



Construction Noise and Vibration Management Plan (CNVMP)

Sydney Metro City & Southwest
Package B – Martin Place

Project/Plan No: MD1968/09
for Transport for NSW

Controlled Document Number: 01

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CNVMP - Revision Control

Issue number	Date Issued	Amended Page(s)	Action / Amendment Description	Approved By
001	10/03/17		Created	Bert Musch
002	08/05/17	As per tracking sheet	Issued for A.A. and E.R. endorsement	Bert Musch
003	20/06/17	Compliance matrix added	Issued for DPE approval	Bert Musch
004	06/07/17	As per DPE Tracking Sheet	Issued for DPE approval	Bert Musch
005	04/10/17	Table 3 Table 9/10 Table 13 Sect 7.4.5 Sect 8.3 Table 17 Table 19 Table 20 Section 10 Section 3.3.2 and Section 4	Updated to include MacBank comments. Refer D. McEwen email of 13 June and B.Musch response to Anne Anderson dated 17/07/17. Update to include comments from DPE letter of approval dated 12/7/17	Bert Musch

CNVMP – Review

Date Reviewed	Reviewed By	Was Revision Required

CNVMP - Controlled Document Distribution

Copy	Issued To	Organisation	Date	Authority
01				
02				
03				

1 Project Information

1.1 Introduction

The New South Wales (NSW) Government through Transport for NSW (TfNSW) is implementing *Sydney's Rail Future*, a plan to transform and modernise Sydney's rail network so that it can grow with the city's population and meet the needs of commuters and customers in the future.

Sydney Metro is a new standalone rail network identified in *Sydney's Rail Future*. The Sydney Metro network consists of Sydney Metro Northwest (previously known as the North West Rail Link) and Sydney Metro City & Southwest.

The proposed Sydney Metro City & Southwest (SMC&SW) comprises of two core components:

- The Chatswood to Sydenham project involves the construction and operation of an underground rail line approximately 15.5 kilometres long inclusive of new stations between Chatswood and Sydenham.
- The second core component will involve upgrading the 13.5 kilometre rail line and existing stations from Sydenham to Bankstown.

1.2 Scope

Metropolitan Demolitions Pty Ltd (MD) is undertaking the Sydney City Metro & Southwest, Package B - Martin Place (the Project) which consists of the demolition and removal of four buildings located at:

- 55 Hunter Street
- 5 Elizabeth Street
- 7 Elizabeth Street;
- 8 to 12 Castlereagh Street.

The demolition Projects scope of works includes:

- Demolition and removal of buildings elements and infrastructure including basement levels, excluding;
 - Concrete slab on ground
 - Section of walls acting as retaining structures
- Disconnect and cap all utilities/services at relevant property boundaries or as per provided location
- Traffic management
- Waste sorting and removal
- Site remediation
- Asbestos removal
- Decommissioning of plant
- Designing and installation of Temporary Works
- Remove all water meters and return to Sydney Water
- Protection of structures
- Transport of waste
- Prepare Management Plans
- Prepare and submit Survey Plan
- Coordination of the interface Work

Key stages of the project will be carried out as described in **MD1968/03.A Demolition Work Plan** (DWP) prepared for the project. Work will generally follow the sequence as indicated below.

1. Receive Handover of Site and sign off services
2. Site induction
3. Demarcate site and define Exclusion Zones
4. Install Environmental Controls
5. Practical Removal of Hazardous Materials
6. Soft strip structure

7. Erect scaffold and protection
8. Mechanical Demolition
9. Remove rubble and rubbish from site
10. Handover
11. Demobilisation.

All works will be completed in accordance with *Code of Practice: Demolition work, AS2601: The demolition of structures* and shall meet the requirements of the *Work Health and Safety Act 2011 (NSW)* and *Work Health and Safety Regulation 2011 (NSW)*.

2 Objectives

The key objectives of the CNVMP are to:

- Minimise unreasonable noise and vibration impacts on surrounding residents and businesses
- Achieve noise management levels where feasible and reasonable
- Avoid damage to buildings as a result of vibration during demolition
- Maintain positive relationships with community stakeholders by participating in communication between the Client, the relevant Council and the community.

This subplan has been prepared to comply with the Sydney Metro City & Southwest Construction Noise and Vibration Strategy (CNVS) and the Interim Construction Noise Guidelines (Department of Environment and Climate Change, 2009) (ICNG). In addition, this subplan will be reassessed and based on new inputs from the Construction Noise and Vibration Impact Statements (CNVIS) to be completed during the pre-construction phase of the project.

This document may be altered during the course of works. Any changes to this document will be submitted to all relevant parties for approval prior to implementation.

2.1 Review of CNVMP

This CNVMP will be reviewed every 6 months to ensure that the management of noise and vibration emissions from the demolition activities to surrounding sensitive receivers remains effective and in compliance with the requirements of the CoA (refer to Section 3.1). The review would include:

- A review of the effectiveness of the management practices, noise and vibration monitoring and compliance with project noise and vibration criteria.
- Collation of incidents and complaints over the preceding 6 months, including response, actions and outcomes.
- Feedback from stakeholders, including ER and AA.

The CNVMP can be reviewed and revised on a more frequent basis due to:

- Poor performance against noise and vibration criteria and/or unacceptable impacts on the surrounding sensitive receivers.
- Significant changes to the proposed works program and activities.
- At the request of the ER.

All changes to the CNVMP would be submitted to the ER for approval.

3 Demolition Activities and Tasks

The site associated with Work Package B is Martin Place. The works generally involves stripping out, all building interiors; including existing fixtures, fittings and equipment, demolishing the structure, awnings and services and disposing of all building materials. Work Package B will include the demolition of:

- 55 Hunter Street
- Elizabeth Street
- Elizabeth Street
- 8-12 Castlereagh Street

The proposed demolition works have been divided into four stages as follows:

- Stage 1 – 55 Hunter Street, Levels 17 to 21
- Stage 2 – 55 Hunter Street, Levels 15 and 16
- Stage 3 – 55 Hunter Street, 5 Elizabeth Street and 8-12 Castlereagh Street, Levels 12 to 14
- Stage 4 – 55 Hunter Street, 5 Elizabeth Street, 7 Elizabeth Street and 8-12 Castlereagh Street, Levels 13 to B2

Figure 1 presents the preliminary demolition program for the Martin Place demolition works.

Figure 1 Preliminary Demolition Program

Stage	July 2017				August 2017				September 2017				October 2017				November 2017				December 2017				January 2018				February 2018				March 2018							
	Wk1	Wk2	Wk3	Wk4	Wk1	Wk2	Wk3	Wk4	Wk1	Wk2	Wk3	Wk4	Wk1	Wk2	Wk3	Wk4	Wk1	Wk2	Wk3	Wk4	Wk1	Wk2	Wk3	Wk4	Wk1	Wk2	Wk3	Wk4	Wk1	Wk2	Wk3	Wk4	Wk1	Wk2	Wk3	Wk4				
1																																								
2																																								
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4																																								

3.1 Conditions of Approval

The conditions in the Infrastructure Approval (CoA, under Section 115ZB of the Environmental Planning Act 1979, Application No: SSI 15_7400) relevant to this CNVMP are presented below in Table 1.

Table 1 Conditions of Approval

Condition of Approval	CNVMP Section Where Addressed															
CONSTRUCTION ENVIRONMENTAL MANAGEMENT PLAN																
<p>C3. <i>The following CEMP sub-plans must be prepared in consultation with the relevant government agencies identified for each CEMP sub-plan and be consistent with the CEMF and CEMP referred to in Condition C1. The Construction Traffic Management Plan must also be prepared in accordance with the Construction Traffic Management Framework as required by Condition E81.</i></p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 10%;"></th> <th style="width: 30%;">Required CEMP sub- plan</th> <th style="width: 60%;">Relevant government agencies to be consulted for each CEMP sub-plan</th> </tr> </thead> <tbody> <tr> <td>(a)</td> <td>Noise and vibration</td> <td>Relevant Council(s)</td> </tr> </tbody> </table>		Required CEMP sub- plan	Relevant government agencies to be consulted for each CEMP sub-plan	(a)	Noise and vibration	Relevant Council(s)	<p>Comments from City of Sydney Council confirmed that they have deemed this plan acceptable to Council.</p>									
	Required CEMP sub- plan	Relevant government agencies to be consulted for each CEMP sub-plan														
(a)	Noise and vibration	Relevant Council(s)														
<p>C4. <i>The CEMP sub-plans must state how:</i></p> <ul style="list-style-type: none"> a) <i>the environmental performance outcomes identified in the EIS as amended by the PIR as modified by these conditions will be achieved;</i> b) <i>the mitigation measures identified in the EIS as amended by the PIR as modified by these conditions will be implemented;</i> c) <i>the relevant terms of this approval will be complied with; and</i> d) <i>issues requiring management during construction, as identified through ongoing environmental risk analysis, will be managed.</i> 	<p>8 9 10 11</p>															
CONSTRUCTION MONITORING PROGRAMS																
<p>C9. <i>The following Construction Monitoring Programs must be prepared in consultation with the relevant government agencies identified for each Construction Monitoring Program to compare actual performance of construction of the CSSI against predicted performance.</i></p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 10%;"></th> <th style="width: 30%;">Required Construction Monitoring Programs</th> <th style="width: 60%;">Relevant government agencies to be consulted for each Construction Monitoring Program</th> </tr> </thead> <tbody> <tr> <td>(a)</td> <td>Noise and Vibration</td> <td>EPA and Relevant Council(s)</td> </tr> <tr> <td>(b)</td> <td>Blasting</td> <td>EPA and Relevant Council(s)</td> </tr> <tr> <td>(c)</td> <td>Water Quality</td> <td>EPA and Relevant Council(s)</td> </tr> <tr> <td>(d)</td> <td>Groundwater</td> <td>DPI Water</td> </tr> </tbody> </table>		Required Construction Monitoring Programs	Relevant government agencies to be consulted for each Construction Monitoring Program	(a)	Noise and Vibration	EPA and Relevant Council(s)	(b)	Blasting	EPA and Relevant Council(s)	(c)	Water Quality	EPA and Relevant Council(s)	(d)	Groundwater	DPI Water	<p>10 No comment from EPA, Awaiting comment from Council</p>
	Required Construction Monitoring Programs	Relevant government agencies to be consulted for each Construction Monitoring Program														
(a)	Noise and Vibration	EPA and Relevant Council(s)														
(b)	Blasting	EPA and Relevant Council(s)														
(c)	Water Quality	EPA and Relevant Council(s)														
(d)	Groundwater	DPI Water														
<p>C10. <i>Each Construction Monitoring Program must provide:</i></p> <ul style="list-style-type: none"> a) <i>details of baseline data available;</i> b) <i>details of baseline data to be obtained and when;</i> c) <i>details of all monitoring of the project to be undertaken;</i> d) <i>the parameters of the project to be monitored;</i> e) <i>the frequency of monitoring to be undertaken;</i> f) <i>the location of monitoring;</i> g) <i>the reporting of monitoring results;</i> h) <i>procedures to identify and implement additional mitigation measures where results of monitoring are unsatisfactory; and</i> i) <i>any consultation to be undertaken in relation to the monitoring programs.</i> 	<p>7.2 9 10</p>															
<p>C11. <i>The Noise and Vibration and Blast Monitoring Plan must include provision of real time noise and vibration monitoring data. The real time data must be available to the construction team, Proponent, ER and AA. The Department and EPA must be provided with access to the real time monitoring data.</i></p>	<p>10</p>															

Condition of Approval	CNVMP Section Where Addressed
C15. <i>The Construction Monitoring Programs, as approved by the Secretary including any minor amendments approved by the ER, must be implemented for the duration of construction and for any longer period set out in the monitoring program or specified by the Secretary, whichever is the greater.</i>	10
C16. <i>The results of the Construction Monitoring Programs must be submitted to the Secretary for information, and relevant regulatory agencies, for information in the form of a Construction Monitoring Report at the frequency identified in the relevant Construction Monitoring Program.</i>	10
C17. <i>Where a relevant CEMP sub-plan exists, the relevant Construction Monitoring Program may be incorporated into that CEMP sub-plan.</i>	10
NOISE AND VIBRATION	
Vibration	
E28. <i>The Proponent must ensure that vibration from construction activities does 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 groundborne vibration</i>	7.4
E29. <i>Owners of properties at risk of exceeding the screening criteria for cosmetic damage must be notified before construction that generates vibration commences in the vicinity of those properties. These properties must be considered in the Noise and Vibration management sub plan required by Condition C3.</i>	0 7.4 CNVIS
E30. <i>The Proponent must conduct vibration testing before and during vibration generating activities that have the potential to impact on heritage items to identify minimum working distances to prevent cosmetic damage. In the event that the vibration testing and monitoring shows that the preferred values for vibration are likely to be exceeded, the Proponent must review the construction methodology and, if necessary, implement additional mitigation measures.</i>	10
E31. <i>The Proponent must seek the advice of a heritage specialist on methods and locations for installing equipment used for vibration, movement and noise monitoring of heritage-listed structures.</i>	10.2 10.3
CONSTRUCTION NOISE AND VIBRATION STRATEGY	
E32. <i>The Proponent must review the Sydney Metro City and Southwest Construction Noise and Vibration Strategy in the PIR during detailed construction planning to consider scale and duration of impacts, the requirements of this approval and all measures to limit construction noise impacts to sensitive receivers including:</i> <ul style="list-style-type: none"> a) <i>at property or architectural treatment;</i> b) <i>relocation; and</i> c) <i>other forms of mitigation where impacts are predicted to be long term and significant.</i> <i>The revised Sydney Metro City and Southwest Construction Noise and Vibration Strategy must be submitted to the Secretary for approval at least one (1) month before construction commences.</i>	9
E33. <i>Construction Noise and Vibration Impact Statements must be prepared for each construction site before construction noise and vibration impacts commence and include specific mitigation measures identified through consultation with affected sensitive receivers.</i>	8.5
E34. <i>Noise generating works in the vicinity of potentially-affected community, religious, educational institutions and noise and vibration-sensitive businesses and critical working areas (such as theatres, laboratories and operating theatres) must not be timetabled within sensitive periods, unless other reasonable arrangements to the affected institutions are made at no cost to the affected institution or as otherwise approved by the Secretary.</i>	7.1.1
E35. <i>The Proponent must review alternative methods to rock hammering and blasting for excavation as part of the detailed construction planning with a view to adopting methods that minimise impacts on sensitive receivers. Construction Noise and Vibration Impact Statements must be updated for each location or activity to adopt the least impact alternative in any given location unless it can be demonstrated, to the satisfaction of the AA, why it should not be adopted.</i>	8.2
STANDARD CONSTRUCTION HOURS	

