and dump chutes away from neighbouring walls and enclosing dump chutes	N/A	Where practicable
NVM14	Where vibration levels are predicted to exceed the screening criteria, a more detailed assessment of the structure and attended vibration monitoring would be carried out to ensure vibration levels remain below appropriate limits for that structure. For heritage items, the more detailed assessment would specifically consider the heritage values of the structure in consultation with a heritage specialist to ensure sensitive heritage fabric is adequately monitored and managed.		Ongoing
Engineering			
NVM15	Use site offices, sheds as noise barriers during demolition works	5 to 15 dB	Prior to starting works
NVM16	Use equipment appropriately sized for each task.	Up to 2 dB	Daily
NVM17	Use a noise reduction kit on the jack hammer to limit its sound power level to 115 dBA.	6 dB per source	When selecting equipment
NVM18	Use smart broadband reversing alarm on mobile equipment where possible.	2 to 5 dB	When selecting equipment
Hours of Work			
NVM19	Operate during standard work hours wherever possible	N/A	Daily
NVM20	Introduce respite periods and/or take smoke and lunch breaks when noisy equipment is operating close to the site boundaries.	N/A	Daily
NVM21	Demolition, Excavator works to be undertaken between 8am and 5pm, Monday to Friday (excluding breaks and respite periods).	N/A	Daily
NVM22	No hard demolition works (unless required for safety measures) between 5pm and 6pm.	N/A	Daily

4.2.2 Additional Measures

The Sydney Metro Construction Noise and Vibration Strategy outlines additional mitigation measures that shall be adopted where exceedance of imposed limits is expected, with the level of measure commensurate with the degree of exceedance.

The latest version of the strategy, as referenced in Section 6, outlines the following additional measures for works within standard construction hours:

Noise

- Letterbox Drops - Information to neighbours on expected duration of noise-intrusive activities
- Monitoring - Monitoring at the nearest affected sensitive receiver (may include attended monitoring where permanent monitors do not reflect the nearest affected sensitive receiver)

It is anticipated that these measures will be required where hammering activity approaches the boundaries of the site.

Vibration

None required

5. Conclusion

The Marrickville site is relatively insensitive in terms of environmental impacts. The nearest sensitive receivers to the North, South and West are of an industrial nature with a suitably higher NML. The residential receivers to the East, and those beyond the industrial receivers in the other directions are generally far enough away from the site that noise and other environmental impacts are minimal.

6. References

Additional guidelines and standards relating to the management of construction noise and vibration from this project include:

- NSW Interim Construction Noise Guideline (ICNG), Department of Environment and Climate Change 2009
- NSW Road Noise Policy, Dept. of Environment, Climate Change and Water 2011
- NSW Industrial Noise Policy, Environment Protection Authority 2000
- NSW Assessing Vibration – a technical guideline (AVTG), Department of Environment and Conservation 2006
- Australian Standard AS/NZS 2107:2000 Acoustics - Recommended design sound levels and reverberation times for building interiors
- Australian Standard 2834-1995 Computer Accommodation, Chapter 2.9 Vibration
- Australian Standard AS 2187.2 Explosives - Storage and use - Part 2 Use of explosives
- Australian Standard AS2436-1981 Guide to Noise Control on Construction, Maintenance and Demolition Sites
- British Standard BS 6472-2008, 'Evaluation of human exposure to vibration in buildings (1- 80Hz)
- British Standard 7385: Part 2-1993 'Evaluation and measurement of vibration in buildings'
- German Standard DIN4150-1999 Structural vibration Part 3: Effects of vibration on Structures
- Sydney Metro Construction Noise and Vibration Strategy, Report No. 610.14213-R3, Transport for NSW 2016
- Sydney Metro City and Southwest Environmental Impact Statement, Transport for NSW 2016
- Sydney Metro City and Southwest Submissions and Preferred Infrastructure Report, Transport for NSW 2016
- Sydney Metro City and Southwest Conditions of Approval, Department of Planning and Environment 2017
- Transit Noise and Vibration Impact Assessment, Federal Transit Administration 2006
- Environmental Noise Management Manual (ENMM), Roads and Traffic Authority 2001
- Sydney Metro Business Management Plan – Early Works, Department of Planning and Environment 2017

Appendices

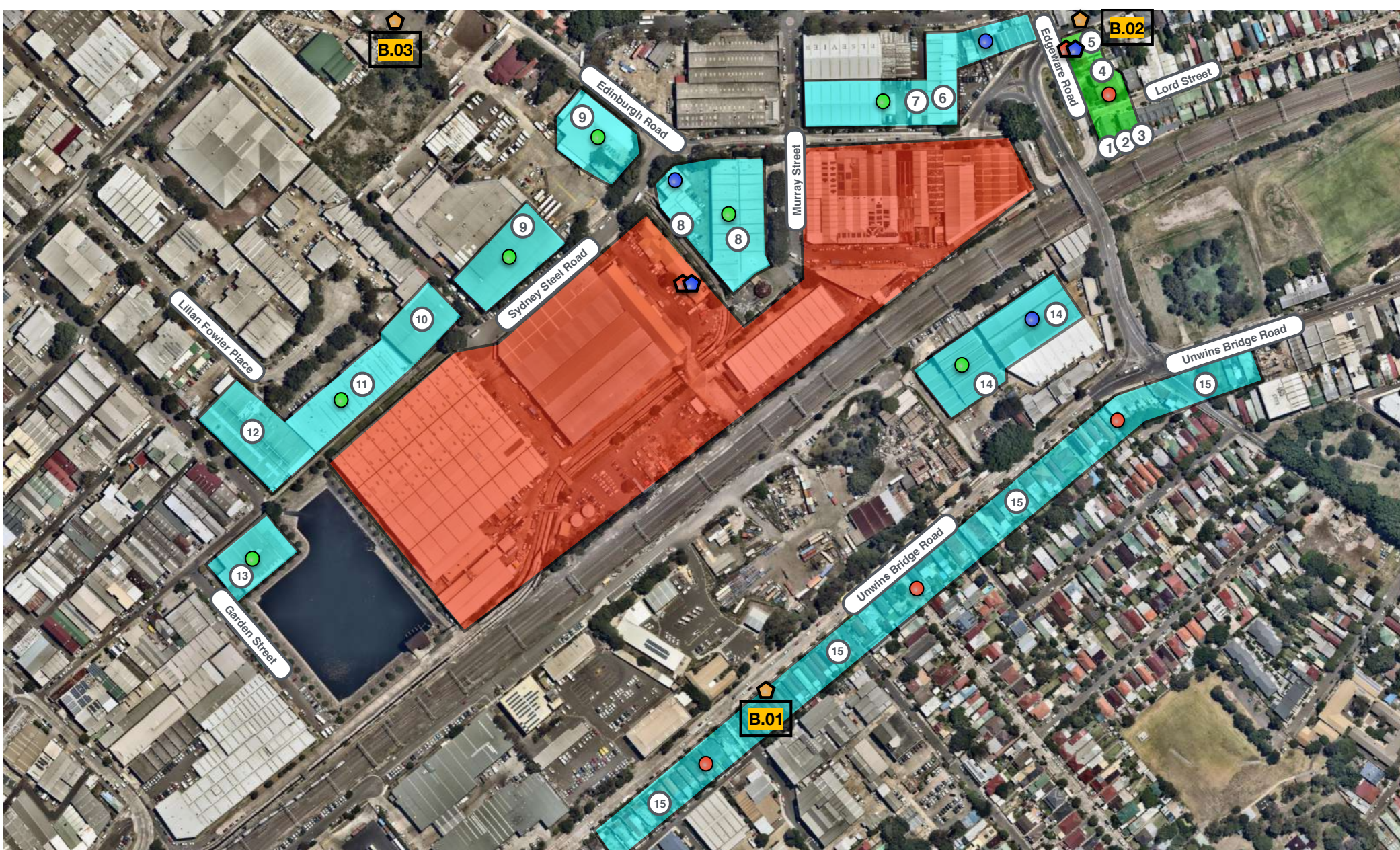
Appendix A - List of Sensitive Receivers