Condition of Approval	CNVMP Section Where Addressed
<p>E36. Construction, except as allowed by Condition E48 (excluding cut and cover tunnelling), must only be undertaken during the following standard construction hours:</p> <ul style="list-style-type: none"> a) 7:00am to 6:00pm Mondays to Fridays, inclusive; b) 8:00am to 1:00pm Saturdays; and c) at no time on Sundays or public holidays. 	6
RESPIRE FOR RECEIVERS	
<p>E37. The Proponent must identify all receivers at Crows Nest, Victoria Cross, Barangaroo, Martin Place, Pitt Street and Central likely to experience internal noise levels greater than Leq(15 minute) 60 dB(A) inclusive of a 5 dB penalty, if rock breaking or any other annoying activity likely to result in regenerated (ground-borne) noise or a perceptible level of vibration is planned (including works associated with utility adjustments), between 7am – 8pm.</p>	7.1
<p>E38. The Proponent must consult with all receivers identified in accordance with Condition E37 with the objective of determining appropriate hours of respite so that construction noise (including ground-borne noise), does not exceed internal noise levels of:</p> <ul style="list-style-type: none"> a) Leq(15 minute) 60 dB(A) inclusive of a 5 dB penalty if rock breaking or any other annoying activity likely to result in ground-borne noise or a perceptible level of vibration is planned between 7am – 8pm for more than 50 percent of the time; and b) Leq(15 minute) 55 dB(A) inclusive of a 5 dB penalty if rock breaking or any other annoying activity likely to result in ground-borne noise or a perceptible level of vibration is planned between 7am – 8pm for more than 25 percent of the time, <p>unless an agreement is reached with those receivers. This condition does not apply to noise associated with the cutting surface of a TBM as it passes under receivers.</p> <p>Note This condition requires that noise levels be less than Leq(15 minute) 60 dB(A) for at least 6.5 hours between 7am and 8pm, of which at least 3.25 hours must be below Laeq(15 minute) 55 dB(A). Noise equal to or above Leq(15 minutes) 60 dB(A) is allowed for the remaining 6.5 hours between 7am and 8pm.</p>	7.1
<p>E39. The Proponent must consult with proponents of other construction works in the vicinity of the CSSI and take reasonable steps to coordinate works to minimise cumulative impacts of noise and vibration and maximise respite for affected sensitive receivers.</p>	8.7
<p>E40. The Proponent must ensure all works (including utility works associated with the CSSI where undertaken by third parties) are coordinated to provide the required respite periods identified in accordance with the terms of this approval.</p>	7.1.1
MITIGATION – NON RESIDENTIAL ZONES	
<p>E41. The Proponent must ensure that residential receivers, located in non-residential zones, likely to experience an internal noise level exceeding Leq(15 minute) 60 dB between 8pm and 9pm or Leq(15 minute) 45 dB between 9pm and 7am (inclusive of a 5 dB penalty if rock breaking or any other annoying activity likely to result in regenerated noise, or a perceptible level of vibration is planned (including works associated with utility adjustments)) must be offered additional mitigation in accordance with the Sydney Metro City and South West Noise and Vibration Strategy referenced in Condition E32.</p>	7.2
WORKPLACE HEALTH AND SAFETY FOR NEARBY WORKERS	
<p>E43. 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.</p>	7.3.3
VARIATION TO STANDARD CONSTRUCTION HOURS	
<p>E44. Notwithstanding Condition E36 construction associated with the CSSI may be undertaken outside the hours specified under those conditions in the following circumstances:</p> <ul style="list-style-type: none"> a) for the delivery of materials required by the NSW Police Force or other authority for safety reasons; or b) where it is required in an emergency to avoid injury or the loss of life, to avoid damage or loss of property or to prevent environmental harm; or 	6.1.1

Condition of Approval	CNVMP Section Where Addressed
<p>c) where different construction hours are permitted or required under an EPL in force in respect of the construction; or</p> <p>d) construction that causes LAeq(15 minute) noise levels:</p> <ul style="list-style-type: none"> i. no more than 5 dB(A) above the rating background level at any residence in accordance with the Interim Construction Noise Guideline (DECC, 2009), and ii. no more than the noise management levels specified in Table 3 of the Interim Construction Noise Guideline (DECC, 2009) at other sensitive land uses, and iii. continuous or impulsive vibration values, measured at the most affected residence are no more than those for human exposure to vibration, specified in Table 2.2 of Assessing Vibration: a technical guideline (DEC, 2006), and iv. intermittent vibration values measured at the most affected residence are no more than those for human exposure to vibration, specified in Table 2.4 of Assessing Vibration: a technical guideline (DEC, 2006); or <p>e) where a negotiated agreement has been reached with a substantial majority of sensitive receivers who are within the vicinity of and may be potentially affected by the particular construction, and the noise management levels and/or limits for ground-borne noise and vibration (human comfort) cannot be achieved. All agreements must be in writing and a copy forwarded to the Secretary at least one (1) week before the works commencing; or</p> <p>f) construction approved through an Out of Hours Work Protocol referred to in Condition E47, provided the relevant council, local residents and other affected stakeholders and sensitive receivers are informed of the timing and duration at least five (5) days and no more than 14 days before the commencement of the works.</p>	
<p>E45. On becoming aware of the need for emergency construction in accordance with Condition E44(b), the Proponent must notify the AA, the ER and the EPA (if an EPL applies) of the need for those activities or work. The Proponent must also use best endeavours to notify all affected sensitive receivers of the likely impact and duration of those works.</p>	6.1
<p>E46. Notwithstanding Conditions E44 and E48, rock breaking and other particularly annoying activities are not permitted outside of standard construction hours, except at Central, unless the noise management level derived from the Interim Construction Noise Guideline can be achieved at sensitive receivers.</p>	6.1.1
OUT OF HOURS WORK PROTOCOL	
<p>E47. An Out of Hours Work Protocol for the assessment, management and approval of work outside of standard construction hours, as defined in Condition E36 of this approval, must be prepared in consultation with the EPA and submitted to the Secretary for approval before construction commences for works not subject to an EPL. The protocol must include:</p> <ul style="list-style-type: none"> a) the identification of low and high risk construction activities; b) a risk assessment process in which the AA reviews all proposed out of hours activities and identifies their risk levels; c) a process for the endorsement of out of hours activities by the AA and approval by the ER for construction activities deemed to be of: <ul style="list-style-type: none"> i. low environmental risk; or ii. high risk where all construction works cease by 9pm. <p>All other high risk out of hours construction must be submitted to the Secretary for approval unless otherwise approved through an EPL.</p> <p>The protocol must detail standard assessment, mitigation and notification requirements for high and low risk out of hours works, and detail a standard protocol for referring applications to the Secretary.</p> 	6.1.1
24 HOUR CONSTRUCTION	
<p>E48. Notwithstanding Condition E36 of this approval and subject to Condition E47, the following activities may be undertaken 24 hours per day, seven (7) days per week:</p> <ul style="list-style-type: none"> a) tunnelling and associated support activities (excluding cut and cover tunnelling); b) excavation within an acoustic enclosure; c) excavation at Central without an acoustic enclosure; d) station and tunnel fit out; and e) haulage and delivery of spoil and materials. 	6.1.1

Condition of Approval	CNVMP Section Where Addressed
CONSTRUCTION ENVIRONMENTAL MANAGEMENT FRAMEWORK	
9.1 Construction Noise and Vibration Management Objectives	
- Minimise unreasonable noise and vibration impacts on residents and businesses	0 7 9 10 11.2
- Avoid structural damage to buildings or heritage items as a result of construction vibration	7.4.4
- Undertake active community consultation	9.1
- Maintain positive, cooperative relationship with schools, child care centres, local residents and business owners	0 9.1 11.2
9.2 Construction Noise and Vibration Management Implementation	
(a) Construction Noise and Vibration Management Plan	2
- Identification of works areas, site compounds and access points	Appendix B – Environmental Controls Map
- Identification of sensitive receivers and relevant construction noise and vibration goals	0 7
- Be consistent with and include the requirements of the noise and vibration mitigation measures as detailed in the environmental approval documentation and the Sydney Metro Construction Noise and Vibration Strategy (CNVS)	9
- Details of construction activities and an indicative schedule for construction works, including the identification of key noise and/or vibration generating construction activities (based on representative construction scenarios) that have the potential to generate noise and vibration impacts on surrounding sensitive receivers, in particular residential areas.	3 8
- Identification of feasible and reasonable procedures and mitigation measures to ensure relevant vibrations and blasting criteria, including a suitable blast program	Blasting is not permitted under the Martin Place North – Demolition scope of works
- Community notification provisions specifically in relation to blasting	Blasting is not permitted under the Martin Place North – Demolition scope of works
- Requirements of any applicable EPL conditions	An EPL is not required as part of the Martin Place North – Demolition Works
- Additional requirements in relation to activities undertaken 24 hours of the day, 7 days per week	N/A to the Martin Place North – Demolition Works
- Pre-construction compliance requirements and hold points	3.3
- The responsibilities of key personnel with respect to the implementation of the plan	11.3
- Noise monitoring requirements	10

Condition of Approval	CNVMP Section Where Addressed
- Compliance record generation and management	10.4 10.4.1
- Community consultation requirements	9.1 11
- An Out of Hours Works Protocol applicable to all construction methods and sites	6.1.1
(b) Construction Noise and Vibration Impact Statement will be prepared	8.5
(c) Noise and vibration monitoring would be undertaken for construction as specified in the Construction Noise and Vibration Strategy (CNVS) and the EPL	10
(c) The following compliance records would be kept by the Principal Contractors:	
- Records of noise and vibration monitoring results against appropriate NMLs and vibration criteria	10.4
- Records of community enquiries and complaints, and the Contractor's response	11.2
9.3 Construction Noise and Vibration Mitigation	
(a) All feasible and reasonable mitigation measures would be implemented in accordance with the CNVS. Examples of noise and vibration mitigation measures include;	
- Construction hours will be in accordance with the working hours specified in Section 5.1	6
- Hoarding and enclosures will be implemented where required to minimise airborne noise impacts	Appendix B – Environmental Controls Map
- The layout of construction sites will aim to minimise airborne noise impacts to surrounding receivers	Appendix B – Environmental Controls Map

3.2 Demolition Contract Schedules

In addition to the CoAs presented above, TfNSW's *Sydney Metro City & Southwest Demolition Contract Schedules* (Contract Number: SMCSW-131) present additional requirements which are to be implemented by both the Principal and the Contractor. The requirements which are relevant to this CNVMP are presented below in Table 2.

Table 2 Demolition Contract Schedules

Demolition Contract Schedule	CNVMP Section Where Addressed
<p>NV1. <i>The Construction Noise and Vibration Strategy would be implemented with the aim of achieving the noise management levels where feasible and reasonable.</i></p> <p><i>This would include the following example standard mitigation measures where feasible and reasonable:</i></p> <ul style="list-style-type: none"> <i>Provision of noise barriers around each construction site</i> <i>Provision of acoustic sheds at Chatswood dive site, Crows Nest, Victoria Cross, Barangaroo, Martin Place, Pitt Street, Waterloo and Marrickville dive site</i> <i>The coincidence of noisy plant working simultaneously close together would be avoided</i> <i>Offset distances between noisy plant and sensitive receivers would be increased</i> <i>Residential grade mufflers would be fitted to all mobile plant</i> <i>Dampened rock hammers would be used</i> <i>Non-tonal reversing alarms would be fitted to all permanent mobile plant</i> <i>High noise generating activities would be scheduled for less sensitive period considering the nearby receivers</i> <i>The layout of construction sites would consider opportunities to shield receivers from noise.</i> 	9 10

Demolition Contract Schedule	CNVMP Section Where Addressed
<ul style="list-style-type: none"> This would also include carrying out the requirements in relation to construction noise and vibration monitoring. 	
NV3. 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.	CNVIS
NV4. Feasible and reasonable measures would be implemented to minimise ground borne noise where exceedences are predicted.	CNVIS
NV7. Alternative demolition techniques that minimise noise and vibration levels would be investigated and implemented where feasible and reasonable. This would include consideration of: <ul style="list-style-type: none"> The use of hydraulic concrete shears in lieu of hammers/rock breakers Sequencing works to shield noise sensitive receivers by retaining building wall elements Locating demolition load out areas away from the nearby noise sensitive receivers Providing respite periods for noise intensive works Methods to minimise structural-borne noise to adjacent buildings including separating the structural connection prior to demolition through sawcutting and propping, using hand held splitters and pulverisers or hand demolition Installing sound barrier screening to scaffolding facing noise sensitive neighbours Modifying demolition works sequencing 1 hours to minimise impacts during peak pedestrian times and 1 or adjoining neighbour outdoor activity periods. 	7.1.1 8.2 9.3.2

3.3 Pre-Construction Compliance Requirements and Hold Points

3.3.1 Out of Hours Works

Out of Hours works, if required, would be conducted in accordance with the Sydney Metro Out of Hours Works Protocol as outlined in Section 6.1.1. In accordance with the CEMP, proposed Out of Hours Works would be assessed within a Construction Noise and Vibration Impact Statement prior to works commencing.

3.3.2 Condition Surveys

Prior to the commencement of construction, MDG will offer pre-construction building condition surveys as described in Section 5, where there is a potential for construction activities to cause cosmetic or structural damage.

4 Sensitive Receivers

This project has noise and vibration sensitive receivers within adjoining or adjacent buildings to the construction site. The properties identified to be potentially most affected by the works are detailed in Table 3. Figure 2 shows the site plan together with surrounding noise and vibration sensitive receivers.

Table 3 Noise and Vibration Sensitive Receivers at Martin Place site

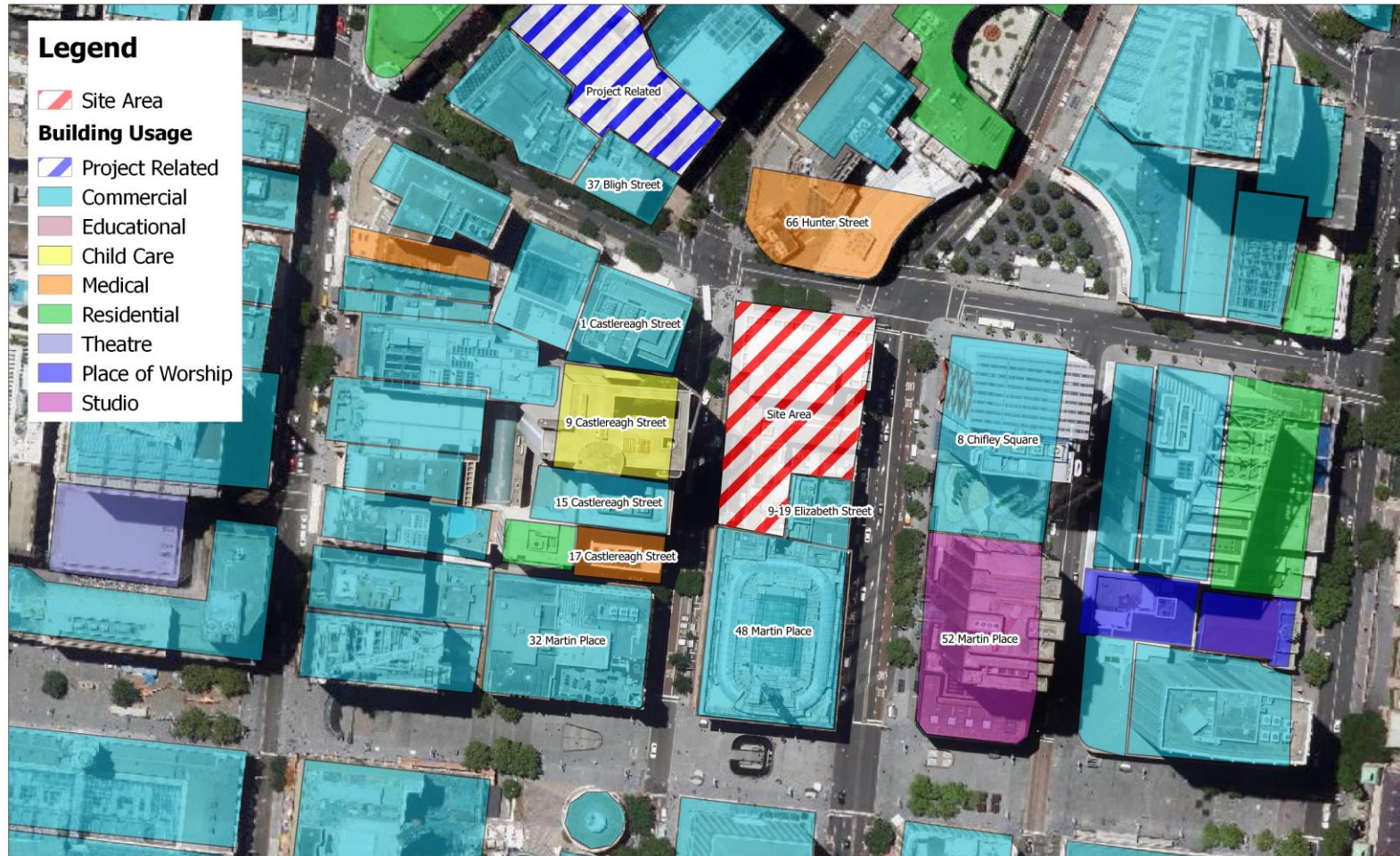
Address	Building Usage	Heritage Vibration Sensitivity	Near point Distance to Works
17 Castlereagh Street	Medical – 9th Floor Only Commercial (Offices/Retail) – All Floors	No	22 m

15 Castlereagh Street	Child Care – 1 st and 2 nd Floors Commercial (Offices) – All Floors	No	20 m
9 Castlereagh Street	Child Care - Ground Floor Only Café – Ground Floor Only Commercial (Offices/Retail) - All Other Floors	No	22 m
1 Castlereagh Street	Commercial (Offices/Retail) – All Floors	No	19 m
37 Bligh Street	Wine Bar – Ground Floor Only Commercial (Offices) – All Floors	No	50 m
66 Hunter Street	Restaurant – Ground and 1 st Floors Medical – 5th Floor Only Mediation Centre – 10 th Floor Only Commercial (Offices) – All Floors	Yes	20 m
8 Chifley Square	Restaurant – Ground Floor Only Commercial (Offices/Retail) – All Floors	No	32 m
50 Martin Place	Vault Area in the lower basement	Yes	<1 m
48 Martin Place (Macquarie Bank)	Commercial (Offices) – All Floors	Yes	<1 m
9-19 Elizabeth Street (Macquarie Bank)	Commercial (Offices) – All Floors Recording Studio ¹	No	<1 m
32 Martin Place	Commercial (Offices) – All Floors	Yes	37 m
52 Martin Place	TV Studio – Ground to 4 th Floors Commercial (Offices/Retail) – All Floors	No	37 m
1 Hosking Place	Residential – All Floors	No	55 m

Note 1: It is understood that Macquarie Bank operates a recording studio within the building located at 9-19 Elizabeth Street. MD have negotiated with Macquarie Bank to coordinate high noise activities around the operation of the recording studio, and communication between MD and Macquarie Bank will be ongoing regarding the studio's scheduled use. This building will not be further considered as a recording studio for assessment purposes.

There is 3rd Party Agreement currently being negotiated between Mac Bank and TfNSW. The CNVMP and/or CNVIS will be amended if required.

Figure 2 Site Plan



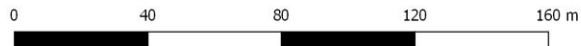
Legend

Site Area

Building Usage

- Project Related
- Commercial
- Educational
- Child Care
- Medical
- Residential
- Theatre
- Place of Worship
- Studio

Note 1: The Receiver Type colour coding presented represents the highest noise sensitive usage throughout the entire building. Refer to Table 3 for detailed building usage.



Project No.:	10-1380
Date:	03/05/2017
Drawn by:	RW
Scale:	1:1,982
Sheet Size:	@A4
Projection:	GDA 1994 MGA Zone 56

Metropolitan Demolitions Group
Sydney Metro City & Southwest
Works Package B - Martin Place
Site Plan



This document may be based on data provided by third parties for which VMS Australia Pty Ltd cannot guarantee the accuracy.

5 Building Dilapidation Surveys

Condition surveys are to be undertaken in accordance with the contract and CoA E59 on surrounding infrastructure (including footpaths and roads) and the following properties:

- 48 Martin Place, Sydney
- 9-19 Elizabeth Street, Sydney

Surveys are to be prepared with the agreement of each property owner/occupier prior to commencement of demolition activities and post demolition works. These reports are to be submitted to the Principal's Representative for review as per the contract.

The vibration monitoring procedure is to be reviewed in accordance with the pre-works dilapidation survey to ensure adequate monitoring to surrounding buildings.

6 Construction Hours

6.1 Approved Construction Hours

The standard construction hours as outlined in the contract and as per CoA E36 are as follows:

- a) 7:00 am to 6:00 pm, Mondays to Fridays, inclusive;
- b) 8:00 am to 1:00 pm on Saturdays; and
- c) at no time on Sundays or public holidays.

Where works are to be undertaken outside of the standard construction hours presented in CoA E36, the Sydney Metro Out of Hours Work Application Form must be completed and sent to Sydney Metro for approval.

In addition to the standard construction hours presented in CoA E36, CoA E37 and E38 specifically name Martin Place as a site where works may be conducted between 7:00 am and 8:00 pm provided that internal LAeq(15 minute) noise levels at sensitive receivers are restricted to no more than 60 dBA for 50% of the time (6.5 hours) and no more than 55 dBA for 25% of the time (3.25 hours). Notwithstanding, the period between 6.00 pm and 8.00 pm is still considered to be outside of standard construction hours and the Out of Hours Work Protocol is to be followed should work be conducted between these times.

The approved construction hours do not apply in the event of a direction from police or other relevant authority for safety reasons, to prevent environmental harm or risk to life. Construction hours may be extended in accordance with CoA E47 and E48.

On becoming aware of the need for emergency construction, MD must notify the AA, the ER of the need for those activities or work. MD must also use best endeavours to notify all affected sensitive receivers of the likely impact and duration of those works.

6.1.1 Out of Hours Work

Construction hours are to be in accordance with the CoA and may be extended or varied in accordance with CoA E 47. Where Out of Hours Works are to be undertaken, they must be in accordance with the "Sydney Metro City and Southwest Out of Hours Work Protocol". This applies to all Out of Hours demolition works regardless of whether they have been assessed within the CNVIS.

Subject to the Out of Hours Work Protocol, haulage and delivery of spoil and materials may be undertaken 24 hours per day, seven (7) days per week.

The use of hydraulic hammers or other annoying activities is not permitted outside of standard construction hours, unless the Noise Management Levels present in Section 7 can be achieved at all sensitive receivers.

7 Demolition Noise Management Levels

The three primary noise metrics used to describe construction noise emissions are:

- LA1(1minute) - The typical 'maximum noise level for an event', used in the assessment of potential sleep disturbance during night-time periods. Alternatively, assessment may be conducted using the L_{Amax} or maximum noise level.
- LA_{eq}(15minute) - The "energy average noise level" evaluated over a 15-minute period. This parameter is used to assess the potential construction noise impacts.
- LA₉₀ - The "background noise level" or "Rating Background Level" (RBL) in the absence of construction activities. This parameter represents the average minimum noise level during the daytime, evening and night-time periods respectively. The LA_{eq}(15minute) construction noise management levels are based on the RBLs.

The subscript "A" indicates that the noise levels are filtered to match normal hearing characteristics (A weighted).

The NSW EPA Interim Construction Noise Guideline (ICNG) requires Project specific Noise Management Levels (NMLs) to be established for noise affected receivers. A site specific Construction Noise Impact Statement (CNVIS) is to be prepared which will predict noise impacts to all nearby sensitive receivers. In the event construction noise levels are predicted to be above the NMLs, all feasible and reasonable work practices are investigated to minimise noise emissions.

Having investigated all feasible and reasonable work practices, if construction noise levels are still predicted to exceed the NMLs then the potential noise impacts would be managed as per Section 8 of this CNVMP.

7.1 Conditions of Approval Noise Limits

CoA E37 and E38 requires that internal noise levels be less than LA_{eq}(15minute) 60 dBA for at least 6.5 hours between 7.00 am and 8.00 pm, of which at least 3.25 hours must be below LA_{eq}(15minute) 55 dBA. Noise levels equal to or above LA_{eq}(15minute) 60 dBA are allowed for the remaining 6.5 hours between 7.00 am and 8.00 pm. Where rock breaking or any other annoying activity is to be undertaken, a 5 dB penalty is to be applied.

It is understood that the internal noise limits imposed by CoA E37 and E38 apply to all receivers regardless of their usage. Notwithstanding, the NMLs presented below in Section 7.2 and Section 7.3 which have been derived from the ICNG, may be used in assessing the requirement to implement additional mitigation measures presented in Table 20 and Table 21, or when assessing noise impacts at receivers such as cafes with outdoor areas.

Airborne and structure-borne noise predictions would be undertaken and presented within the CNVIS in order to identify all receivers likely to experience internal noise levels greater than LA_{eq}(15minute) 60 dBA.

7.1.1 Respite for Receivers

Where it has been predicted that internal noise levels may exceed LA_{eq}(15minute) 60 dBA, MDG must consult with all affected receivers with the objective of determining appropriate hours of respite so that construction noise does not exceed the criteria presented in E37 and E38. In accordance with E40, all works must be coordinated around the identified respite periods.

In addition to the above, high noise and vibration generating activities, such as jackhammering, rock hammering, rock breaking and saw-cutting, may only be carried out in continuous blocks, not exceeding 3 hours each, with a minimum respite period of one hour between each block.

In accordance with CoA E34, where works are to be conducted in the vicinity of potentially-affected community, religious, educational institutions and noise and vibration-sensitive businesses and critical working areas (such as theatres, laboratories and operating theatres), consultation would be undertaken with these receivers in order to identify sensitive time periods and schedule works accordingly.

7.2 Residential Receivers

The ICNG provides an approach for determining LAeq(15minute) NMLs at residential receivers and applying the measured RBLs, as described in Table 4. These Noise Management Levels will be applied to the Construction Hours and Out of Hours Works as defined in Conditions E36 and E48 of the COA.

Table 4 Determination of NMLs for Residential Receivers

Time of Day	NML LAeq(15minute)	How to Apply
Standard hours Monday to Friday 7:00 am to 6:00 pm Saturday 8:00 am to 1:00 pm No work on Sundays or public holidays	RBL + 10 dBA	The noise affected level represents the point above which there may be some community reaction to noise. <ul style="list-style-type: none"> Where the predicted or measured LAeq(15minute) is greater than the noise affected level, MDG should apply all feasible and reasonable work practises to meet the noise affected level. MDG 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 dBA	The highly noise affected level represents the point above which there may be strong community reaction to noise. Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restructuring the hours that the very noisy activities can occur, taking into account: <ul 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.
Outside recommended standard hours	RBL + 5 dBA	<ul style="list-style-type: none"> A strong justification would typically be required for works outside the recommended standard hours. MDG should apply all feasible and reasonable work practises to meet the noise affected level. Where all feasible and reasonable practices have been applied and noise is more than 5 dB above the noise affected level, MDG should negotiate with the community (refer to the Additional Noise Mitigation Measures in Section 8.2.3).

Note 1: 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.

Note 2: The RBL (Rating Background Level) is the overall single-figure background noise level measured in each relevant assessment period (during or outside the recommended standard hours). The term RBL is described in detail in the NSW Industrial Noise Policy.

Site specific residential construction NMLs for Martin Place have been nominated in the Sydney Metro Chatswood to Sydenham EIS Technical Paper 2: *Noise and Vibration* (SLR Consulting Report 610.14718R8 dated 28 April 2016).

These NMLs have been reproduced in Table 5. The NML's have been derived in the EIS from background noise monitoring data obtained by SLR Consulting at 1 Hoskings Place, Sydney (B.11) between 19 June to 2 July 2017.

Table 5 Residential Construction Noise Management Levels

Receiver Types	LA90 Background Noise Level (RBL)			LAeq(15minute) Construction NMLs (dBA)			
	Daytime	Evening	Night-time	Daytime ¹	Daytime OoH ²	Evening ³	Night-time ⁴
Residential	61	56	52	71	66	61	57

Note 1: The Daytime period includes Monday to Friday 7.00 am to 6.00 pm and Saturdays 8.00 am to 1.00 pm, except for Public Holidays.

Note 2: The Daytime Out of Hours period includes Saturdays 7.00 am to 8.00 am and 1.00 pm to 6.00 pm, and Sundays and Public Holidays 7.00 am to 6.00 pm

Note 3: The Evening period includes 6.00 pm to 10.00 pm.

Note 4: The Night-time period includes 10.00 pm to 7.00 am.

Where residential receivers, namely 1 Hosking Place, are likely to experience an internal noise level exceeding Leq(15 minute) 60 dB between 8.00 pm and 9.00 pm or Leq(15 minute) 45 dB between 9.00 pm and 7.00 am, they must be offered additional mitigation in accordance with Section 9.3.3.

7.3 Other Sensitive Land Uses

The Project specific LAeq(15minute) NMLs for non-residential noise sensitive receivers from the ICNG are provided in Table 6.

Other noise-sensitive businesses (commercial premises) require separate Project specific noise goals and it is suggested in the ICNG that the internal construction noise levels at these premises are to be referenced to the upper internal design sound levels presented in AS 2107:2016 Acoustics – *Recommended design sound levels and reverberation times for building interiors*. Recommended upper internal design sound levels from AS2107 are reproduced in Table 6 for other sensitive receiver types identified within the Project area.