Property Numbers	Address	Business	Business Category	Distance	Impact		Sensitive Equipment
					Noise	Vibration	
1	330 - 360 Edgeware Road	Residential	Residential Buildings	64m	Moderate Impact	Low Impact	
2	190 Lord st	Residential	Residential Buildings	80m	Moderate Impact	Low Impact	
3	188 Lord st	Residential	Residential Buildings	86m	Moderate Impact	Low Impact	
4	346 Edgeware Road	Residential	Residential Buildings	72m	Moderate Impact	Low Impact	
5	330 - 3368 Edgeware Road	Residential	Residential Buildings	78m	Moderate Impact	Low Impact	
6	54 - 56 Smidmore Road	Nrma Smash Repairs	Industrial Buildings	20m	Low Impact	Low Impact	
7	11 Edinburgh Road	Metro Storage	Industrial Buildings	20m	Low Impact	Low Impact	
8	102 - 110 Edinburgh Road	Rutledge Engineering	Office Buildings	12m	Low Impact	Low Impact	
8	102 - 110 Edinburgh Road	Science Press	Office Buildings	12m	Low Impact	Low Impact	
8	102 - 110 Edinburgh Road	Bamboo Floors	Shop Buildings	12m	Low Impact	Low Impact	
8	102 - 110 Edinburgh Road	Innerwest Gymnastics	Indoor Sports Buildings	12m	Low Impact	Low Impact	
8	102 - 110 Edinburgh Road	Nice Products	Industrial Buildings	12m	Low Impact	Low Impact	
8	102 - 110 Edinburgh Road	Fine Point Group	Office Buildings	12m	Low Impact	Low Impact	
8	102 - 110 Edinburgh Road	Casa Del Australia	Industrial Buildings	12m	Low Impact	Low Impact	
8	102 - 110 Edinburgh Road	Sunnyfield Services	Health Buildings	12m	Low Impact	Low Impact	
8	102 - 110 Edinburgh Road	Flymotion	Industrial Buildings	12m	Low Impact	Low Impact	
8	102 - 110 Edinburgh Road	Print Portal	Industrial Buildings	12m	Low Impact	Low Impact	

Property Numbers	Address	Business	Business Category	Distance	Impact		Sensitive Equipment
					Noise	Vibration	
9	74 Edinburgh Road	Bacchus Wine	Industrial Buildings	24m	Low Impact	Low Impact	
9	74 Edinburgh Road	Citymove	Industrial Buildings	24m	Low Impact	Low Impact	
9	74 Edinburgh Road	G&K Transport	Industrial Buildings	24m	Low Impact	Low Impact	
9	74 Edinburgh Road	Heliguy	Industrial Buildings	24m	Low Impact	Low Impact	
9	74 Edinburgh Road	Tender Liqour	Industrial Buildings	24m	Low Impact	Low Impact	
9	74 Edinburgh Road	The Wine Point	Industrial Buildings	24m	Low Impact	Low Impact	
9	74 Edinburgh Road	United Cellars	Industrial Buildings	24m	Low Impact	Low Impact	
9	74 Edinburgh Road	Ecosmart Fires	Industrial Buildings	24m	Low Impact	Low Impact	
10	16 Lillian Fowler Place	Dairy Farmers (Lions)	Industrial Buildings	12m	Low Impact	Low Impact	
11	18 Lillian Fowler Place	Hong Kong Dim Sim	Industrial Buildings	10m	Low Impact	Low Impact	
11	18 Lillian Fowler Place	Simmons Logue	Industrial Buildings	10m	Low Impact	Low Impact	
11	18 Lillian Fowler Place	Stylex	Industrial Buildings	10m	Low Impact	Low Impact	
11	18 Lillian Fowler Place	Afford	Industrial Buildings	10m	Low Impact	Low Impact	
12	24 Lillian Fowler Place	Spotpress Printing	Industrial Buildings	11m	Low Impact	Low Impact	
13	39 - 45 Garden st	Warehouse	Industrial Buildings	66m	Low Impact	Low Impact	
14	1-7 Unwins Bridge road	Sydney Indoor Climbing Gym	Indoor Sports Buildings	63m	Low Impact	Low Impact	
14	1-7 Unwins Bridge road	Gracie Barra Brazilian Jiu-Jitsu St Peters	Indoor Sports Buildings	63m	Low Impact	Low Impact	
15	2-152 Unwins Bridge road	Residential	Residential Buildings	170-208m	Low Impact	Negligible	

Appendix B - Monitoring Locations and Sensitive Receivers

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Impact Category

- Low Impact
- Moderate Impact
- High Impact
- Demolition Zone

Monitoring Category

- Noise
- Regenerated Noise
- Vibration
- Noise & Vibration

Sensitive Receiver Category

- Commercial
- Residential
- Educat/Childcare
- Industrial
- Heritage
- Place of worship
- Property no.
- EIS Monitored RBL



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Sydney Metro Demolition - Marrickville
Noise and Vibration Receivers & Land Uses

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The contents within this document are based on third party data. The accuracy of the information can not be guaranteed