The Education classified business shown in Table 3 at 9 Castlereagh Street, Sydney is the Castlereagh Street Early Learning Centre, which may be classified as a childcare. ICNG and AS 2107 do not detail specific criteria relating to childcare centres. Accordingly, reference is made to the Association of Australian Acoustic Consultants recommendations of LAeq (1 hour) of 40 dBA for indoor play and sleep areas. Receivers which may require further investigation into level of sensitivity include educational, health and studio businesses and residential as noted in the CNVS.

Table 6 Summary of Noise Management Levels for Other Sensitive Land Uses

Land Use	Area	NML LAeq(15minute) Noise Levels	
		External	Internal
Hotel ¹	Bars and Lounges	70 dBA	50 ^{2,3} (Daytime & Evening)
	Sleeping Areas: - Hotels near major roads	As per Table 6 for residential ⁴	40 ⁴ (Night-time)
Café ¹	Coffee bar	70 dBA ³	50 ^{2,3} (when in use)
Bar/Restaurant ¹	Bars and Lounges / Restaurant	70 dBA ³	50 ^{2,3} (when in use)
Library ¹	Reading Areas	70 dBA	45 ⁵ (when in use)
Recording Studio ¹	Music Recording Studios	70 dBA	25 ⁶ (when in use)
Theatre/ Auditorium ¹	Drama Theatres	70 dBA	30 ⁶ (when in use)
Childcare Centres	Internal Play Area	65 dBA	55 dBA

Land Use	Area	NML LAeq(15minute) Noise Levels	
		External	Internal
	Sleeping Area	50 dBA (when in use)	40 dBA (when in use)
Classrooms at schools and other education institutions		55 dBA	45 dBA ⁷ (when in use)
Hospital wards and operating theatres		70 dBA	45 dBA
Places of Worship		70 dBA	45 dBA
Active recreation areas ⁸		65 dBA	-
Passive recreation areas ⁹		60 dBA	-
Community centres		Depends on the intended use of the centre. Refer to the recommended upper internal design sound levels in AS 2107 for specific uses.	
Commercial premises ¹⁰	offices, retail outlets and small commercial premises	70 dBA (when in use)	45 dBA (when in use)
Industrial premises ¹⁰		75 dBA (when in use)	-

Note 1: Design noise levels specified in AS 2107 internal noise levels.

Note 2: Where no external seating has been identified, fixed window glazing and air conditioning is assumed to mitigate high existing ambient noise levels and/or control internal noise break-out. A minimum outside-to-inside attenuation of 20 dB is assumed. The internal ICNG noise goal then corresponds to a façade level of 70 dBA.

Note 3: Where an open frontage or outdoor seating area has been identified, the external noise goal is taken as 60 dBA.

Note 4: Hotels (sleeping areas during the night-time) are assumed to have incorporated acoustic façade design in order to mitigate high existing ambient noise levels (refer to Section 3) to achieve the internal design noise level of 40 dBA specified in AS 2107. Notwithstanding, the more conservative external NML corresponding to residential receivers (refer to Table 6) has been applied to the sleeping areas of hotels.

Note 5: These receivers are typically well insulated from external noise break-in.

Note 6: These receivers are typically well insulated from external noise break-in, with significant acoustic mitigation included in the façade design.

Note 7: Assumed based on external noise levels being 10 dB higher than internal noise levels when windows are open.

Note 8: Characterised by sporting activities and activities which generate their own noise or focus for participants, making them less sensitive to external noise intrusion.

Note 9: Characterised by contemplative activities that generate little noise and where benefits are compromised by external noise intrusion (eg reading and meditation).

Note 10: Assess at the most affected occupied point on the premises.

7.3.1 Ground-borne Noise

Ground-borne noise refers to noise produced by vibration of floor slabs and other building elements, which radiates noise into the interior of a building, sometimes referred to as regenerated noise. The ICNG provides ground-borne noise criteria for evening and night time periods only, as the objectives are to protect the amenity and sleep of inhabitants whilst they are at home.

Ground-borne noise levels higher than those nominated in Table 7 indicate mitigation measures would be implemented. Note, these levels only apply when ground-borne noises levels are higher than airborne noise levels.

Table 7 Management Levels according to Building Category and Time of Day (ICNG)

Time	Building Category	Management Level – LAeq(15minute)
Day: 7:00 am – 6:00 pm	Internal residential	45 dB
	Internal commercial	50 dB
Evening: 6:00 pm – 10:00 pm	Internal residential	40 dB
Night: 10:00 pm – 7:00 am	Internal residential	35 dB

Where ground-borne noise levels are predicted to exceed the Management Levels presented in Table 7, the following measures would be implemented:

- Where possible separate structural connections between adjoining buildings using sawcutting and propping, hand held splitters and pulverisers or hand demolition to reduce structure borne noise impacts.
- Establish “safe working distances” for vibration intensive plant and equipment in order to ensure compliance with the nominated vibration criteria (see Section 7.4.6). By limiting site vibration emissions, ground-borne noise would also be reduced.
- Implement additional noise management measures, including respite periods where appropriate, as per Section 9.

Where levels are higher than predicted or in response to complaints ground-borne noise monitoring may be required. Where attended ground-borne noise monitoring is not possible, indirect unattended remote monitoring may be considered.

7.3.2 Demolition Traffic Noise

Assessing permissible noise increases for construction traffic aims to protect sensitive receivers against decreases in amenity as a result of the construction works. An increase of up to 2 dB on existing noise management levels represents a minor impact barely perceptible in the CBD. Where levels are expected to exceed an increase of 2 dB feasible and reasonable noise mitigation measures are to be applied. The extent and type of mitigation measures are to consider the existing actual noise levels associated with traffic.

It is proposed that heavy construction vehicle movements associated with the demolition works would be restricted to enter and exit the site via Elizabeth Street. In addition, it is understood that the proposed haulage routes are on arterial and sub-arterial roads with significant existing traffic flows whereby increased traffic flows are not likely to exceed existing traffic flows by 60%. It is therefore expected that increased traffic noise due to demolition works is likely to be less than the 2 dB allowance at all locations.

7.3.3 Workplace Health and Safety

Noise induced hearing loss typically occurs when individuals are exposed to excessive noise levels for extended periods of time (normally over several months or perhaps years). Alternatively hearing damage can occur when a person is exposed to very high (peak) noise levels.

Section 56 of the “Work Health and Safety Regulation 2011” provides acceptable noise limits for the workplace. The full section is reproduced below:

56 Meaning of “exposure standard for noise”

(1) In this Regulation, “exposure standard for noise”, in relation to a person, means:

(a) LAeq(8hour) of 85 dB(A), or

(b) LCpeak of 140 dB(C).

The “noise level equivalent” is defined as the steady sound pressure level which in the course of an 8 hour period, delivers the same A-weighted sound energy as the actual noise on any particular representative working day. The peak noise level is the C-weighted peak sound pressure level.

For employees confined to one work location for a typical 8 hour shift, the LAeq noise level for that particular task will represent their daily noise exposure. Conversely, if an employee works on a variety of tasks during a typical 8 hour

shift then the total noise exposure level would be composed of several partial noise exposures for the variety of tasks undertaken. The relationship between noise exposure level and duration is demonstrated in Table 8.

Table 8 Relationship between Noise Exposure Level and Noise Exposure Duration

Noise Exposure Level (LAeq)	Approximate Duration of Noise Exposure Equivalent to WHS Regulation Level of LAeq(8hour) 85 dBA
80 dBA	24 hours
82 dBA	16 hours
85 dBA	8 hours
88 dBA	4 hours
92 dBA	2 hours
95 dBA	1 hour
98 dBA	30 minutes
101 dBA	15 minutes
104 dBA	8 minutes
107 dBA	4 minutes
110 dBA	2 minutes
113 dBA	1 minute
116 dBA	30 seconds

A number of management and mitigation measures may be implemented in order to ensure compliance with the WHS criteria for workers within and surrounding the demolition site. Such measures may include:

- The use of hoarding and/or temporary noise barriers around the site.
- Rotation of employees so as to not be located in high noise exposure areas for extended periods of time.
- Ensuring employees are given appropriate shift lengths and provided respite between shifts.
- Providing hearing protection to employees where appropriate.
- Providing specific WHS noise training to employers in order to provide awareness and guidance on managing their employees during highly noisy periods.

In accordance with CoA E43, 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(8 hour), of 85dBA for any employee working at a location near the site.

It is considered highly unlikely that any sensitive receiver, including pedestrians and staff of nearby businesses would be exposed to high noise levels (>85 dBA) for periods long enough to exceed the WHS criteria. Notwithstanding, signage should be posted around construction sites in order to inform the general public of high noise exposure areas.

7.4 Vibration Criteria

7.4.1 Human Comfort Continuous and Impulsive Vibration Criteria

Vibration and its associated effects on people are usually classified as continuous, impulsive or intermittent as follows:

- Continuous vibration: machinery, steady road traffic, continuous construction activity such as underground drilling
- Impulsive vibration: infrequent activities that create up to three distinct vibration events in an assessment period, e.g. occasional dropping of heavy equipment, occasional loading and unloading
- Intermittent vibration: trains, nearby intermittent demolition activity, rock breakers and jack hammers.

Structural vibration in buildings can be detected by the occupants possibly affecting them in various ways including reducing working efficiency and quality of life. Complaint levels from occupants of the buildings subject to vibration depend on the use of the building and the time of day.

Acceptable levels of continuous vibrations depend on the time of day and the activity being undertaken. The preferred values for continuous and impulsive vibration for office and residential buildings are presented in Table 9 and Table 10 below (as presented in the EPA's *Assessing Vibrations: a technical guideline, Table C1.1*). It is noted that the Conditions of Approval define a "perceptible level of vibration" as the "preferred" peak velocity levels presented in Table 9 and Table 10.

Table 9 Criteria for exposure to Continuous Vibration

Space Occupancy	Time of Day	Peak velocity(mm/s)	
		Preferred ¹	Maximum
Residential	Day	0.28	0.56
	Night	0.20	0.4
Offices	Day/Night	0.56	1.1

Note 1: The Preferred Peak Velocity presented represent a "perceptible level of vibration".

Table 10 Criteria for exposure to Impulsive Vibration

Space Occupancy	Time of Day	Peak velocity(mm/s)	
		Preferred ¹	Maximum
Residential	Day	8.6	17.0
	Night	2.8	5.6
Offices	Day/Night	18.0	36.0

Note 1: The Preferred Peak Velocity presented represent a "perceptible level of vibration".

7.4.2 Human Comfort Intermittent Vibration Criteria

In the case of intermittent vibration, which is caused by plant such as rock breakers, the criteria are expressed as a Vibration Dose Value (VDV). The calculation of a VDV is used to evaluate the cumulative effects of bursts of intermittent vibration. Various studies have shown that VDV assessment methods far more accurately assess the level of disturbance than methods which assess the vibration magnitude only.

The acceptable VDV intermittent vibration for residential and office building uses are outlined in Table 11 below (as presented in the EPA's *Assessing Vibrations: a technical guideline, Table 2.4*).

Table 11 Acceptable Vibration Dose Values

Space Occupancy	Time of Day	VDV ($m/s^{1.75}$)	
		Preferred	Maximum
Residential	Day	0.20	0.40
	Night	0.13	0.26
Offices, schools, educational institutions, places of worship	Day/Night	0.40	0.80

7.4.3 Cosmetic Damage Vibration Criteria

Structural vibration criteria are defined in terms of levels of vibration emission from the works that will minimise the risk of damage to buildings and other structures.

Structural vibration criteria are designed to minimise the risk of cosmetic surface cracks and are set well below the levels that have the potential to cause damage to the main structure. Structural damage criteria are presented in British Standard (BS) 7385-Part 2:1993 ‘*Evaluation and Measurement for Vibration in Buildings*’ which have also been referenced and reproduced in AS 2187:2006.

The recommended limits from BS 7385 for transient vibration to ensure minimal risk of cosmetic damage to residential and industrial buildings are presented in Table 12. In accordance with CoA E28, the vibration criteria presented in BS 7385 must not be exceeded by the demolition works.

Table 12 Transient vibration guide values – minimal risk of cosmetic damage

Type Building	Peak Component particle velocity in frequency range of predominant pulse	
	4Hz to 15Hz ¹	15Hz and above ¹
Reinforced or framed structures, industrial and heavy commercial buildings	50 mm/s at 4Hz and above	
Dwellings and buildings of similar design and/or use	15mm/s at 4Hz increasing to 20mm/s at 15Hz	20mm/s at 15Hz increasing to 50mm/s at 40Hz and above

Note 1: Vibration values may need to be reduced by up to 50% if the dynamic loading caused by continuous vibration gives rise to dynamic magnification due to resonance, especially at the lower frequencies where lower guide values apply.

7.4.4 Structural Damage to Heritage Buildings

BS 7385 notes that a building of historical value should not, unless it is structurally unsound, be assumed to be more sensitive. In the case of heritage listed buildings which are considered to be “structurally unsound”, guidance for structural damage can be derived from the German Standard DIN 4150-3. The guideline values for vibration levels for heritage buildings are reproduced in Table 13.

Table 13 DIN 4150 Recommended PPV vibration levels for Heritage Listed Buildings

Frequency (Hz)	Guideline Velocity (mm/s)
1-10	3
10-40	3-8
40-50	8-10

Demolition works are to be undertaken to comply with the above recommended vibration criteria. If compliance with the above levels is not being met using approved demolition methods, alternative demolition methods are to be considered, whilst assessment of the recommended velocity levels are reviewed in consideration of whether there is scope for altering the vibration criteria from the DIN 4150 vibration levels.

7.4.5 Structure Specific Vibration Criteria

In addition to the structural damage and human comfort criteria presented above, it is understood the Macquarie Bank building located at 48 Martin Place contains a vault which is particularly sensitive to vibration. MDG have received advice from Macquarie Bank that for security reasons the Commonwealth Bank will not divulge vibration limits for the vault area. It is recommended that vibration trials be conducted upon the commencement of demolition works within the vault (or within the vicinity of the vault if appropriate) to ensure that the acceptable limit is achieved.

7.4.6 Site Vibration Control Criteria

Based on the information contained in the CNVS and EIs, site specific vibration control criteria haven been nominated and are reproduced in Table 14.

Table 14 Nominated Site Vibration Control Criteria

Building type	Included Buildings	Site Control Criteria ¹	
		Operator warning level (mm/s)	Operator halt level (mm/s)
Reinforced frame structure	17 Castlereagh Street 15 Castlereagh Street 9 Castlereagh Street 1 Castlereagh Street 37 Bligh Street 8 Chifley Square 9-19 Elizabeth Street 2 Martin Place	20	25
Bank Vault	48 Martin Place (vault area)	5	7.5
Heritage (structurally sound)	48 Martin Place (all other areas) 66 Hunter Street 32 Martin Place	5	7.5
Unreinforced or light framed structures	N/A ²	5	7.5

Note 1: An exceedance of the operator warning level does not require activities to cease, but will alert the Project Manager and Foreman to proceed with caution at a reduced force or load.

Note 2: No unreinforced or light framed structures have been currently identified within the vicinity of the demolition works.

Where it has been predicted within the CNVIS that the vibration criteria presented in Table 14 may be exceeded, the affected receivers would be notified in accordance with E29. In addition, operator-attended vibration monitoring would be undertaken upon commencement of the demolition activities which have been predicted to exceed the nominated criteria. The purpose of the operator-attended vibration monitoring is to establish “safe working distances”, beyond which plant can be safely operated while maintaining compliance with the nominated criteria.

8 Demolition Methodology - Noise and Vibration Sources

8.1 Early Works

Before demolition activities can be undertaken, a number of preparation works and control measures must be implemented. Table 15 presents the proposed early works together with the proposed construction hours and equipment required.

Table 15 Early Works

Activity	Hours	Equipment
Scaffolding	Standard Hours	Hand Tools
Hoarding	Monday to Thursday Out of Hours	Hand Tools
Driveway Works	Standard Hours (hammering), Daytime Out of Hours (formwork and concreting)	5t Excavator with Hammer and Hand Tools
Soft Strip out and Oxy Cutting	Standard Hours and Out of Hours	Hand Tools and Oxy Cutter

8.2 Selection of Demolition Methodology

A variety of demolition methodologies have been considered analysed and reviewed prior to deciding on the Demolition Methodology for the demolition of the structures. The various methods of demolition and the reasons behind their selection and rejection are detailed in Table 16.

Table 16 Analysis of Demolition Methodology

Task	Demolition Method	Comment
Removal of concrete encasement form the structural steel beams and columns	<u>Conventional Method</u> - Hammer in situ all of the concrete encasement off the beams and columns using hydraulic excavators.	This method does not allow sufficient respite from hydraulic hammering to be provided to affected receivers.
	<u>Option 1</u> - Use Pulverisers and shear attachments to cut through the member or remove concrete encasing.	This option would require larger excavators to operate the pulveriser and shear attachments. Access restrictions within the demolition site prevent this option from being viable.
	<u>Option 2</u> - Use a wire saw or other type saw to cut through the member or remove concrete encasing.	Saw cutting is considered a high noise activity. Considering the duration of saw cutting required in this method, it is not considered to be more effective than the conventional method from an acoustic standpoint.
	<u>Option 3</u> - Bursting, splitting, fracturing using bursting heads or other similar methods.	Hydraulic hammering of material which results in 'dry' hits can significantly increase the overall sound power levels of the hammer. On this basis, Option 3 is not considered to be acoustically beneficial.
	<u>Option 4</u> – Exposing the ends of the steel members by hydraulic hammering, oxy cutting them and then lifting them out.	This method requires the least noise intensive works and is therefore the preferred method.
Demolish Slabs and walls	<u>Conventional Method</u> - Hammer in situ all of the reinforced concrete walls slabs stairs and the like using excavators with hydraulic hammer attachments.	This method does not allow sufficient respite from hydraulic hammering to be provided to affected receivers.
	<u>Option 1</u> – Section sawing, slab sawing and wall sawing the slabs and walls into smaller sections, and then lifting them off the building.	Saw cutting is considered a high noise activity. Considering the duration of saw cutting required in this method, it is not considered to be more effective than the conventional method from an acoustic standpoint.
	<u>Option 2</u> – Using a combination of mainly pulverising, however sometimes hydraulic hammering to demolish the reinforced concrete walls, slabs, stairs and the like.	The reduction in time spent using hydraulic hammers will provide opportunity to offer sufficient respite periods to affected receivers. For this reason Option 2 is the preferred method.

8.3 Demolition Activities

Demolition activities will comprise two stages of work: site preparation and demolition of the existing building.

The site preparation involves erection of hoardings, amenities and offices, dilapidation surveys, scaffolding and establishment of site access. In general, minimal noise will be generated during these activities, however mobile cranes and delivery trucks would be required periodically which would result in higher noise emissions for short periods.

Demolition will comprise removal of internal and external hazardous materials, internal strip-out of non-structural components of the building and structural demolition. Noise and vibration will be generated from a range of activities including hammering of concrete and loading materials into trucks. To reduce noise and vibration emissions, concrete slabs will be demolished using an excavator with shear attachment where possible.

To reduce structure borne noise and vibration impacts at the directly adjoin receivers located at 48 Martin Place and 9-19 Elizabeth Street, saw-cutting of concrete slabs would be undertaken to “decouple” structural components of the adjoining structures. In addition, it is understood that there is already a void between the structures which will significantly reduce structure borne noise and vibration impacts to these receivers. This void will need to be kept clear of rubble to avoid the transmission of noise and vibration between the buildings.

Table 17 presents each demolition stage, together with the associated tasks and the proposed usage of hydraulic hammers.

Table 17 Hammering vs Non-Hammering Durations for Selected Method

Staging Level	Task Number	Task	Use Of Hydraulic Hammers
Stage 1	55 Hunter Street		
	1	Asbestos and SMF removal on external roof	No hammering, over 1 day
	2	Lift down plant, lift-up 13T excavator & skid steer to roof	No hammering, over 1 day (Out-of-hours Work / Sunday)
	3	Demo plant room roof slab (L-21)	13T excavator, 6 hours, hammering over 2 days
	4	Demo plant, internal walls, etc.	13T excavator, 12 hours, hammering over 4 days
	5	Demo plant room slab (L-20)	13T excavator, 6 hours, hammering over 1 day
	6	Ramp down and clean up	13T excavator, 3 hours, hammering over 3 days
	7	Demo perimeter walls of plant room level	13T excavator, 15 hours, hammering over 3 days
	8	Demo plant room slabs (L-19)	13T excavator, 6 hours, hammering over 1 day
	9	Ramp down and clean up	13T excavator, 3 hours, hammering over 3 days
	10	Demo perimeter walls of plant room level	13T excavator, 15 hours, hammering over 3 days
	11	Demo plant room slabs (L-18)	13T excavator, 6 hours, hammering over 1 day
	12	Ramp down and clean up	13T excavator, 3 hours, hammering over 3 days
	TOTAL = 81 Hours hammering over 29 Days (for all levels) = 27.9% of the time hammering NOTE: This duration and steps 1 to 12 cover plant room levels and terrace level, i.e. 29 days = 4 levels and based on a 10-hr day		
Stage 2	55 Hunter Street and See Note Regarding 8/12 Castlereagh St		
	1	Lift-up of 20T excavator to roof	No hammering, over 1 day (Out-of-hours Work / Sunday)

Staging Level	Task Number	Task	Use Of Hydraulic Hammers
	2	Hammer slab near core	20T excavator, 3 hours, hammering over half day
	3	Ramp down and clean up	No hammering, over half day
	4	Demo slab, internal beams and core (incl. clean up) (L-17)	13T + 20T excavators, 16 hours, hammering over 4 days
	5	Demolish perimeter walls and beams (incl. clean up)	13T + 20T excavators, 6 hours, hammering over 2 days
	6	Repeat steps 2-5 for demolition of L-16	-
<p>TOTAL = 25 hours of hammering over 8 days (for each level) = 31.3% of the time hammering</p> <p>NOTE: This duration and steps 1 to 6 cover typical floors to be 8 days each level and based on a 10-hr day. Also at this stage, the demolition of the bays of 8/12 Castlereagh St that adjoin Macquarie Bank may be implemented to lessen the structural vibration impact during demolition. The proposed methodology will include the use of 5T excavator hammering the slab bays followed by the saw cutting the columns adjacent to the Macquarie Bank. An assessment will be made if this is to be an ongoing requirement for the entirety of the project.</p>			
Stage 3	55 Hunter Street		
	1	Hammer slab near core	20T excavator, 3 hours, hammering over half day
	2	Ramp down and clean up	No hammering, over half day
	3	Demo slab, internal beams and core (incl. clean up) (L-15)	13T + 20T excavators, 16 hours, hammering over 4 days
	4	Demolish perimeter walls and beams (incl. clean up)	13T + 20T excavators, 6 hours, hammering over 2 days
	5	Repeat steps 1-4 for demolition of L-14 to L-13	-
<p>TOTAL = 25 hours of hammering over 7 days (for each level) = 35.7% of the time hammering</p>			
	5 Elizabeth Street		
	1	Lift-up 20T + 5T excavators to roof and lift plant down	No hammering, over 1 day (Out-of-hours Work / Sunday)
	2	Demo plant room roof slab (L-14)	20T + 5T excavators, 4 hours, hammering over 2 days
	3	Demo plant, internal walls, etc. (incl. ramp down)	20T excavator, 20 hours, hammering over 5 days
	4	Demo plant room slab (L-13)	20T + 5T excavators, 10 hours, hammering over 2 days
	5	Ramp down and clean up	20T + 5T excavator, 3 hours, hammering over 1 day
	6	Demo perimeter walls of plant room level	20T + 5T excavators, 12 hours, hammering over 4 days
<p>TOTAL = 49 hours of hammering over 15 days (for all levels) = 32.7% of the time hammering</p> <p>NOTE: This duration and steps 1 to 6 cover plant room levels, i.e. 15 days = 2 levels and based on a 10-hr day</p>			
	8-12 Castlereagh Street		
	1	Lift down plant, lift-up 13T + 20T excavators & skid steer to roof	No hammering, over 1 day (Out-of-hours Work / Sunday)
	2	Demo plant room roof slab (L-14)	13T + 20T excavators, 4 hours, hammering over 2 days

Staging Level	Task Number	Task	Use Of Hydraulic Hammers
	3	Demo plant, internal walls, etc. (incl. ramp down)	13T + 20T excavators, 10 hours, hammering over 4 days
	4	Demo plant room slab (L-13)	13T + 20T excavators, 5 hours, hammering over 1 day
	5	Ramp down and clean up	13T excavator, 3 hours, hammering over 3 days
	6	Demo perimeter walls of plant room level	13T + 20T excavators, 15 hours, hammering over 3 days
	TOTAL = 37 hours of hammering over 14 days (for all levels) = 26.4% of the time hammering NOTE: This duration and steps 1 to 5 cover plant room levels, i.e. 14 days = 2 levels and based on a 10-hr day		
Stage 4	55 Hunter Street		
	1	Hammer slab near core	20T excavator, 3 hours, hammering over half day
	2	Ramp down and clean up	No hammering, over half day
	3	Demo slab, internal beams and core (incl. clean up) (L-12)	13T + 20T excavators, 16 hours, hammering over 4 days
	4	Demolish perimeter walls and beams (incl. clean up)	13T + 20T excavators, 6 hours, hammering over 2 days
	5	Repeat steps 1-4 for demolition of L-11 to basement	-
	TOTAL = 25 hours of hammering over 7 days (for each level) = 35.7% of the time hammering NOTE: This duration and steps 1 to 5 cover plant room levels, i.e. 7 days = each level and based on a 10-hr day		
	5 Elizabeth Street		
	1	Hammer slab near core	20T excavator, 2 hours, hammering over half day
	2	Ramp down and clean up	No hammering, over half day
	3	Demo slab, internal beams and core (incl. clean up) (L-12)	5T + 20T excavators, 14 hours, hammering over 4 days
	4	Demolish perimeter walls and beams (incl. clean up)	5T + 20T excavators, 6 hours, hammering over 2 days
	5	Repeat steps 1-4 for demolition of L-11 to basement	-
	TOTAL = 22 hours of hammering over 7 days (for each level) = 31.4% of the time hammering NOTE: This duration and steps 1 to 5 cover plant room levels, i.e. 7 days = each level and based on a 10-hr day		
	7 Elizabeth Street		
	1	Demo plant roof slab/typical slab, internal beams and core - access via 5 Elizabeth St building (L-10)	20T + 5T excavators, 6 hours, hammering over 2 days
	2	Skid steer clean up	No hammering, over 2 days
	3	Demo perimeter walls of plant room level	20T + 5T excavators, 5 hours, hammering over 1 day
	4	Skid steer clean up	No hammering, over 2 days
	5	Repeat steps 1-2 for demolition of L-9 to basement	-
	8-12 Castlereagh Street		

Staging Level	Task Number	Task	Use Of Hydraulic Hammers
	1	Hammer slab near core	20T excavator, 3 hours, hammering over half day
	2	Ramp down and clean up	No hammering, over half day
	3	Demo slab, internal beams and core (incl. clean up) (L-12)	13T + 20T excavators, 16 hours, hammering over 4 days
	4	Demolish perimeter walls and beams (incl. clean up)	13T + 20T excavators, 6 hours, hammering over 2 days
	5	Repeat steps 1-4 for demolition of L-11 to basement	-
TOTAL = 25 hours of hammering over 7 days (for each level) = 35.7% of the time hammering NOTE: This duration and steps 1 to 5 cover plant room levels, i.e. 7 days = each level and based on a 10-hr day			

Note 1: Hammering works would only be undertaken during approved construction hours. In addition and in accordance with the CNVS, a one hour period of respite would be required for every three hours of continuous hammering.

8.4 Noise and Vibration Sources

8.4.1 Plant and Equipment

Plant and equipment likely to be used during demolition are identified in Table 18 along with maximum allowable sound levels in accordance with the CNVS.

Table 18 Maximum Plant and Equipment Sound Levels

Plant Item	Maximum Allowable Construction Plant Sound Levels – dBA	
	Sound Power Level	Sound Pressure Level at 7m
Excavator 3T	90	65
Excavator 20T (with bucket/shear)	105	80
Excavator 20T (with pulveriser)	108	83
Excavator Hammer	118	93
Concrete Saw	118	93
Generators	104	79
Compressor	105	80
Skidsteer Loader 1T	110	85
Jackhammer	113	88
Dump trucks 15T	108	83

8.5 Construction Noise and Vibration Impact Statement

In accordance with CoA E33, a Construction Noise and Vibration Impact Statement (CNVIS) will be prepared prior to the commencement of demolition activities which would include predictive modelling of noise and vibration impacts. Where noise and/or vibration levels are predicted to exceed their corresponding noise and vibration objective, the CNVIS will include specific mitigation measures identified through consultation with affected sensitive receivers.

MDG proposes to use similar types of equipment as detailed in Table 15 and expects noise and vibration produced by the works to be consistent with previous projects. Predicted noise levels are to be based on the above equipment noise levels, distance attenuation and shielding from existing building and structures where applicable.

8.6 Management of Material

Noise from the drop zone, where material undergoes a controlled fall from the upper levels to the ground floor down the existing lift shaft, will not be included in the predicted noise levels. This noise is mitigated due to the location of the drop zone typically towards the centre of the building. Noise impacts are reduced by the surrounding building internal structure, the building facade and the Class 'B' plywood hoarding installed at street level. In addition, there will also be a layer of rubble in the base of the shaft to provide absorption of the falling material.

8.7 Cumulative Works

Where it has been identified that other construction works are scheduled to be undertaken in the vicinity of the site, MD must consult with proponents of the other construction works and take reasonable steps to coordinate works to minimise cumulative impacts of noise and vibration and maximise respite for affected sensitive receivers.

9 Mitigation Measures

The EIS identified significant potential noise and vibration impacts at the surrounding sensitive receivers due to the demolition works. Consequently, the CNVS was submitted together with the EIS to identify the noise and vibration mitigation and management practices that will be adopted for the project and forms part of the CoA. Mitigation includes, controlling noise emissions from the project, in order of priority, at the source, the transmission path and at the receiver. Investigations were carried out in relation to alternative demolition methods to reduce emissions while still achieving an acceptable project delivery (refer to Table 16 for more details). Paths controls will also be implemented primarily via installing plywood hoarding around the perimeter of demolition works. No receiver controls are anticipated. Notwithstanding the implementation of these mitigation controls, noise and vibration disturbance is still anticipated, accordingly there will be a significant reliance on the management of potential impacts on the surrounding receivers, with a particular emphasis on consultation and respite management. Details are provided in the sections below.

9.1 Community Consultation and Respite

Alternative demolition techniques that minimise noise and vibration levels would be investigated and implemented where feasible and reasonable, however, where it is found that hydraulic hammering is still required, a period of at least 3.25 hours each day will be negotiated with the surrounding receivers to ensure that hammering is not undertaken in order to provide some respite.

In accordance with CoA E37 and E38, receivers identified in the CNVIS as being likely to experience internal LAeq(15 minute) noise levels of greater than 60 dBA as a result of demolition works would be required to be consulted with in order to determine appropriate hours of respite.

Based on the outcomes of these consultations, noise and vibration intensive works (namely hydraulic hammering) would be scheduled to provide periods of respite at each receiver location whereby internal noise levels would not exceed 60 dBA for 50% of the time, and 55 dBA for 25% of the time.

9.2 Standard Mitigation Measures

Standard mitigation measures to minimise noise and vibration related impacts during demolition activities are applied where possible and feasible in order to ensure the noise and vibration performance outcomes identified in the EIS will be achieved. These are included in Table 19 below.

Table 19 Noise and Vibration Management and Mitigation Measures

Management and Mitigation Measures	Responsibility	Timing
Pre-demolition		
Dilapidation/Condition Surveys of the surrounding infrastructure (roads and footpaths) and required properties to be submitted to the Principal's Representative 30 days prior to commencement of work.	PM	Pre- demolition

Management and Mitigation Measures	Responsibility	Timing
Register of Noise Sensitive Receivers including name and category or receiver.	PM	Pre- demolition
Solid hoardings and/or site sheds are to be erected on work site boundaries to function as noise barriers shielding noisy activities from receivers. Class B hoarding is to be erected in accordance with City of Sydney Council guidelines. Minimum 17mm thick ply will be used on the hoarding around the boundary to act as a noise barrier.	PM, Foreman	Pre- demolition
Location of site access and egress and load out areas are to consider noise sensitive receivers and where feasible and reasonable to minimise reversing movements within the site.	PM	Pre- demolition
All fixed plant at the work site is to be appropriately selected, and where necessary, fitted with silencers, acoustical enclosures and other noise attenuation measures in order to ensure that the total noise emission from each work site complies with conditions of approval requirements.	PM, Foreman	Pre- subcontractor engagement
General Demolition		
Site Induction of all site personnel. Site Induction, Toolbox Talks and Team Meetings are to include a noise and vibration awareness/education component identifying impacts and implementation of control measures for the project. Site inductions are to include: <ul style="list-style-type: none"> • Project specific and standard noise and vibration measures • Construction hours of work • Nearest sensitive receivers • Relevant licence and approval conditions • Loading and unloading areas. 	PM, Foreman	Ongoing
Ensure works are only performed during approved constructions hours as per Conditions of Approval.	PM	Ongoing
Complaints management will be as per the protocol outlined in the Sydney Metro Construction Complaints Management System.	Comm Officer/ PM	As received
Noise and vibration monitoring to be carried out as per CNVS and this CNVMP.	PM, Env Mgr	Ongoing/As required
Minimise structure-borne noise to connected buildings or buildings where cavity is bridged such as separating connection prior to demolition by means of saw-cutting/propping.	PM, Foreman	As required
Ensure voids between neighbouring buildings are kept clear of rubble to reduce structure borne noise and vibration.	PM, Foreman	As required
Deliveries will be carried out within the approved demolition hours, unless directed by police or other relevant authority (RMS, Council, etc.).	PM, Foreman	Ongoing
Where noise monitoring indicates that the existing measures are not adequate to meet noise goals then additional controls will be implemented where practicable and feasible including: <ul style="list-style-type: none"> • Installation of localised noise barriers around noisy areas • Modifications or alterations to plant and equipment ie. consider use of alternative excavator attachments • Residential grade mufflers would be fitted to all mobile plant. • Avoid the simultaneous operation of two or more noisy plant items 	Env Mgr, Foreman	As required

Management and Mitigation Measures	Responsibility	Timing
<ul style="list-style-type: none"> Provision of respite from noise intensive activities ie. high noise and vibration activities may only be carried out in continuous blocks not exceeding 3 hours each with minimum respite 1 hour Alternate demolition method or other negotiated outcomes with the affected community. 		
Plant and Equipment		
Plant and equipment is to be selected to minimise noise emissions, in-so-far-as possible whilst maintaining efficiency of function. Preference will be given to dampened/city or smaller/alternate sized rock hammers and where feasible and practicable the use of hydraulic concrete shears/propping in lieu of rock breakers. Where required, this method may be used to remove perimeter walls.	PM, Foreman	Ongoing
Non-tonal reversing alarms, such as quackers, to be used for all permanent mobile plant operating on Sydney Metro construction sites. Note WHS requirements must also be satisfied.	PM, Foreman	Ongoing
The offset distance between noisy operating plant and sensitive receivers is to be as great as possible.	PM, Foreman	Ongoing
Where feasible and reasonable the layout and positioning of noise-producing plant and activities on the work site are organised to minimise noise emission levels. Also, avoidance of the use of noisy plant working simultaneously close together when close to sensitive receivers.	PM, Foreman	Ongoing
Where feasible and reasonable noise intensive demolition activities, including sledge hammering or rock/concrete hammering, shall be undertaken during less sensitive daytime periods.	PM, Foreman	Ongoing
Air brake silencers are to be correctly installed and fully operational for any heavy vehicle that uses Sydney Metro construction site.	PM, Foreman	Ongoing
Regular maintenance on plant and equipment to include compliance checks on plant noise emissions in accordance with predicted noise levels. Service and performance records are reviewed as per Incoming Plant Inspection Checklist.	Env Mgr, Foreman	Pre- demolition
All plant and equipment is to be maintained in good order and in accordance with manufacturer's recommendations. Plant or equipment causing excessive noise are to be modified or if required removed from site.	PM, Foreman	Ongoing
Post - Demolition		
A post-demolition Dilapidation/Condition survey will be carried out with the agreement of the property owner/occupier on the surrounding infrastructure (including footpath and roads) and required buildings. Reports are to be submitted to the Principal's Representative for review as per the contract.	PM	Post demolition

9.3 Implementation of Further Mitigation Measures and Corrective Actions

A range of noise mitigation measures have been recommended to reduce and control potential construction noise impacts.

Mitigation measures will be considered during the construction planning and site establishment phases of the Project, and in the development of the CNVIS. This will include the investigation and the selection of alternative methods for demolition activities that affect sensitive receivers. Equipment selection will be undertaken during the development of the CNVIS, based on the predicted noise levels additional plant equipment will be selected for use wherever practicable.

The construction noise mitigation measures are recommended to, where feasible and reasonable, minimise potential for disturbance at receivers, preserve the acoustic amenity of the surrounding environment and aim to control noise levels within the construction NMLs.

9.3.1 Construction Environmental Management Plan

This CNVMP will be included in the CEMP in order to provide the framework and mechanisms for the management and mitigation of all potential noise and vibration impacts from the construction works. The subsequently developed CNVIS will include restrictions on the hours of construction and the construction noise levels at sensitive receivers.

9.3.2 General Construction Noise Mitigation

On the basis of being feasible and reasonable, mitigation measures that will be implemented during the construction works are summarised as follows:

- Adherence to daytime construction hours is recommended for demolition works, in particular hydraulic hammering activities
- Use hydraulic shears or pulverisers instead of hydraulic hammering where possible
- Use dampened rock hammers
- Night works, where applicable, should be programmed to minimise the number of consecutive nights work impacting the same receivers
- Avoiding the coincidence of noisy plant working simultaneously close together and adjacent to sensitive receivers will result in reduced noise emissions
- Equipment which is used intermittently is to be shut down when not in use
- Where possible, the offset distance between noisy plant items and nearby noise sensitive receivers should be as great as possible
- Where possible, equipment with directional noise emissions should be oriented away from sensitive receivers
- Undertake compliance checks on the noise emissions of plant and machinery used for the Project to indicate whether noise emissions from plant items are higher than noise emissions from well-maintained plant
- Regular noise monitoring during construction at sensitive receivers during critical periods to identify and assist in managing high risk noise events
- Where possible heavy vehicle movements should be limited to daytime hours
- Non-tonal reversing alarms should be fitted to all permanent mobile plant
- Reversing of equipment should be minimised so as to prevent nuisance caused by reversing alarms
- Loading and unloading should be carried out away from sensitive receivers, where practicable
- Installation of localised noise barriers around noisy areas
- Installation of sound barrier screening to scaffolding where permitted noise levels are exceeded at neighbouring noise affected properties
- Provision of respite from noise intensive activities
- Alternate demolition method or other negotiated outcomes with the affected community
- Modifications or alterations to plant and equipment
- Limiting times for certain demolition activities
- Where possible separate structural connections between adjoining buildings using sawcutting and propping, hand held splitters and pulverisers or hand demolition to reduce structure borne noise impacts.
- Retain building wall elements for as long as possible in order to provide additional screening to sensitive receivers.
- Where possible, sequence works to minimise noise impacts during peak pedestrian times.

These corrective actions will each alter the noise being produced in a different way. For example, the installation of localised noise barriers will be suitable for smaller or stationary items such as generators, whereas an equivalent reduction in noise would not be produced from an excavator on the top floor of a building. Similarly, respite periods may only be required for certain activities. This might mean demolition of a floor of a building can continue, however the dropping of material to the ground floor may be scheduled for an alternative period.

To ensure the rectification of exceedance of noise and vibration levels, if required a specific procedure is to be developed which may involve a reduction in the impacting activity until the activity complies with noise and vibration goals, or reappraisal of the CNVMP and introduction of additional control measures.

9.3.3 Additional Noise Mitigation Measures

Additional noise mitigation measures to be explored in the CNVIS in the event of predicted exceedances of the noise goals (particularly during OOHWs) are described in the CNVS. The strategy includes definition of the level of noise impact which triggers consideration of each additional mitigation measure (reproduced in Table 20, Table 21 and Table 22).

The additional mitigation measures described in the CNVS are summarised below, with discussion of their potential applicability to these works. Upon finalization of the CNVIS and modelling of impacts of the residual noise, after noise reduction measures are determined, the following additional noise mitigation measures below will be considered. During the planning of the works the Community and Stakeholders Management Team will liaise with the Project team for the implementation of the selected measures. The objective of these additional noise mitigation measures is to engage, inform and provide Project-specific messages to the community, recognising that advanced warning of potential disruptions can assist in reducing the impact.

- **Periodic Notifications** - Periodic notifications include regular newsletters, letterbox drops or advertisements in local papers to provide an overview of current and upcoming works and other topics of interest.
- **Website** - The Project website would form a resource for members of the community to seek further information, including noise and vibration management plans and current and upcoming construction activities.
- **Project Info-line and Construction Response Line** - TfNSW operate a Construction Response Line and Project Info-line. These numbers provide a dedicated 24 hour contact point for any complaints regarding construction works and for any Project enquiries. All complaints require a verbal response within 2 hours. All enquiries require a verbal response within 24 hours during standard construction hours, or on the next working day during out of hours work (unless the enquirer agrees otherwise).
- **Email Distribution List** - An email distribution list would be used to disseminate Project information to interested stakeholders.
- **Signage** - Signage on construction sites would be provided to notify stakeholders of Project details and Project emergency or enquiry information.
- **Alternative Accommodation (AA)** - Alternative accommodation options may be provided for residents living in close proximity to construction works that are likely to incur unreasonably high impacts over an extended period of time. Alternative accommodation will be determined on a case-by-case basis.
- **Specific Notifications (SN)** - Specific notifications would be letterbox dropped or hand distributed to the nearby residences and other sensitive receivers no later than seven days ahead of construction activities that are likely to exceed the noise objectives. This form of communication is used to support periodic notifications, or to advertise unscheduled works.
- **Phone Calls (PC)** - Phone calls may be made to identified/affected stakeholders within seven days of proposed work. For these works considering the large numbers of receivers, phone calls are not likely to be considered a reasonable mitigation measure in all cases, but could be used to inform specific receivers if requested (after notification of the works as above).
- **Individual Briefings (IB)** - Individual briefings may be used to inform stakeholders about the impacts of high noise activities and mitigation measures that will be implemented. Communications representatives from the contractor would visit identified stakeholders at least 48 hours ahead of potentially disturbing construction activities. For these works considering the large numbers of potentially affected receivers, individual briefings may not be considered a reasonable mitigation measure in all cases, but could be used for specific receivers if requested (after notification of the works as above).
- **Letter Box Drops (LB)** – May be used to disseminate Project information to interested stakeholders.
- **Monitoring (M)** - Regular noise monitoring during construction at sensitive receivers during critical periods would be used to identify and assist in managing high risk noise events. Monitoring of noise would also be undertaken in response to complaints. All noise monitoring would be carried out by an appropriately trained person in the measurement and assessment of construction noise and vibration, who is familiar with the requirements of the relevant standards and procedures.

- Project Specific Respite Offer (RO)** - Residents subjected to lengthy periods of noise or vibration may be eligible for a Project specific respite offer. The purpose of such an offer is to provide residents with respite from an ongoing impact. An example of a respite offer might be pre-purchased movie tickets. The provision of this measure would be determined on a case-by-case basis.

Table 20 Additional Mitigation Measures Matrix (AMMM) - Airborne Construction Noise

Time Period		Mitigation Measures Predicted LAeq(15minute) Noise Level Above Background (RBL)			
		0 to 10 dB	10 to 20 dB	20 to 30 dB	> 30 dB
Standard	Mon-Fri (7.00 am - 6.00 pm)	-	-	M, LB	M, LB
	Sat (8.00 am - 1.00 pm)				
	Sun/Pub Hol (Nil)				
OOHW	Mon-Fri (6.00 pm - 10.00 pm)	-	LB	M, LB	M, IB, LB, PC, RO, SN
	Sat (1.00 pm - 10.00 pm)				
	Sun/Pub Hol (8.00 am - 6.00 pm)				
OOHW	Mon-Fri (10.00 pm - 7.00 am)	-	M, LB	M, IB, LB, PC, RO, SN	AA, M, IB, LB, PC, RO, SN
	Sat (10.00 pm - 8.00 am)				
	Sun/Pub Hol (6.00 pm - 7.00 am)				

Table 21 AMMM - Ground-borne Construction Noise

Time Period		Mitigation Measures Predicted LAeq(15minute) Noise Level Exceedance		
		0 to 10 dB	10 to 20 dB	>20 dB
Standard	Mon-Fri (7.00 am - 6.00 pm)	LB	LB	M, LB, SN
	Sat (8.00 am - 1.00 pm)			
	Sun/Pub Hol (Nil)			
OOHW	Mon-Fri (6.00 pm - 10.00 pm)	LB	M, LB, SN	M, IB, LB, PC, RO, SN
	Sat (1.00 pm - 10.00 pm)			
	Sun/Pub Hol (8.00 am - 6.00 pm)			
OOHW	Mon-Fri (10.00 pm - 7.00 am)	M, LB, SN	AA, M, IB, LB, PC, RO, SN	AA, M, IB, LB, PC, RO, SN
	Sat (10.00 pm - 8.00 am)			
	Sun/Pub Hol (6.00 pm - 7.00 am)			

Table 22 AMMM - Ground-borne Vibration

Time Period		Mitigation Measures Predicted Vibration Levels Exceed Maximum Levels
Standard	Mon-Fri (7.00 am - 6.00 pm)	M, LB, RP
	Sat (8.00 am - 1.00 pm)	
	Sun/Pub Hol (Nil)	
OOHW	Mon-Fri (6.00 pm - 10.00 pm)	M, IB, LB, PC, RO, SN
	Sat (1.00 pm - 10.00 pm)	
	Sun/Pub Hol (8.00 am - 6.00 pm)	
OOHW	Mon-Fri (10.00 pm - 7.00 am)	AA, M, IB, LB, PC, RO, SN

	Sat (10.00 pm - 8.00 am)	
	Sun/Pub Hol (6.00 pm - 7.00 am)	

10 Noise and Vibration Monitoring

Management and control of noise and vibration impacts shall be monitored and assessed as described below. Noise and vibration monitoring is to be undertaken by suitably qualified persons in accordance with the CNVMP.

Attended measurements are to be undertaken within a period of 14 days from the commencement of each phase of demolition in order to confirm that the noise and vibration levels in the adjacent community are consistent with the predictions in the CNVIS. Attended noise measurements would be repeated at a minimum interval of every 2 weeks in order to ensure ongoing compliance.

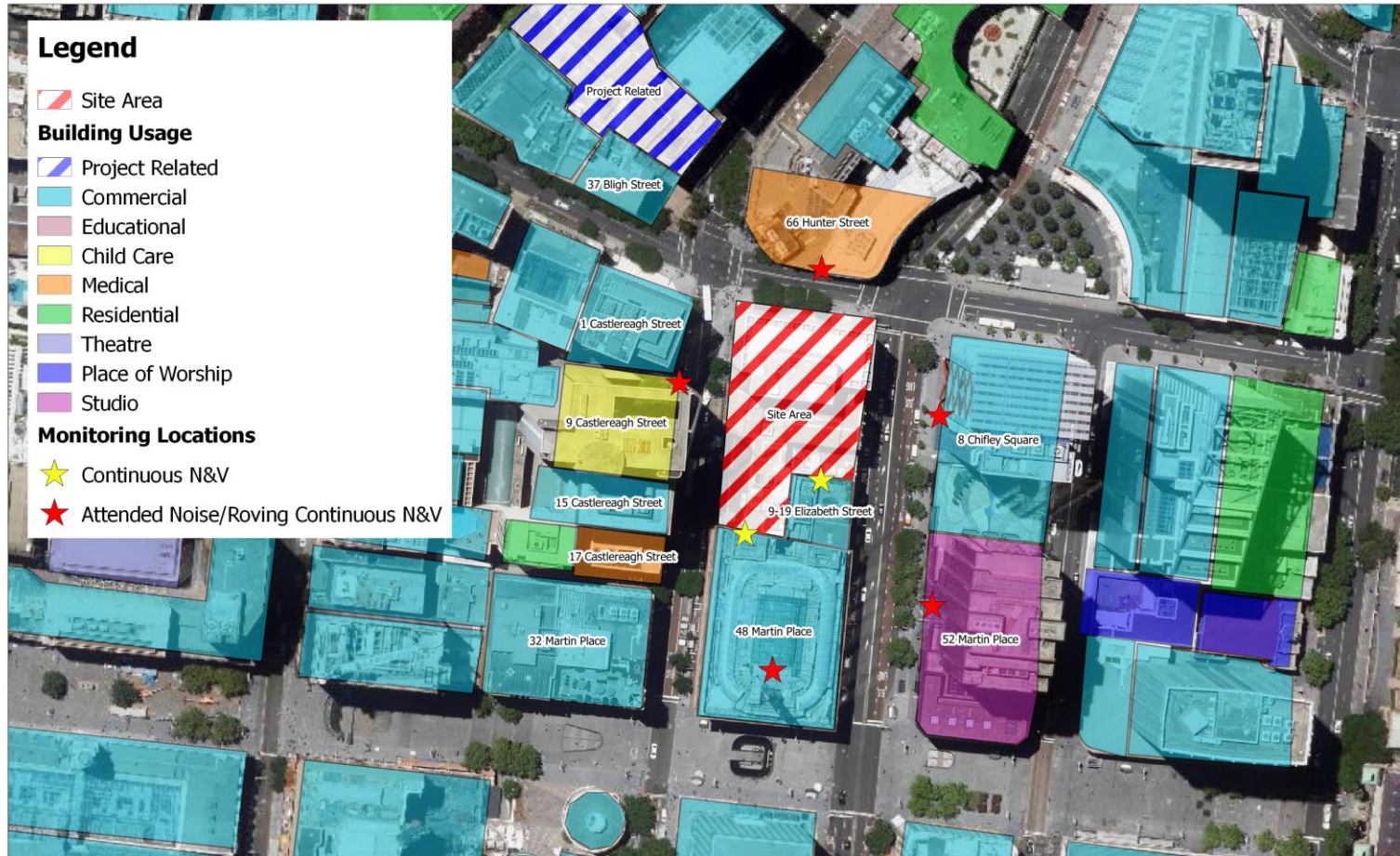
Figure 3 presents the proposed noise and vibration monitoring locations during Martin Place demolition works. Real-time continuous noise and vibration monitoring would be implemented throughout hard demolition at a minimum of two locations within the Macquarie Bank buildings. In addition, a “roving” real-time continuous noise and vibration monitoring system would be rotated between the most affected receiver locations on Castlereagh Street, Hunter Street and Elizabeth Street during the various stages of demolition. Where high noise or vibration impacts have been predicted in the CNVIS, supplementary real-time continuous monitoring may be required during noise and/or vibration intensive works.

Operator-attended noise and vibration monitoring is to be conducted upon commencement of demolition works in order to verify the noise modelling assumptions and results presented in the CNVIS. The following key locations are to be included in this monitoring:

- 48 Martin Place – Macquarie Bank Building
- 9-19 Elizabeth Street – Recording Studio
- 52 Martin Place – TV Studio

Where it has been predicted that vibration emissions may exceed the nominated vibration criteria, operator-attended vibration monitoring would be conducted upon the commencement of demolition works to establish “safe working distances” for vibration intensive plant and equipment.

Figure 3 Noise and Vibration Monitoring Locations



Note 1: The Receiver Type colour coding presented above represents the highest noise sensitive usage throughout the entire building. Refer to Table 3 for detailed building usage.



Project No.:	10-1380
Date:	03/05/2017
Drawn by:	RW
Scale:	1:1,982
Sheet Size:	@A4
Projection:	GDA 1994 MGA Zone 56

Metropolitan Demolitions Group
Sydney Metro City & Southwest
Works Package B - Martin Place
Noise and Vibration Monitoring Locations

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This document may be based on data provided by third parties for which VMS Australia Pty Ltd cannot guarantee the accuracy.

Table 23 presents the noise and vibration monitoring program for the demolition works.

Noise measurements shall be undertaken consistent with the procedures documented in *AS 1055.1-1997 Acoustics - Description and Measurement of Environmental Noise - General Procedures*.

Vibration measurements shall be undertaken in accordance with the procedures documented in the OEH's *Assessing Vibration - a technical guideline (2006)*, *AS 2107.2 2006 Explosives – Storage and Use* and *DIN 4150:Part 3-1999 Structural Vibration - Effects of Vibration on Structures*.

Table 23 Noise and Vibration Monitoring Program

Type	Location	Timing/Frequency	Purpose
Operator-attended Noise	<ul style="list-style-type: none"> 48 Martin Place 9-19 Elizabeth Street 	<ul style="list-style-type: none"> Upon commencement of the demolition for the load out zone in Castlereagh Street using machines fitted with hydraulic hammers Twice per week 	<ul style="list-style-type: none"> Verify CNVIS transmission loss assumptions and noise propagation characteristics within the building. Verify compliance.
Operator-attended Vibration	<ul style="list-style-type: none"> Within the demolition site 48 Martin Place (including structural elements, sensitive tiled areas and vault) 9-19 Elizabeth Street 	<ul style="list-style-type: none"> Upon commencement of the demolition of the load out zone in Castlereagh Street using machines fitted with hydraulic hammers Twice per week 	<ul style="list-style-type: none"> Establish safe working distances for vibration intensive equipment. Verify compliance.
Operator-attended Noise	<ul style="list-style-type: none"> 48 Martin Place 9-19 Elizabeth Street 52 Martin Place 9 Castlereagh Street 66 Hunter Street 8 Chifley Square 	<ul style="list-style-type: none"> Upon commencement of the demolition of the plant room to 55 Hunter Street using machines fitted with hydraulic hammers Fortnightly at the beginning of each of the four stages of demolition 	Verify CNVIS noise modelling results and ensure ongoing compliance.
Real-time Continuous Noise and Vibration	<ul style="list-style-type: none"> 48 Martin Place 9-19 Elizabeth Street 	<ul style="list-style-type: none"> Upon commencement of the demolition of the plant room to 8-12 Castlereagh Street using machines fitted with Hydraulic hammers Continuous 	Ensure ongoing compliance and provide real-time data to MD, ER, AA, DP&E and EPA.
"Roving" Real-time Continuous Noise and Vibration	Roving monitor to be rotated between affected receivers as predicted in the CNVIS. Where there are multiple receivers in different localities with high noise or vibration impacts predicted, multiple monitors may be required.	<ul style="list-style-type: none"> Upon commencement of the demolition of the plant room to 55 Hunter St using machines fitted with hydraulic hammers Continuous 	Ensure ongoing compliance and provide real-time data to MD, ER, AA, DP&E and EPA.
Operator-attended Noise and/or Vibration	As required.	In response to complaints.	To quantify noise and/or vibration emissions relating to complaints.

10.1 Plant and Equipment Noise Auditing

Internal compliance auditing of plant and equipment noise emissions would be undertaken via attended measurements of a representative selection of plant and equipment used on-site are to be undertaken. The representative items of equipment are to be regularly monitored to confirm that the operating noise levels of all noise intensive plant items comply with the maximum levels (LA_{max}) in Table 18.

10.2 Noise Monitoring

Noise monitoring undertaken by an Acoustic Consultant or suitably skilled and experienced person is required as per the Noise and Vibration Monitoring Program presented in Table 23. This initial monitoring measures airborne and ground-borne noise to assess whether construction activities exceed predictions in the CNVIS. Determination is made if the existing noise controls on site are adequate or whether changes are required prior to demolition proceeding.

MD must seek the advice of a heritage specialist on methods and locations for installing equipment used for noise monitoring of heritage-listed structures.

Monitoring undertaken on private property is to be followed in strict accordance with the CNVS and notification to the Client if agreement from the property owner/occupier is not granted.

Noise monitoring is to occur within the noise sensitive areas identified in Figure 3.

All noise monitoring would record the following information as a minimum:

- The precise monitoring location.
- Name of the person undertaking monitoring (in the case of attended monitoring) and site manager.
- Details of the instrument used for the measurement including make, model, serial number and last calibration date.
- Date and time of test.
- Weather condition during test, including air temperature, wind speed, wind direction and details of rain/wet conditions if applicable.
- Plant and equipment operating at the time of measurement (in the case of attended monitoring).
- Measured 15 minute noise level(s) at the monitoring location, including LA_{eq}, LA_{max} and LA₉₀ statistical parameters.

If noise monitoring measurements show that permitted levels are being exceeded, alternative methods and/or equipment will be reviewed as per the Standard Mitigation Measures. If construction noise levels continue to exceed NMLs the Additional Mitigation Measures Matrix (AMMM) may be applied to reduce the noise impacts.

10.3 Vibration Monitoring

Vibration monitoring is to be undertaken in accordance with the Noise and Vibration Monitoring Program presented in Table 23 to assess the vibration impacts on the adjacent buildings and occupants. Periods of continuous vibration monitoring may be undertaken during the initial phases and as required by high impact phases of the works or any changes in methodology. Initial vibration monitoring is likely to be located at the closest accessible point on the adjacent building and moved down to follow the demolition works. As the demolition proceeds down the building vibration levels impact to differing degrees on receivers in different locations.

MD must seek the advice of a heritage specialist on methods and locations for installing equipment used for vibration monitoring of heritage-listed structures.

If ongoing vibration monitoring is required peak vibration levels are recorded and trigger an audible/visual alarm and/or SMS Alert corresponding to both "Operator Warning Level" and "Operator Halt Level" set according to nominated site vibration criteria levels presented in Table 14.

Monitoring can also be undertaken at various stages of demolition to determine the effect in alterations to the demolition methodology, or as proximity of the active demolition face approaches adjacent receivers, or if deemed appropriate and after consultation with the various stakeholders.

In response to vibration complaints additional monitoring may be undertaken to investigate and assess the extent and source of vibration exceedances and to apply mitigation measures preventing the complaint from reoccurring.

All vibration monitoring would record the following information as a minimum:

- The precise monitoring location.
- Name of the person undertaking monitoring (in the case of attended monitoring) and site manager.
- Details of the instrument used for the measurement including make, model, serial number and last calibration date.
- Date and time of test.
- Plant and equipment operating at the time of measurement (in the case of attended monitoring).
- Measured vibration level(s) at the monitoring location, including the Peak Particle Velocity (PPV), the dominant frequency of vibration (in Hz).

If vibration monitoring measurements show that permitted levels are being exceeded, alternative methods and/or equipment will be reviewed as per the Standard Mitigation Measures. If construction vibration levels continue to exceed the vibration objectives the Additional Mitigation Measures Matrix (AMMM) may be applied to reduce the vibration impacts.

The MDG Project Manager will;

- (a) Be notified if the vibration reading is between 0mm/s and 3mm/s
- (b) Undertake investigations if the vibration reading is over 3mm/s and up to 5mm/s
- (c) Order the works to stop if the vibration reading reaches 7.5mm/s

10.4 Reporting

As per the requirements of the CNVS, noise and vibration monitoring reports are to be submitted to the Construction Contractor and the Project Manager and if required the Principal's Representative with noise and/or vibration monitoring results and details of affected sensitive receivers within one week of being undertaken or at weekly intervals for continuous monitoring. In the case of noise exceedances, details of the plant or operations causing the exceedances along with corrective action and the status of its implementation are to be supplied.

All reasonable and feasible mitigation measures presented in Section 9. Where noise exceedances are demonstrated through monitoring the demolition methodology and sequencing would be reviewed and additional respite periods implemented where appropriate to ensure ongoing compliance.

10.4.1 Records Management

All noise and vibration monitoring reports shall be maintained in a secure and orderly manner such that they remain legible, identifiable and traceable until project completion. At the end of the project, monitoring reports will be archived for a period (minimum 7 years) in accordance with the **Document Control & Records Management Procedure P-QSE-001**.

10.5 Inspections

A log will be used on site to keep an accurate record of demolition activities on a daily basis. This shall be used to correlate on-site activities with measured noise and vibration levels and/or complaints. An acoustic consultant may periodically review the proposed monitoring program with the aim to reduce or increase the monitoring depending on monitoring results and community feedback received.

The Site Supervisor is to conduct regular site inspections, observing any instances of excessively noisy machinery or key activities that are associated with the demolition works. Noise or vibration records are to be reviewed for potential issues arising from works. Results from the inspection are then to be recorded on an environmental checklist.

Copies of noise and vibration monitoring results will be made available to the Client as required.

11 Communication, Community Consultation and Reporting

MDG will ensure meaningful and effective consultation and communication processes are established and maintained throughout the life of the project in accordance with the CEMP and Client nominated project requirements.

Community consultation and the fostering of positive cooperative relationships assists in managing impacts from noisier operations and alleviating community concerns thereby minimizing complaints. This includes the following in consultation with the Client:

- Periodic notification of construction activities
- Specific works notification prior to disruptive or noisy activities
- Community consultation meetings

The Client will take the lead on stakeholder and community liaison. MDG is to support the overall management and coordination of stakeholder community liaison and ensuring notifications and consultation are provided within adequate periods. This is to include participation in the Communications Management Control Group (CMCG) prior to commencement of construction.

MDG will display emergency contact numbers on site entry points.

All community consultation is to be in accordance with the Sydney Metro Overarching Stakeholder and Community Involvement Plan and the Community Communication Strategy. Community consultation strategies are to be developed by the Project Manager in accordance with contract requirements, where required refer **Community Consultation Plan (FOR-IMS-04.3.J)**.

11.1 Communication and Reporting

Table 24 presents the reporting and communication summary requirements during the project.

Table 24 Reporting and Communication Summary Requirements

Reporting & Communication	Frequency	Responsibility	Report To
Daily Prestart Meetings	Daily	Site Supervisor	Place on notice board or sign-in area
Toolbox Meeting	Weekly	Project Manager	File on site. Most recent to be placed on notice board or sign-in area
Notifiable Incident	As occurs	Project Manager / QSE Manager	ER / Relevant Authority / Project Director / Sydney Metro
Incident Investigation Report	As required	Site Supervisor / Environmental Representative	Project Manager / QSE Manager
Monthly Statistics Report	Monthly (on 9 th)	Site Supervisor	Project Manager / QSE Manager
Notifiable Incidents Form	As occurs	QSE Manager	Relevant authority / Project Director / Sydney Metro
Emergency Debrief Record	Annually	Site Supervisor	QSE Manager

11.2 Noise Complaints and Community Consultation

All complaints handling is to be in accordance with the Sydney Metro Construction Complaints Management System. Complaints and response actions are documented in the **Customer Complaints Register (FOR-IMS-04.3.H)** and communicated to the Client. The Project Manager is to promptly respond to all noise and vibration complaints.

11.3 Roles and Responsibilities

Table 25 presents the roles and responsibilities of key personnel applicable to the demolition works.

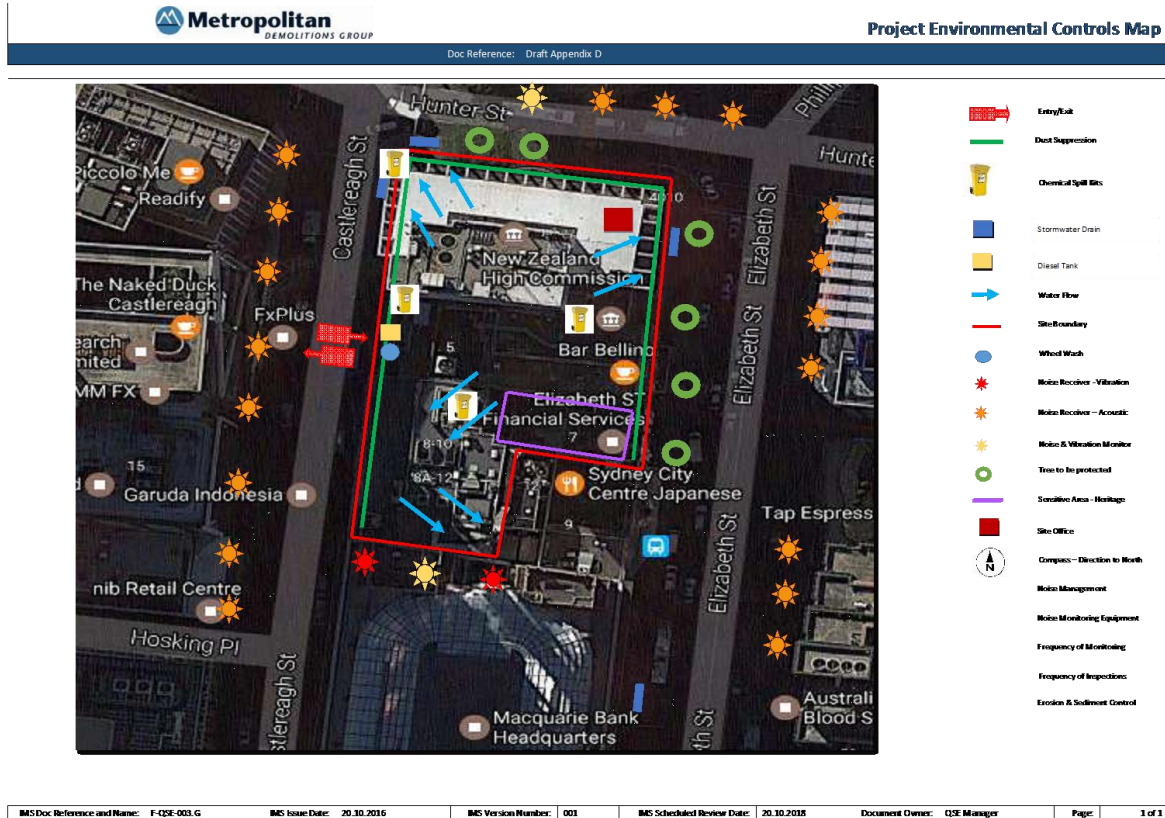
Table 25 Roles and Responsibilities

Role	Department or Company	Responsibility
Project Manager	Metropolitan Demolitions Group (MD)	<ul style="list-style-type: none"> Ongoing review of work practices to ensure compliance with the CoA and CNVMP. Where appropriate, coordinate via the Client consultation with noise and vibration affected receivers to coordinate respite periods. Communicate noise and vibration complaints to the Client in accordance with the Sydney Metro Construction Complaints Management System.
Site Manager	Metropolitan Demolitions Group (MD)	<ul style="list-style-type: none"> Implement noise and vibration mitigation measures presented in the CNVMP. Ensure all mobile plant used on site complies with the Maximum Plant and Equipment Noise Levels presented in the CNVMP. Coordinate noise and vibration monitoring with the Noise and Vibration Consultant.
Noise and Vibration Consultant	VMS Australia (VMS)	<ul style="list-style-type: none"> Prepare and site specific CNVMP and CNVIS. Conduct noise and vibration monitoring in accordance with the CNVMP.
Project Approval	NSW Department of Planning and Environment (DoPE)	<ul style="list-style-type: none"> Project Approval. Approval of Out of Hours Work Protocols.
Acoustic Adviser (AA)	Acoustic Studios	<ul style="list-style-type: none"> Endorse the CNVMP and CNVIS. Review noise and vibration monitoring data as required. Endorse Out of Hours Work Protocols.
Environmental Representative (ER)	MCW Environmental Consulting	<ul style="list-style-type: none"> Review and endorse the CNVMP and CNVIS. Approval of Out of Hours Work Protocols.
Environmental Authority	NSW Environmental Protection Authority (EPA)	<ul style="list-style-type: none"> Enforce the Environmental Protection Act. Consult with the Client when preparing Out of Hours Work Protocols. Issue Environmental Protection Licences (EPL) if required. Review noise and vibration monitoring data as required.

Appendix A - Acoustic Terminology

Terminology Relating to Noise and Vibration	
Sound Pressure	Sound, or sound pressure, is a fluctuation in air pressure over the static ambient pressure.
Sound Power	Sound Power is the rate at which sound energy is emitted, reflected, transmitted or received, per unit time. Unlike sound pressure, sound power is neither room-dependent nor distance-dependent.
Sound Pressure Level (SPL)	The sound level is the sound pressure relative to a standard reference pressure of 20µPa (20x10 ⁻⁶ Pascals) on a decibel scale.
Sound Power Level (SWL)	The Sound Power Level is the sound power relative to a standard reference pressure of 1pW (20x10 ⁻¹² Watts) on a decibel scale. The SWL of a simple point source may be used to calculate the SPL at a given distance (r) using the following formula: $SPL = SWL - 10 \times \log_{10}(4 \times \pi \times r^2)$ Note that the above formula is only valid for sound propagation in the free-field (see below).
Decibel (dB)	A scale for comparing the ratios of two quantities, including sound pressure and sound power. The difference in level between two sounds s1 and s2 is given by $20 \log_{10}(s1 / s2)$. The decibel can also be used to measure absolute quantities by specifying a reference value that fixes one point on the scale. For sound pressure, the reference value is 20µPa.
A-weighting, dBA	The unit of sound level, weighted according to the A-scale, which takes into account the increased sensitivity of the human ear at some frequencies.
Noise Level Indices	Noise levels usually fluctuate over time, so it is often necessary to consider an average or statistical noise level. This can be done in several ways, so a number of different noise indices have been defined, according to how the averaging or statistics are carried out.
Leq,T	A noise level index called the equivalent continuous noise level over the time period T. This is the level of a notional steady sound that would contain the same amount of sound energy as the actual, possibly fluctuating, sound that was recorded.
Lmax,T	A noise level index defined as the maximum noise level during the period T. Lmax is sometimes used for the assessment of occasional loud noises, which may have little effect on the overall Leq noise level but will still affect the noise environment. Unless described otherwise, it is measured using the 'fast' sound level meter response.
L90,T	A noise level index. The noise level exceeded for 90% of the time over the period T. L90 can be considered to be the "average minimum" noise level and is often used to describe the background noise.
L10,T	A noise level index. The noise level exceeded for 10% of the time over the period T. L10 can be considered to be the "average maximum" noise level. Generally used to describe road traffic noise.
Free-Field	Far from the presence of sound reflecting objects (except the ground), usually taken to mean at least 3.5m
Fast/Slow Time Weighting	Averaging times used in sound level meters.
Octave Band	A range of frequencies whose upper limit is twice the frequency of the lower limit.
DnT,w	The single number quantity that characterises airborne sound insulation between rooms over a range of frequencies.
Rw	Single number quantity that characterises the airborne sound insulating properties of a material or building element over a range of frequencies.
Reverberation	The persistence of sound in a space after a sound source has been stopped.
PPV	The particles of a medium are displaced from their random motion in the presence of a vibration wave. The greatest instantaneous velocity of a particle during this displacement is called the Peak Particle Velocity (PPV) and is typically measured in the units of mm/s.
Hertz, Hz	The unit of Frequency (or Pitch) of a sound or vibration. One hertz equals one cycle per second. 1 kHz = 1000 Hz, 2 kHz = 2000 Hz, etc.
Acceleration	Acceleration is defined as the rate of change of Velocity of a particle over a period of time and is typically measured in the units of m/sec ² .
Vibration Dose, VDV	When assessing intermittent vibration it is necessary to use the vibration dose value (VDV), a cumulative measurement of the vibration level received over an 8-hour or 16-hour period. The VDV formulae uses the RMS Acceleration raised to the fourth power and is known as the Rootmean-quad method. This technique ensures the VDV is more sensitive to the peaks in the acceleration levels. VDV's are typically measured in the units of m/s ^{1.75} .

Appendix B – Environmental Controls Map



**ENDORSEMENT
CITY & SOUTHWEST ACOUSTIC ADVISOR**

Review of	CNVMP and CNVIS for Metropolitan demolition works at Martin Place	Document reference:	Construction Noise & Vibration Management Plan prepared by VMS Australia for Metropolitan Demolitions Group Report number MD1968/09 Issue 005 and Construction Noise & Vibration Impact Statement prepared by VMS Australia for Metropolitan Demolitions Group Report number MD1968/09A Issue 004
Prepared by:	Dave Anderson		
Date of issue:	8 November 2017		

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

I met with VMS Australia to discuss earlier drafts of the documents and to discuss my formal comments. I previously endorsed the CNVMP (issue 002) and CNVIS (issue 002) and note that the current revisions address comments by Macquarie Bank and DPE, as well as some minor comments I noted in my earlier endorsement of the CNVIS.

I endorse the Construction Noise & Vibration Management Plan (issue 005) and Construction Noise and Vibration Impact Statement (issue 004).



Dave Anderson, City & Southwest Acoustic Advisor

Mr Stuart Hodgson
Director
Program Sustainability Environment & Planning
Sydney Metro
Transport for NSW
PO Box K659
HAYMARKET NSW 1240

8 November 2017

Ref: CNVIS-CNVMP Metropolitan

Dear Stuart

RE: Endorsement of revised Construction Noise and Vibration Management Plan and Construction Noise and Vibration Impact Statement – Martin Place, Sydney Metro City & Southwest

Thank you for providing the following revised documents for Environmental Representative (ER) review and endorsement as required by the Condition of Approval A24(d) of the Sydney Metro City & Southwest project (SSI – 15_7400 January 9 2017):

- Construction Noise and Vibration Management Plan (Document Reference: MD1968/09 Issue 005 dated 4-10-17)
- Construction Noise and Vibration Impact Statement (CNVIS) – Package B – Martin Place, (Plan Issue 004; Document Reference MD1968/09A dated 7 -8-17).
- Acoustic Advisor (AA) Endorsement of the above documents dated 8 November 2017

As an approved ER for the Sydney Metro City & Southwest project, I have reviewed the revisions of the above documents. 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 documents by the AA, the documents are endorsed by the ER.

Yours sincerely



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